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Co-ordination of Scientific Digests.

FEW matters are more disturbing to the specialist in science and technology than the increasing number of scientific and technical periodicals which are published each year. The World List of Scientific Periodicals issued in 1927 contains nearly 25,000 entries and is already out of date. Reliable estimates in 1931 indicate that about three-quarters of a million scientific and technical papers are published every year in some 15,000 current periodicals, and there are as yet no signs that the limit of expansion has been reached. The task of keeping in touch with all that is published even in a limited field is becoming a physical impossibility to the most rigid specialist, and industrial and scientific research are alike more and more dependent upon the abstracting bureaux for directing their attention to the papers which it is essential that the investigator on particular problems should read.

This tendency in itself throws a heavier responsibility on the various abstracting bureaux, for more depends upon their efficiency and vigilance. At the same time, the multiplicity of publications has greatly increased the strain on the meagre resources of the societies maintaining such services, and in recent months the British Bureau of Chemical Abstracts has been compelled by financial stringency to introduce abbreviations into its abstracts. Opinion is strongly held in some quarters that the innovation has introduced ambiguity and diminished the utility of the abstracts, but it is doubtful whether in the present circumstances the Bureau could as the alternative have raised the price of its Abstract publications.

The seriousness of the situation is fully realised by the officers of the Bureau, and a full discussion was held in May 1930 by the Chemical Engineering Group of the Society of Chemical Industry, at which Sir Frederic Nathan presented his paper on the international abstracting of scientific literature, outlining a scheme based on each country abstracting its own literature and the use of the International Decimal Classification for classification. The scheme was considered again at the conference of the International Institute of Bibliography at The Hague last August, and again by the Association of Special Libraries and Information Bureaux at its annual conference at Oxford in September. Mr. H. T. Tizard, president of the latter Association, had already convened a representative conference at the Imperial College of Science and Technology in July for the informal discussion and interchange of experience on problems of preparing

and utilising abstracts of scientific and technical literature.

The subject is one that bristles with difficulties, and co-operation even between the British and the American abstracting services is by no means simple to organise. It is clear, however, that the magnitude of the existing and rapidly increasing mass of scientific literature requires more systematic methods for its abstracting and classification than have been applied in the past. It may be that definite steps must be taken towards a comprehensive world scheme, even if it is only in one or two limited fields such as chemistry that definite proposals are possible in the near future. On the other hand, it is possible that, so far from the various technical abstracting services which at present overlap with scientific organisations like *Science Abstracts* and the British Bureau of Chemical Abstracts becoming merged in the latter, the scientific bureaux themselves may be divided and the abstracting of applied science be arranged by industries and not by sciences. It is not unlikely that more generous financial support might be received from industries for such schemes apart from the possibilities of co-operation with the efficient technical abstracting services which are already maintained by some industrial firms with large research departments. It is significant that the bulletins issued by the National Committees of the World Power Conference represent the first successful attempts at international bibliography.

Progress in any direction without overlapping and waste of effort is by no means easy, and in the meantime the danger of research work being duplicated in different parts of the world for lack of prompt and adequate means of exchange of information continues. With the idea of minimising the waste of scientific and technical effort in this way, apart from facilitating the exchange of scientific thought, a committee of scientific advisers, set up by the International Committee on Intellectual Co-operation, has considered the co-ordination of scientific bibliographies. With the object of assisting in the compilation of authoritative and complete bibliographies, the committee has adopted a recommendation that no scientific papers should be published which do not contain at the beginning or end analytical summaries compiled by the authors to facilitate the reading of the work or memorandum in question. The committee expressed the further opinion that the use of summaries should be extended to the reports of academic bodies, excepting very short articles or publications which are themselves in the nature of summaries.

The committee rightly insists that such summaries should conform to precise rules, failing which they lose most of their usefulness, and the rules recommended cover an exhaustive index of the subject, indicating new methods and results even though unconnected with the general subject of the paper as well as the conclusions and numerical data of general importance. A length four to eight per cent of that of the article is suggested.

This recommendation has been communicated to the Royal Society by the International Committee, with a request that it should be brought to the notice of all scientific organisations and editorial bodies responsible for the publication of scientific papers and communications in Great Britain. The council of the Royal Society, while generally favourable to the recommendation and its purpose, did not commit itself to the recommendation of the adoption of the proposed rules in their exact detail, but expressed the opinion that the recommendation could most usefully be brought to the notice of those concerned in the columns of NATURE.

It is obvious that original papers of the type to which the recommendation mainly relates are rarely published in NATURE. Nor are the summaries or reviews of research work included in our pages usually of sufficient length to justify even the enumeration of subjects proposed by the recommendation. There can, however, be little doubt as to the usefulness of providing an adequate summary with all scientific papers. Its value has already been demonstrated by the practice of providing an abstract of German, French, or English with the papers published in the Czechoslovakian, Rumanian, and similar scientific journals since the War. These summaries have greatly assisted in making more widely known the valuable research work being carried out in these countries in spite of the language difficulty.

The major criticism of the proposal will undoubtedly centre on the ability of the author to provide an adequate analytical summary even when furnished with rigid rules for its preparation. At the conference convened by Mr. Tizard there was an interesting discussion as to the merits of authors as abstractors of their own papers, one delegate holding that the author, although the worst critic, was the best abstractor of his own work. Much would, however, undoubtedly depend on the editorial board to which the paper with its summary was submitted, for, apart from wide variations in the capacity of individual scientific workers to summarise or abstract their own papers, there is

the ever-present danger that the specialist mind which can best indicate the immediate and specialised bearing of the paper may completely overlook the general bearing of the paper which it should equally be the purpose of the summary to indicate. Co-operation between the author and editor might do much to remedy any such defect.

With papers published in the lesser known languages, such as Russian, a further difficulty arises regarding the language in which the abstract should be published. The whole purpose of the recommendation would be defeated if the summary were not issued in a generally known language, and probably it should be limited to English, French, or German. This raises a further obstacle to the preparation of an author's summary. While the knowledge of a foreign language is often deplorably small among scientific workers, it is even rarer to find a scientific worker who can write clearly and concisely in a language other than his own. Much greater linguistic powers must be assumed on the part of authors of scientific and technical articles if the preparation of such summaries is to be left to their own unaided efforts, and present experience of the abstracts provided in foreign languages does not encourage the assumption.

The same difficulty is, of course, encountered in regard to Sir Frederic Nathan's scheme for international abstracting, but while the difficulty is acute it should not necessarily be insurmountable. The very wide variation in the merits of the technical and scientific papers which are published in different countries, and even in the same country, tends, however, to discourage the expectation of early success. If steps could be taken simultaneously to secure some general improvement in the standard required for the publication of a paper in a reputable scientific journal; some general discouragement of premature publication; the repression of a widespread practice, for which some countries are notorious, of publishing the same investigation two or three times over in different journals without acknowledgment; and the curtailment of the practice of reprinting papers in different journals in the same country, real progress should undoubtedly be achieved. The selection of material and the discarding of the useless or irrelevant which are so essential in special libraries or information bureaux must be adopted judiciously but widely as fundamental principles both in publication and in abstracting.

Meanwhile the urgency of the problem continues unabated, with its tale of wasted effort, time, and money in every branch of science and invention due to lack of information as to previous work. Vast stores of information are still out of reach which, when brought into juxtaposition with related facts in the mind of the investigator, might stimulate the growth of further knowledge and the birth of new ideas. The recommendations of the International Committee at least deserve the serious attention and careful study of all who realise the gigantic problem which scientific and technical literature now presents, and how long overdue is a determined effort for reform.

The Sphere of Chemical Embryology.

Chemical Embryology. By Dr. Joseph Needham. In 3 volumes. Vol. 1. Pp. xxii + 613 + 11 plates. Vol. 2. Pp. xvi + 615-1253 + 3 plates. Vol. 3. Pp. xvi + 1255-2021 + 1 plate. (Cambridge: At the University Press, 1931.) 105*s.* net.

THIS is in its way a classical book. It is true, as T. H. Huxley said, that "books are the money of literature, but the counters of science", so that the term classical has a somewhat different connotation in the two fields. It is rare for a scientific book to conserve its scientific as opposed to its historical value through the centuries or even through the decades. There are a few which have done so. The "Origin of Species", for example, is one, and Wallace's "Malay Archipelago" is another; to go back, no one can read Harvey's "De motu cordis" without gaining new insight into scientific method and, indeed, into the physiology of the circulation, while one may prophesy that in its very different way D'Arcy Thompson's "Growth and Form" will long continue to make its own appeal.

Most of the classics of science are, however, classical because they mark a stage, like Linnæus's "Systema Naturæ"; open a door, like Mendel's papers; consolidate a position, like Wilson's "The Cell". Dr. Needham's book falls into this last sub-category. It demonstrates the extent of ground won by the pioneers in this new field, defines its scope, consolidates one part with another, and proclaims to the world the title of this young branch of biology from now on to sovereign rights in a territory of its own.

Faced with the formidable bulk of its more than two thousand pages, the reviewer cannot begin better than by giving an outline of its contents. The work opens with a short theoretical part, in which various biological philosophies are discussed with reference to the possibility of chemical embryology existing in its own right; and, this granted,

to the best method of prosecuting its study. The views of Driesch, Rignano, Haldane, Lloyd Morgan, E. S. Russell are discussed, as well as the early vitalistic controversies and the long battle over preformation and epigenesis; and the section concludes with an exposé of that well-thought-out 'neo-mechanism' with which those who have read the author's "Sceptical Biologist" are already familiar.

Part ii., comprising nearly two hundred pages, is an extremely able and detailed account of the origins of chemical embryology, which, it may be prophesied, will long remain the best history of the subject.

Part iii. constitutes the bulk of the work, the treatise proper. To it we will return, after noting the existence of Part iv., with a number of special appendices, and Part v., with a two-hundred-and-fifty-page bibliography (and this with citation only of the author and the journal, not the title of the paper), an ample index of subjects, and another of the animals referred to.

Part iii. is entitled "General Chemical Embryology", and includes twenty-four sections: The unfertilised egg as a physico-chemical system. Growth. Differentiation. Embryonic respiration. The biophysics of development. The general metabolism of the embryo: its energetics: its special metabolisms—of carbohydrates, of proteins, of other nitrogen compounds, of fats, of lipoids and other oddments, of inorganic substances. Then the rôle of enzymes, hormones, vitamins, and pigments in development. The resistance and susceptibility of the embryo: its serology and immunology. The biochemistry of the placenta, of the amniotic and allantoic fluid. The blood and tissue chemistry of the embryo, and finally hatching and birth, on which follow fifty admirable pages of epilegomena, summarising some of the more salient ideas which emerged from the fourteen hundred pages of Part iii.

This will at least give some idea of the ample scope of these three volumes, and demonstrate that it is impossible for a reviewer to offer any adequate criticism of details in his 'thousand words'. It will be best to give some idea of the interesting contacts which Needham's discussion offers with other fields of inquiry; for, since the scientific analysis of ontogeny is perhaps less advanced than that of any equally universal and equally important characteristic of living things, we must expect that a thorough exploration of any single one of its aspects will reveal many new contacts and unsuspected points of view.

Let not even the morphologists imagine that their studies are immune. The theory of recapitulation, for example (p. 1629), suffers somewhat of a sea-change at the hands of the chemical embryologist. Consideration of the 'cleidoic' or closed system, for example, of birds and reptiles, leads to a number of interesting and important evolutionary suggestions; and the discussion of its 'uricotelic' metabolism, in which uric acid instead of urea or ammonia is the final product of nitrogen excretion, suggests the important reflection that the type of metabolism characteristic of a group may often have been determined by the metabolic exigencies of embryonic life—a view which links up with those more morphological ones of Garstang on the importance of larval characters as stepping-stones to new evolution.

The *Entwicklungsmechaniker* will find much to interest him, including a valuable theoretical discussion of the problem of differentiation, and perhaps the best balanced critique of Child's theory of axial gradients which has yet appeared. Needham concludes one of his sections with the remark that the prerequisite for real and rapid progress in the scientific analysis of ontogeny is the linking up of the results of chemical embryology and those of *Entwicklungsmechanik*. With this we can all agree, but may add that Needham himself has thrown out a number of suggestions which will be of value in bringing about the liaison.

The physiologist will find a great deal to interest him. In the past, physiology has had a distinctly confined scope. Just as its virtual restriction to a few terrestrial vertebrate types has made the vistas opened up by comparative study of other organic types so very alluring, so its virtual restriction to adult function means that the conception, opened up by these volumes, of a physiological as well as a morphological ontogeny will provide an equally dazzling prospect of research. It is by stepping backwards into developmental problems that morphology and physiology are ceasing to be 'pure' and are becoming parts of a synthetic and truly general biology.

Among specific topics of physiological interest may be mentioned the successive predominance of carbohydrates, proteins, and fats in the metabolism of embryonic life; the different methods adopted by marine, fresh-water, and terrestrial embryos for obtaining mineral substances and water; the apparently universal peaked curve for intensity of metabolism during ontogeny, rising to a maximum and then declining; the difficult but fascinating problems concerning the energetics of embryonic life; and

the temporal succession of various physiologically important substances, such as enzymes, hormones, and antigens, during development.

Those interested in growth will find in the section on increase in size and weight a valuable summary, critical and up-to-date, of the various theories on the subject of growth; while specialists in mammalian embryology are presented with a full account of the metabolism and functions of the placenta.

The general biologist will all the time be adding interesting items to his store of facts and ideas. Among these subjects the following may be mentioned: The notion that the activity of free marine larvæ may be concerned less with disposal than with the necessity of bringing large volumes of water in contact with the tiny organism to satisfy its need for phosphorus. The fact that the dogfish embryo excretes its urea into its yolk, so retaining it for osmotic purposes. The possibility that the shortage of mineral salts in fresh water may have been one of the major factors limiting the colonisation of this element by marine groups. The fact that one and the same tissue grown *in vitro* shows marked metabolic differences according to the age of the embryo from which it is taken, but that these differences disappear with prolonged sub-culturing. The curious progressive decrease of the melting point of human fat with age. The existence of numerous extra-embryonic enzymes during the early development of the chick, and the fascinating puzzle of how their operations are controlled before the control can be taken over by the embryo. The concordance of chemical with general biological evidence as to the intensely critical nature of the processes associated with gastrulation. The presence of subsidiary 'hearts' in the bat's placenta. The fact that the existence of special hatching enzymes in teleosts causes a veritable race between hatching and death, in which a slight fault of timing may prove fatal. The 'anarchistic' growth of oxygen-starved chick embryos, and the dislocation of differentiation from growth by means of cold. The fact that the semi-lethal yellow gene of mice exerts three different effects at three widely separated points in time during development. The existence of two groups of processes in embryonic life, one (including growth and differentiation) the maximum intensity of which falls early, the other (including metabolic rate) with a maximum intensity falling late.

So we might continue; but enough has been said to show what a mine of interest and information is to be found in Needham's pages.

There are naturally some minor criticisms to be made. The problem of dedifferentiation, whether in its own right or in relation to metamorphosis, receives very scant treatment. No attempt is made to link up the discussion of Child's axial gradients with the important concepts of morphogenetic 'fields' associated with the names of Gurvich, Weiss, Schotté, and Bertalanffy. The implications of recent work on mitogenetic rays for the regulation of cleavage rate are not mentioned. It is a pity that the interesting appendix on the metamorphosis of insects has not been supplemented by a comparison with that of amphibia. Needham's surprise at the failure of insects to develop a placenta is perhaps misplaced: its advantage would be small in organisms of such limited size.

If there is a general criticism to make, it is that the book is sometimes ponderous in treatment, notably in sections dealing with disputed points, where it often reads like a series of notes on individual papers. If brief critical summaries could have been provided at the end of each section, it would have been very helpful.

The work, however, remains a classic. It has vindicated the claims of chemical embryology to independent and fruitful existence, and marks another mile-stone on the road biology is taking in its transformation from a static to a dynamic science. Biologists are under a very real debt to Dr. Needham for his wide reading, his critical and constructive faculty, and his patient industry, which have issued in this fine work. J. S. H.

Archæology of the Amazon Basin.

(1) *L'Archéologie du bassin de l'Amazone.* Par Prof. Erland Nordenskiöld. (*Ars Americana*, 1.) Pp. viii + 72 + 57 planches. (Paris: Les Éditions G. Van Oest, 1930.) 350 francs.

(2) *L'ancienne civilisation des Barréales du nord-ouest Argentin (La Ciénega et la Aguada) d'après les collections privées et les documents de Benjamin Muniz Baretto.* Par Prof. Salvador Debenedetti. (*Ars Americana*, 2.) Pp. 60 + 68 planches. (Paris: Les Éditions G. Van Oest, 1931.) 350 francs.

(1) THIS large quarto volume, illustrated by fifty-seven plates, many in colours, is the first of a series devoted to the art of aboriginal America. The series is published under the auspices of an international committee which includes representatives, all well known in the archæological world, from France, Germany, Sweden, Brazil, and the Argentine Republic.

The theme of this, the inaugural volume, is the archæology of the Amazon basin, and the author is the distinguished Swedish anthropologist and

traveller, Baron Erland Nordenskiöld, director of the Göteburg Museum, who in 1929 was awarded the Huxley Memorial Medal of the Royal Anthropological Institute of Great Britain and Ireland.

A work dealing comprehensively with the archæology of this area is as welcome to students as it is difficult to prepare. The territory is vast, and huge tracts of it, owing to the dense forests, never harboured a sedentary population. The same conditions which hampered the development of arts and crafts have also hampered exploration; and the archæology of this great region is very imperfectly known.

Baron Nordenskiöld has given us an admirable survey of the archæology of the country covered by the Amazon and its tributaries east of the Andes, based on a study of early travellers and his own personal expeditions, illustrated by such specimens as have been rescued from the earth by the very few excavators who have faced the difficulties provided by climate and forest. Added to the investigations of previous explorers are the results obtained by Mr. Curt Nimuendaju, whose recent expeditions on behalf of the Göteborg Museum, combined with the collections secured by Baron Nordenskiöld himself, have provided that institution with what is probably the finest series of Brazilian antiquities in the world.

In sixty-three pages of text and fifty-seven plates the author has succeeded in providing not only material and guidance for future workers, but also a number of soundly substantiated theories. He shows fairly clearly that, of the three important tribes inhabiting the Amazon east of the Andes (the Arawak, Carib, and Guarani), the Arawak provided the predominant influence in art, an influence extending northward to the Antilles, and even, faintly, to Florida, and southward into Bolivia. The incised pottery of Marajo and the modelled ware of Santarem, in spite of the difference of technique, display the same artistic traditions, and these are echoed in the primitive ware of the districts populated, in historical times, by Caribs.

Little trace of the great Andean culture, the pre-Inca and Inca, can be discerned except in the extreme south of the region under review. What traces exist relate only to the north-western provinces of Argentina, where there seems to be some mingling of influences emanating both from the early Tiahuanaco Empire and the Arawak culture.

It is not too much to say that the text is a model of construction and commentary. It is short, and the conclusions which the author offers are drawn directly from the evidence at his disposal.

As regards the illustrations, which constitute so large a proportion of the work, whether coloured or monochrome, it need only be said that both publisher and printer deserve the most sincere congratulations on the part of all students of science and art.

(2) The second monograph of the series carries a melancholy significance, because the author, Salvador Debenedetti, perhaps the leading archæologist of Argentina, died unexpectedly on his voyage home from Europe, where he had been attending the International Congress of Americanists in Hamburg as Argentine delegate, and had conveyed the invitation of his Government to the Congress to meet in La Plata in 1932. He therefore never saw the publication of a volume to which he had devoted much time and thought, and which fully supports his reputation.

Debenedetti's introduction, though short, provides an excellent picture of what is known of the archæology of the north-west Argentine Republic, and the sixty-eight plates, admirably printed, are a storehouse of design for students of primitive American art. The volume is a very good companion to Baron Nordenskiöld's monograph, because it shows the twofold influences of Amazonian art and the art of the early Tiahuanaco period of the Bolivian highlands, the latter predominating. Further, it provides very clear indications of artistic affinity with the art of the Nasca valley in southern Peru, in which Amazonian influences are almost indistinguishable. The art of Nasca and the north-west Argentine are definitely akin; but the technique is different. The majority of the Nasca designs are painted in coloured slip; the majority of the Argentine designs are engraved, or incised.

A comparison of the artistic motives illustrated in the two volumes, combined with what is known of the art of southern Peru, suggests that the early centre was Tiahuanaco, the influence of which spread to the Amazon, northern Argentina, and southern Peru; with a reflex action on the part of the Amazonian tribes which affected Tiahuanaco and Argentina more than the Peruvian coast.

The illustrations are taken from the magnificent collections made by the Benjamin Muñiz Barreto expeditions between 1925 and 1929 in the province of Catamarca. The excavations undertaken by Sr. Muñiz Barreto have produced the largest and most notable series of ceramic and stone remains illustrating the archæology of the region, and the publication of this, proportionally small, selection of his private collection will be welcomed by all students of American archæology.

High-Frequency Alternating Currents.

High Frequency Alternating Currents. By Knox McIlwain and J. G. Brainerd. Pp. xiii + 510. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1931.) 30*s.* net.

THIS is a remarkably good book. "No claim is made for originality of most of the material, for the presentation of new results, or for an exhaustive treatment of the subject matter." This disclaimer in the preface is in exact accord with our estimate in reading through the text. Moreover, it is not improbable that a reader depending on this book for all his knowledge of the subject would fail to recognise a wireless set when it was put before him. Yet the very essence of quantitative high-frequency work is set down here in a well-ordered array, with just that orientation and emphasis which many of us have had, painfully and with labour, to develop in default of such guidance as the authors now offer to our happy juniors. There is a measured neglect of much of the secondary matter that has cumbered and disbalanced preceding textbooks; there is no running away from detailed expansion in cases where a superficial treatment has in many previous texts left the student with a stock of unjustified certainties to unlearn.

It is to be observed that the authors define 'high frequency' in a way which is, in fact, illogical and unusual, but corresponds to the requirements of the radio engineer, who is concerned not merely with the radio frequencies—20 kilocycles per second or above—which are the mail-vans of his communication system, but with the audible frequencies which are the postal packets containing the intelligence to be conveyed. Accordingly, "the term *high frequency* will be used to designate any frequency used in telephony and sound reproduction, in carrier telegraphy and telephony, and in radio telegraphy and telephony. . . . [It] may then be applied to frequencies from twelve cycles to 300 million cycles per second."

The first three chapters, dealing with the general phenomena of high-frequency currents, of resonance, and of coupled circuits, are followed by the longest individual chapter in the book, sixty pages on "Thermionic Vacuum Tubes". This chapter contains an adequate analysis of the unloaded and loaded triode, starting from a discussion of the diode, and proceeding to the development of the equivalent circuit of the tube, touching perhaps more briefly than might have been desired—even in these days of screen-grid tubes—on the important subject of the 'input impedance' of the loaded triode. A more complete mathematical analysis of the action of tetrode and triode, allowing for grid currents and variation of amplification factors, occupies a further thirteen pages of appendix.

To the chapter on amplification, which is on sound normal lines, succeed two of the most valuable chapters in the book, those on modulation (18 pp.) and detection (23 pp.). The phenomena of cross-modulation and allied effects, which are rapidly assuming primary importance in reception problems, are not treated. The exhaustive treatment of the simpler demodulation problems, with full tabulations of the audio-frequency terms resulting from 'plate current detection' and 'grid current detection', will, however, prepare the student for more specialised work on the response of the detector to two or more modulated signal voltages simultaneously applied.

Other important chapters, equally characteristic of the outlook of the book, are those on electric wave filters (45 pp.) and transmission lines (28 pp.). This is almost the first appearance in a general textbook of a 'student's guide' to two comparatively recent importations from 'line practice' into radio practice. No entrant into radio engineering can afford to be ignorant of the enormous scope and flexibility of filter circuits, nor is it merely in the increasingly frequent interconnexion of radio and line links that transmission line theory is essential. The antenna array on which depends the economy and efficiency of a purely radio channel must be designed by the transmission line engineer. In both these fields the authors' treatment lays a solid foundation for further reading.

The chapter on electromagnetic waves develops the Maxwell equations and applies them to radiation from antenna systems. It is followed by a chapter on reflection and refraction, in which the treatment of attenuation of radio waves in transmission is less satisfactory than is most of the material in the book. The last chapter is devoted to a useful discussion on electro-mechanical systems, with special reference, of course, to the telephone receiver.

The defect mentioned in the preceding paragraph is of the less important class of sins of omission; the sins of commission, in the form of definitely misleading or erroneous statements, are gratifyingly few. In one respect, however, the book in general will offend the sensibilities of the non-American reader. The reader familiar with the *Bell System Technical Journal* will not require a bibliography to show how much the authors owe to that remarkably

fine and generous periodical, and will join the authors and the reviewer in offering full measure of gratitude and admiration to its enlightened publishers. But he will not willingly accept the implication, in text and bibliography of the work under review, that the eastern hemisphere ceased to contribute to the science of high frequency alternating currents in the early years of the twentieth century. Clerk Maxwell, Drude, J. J. Thomson, and Richardson do find their way into the references, but it would be chastening to feel that the most readily checked framework in the book is really "in drawing". Each chapter of the book carries at its end a very useful bibliography. These fifteen tabular bibliographies contain 121 references (some naturally duplicative, but here treated as independent). The references to American periodicals number 81, to English 1, to Continental nil. Of 39 book references, 30 are American, 6 English, 2 are to the English translation of Drude, the remaining 1 to Pedersen's remarkable work published in English *ab initio*. The gold has been re-interred; must the laurels be transplanted too?

Medical Statistics.

An Introduction to Medical Statistics. By Hilda M. Woods and William T. Russell. Pp. x + 125. (London: P. S. King and Son, Ltd., 1931.) 7*s.* 6*d.*

QUITE apart from the academic consideration that vital and medical statistics now form an obligatory part of the education of students seeking the University of London's diploma in public health, the demand for information about the methods of vital and medical statistics is increasing. The most casual reader of the newspapers is now aware that population problems are of serious practical importance and that the publications of the General Register Office cannot be ignored. It is scarcely an exaggeration to say that the recently issued preliminary report on the census of 1931 is one of the most sensational documents which has appeared for years, and that he who reads it intelligently will understand what is meant by saying that civilisation is in the melting pot.

In order to read vital-statistical documents intelligently, some technical training is required. Published manuals tend to fall between two stools; either they bewilder the ordinary reader with mathematical formulæ or they are couched in dogmatic terms which irritate him. Miss Woods and Mr. Russell have avoided both these dangers. They make no claim to provide a complete treatise on statistical methodology, and, at the outset, warn the reader that he must consult larger books if he wishes to become a fully equipped statistician. But, within the compass of 125 pages and without dogmatism, they have given information quite adequate to enable the reader to peruse with understanding *any* official report on vital or medical statistics.

The first two chapters deal with the nature of the original material and its tabulation. These are followed by a short but sensible chapter on charts and diagrams. The next two chapters discuss estimates of population and the measurement of birth and death rates. The following four chapters are of a more general character, but the illustrations are drawn from vital-statistical data. The next chapter is a clear account of the principles involved in the construction of a life table, and the last expounds the root idea involved in the determination of a 'probable error'.

Here and there the printer has failed to cope with a subscript notation, but on the whole the format is good and the reader should have no difficulty in following the exposition. This book deserves a wide circulation. M. GREENWOOD.

Short Reviews.

(1) *Race as a Political Factor.* By Prof. J. W. Gregory. (Conway Memorial Lecture delivered at Conway Hall, Red Lion Square, W.C.1, on April 15, 1931.) Pp. 72. (London: Watts and Co., 1931.) 2*s.* net.

(2) *Race Mixture: Studies in Intermarriage and Miscegenation.* By E. B. Reuter. (Whittlesey House Publication.) Pp. vii + 224. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1931.) 12*s.* 6*d.* net.

EACH of these two books deals, though from very different points of view, with the question of the effects of contact between two or more races differing in physical character and in culture—a problem which to-day is probably of more importance for the future of the world than any other with which public policy is concerned in the countries affected.

(1) Prof. Gregory's Conway lecture has the practical end very directly in view. His remedy for the present situation and the avoidance of greater danger in the future is segregation of the inferior race. His argument is that otherwise social absorption is inevitable in present conditions; and the product of crossing races so diverse as black, white, and brown, so far as we are able to judge from the biological evidence, is likely to be of an inferior type. Further, in communities in which white and coloured live side by side, the

coloured so reduce the wages of the white low-grade labour as to render even their minimum standard of living unattainable.

(2) Prof. Gregory's argument rests largely on the inferiority of the hybrid. To this Prof. Reuter's book is a foil. He points out that the weakness of all argument about 'superior' and 'inferior' races is that, mistakenly, it makes culture a function of race. He then examines in considerable detail, in a number of essays, various aspects of the colour problem in the United States but with special reference to the position and achievement of the mulatto and the lesser degrees of negro blood. He shows that, so far from being inferior, these crosses have attained a very high degree of achievement. He makes one very interesting point which is apt to be overlooked. In the case of the parents of a very large proportion of these mixed breeds, so far as the individual is concerned, the black has been exceptional in physical character and intelligence, while the white has often been of a low type intellectually or morally.

Die westfälische Sedimentation und die asturische Phase in der innersudetischen Mulde. Von S. von Bubnoff. (*Fortschritte der Geologie und Paläontologie*, herausgegeben von Prof. Dr. W. Soergel, Band 9, Heft 29.) Pp. iv + 407-497. (Berlin: Gebrüder Borntraeger, 1931.)

PROF. BUBNOFF has made a valuable stratigraphical and tectonic study of the Westphalian sediments of the Inner-Sudetic Basin in southern Silesia with the view of determining the relative duration of the Asturian phase of orogeny. The basin lies between the crystalline rocks of the Riesengebirge and the Eulengebirge, and is otherwise bounded by Lower Palæozoic phyllites or by Kulm. A geological map which accompanies the book shows the limits within this frame of the successive basins of sedimentation in Namurian, Westphalian, and Stephanian times.

It is pointed out that the exact determination of the time of an orogenic phase is only possible where the earlier and later sediments can be exactly dated. As a result of the detailed work in the region described, it is clear that the Asturian phase was not a single episode of concentrated movement, but the sum of a series of differential disturbances which occurred throughout Westphalian time. The maximum intensity of movement occurred not at the close of the Westphalian, as generally stated, but during the later part of Westphalian time. The direction of movement deviated considerably from the trends of earlier and later orogenic phases. The development of each successive basin of subsidence is found to be related to an orogenic event.

It will be realised from these results that the author has made a contribution to comparative tectonics of great importance. Similar conclusions are being reached elsewhere (for example, in the Pennines and adjacent coalfields, in Wales, and in various North American areas) from a careful scrutiny of the sedimentary and structural record, suggesting that adjustment to stresses is more nearly continuous than has hitherto been realised.

The Electric Trolley Bus. By R. A. Bishop. (The Specialists' Series.) Pp. xi + 193. (London: Sir Isaac Pitman and Sons, Ltd., 1931.) 12*s.* 6*d.* net.

THE Royal Commission on Transport has suggested that the tramways are "in a state of obsolescence". It suggested also that the petrol bus has advantages as compared with trolley buses. The author points out that there are many reasons which make the trolley bus the more desirable. For example, if the whole of the 14,000 tramcars in Great Britain were replaced by petrol buses, the coal industry would lose one of its most important customers. Assuming that an omnibus takes a gallon for every five miles travelled, there would be an additional consumption of about 87 million gallons per annum. From the point of view of national economics, therefore, it is necessary that the load on the generating stations be retained. This is done when the change is made to the trolley bus.

The modern electric trolley bus is not being installed merely to replace obsolete tramway systems; in some cases it is being put into service where petrol buses previously ran because it is more efficient and considerably cheaper to operate. It has to be remembered also that the city street passenger systems are largely owned by the public and should be operated on the most efficient lines for the benefit of the public. This book is to be commended. Good chapters are given on "The Changing Outlook" and "On the Future of City Transport".

The Chemistry, Flavouring and Manufacture of Chocolate Confectionery and Cocoa. By H. R. Jensen. Pp. xvi + 406. (London: J. and A. Churchill, 1931.) 27*s.*

ALTHOUGH "the captains and the kings depart", the world goes on eating chocolates, particularly in countries where alcohol is prohibited. Further, since science and the chemist have penetrated into the industry, there is an amazing store of accumulated technical knowledge in every branch of it. As to how far the best use of this is made by British industry is a question over which the author breaks a lance in his introduction; as a past chairman of the panel of the British Association of Research for Cocoa, Chocolate, Sugar Confectionery, and Jam Trades, he is well qualified for the task. It is disturbing to notice that he is so far critical of the condition of affairs in Great Britain as to state that the failure to make effective use of the laboratory is both limiting the scope of the younger men and definitely reacting on the class of men who enter the industry.

The book is essentially a reference manual: it deals in turn with cocoa, with chocolate manufacture, with ingredients such as fats, sugars, milk, agglutinants, flavours, colours, and analysis. It is clearly printed, contains ample tables and the usual necessary illustrations from plant manufacturers' catalogues. Such problems as bloom, both sugar and fat, which are the bugbear of the manufacture, and other difficulties arising out of improper storage of chocolate goods are discussed briefly.

The Dehra Dun and Saharanpur Herbaria.

THE Saharanpur Botanic Garden, situated in the old North-Western Provinces, India, was at one time in the charge of the late Mr. J. E. Duthie, who was responsible for placing the herbarium of that place in an exceptional position. This herbarium was transferred later to the Forest Research Institute, Dehra Dun. Mr. Duthie left numerous manuscript notes on the herbarium, and with their aid, Mr. R. N. Parker, forest botanist, has published an account of "The Herbarium of the Forest Research Institute".*

Mr. Parker tells us: "The Herbarium of the Forest Research Institute is composed of two very unequal portions, the larger being the herbarium of the Botanical Department of Northern India, usually known as the Saharanpur Herbarium, which was transferred to Dehra Dun in 1908 and amalgamated with the herbarium of the Forest School. Nothing is now known of the relative sizes of the two herbaria. The present collection was estimated to contain 222,000 sheets on 1st January 1929." This brings the existing position of the herbarium nearly up to date. But to many the chief interest of Mr. Parker's account will be found in the concise history he gives of the Saharanpur Botanic Garden, and the long line of distinguished botanists who had more or less connexion with it. To those who are acquainted with the botanical and, it may be added, the forestry history of India, such names as Govan, Wallich, Royle, Falconer, Helfer, Griffith, Hooker, Jameson, and J. L. Stewart will take them back to the earlier work accomplished in the first half of last century. For this reason it is proposed to glance briefly at some of the more important passages in this history of botany and the Botanic Gardens at Saharanpur, with which the name of Duthie (an excellent portrait of whom is reproduced in the *Bulletin*) will be for all time associated.

The Botanic Gardens were established in 1816 on the site of an old native garden, which was much enlarged at various times. The first superintendent was Dr. Govan, who collected plants mainly in what is now Sirmoor State in the Simla district. A part, if not the whole, of his collections were listed with others in Wallich's Catalogue. What became of the plants is unknown, but a collection of drawings was ultimately presented to Kew. Dr. Royle succeeded Govan in 1823, and the results of his collections were published by him after retirement in "Illustrations of the Botany of the Himalayan Mountains", which appeared in parts during 1833–40. In this work, Royle describes the area he explored and refers to a herbarium of 3500 species. He took the bulk of this collection home with him, there being no facilities for housing it at Saharanpur. This herbarium after his death was actually sold, by auction in London, for 11*s.*, and is believed to have gone to Russia! Royle, however, presented a set of his plants to the Linnean Society and many of his plants are now at Kew, some having been sent to Hooker or Bentham and going to Kew with the herbaria of these botanists. That Dehra Dun to-day possesses some of Royle's plants is chiefly due to the fact that, in 1876, Duthie found some bundles of the former's plants at Saharanpur, which were preserved.

Owing to his medical duties (as station surgeon) Royle was unable to undertake any botanical tours for the first three and a half years of his tenure at Saharanpur, but from a letter he wrote, dated June 28, 1828, it appears that he explored part of the Siwaliks and the Dun plateau, went up to Mussoorie, where he established an experimental physic garden, and marched across to Simla and on to Kotgarh. In the following year he made a more extensive tour in this part of the Himalaya. Wallich was superintendent of the Calcutta Botanic Gardens, and in the previous year had made the first botanical visit to the great forests of the newly acquired Province of Tenasserim and made some considerable collections.

Dr. Falconer succeeded Royle in 1831. His collections were augmented by his adopting Royle's method of sending natives to accompany caravans into the interior of the mountains. These collections, with the exception of a few bundles found by Duthie with those of Royle, were sent to the India House, London. They are referred to by Hooker in the preface to the "Catalogue of the Plants distributed at the Royal Gardens, Kew, from the Herbaria of Griffith, Falconer and Helfer". Falconer was also a geologist and investigated the fossil Siwalik fauna. Both Helfer and Falconer followed in Wallich's footsteps and were sent to report upon, and collect in, the forests of the Tenasserim Province in 1838–39 and 1849 respectively, the unrestricted fellings in the teak of that region having begun seriously to alarm the Government and the Court of Directors.

Dr. Jameson followed Falconer in 1842, retiring in 1876. He was not a botanist, but had the credit of establishing the tea industry in Northern India. During brief periods of leave, Dr. J. L. Stewart (first conservator of forests in the Punjab, 1864, and author of "Punjab Plants") officiated for him in 1861, and Dr. G. King, afterwards superintendent of the Royal Botanic Gardens, Calcutta, in 1868.

Dr. Duthie arrived in Saharanpur in December 1876 as superintendent of the Botanic Gardens, which post he held until April 1, 1887, when he became director of the Botanical Department of Northern India; he was then able to devote his whole time to botanical work until he retired in December 1902. The position of affairs on Duthie taking over his charge is thus described by himself: "On my arrival in Saharanpur I found the Museum (erected in 1859) filled with miscellaneous collections including animals, mostly birds, as well as many kinds of vegetable products such as fibres, drugs, etc., and in one of the glass cases sundry articles used in the manufacture of tea were exhibited. Other cases contained various rock specimens,

* *Forest Bulletin*, No. 73: The Herbarium of the Forest Research Institute. By R. N. Parker. Pp. iii+10. (Calcutta: Government of India Central Publication Branch, 1931.) 5 annas; 6*d.*

including some of Falconer's original specimens of the Siwalik fossil remains of animals. The herbarium, such as it was, occupied a very subordinate position of the Museum; for, as the specimens were unarranged, unmounted, and for the most part unnamed, the collection could not in that condition be considered of any practical use to the public. The material consisted mainly of specimens collected by natives employed by Dr. Jameson during his tours in connection with tea culture. There were also a few bundles of specimens collected by Royle and Falconer in various parts of North-West India and labelled in their own handwriting. These, however, were mere remnants and scraps of their original collections."

Reference to Mr. Parker's article must be made for a study of the methods by which Duthie grappled with the position and built up the magnificent herbarium, ultimately to prove so firm a foundation upon which the Dehra Dun Forest Research Institute could build.

Reference has been made to the Dehra Forest School Herbarium. This was started by Mr. Gamble, who became director of the School in 1890 and held the position for some ten years. To start this collection, Gamble presented a set of his own duplicates collected in Bengal and Madras. He collected assiduously during his stay at Dehra and received many contributions from forest officers and others. Duthie also contributed, and the instructors at the School, especially Upendra Nath Kanjilal and Birbal, collected many species of local trees and shrubs. Some private herbaria made by forest officers were also presented.

Mr. Parker details some interesting facts in connexion with the earlier collectors and their direct or indirect influence on the present herbarium at Dehra Dun. The names include Roxburgh, Wallich, Strachey, Winterbottom, Griffith, Helfer, Hooker *fils*, Thomson, Stocks, Dalzell (Bombay), Wight (South India), Thomson, Beddome (conservator of forests, Madras and Bombay), Falconer, and Jameson. Amongst later collectors are the names of Col. Davidson, R.E. (Kumaon), Dr. Aitcheson (Punjab and Afghanistan), Dr. Goodenough (collection received from Kew), Sir D. Brandis (greater part of herbarium received from Kew), Thwaites (Ceylon), Gamble, Lace (Punjab, Baluchistan, Burma), Sir H. Collett (Simla, North-West Frontier, and Upper Burma), C. B. Clarke, C. F. Elliott (conservator of forests, Punjab and North-West Frontier), A. V. Munro (conservator of forests, Hazara, Multan, Baluchistan), C. W. Hope (many ferns), W. Gollan (superintendent of the Botanic Gardens, Saharanpur, 1887–1904—many plants and mosses), W. A. Talbot (conservator of forests—Bombay plants), Cooke (College of Science, Poona), and Dr. Lisboa (grasses). The Herbarium also contains series of plants obtained by foreign exchanges.

Intelligence and Fertility.*

By Dr. SHEPHERD DAWSON.

INVESTIGATIONS have recently been carried out in Glasgow into the relationship between birth-rate and intelligence. Individual Binet tests were given to more than twelve hundred children of ages three to fourteen years, and the results of these tests have been correlated with the size of the family to which each child belonged. The population studied was slightly below average both socially and intellectually; among the fathers of the children there was a high proportion of labourers, and the average intelligence ratio of the children themselves was about ten per cent below the average of the general population.

Most previous investigations have been concerned with birth-rates only. In the present inquiry, information was collected also regarding fatalities and survivals; as regards the family to which a child belonged, there was a record of the number of children alive, the number of fatalities (ante-natal, natal, and post-natal), the ages of the children and the parents, and the number of years the latter had been married.

Correlations were calculated between the intelligence of the child and (*a*) the number of surviving children in the family to which he belonged, (*b*) the number born alive, (*c*) the number of births, and (*d*) the number of possible lives. The correlations were all negative and small, but significant, that is, they showed a tendency for dull children to belong to larger families; they were slightly higher when only those families were considered in which the age of the mother was forty-five years or more, and the family presumably complete.

By dividing the children into three groups, 'bright', 'average', and 'dull', with intelligence ratios above 114, 114 to 85, and below 85 (100 being the normal), it has been shown that the birth-rate in the 'dull' group is about 50 per cent higher than in the 'bright', while in the 'average' group it is about 35 per cent higher. The fatalities (ante-natal, natal, and post-natal) are most numerous in the dullest families and fewest in the brightest; yet, in spite of this, the proportions of survivors at the time of the examination remained about the same; there were about 50 per cent more 'dull' than 'bright', and about 40 per cent more 'average' than 'bright'. In the completed families the differences were greater.

The dullest children obviously came from the largest families. If it be assumed, as is commonly done, that, on the whole, the intelligence of children is like that of their parents, then the dull parents have, on the whole, slightly more children than brighter parents.

The question how far these results are representative of what is happening in the population as a whole is clearly of importance. There is ground for thinking that in a group which contains a higher

* Substance of a paper read before Section J (Psychology) of the British Association in London on Sept. 24.

proportion of brighter intellects, the difference between the 'dull' and the 'bright' in respect of size of family may be greater, especially if sterility also be considered. An inquiry made some years ago in Glasgow into mortality-rates in 1789 poor families and 455 that were well-to-do, showed that when only families of more than one child were included, the average number of possible lives in the former was 5·6, while among the well-to-do it was 3·2. 'Well-to-do' and 'intelligent' are not synonymous terms, but there is a correlation between intelligence and social position, at any rate, up to the professional grade. Galton's inquiries into the family histories of 180 Englishmen who had distinguished themselves in science pointed in the same direction; the average size of the completed families of these men of distinction was almost exactly the same as that of the 'bright' Glasgow group.

These observations, then, show conclusively that the birth-rate is highest among the dullest members of the community, and that, in spite of their higher fatalities, they appear to be leaving a larger proportion of survivors, for at the time of the examination there was a higher average of surviving children in the dull and average groups than in the other. It is a problem for the future to determine what proportion of the children in each group will reach maturity and establish families of their own, for, unless there is a much higher fatality-rate among the present survivors of the duller groups, it is clear that the less intelligent elements of the population are increasing at a greater rate than the more intelligent.

The problem is one of national importance, for, although a slight difference, even a difference of *one*, between the families of the 'bright' and the 'dull' may seem a small matter, it is really serious, for the influence of a differential birth-rate is probably cumulative, since people of the same intellectual grade tend to intermarry, and there is the possibility that the fertility of each grade may remain the same from one generation to another.

The only source of consolation in the dismal picture is the consciousness of our profound ignorance of some of the important factors in the situation. We have still to find the proportion of children of each grade of intelligence who survive to establish families of their own; we have to find to what extent the dull and the bright intermarry, and whether the fertility of each group remains constant. It is well known that superior intellects sometimes spring from apparently mediocre stock, but we still require exact information regarding the extent to which they pass on their brilliance to their children; the common belief is that able parents have, on the whole, gifted children, that mental capacity is inherited like stature and other physical characters. Also there are different kinds of dullness to be distinguished, dullness that is the result of pathological conditions, accident and disease, and dullness that is the result of traits inherent in the stock, and we are very much in need of methods of distinguishing these and assessing their incidence.

There is, however, clear evidence that the duller elements of society have bigger families than the more gifted, and the little we know about the fatalities among them suggests that dullness is being bred rather than intellect. In view of the tendency of the State and private enterprise to do so much for the unfit, it is obvious that the question of the relationship between intellect and birth-rate is of more than academic importance and requires careful study, not only of the facts regarding birth-rate and survival, but also of the laws of mental inheritance, for, until these are known, speculation on methods of treatment is somewhat futile.

Intellectual Co-operation.

AMONG the subjects considered by the Executive Committee of the International Committee on Intellectual Co-operation at its thirteenth session last July, was a report from the Committee of Scientific Advisers appointed in April. This Committee had discussed the general question of the manner in which international intellectual co-operation can assist the co-ordination or organisation of scientific work, and had surveyed the various scientific matters which had already come before the International Committee.

The latter included a scheme of Prof. Cramer for the organisation of the documentation of chemistry, which the Committee of Scientific Advisers considered is primarily a question for the International Union of Chemistry, and in the field of bibliography the Committee limited itself to recommendations that authors' analytical summaries should be provided with all papers in scientific journals—a subject discussed elsewhere in this issue (p. 181)—and that, in agreement with the scientific unions, national centres for scientific bibliography should be established where they do not already exist.

A proposal from the French National Committee regarding the unification of scientific terminology was regarded as within the competence of the scientific unions unless the latter should desire to utilise the relations already established between them and the International Committee. Similarly, the Committee of Scientific Advisers in its report endorsed the resolution of the Committee of Library Experts on the standardisation of printed publications. In view of the great advantages offered to the whole of the scientific world by the adoption of uniform rules for the classification of printed works and their utilisation, the immediate adoption of a standard format for periodicals and a bibliographical cover note was recommended.

The present financial position of the fund for the publication of Tables of Constants and Numerical Data was considered, and the great value of this publication was stressed. To assist in the solution of existing difficulties, an agreement between the International Committee on Tables of Constants and the Unions of Chemistry and Physics regarding the scientific and material

organisation of the publication is desirable, and it was recommended that, following agreement, the International Committee on Intellectual Co-operation should support the International Committee in action taken to secure regular contribution by all countries of the funds required for the publication.

In the discussion on this report, the value of international bibliography was stressed, although it was agreed that Prof. Severi's scheme for the organisation of an international centre for mathematical bibliography is primarily a matter for the International Union of Mathematics. On the other hand, opinion was freely expressed that the Committee should extend its scope to include the bibliography of historical, economic, and social sciences. Against the latter proposal, M. Painlevé and Prof. J. T. Shotwell urged that the methods required for preparing bibliographies of the exact sciences are entirely different from those which should be adopted for historical, legal, and social sciences, requiring the co-operation of specialists in the various exact sciences. Accordingly, no advantage would accrue from such an extension of the Committee's scope. It was further suggested that the Institute should inquire of the national scientific unions what means they have of obtaining information on the scientific output of their countries, and thus providing a foundation for an international bibliography of each science.

In a slightly different field is the proposal by Prof. Cabrera for a repertory of scientific laboratories. This proposal was unanimously approved by the Committee of Scientific Advisers, who requested the International Committee to have the present situation in the laboratories studied by the Institute from the point of view of the working facilities accorded to foreign professors and students and the practical means of making the existing facilities known. So far as Great Britain is concerned, this information is largely contained in the "Year-book of the Universities of the Empire", and it was suggested that application should be made to the national committees in all countries where such committees exist. The national committee would be able to state whether a suitable year-book is published in the country which, as such or in modified form, could serve as a repertory. Even members of the International Committee who had questioned the advisability of continuing the Committee of Scientific Advisers were strongly in favour of this proposal, which was embodied in a resolution, expressing the opinion that a repertory of scientific laboratories would be a valuable supplement to the publications of the Institute and that its preparation might immediately be considered by the Institute.

Apart from such questions bearing on the interdependence of research and instruction, the Plenary Committee discussed a number of other matters of great interest to scientific workers. The results of the consultation with governments regarding the draft convention for the protection of intellectual rights were reviewed, together with the results of a meeting with representatives of legal institutions and, considering the scientific advisers' recommendation in favour of recognising the rights of the scientific worker, it was agreed to establish a committee of specialists to consider, with the assistance of the Institute, the whole of the replies received from governments, with any other documentary information collected, and to continue the action already initiated.

The publication of an international code of abbreviations of titles of periodicals has now been completed in regard to Slav terms, and a proposal for the preparation of an international bibliography of translations was approved, a preliminary technical study of the necessary methods by the Institute being recommended. The scientific study of international relations, university exchanges, the international use of the cinematograph in education, the utilisation of leisure in general education, popular arts, educational cinematography, etc., are other topics coming within the scope of the International Committee, which, with the assistance it is giving towards the reorganisation of education in China, illustrate its great potentialities for raising the general level of intellectual life.

Obituary.

SIR ALFRED YARROW, BT., F.R.S.

MY first long talk with Sir Alfred Yarrow was at Oxford in 1926, during the British Association meeting. Yarrow was at that time much interested in the relation between the world's output of gold and the cost of living index figure. A year later he read a paper on the subject at the British Association meeting at Leeds. I knew little of the matter, but I listened to him with interest. Later on, at Brighton, we discussed the future of scientific societies and technical institutions, and particularly the relative merits of short term donations and endowments for perpetuity. It was a most interesting talk, and we agreed that only in exceptional circumstances were perpetuity endowments wise, and that it was better for capital and interest on donations to be spent within twenty years or so, and to leave subsequent generations to do their bit. Yarrow thereupon told me he proposed giving me £5000 for the British Association, the capital and interest on which were to be spent within twenty years. I asked him not to spoil a very pleasant evening by putting me in the position of a beggar, and suggested the donation could wait. He agreed, but shortly after midnight he wrote out a cheque, and handing it to me, said, "I have doubled it—there is £10,000".

This principle of giving money to be spent within twenty years appealed to Yarrow very much, and whenever he read an announcement of a gift stipulating similar conditions he sent me a line expressing his pleasure. From that time I dined with Yarrow some ten or twelve times every year, and my respect and affection for him grew steadily

stronger. One of the proudest moments of his life was when he was elected a fellow of the Royal Society, the proceedings of which he followed with great interest. He read a large amount of scientific and technical literature, familiarising himself with all the latest developments of modern engineering and many of the more important discoveries in biology and biochemistry. He questioned me for more than two hours in November last about Sir Frederick Gowland Hopkins' presidential address to the Royal Society, and the recent work on vitamins. Fortunately I was familiar with some of the recent literature, but it was evident that he had read much more.

Always Yarrow's mind was singularly clear, and not only could he describe in detail his early work on the Thames, on the Clyde, his experiences during the War, and the latest improvements in ship-building, but also he was continually inventing new devices. The road-rail car was developed in Yarrow's mind long before such a car was built, and he was convinced that it would be an important factor in the development of the railways. He also sketched out a project which, had he been a younger man, he would have developed. It was to facilitate rapid transport across Europe, and particularly across Canada. In the scheme he had in mind, transport was to be by aeroplane during the day and in train sleeping-cars by night. In his ninetieth year he travelled by aeroplane a great deal, and although slightly deaf, he listened whenever possible to the throb of the engines in order to detect any failure on the part of a sparking plug. He declared that he had never known one to fail. The development of the London-Brighton line greatly interested him—possibly because of his stay at Brighton for long periods—and he worked out from data given in the technical press the relative merits of traction systems using steam, the Diesel engine, and electricity, making various hypotheses on the increase in passenger traffic.

Yarrow's very early work in life has been insufficiently described; long before he built the water-tube boiler he studied the motion of hot water in glass tubes, varying the conditions of pressure and temperature and noting the size of bubbles and their effect on the circulation. I believe that no full description of this work was published, but he was so impressed with the readiness of application of the results that he never wavered in his faith in laboratory experiments. His work on the resistance of ships at high speeds in deep and in shallow water, on propellers, and on the balancing of engines, is well known, but little is known of the small-scale experiments subsequent to sea trials.

In simpler matters, too, Yarrow's mind was very active. I remember a long talk we had on the subject of medals awarded by scientific societies. He pointed out that they were invariably tucked away in a drawer or deposited at a bank, and were rarely seen by the recipient and practically never by friends. Yarrow was of the opinion that such medals should be a source of inspiration, and devised a simple kind of mount so that a medal could be hung on a wall or supported on a mantel. Better still, the medal might be sunk into a nice block of clear glass and used as a paper-weight, so that it could be seen while the recipient was at work.

An illustration of a different kind is associated with the 'Compleat Angler' at Marlow, which he bought, so he said, to show that an engineer could run an inn. He supplied some of the waiters with pedometers, and was astonished to find that on one Sunday a waiter said he had walked twenty miles. With a twinkle in his eye he said: "I took the pedometers away in case they should ask for an increase in wages". To help the waiters and also to lessen the irritation produced when guests desired attention, he caused to be placed on each dining-table a telescopic tube flying a small Union Jack with a notice at the base: "When you want the waiter, raise the flag". I give this illustration to show that Yarrow was ingenious in the smaller matters of life as well as in the larger ones.

Yarrow was rarely deceived by anyone, but he told with great relish how his firm sold the *Caroline* during the Russian-Japanese war to two Irish gentlemen who paid an instalment in advance. Yarrow had previously constructed the high-speed yacht *Tarantula*, which was built on the lines of a torpedo boat, and its speed was thirty knots, which was very high in those days. The *Caroline* was of similar design, but it was only completed to a certain stage so that it might be fitted up either as a torpedo boat or as a fast yacht. She left the Thames hurriedly, had an exciting passage through the Kiel Canal, and was delivered to a Russian admiral at Libau. I understand that representations were made by Japan, and *Punch* had a cartoon depicting Russia with Yarrow's *Caroline* under her arm, while Japan cried out, "I thought you weren't selling any". Yarrow admitted that both he and the *Caroline* were sold handsomely on this occasion, and as he humorously put it—"The *Caroline* got to Russia, but left many 'care lines' on me".

Yarrow's generous gifts to scientific bodies, the London Hospital, Girton College, and the Yarrow Home at Broadstairs, total more than £500,000. However, not all of his scientific friends can be fully aware of the very kind and generous heart he had. By accident I have come into contact with some who have benefited by his kindness, and I do not wonder at the very great affection with which he was held. F. E. SMITH.

MR. R. W. WILLIAMSON.

WE regret to record the death of Robert Wood Williamson, anthropologist and former treasurer of the Royal Anthropological Institute, which took place on Jan. 12, at the age of seventy-five years. The son of Prof. William Crawford Williamson, F.R.S., he was born in Manchester in 1856. After being educated privately and at Owens College, Manchester, where he took a degree in engineering, he took up law. A successful career as a solicitor was brought to a close voluntarily in 1908, at the early age of fifty-two, in order that he might devote himself to scientific research.

Acting under advice, Williamson elected to visit New Guinea and the Solomon Islands as fields still offering scope for anthropological exploration. In 1910 he started out, and penetrated the interior of New Guinea, where he spent some time in the villages of the Mafulu, a mountain people until then practically unknown, recording their customs and magical beliefs. The scientific results of this expedition were published in "The Mafulu Mountain Peoples of British New Guinea", which appeared in 1912. The personal narrative of Williamson's experiences, including his travels in the Solomons, was published a short time after in "The Ways of the South Sea Savage".

For the remainder of his life, Williamson devoted himself to the study of the ethnology of Polynesia. He set himself to the stupendous task of preparing a complete critical digest of the literature relating to Polynesia, with special reference to the central area. This was a work for which Williamson's acute critical faculty and his legal training peculiarly fitted him. The first instalment appeared in 1924 under the title "The Social and Political Systems of Central Polynesia", a monumental work, very fully illustrated, which will be of permanent value as an authority on the formal aspect of Polynesian institutions. In the succeeding years he prepared a large amount of material for the work which was to follow. It may be hoped that this will be preserved for reference, if not for posthumous publication.

From 1912 until 1921, Williamson was treasurer of the Royal Anthropological Institute, afterwards becoming a councillor and vice-president. His judgment and his counsel, tempered by a lawyer's caution, but undismayed by difficulties, were highly valued by his colleagues.

In addition to his professional and anthropological activities, Williamson was devoted to gardening, and was at one time well known as an amateur grower of rock-plants and alpines. The gardens on his estate became public property after he left Manchester for Witley, near Godalming, his summer residence in his later years.

News and Views.

Tariffs and Imported Scientific Books.

ON Thursday, Feb. 4, after this week's issue of NATURE has gone to press, the House of Commons is to hear a statement from Mr. Chamberlain of the Government's proposals for the imposition of a ten per cent duty on all imported goods with certain exceptions, and for the setting up of a Tariff Commission. As imported goods include scientific books and periodicals, we hope that a member of the House, perhaps one of the universities' representatives, will have an opportunity of putting the case for their exclusion from the proposed ten per cent duty. The revenue that would be obtained from the duty on such books would be trifling, while the imposition of the duty would add to the cost of scientific literature. The high prices of Continental publications have been commented upon in our columns on several occasions, and any action which would increase them would result in a further reduction of the number of such works purchased by scientific societies or individuals. With works of fiction and other literature having large circulations, the probable result of a tariff would be the printing of the publications in Great Britain. Scientific and technical publications belong, however, to a different category; their circulation must always be so small that printing in Great Britain could never be contemplated as a business proposition. Their success always depends on international circulation. The only result of a tariff would be to prevent scientific investigators from consulting works dealing with their particular subjects, and thus to hamper progress.

Agricultural Industry.

THE fall in the price of agricultural produce in all countries has resulted in a depression, so long continued and so intense, that it is certain to lead to far-reaching changes in agriculture itself. One of these is now becoming evident. Agriculture is rapidly becoming an industry dependent on the market, and is ceasing to be a mode of living for the great mass of the people engaged in it. Both the farmer and the peasant sell most of what they produce and buy most of what they require. They are in business and the market dominates them. This fact must be kept steadily in view in considering the future development of the industry. Up to the present, the application of science to agriculture has been concentrated on the discovery of improvements which can be applied within the existing structure of the industry. This no longer suffices. What is now needed are fresh approaches to the problems of production and distribution. The framework of the industry itself must now be added to the list of subjects for investigation, so that new and novel means can be found to increase the output per unit of capital and per unit of labour. One such experiment, in which the small holdings of the peasant have been converted into large-scale communal farms, is now in progress in Russia. Proposals for experiments in new methods of farming have recently been before our own Parliament, but have had to be dropped for the present for reasons connected with the general financial position. Another obvious field of experiment lies in the educational domain, in extending the area from which the industry is recruited, so that new ideas and new points of view may rapidly gain adherents.

An Opportunity in India.

AN interesting experiment in agricultural education and training is now being undertaken in India by Capt. J. W. Petavel, at Kamshet, near Poona. An area of five hundred acres of suitable land, close to the railway line between Poona and Bombay, in a good climate and provided with facilities for the development of irrigation, has been secured for trying out a novel method of preparing the sons of the Indian

intelligentsia for a career on the land. The project received the active support of the late Sir Ashutosh Mukherji, vice-chancellor of the University of Calcutta. The idea underlying the scheme is the creation of an educational and training colony in which practical work in agriculture can be combined with ordinary schooling. The boys will be prepared for the usual examinations, but will take part in the growing of crops and in the care of animals. This will be possible by reducing the time devoted to study by two hours daily, so as to make room for three hours' productive work in the fields. An effort is being made to collect the best boys possible and not to confine recruitment to any particular class. It is hoped, in this way, to attract to the land a number of youths who otherwise would merely increase the army of unemployed university graduates now such an acute problem in India. So far, all efforts in this direction which have been made in the past have failed. Great changes in the outlook of educated India are, however, now taking place. The dislike of manual work which, a quarter of a century ago, used to be such a marked characteristic of the higher castes is rapidly disappearing. There is at the moment nothing impossible in the idea of utilising large numbers of the new generation for the development of agriculture—India's greatest industry. All that is needed are successful experiments, followed in due course by effective publicity.

Prehistoric Cornish Village.

RECENT excavations in the prehistoric village of Chrysauster, ten miles from Penzance, under the Ancient Monuments Branch of the Board of Works, have added considerably to the evidence bearing on the age and character of one of the most interesting of 'British' settlements. The exploration of the large house opened up by Mr. T. D. Kendrick in 1928 has been completed; two houses untouched by previous explorers have been completely excavated, and the round walls and floors uncovered by Borlase in 1873 and J. B. Cornish in 1897 have been cleared. This settlement, of which eight houses remain overground, with the remnant of its covered pathway of approach, entered by a granite arch, strongly recalls Skara Brae in the Orkneys, which has recently been excavated by Prof. Gordon Childe. The resemblance of the structures to those of Skara Brae is noted by the writer of an article on Chrysauster which appeared in the *Times* of Jan. 23; but the author would appear to be imperfectly acquainted with the character of the former site. He is in error in regarding Chrysauster as the only known example of prehistoric houses filing along either side of what is apparently a village street, for this arrangement is one of the most characteristic features of Skara Brae. The northern site is more primitive in character, and undoubtedly earlier than Chrysauster, of which the occupation is now dated by the pottery at from about the first century B.C. to the second century A.D. Some of the pottery suggests coarse imitation of contemporary Roman ware. The inhabitants were in part agriculturists, as is indicated by the lynchets behind the village, and, in all probability, tin-streamers. Tin-slag and lumps of shapeless iron have been found, but little else indicative of the character of the material culture.

Regional Smoke Abatement.

AN observer looking from a height upon a town of considerable size, whether industrial or otherwise, cannot fail to be impressed by the foul condition of the atmosphere below him. A thoughtful person can scarcely fail to marvel at the indifference of the public to the nuisance and its inertia towards remedial measures. The law in Great Britain relating to smoke abatement has hitherto been administered by local authorities, and while in some cases it has been efficiently and successfully applied, in many others it is either a dead letter or applied only intermittently. Ample provisions exist, however, for the formation of statutory regional authorities by means of which uniform and more thorough administration over any suitable geographical unit may be instituted. So far, only one such authority, the Sheffield, Rotherham, and District Smoke Abatement Committee, has been set up. The Council of the National Smoke Abatement Society met at York on Jan. 26, and passed a resolution that local authorities be urged to combine for the purpose of setting up suitable statutory regional organisations for the administration of smoke abatement law; that, pending the formation of statutory regional organisations, local authorities be urged to establish advisory committees similar to those already in existence, and that the support of the National Smoke Abatement Society be given to such projects as will further these proposals. The Council's report shows that regional effort should be both more economical and effective than local action only, which is often rendered useless by the apathy of neighbouring areas.

Development of Lighthouses.

THE paper by D. Alan Stevenson on lighthouses which was read to the Royal Society of Arts on Dec. 2 and is published in the Society's *Journal* for Jan. 15 is of great interest. Mr. Stevenson comes from a family which for generations has been responsible for the lights and aids to navigation on the Scottish coasts. R. L. Stevenson was one of this family. Up to just over a hundred years ago a fire set on the top of a tower and exposed to all conditions of the weather still continued to be used in Britain. There are grounds for supposing that this method dates back to the twelfth century B.C. The author and his father have just been awarded a special prize by the Royal Society of Arts for their invention of the talking beacon, which combines radio and fog signal methods most satisfactorily. Many people estimate the distance of a flash of lightning by noting the time between seeing the flash and hearing the thunder. Dividing this time expressed in seconds by five gives a rough approximation to the distance of the flash in miles. Similarly, if we use fog signals and radio waves, the distance of the beacon from the ship is found in nautical miles by dividing by $5\frac{1}{4}$, the

radio waves travelling practically instantaneously and the air waves with the velocity of sound. In the Stevensons' method, the ship does not need a stop-watch, only a simple radio receiver and a loud speaker, and the mariner is told in speech his exact distance at any time from the beacon whenever he hears the sound of the fog signal through the air. Suppose, for example, that the third blast of the air fog signal is heard by the navigator when the loud speaker is saying 'one mile two cables', then this is the distance of the ship from the beacon. This system has been tried out successfully on the Little Cumbrae Island in the Firth of Clyde for the last twelve months (see NATURE, Jan. 24, 1931, p. 138).

Czechoslovakian Broadcasting Station.

ONE of the smallest countries in Europe, Czechoslovakia, now possesses the most powerful broadcasting station in the world. It is situated near Cesky-Brod, some twenty-two miles east of Prague, and is near the geographical centre of Europe. The power of the station is 200 kilowatts, which places it well ahead of the 158-kilowatt station at Warsaw, the next largest. The power is derived from a 15,000-volt three-phase high tension line by Hewittic rectifier valves in oil-filled tanks, duplicated so as to avoid the risk of a breakdown. It was opened on Nov. 21, but the power is temporarily restricted. There are two antennæ towers, each 492 feet high and spaced 820 feet apart. The building has a copper roof, which is connected to the ground by a copper conductor. As there is also a copper mesh screen on the floor of the radio room, all the radio apparatus is actually contained within a copper screen. Switching arrangements enable the station to be worked either at half or full power. In the former case six valves are used in the final stage, and in the latter twelve valves. An ingenious counting device indicates the number of times a valve has operated the circuit breaker, and hence the behaviour of each valve throughout its life is recorded. The engineer supervising the working of the transmitter sits at a 'monitoring desk'. He listens at various stages to the speech or music passing through the transmitter and so can compare the quality at each point. Push buttons enable him to start up the motor generator sets and the pumps for the water-cooled valves. The wave-length is 486·2 metres, and it will be interesting to listen to this station when it is operating at full power.

Constants of High Voltage Lines.

IN a paper by J. S. Forrest published in the December number of the *Journal of the Institution of Electrical Engineers*, instructive data are given about the 'constants' of the high voltage lines used in the national 'grid' of Great Britain. Twenty years ago, engineers considered merely the coefficients of electromagnetic induction between neighbouring power lines. Experience, however, has proved that the electrostatic coefficients are in many cases much more important. If we have two parallel lines, one maintained at a high voltage and the other insulated, a voltage will be induced in the latter which can be computed when the mutual electrostatic coefficient between the two is known. Many years ago, Kelvin and Maxwell showed how these coefficients could be calculated, and now engineers are beginning to adopt their methods. The experiments described in this paper show that when the pressures on the live wires are 132 kilovolts, the induced pressures on neighbouring 'dead' wires may sometimes be thousands of volts. Experiments were made by measuring the resistance of a fisherman's line when wet with river water, to find out whether he ran any risk of getting a serious shock if his line hit a live wire. It was found that the resistance of the line measured half a megohm per centimetre length, and it is inferred that, provided the line beyond his rod be several yards in length, there is little risk. We do not agree with this conclusion. A few years ago an engineer, thinking that a 33,000-volt line was dead and wishing to measure its sag, threw up his measuring tape, which was not of metal, over it, and was instantly electrocuted. We feel certain that a fisherman would run a very serious risk if his line touched a high tension wire at a river crossing.

Physiology and the 'Aura'.

AT the annual general meeting of the British Psychological Society on Dec. 19, Prof. D. F. Fraser-Harris read a preliminary communication on a physiological study of the human 'aura', as it is called by occultists. By the 'aura', or 'human atmosphere', spiritists refer to a misty emanation which envelops the living body but cannot penetrate the clothes. Unless the body is naked, the aura can be seen only around the head, hands, and fingers. A typical experiment claimed to demonstrate the aura is as follows: Hold the outstretched fingers of the two hands touching one another at the level of the eyes about a foot or so in front of a black back-ground, then after staring at the finger-tips for about fifteen seconds, slowly draw the fingers apart, when the aura in the form of 'greyish mists' will be seen streaming from the ends of the receding fingers. At the outset, Prof. Fraser-Harris said that he questioned the accuracy of these observations. What are actually seen are very dark or black areas corresponding exactly in shape to the fingers, and *inter*digital spaces filled with the 'greyish mists'. His explanation is that the black areas are the negative after-images of the pale fingers viewed against the black background and produced by temporal retino-cerebral induction. The grey mists of the interdigital spaces are the whitish after-images of the corresponding spaces of the black ground similarly produced by this form of induction. That the phenomenon is optical and subjective is shown by the fact that when the conditions are reversed the after-images are also reversed. It is claimed, therefore, that the so-called 'aura' of fingers (or hand or head) has nothing to do with vitality, and, under the conditions just observed, is the familiar negative after-image produced by temporal retinal induction.

The Appeal of Natural Beauty.

IN the third Rickman Godlee Lecture, delivered in University College, London, in October, Prof. G. M. Trevelyan directed attention to the call and claims

of natural beauty. The appeal of beauty he analysed into elements partly æsthetic and partly belonging to the primitive nature of man, whose emotions react to the combined reality and allegory of the recurrence of natural events. But the reaction is not the same for all nations or for all times. Two hundred years ago the southerner looked upon the mountains of Scotland as "monstrous excrescencies" upon the face of Nature, the bare rocky summits of which "produce the disagreeable appearance of a scabbed head", and the "stupendous bulk, frightful irregularity, and horrid gloom" of which can stand no comparison with the verdant beauties of Richmond Hill. There has been a great change in æsthetic appreciation since that day, due perhaps to the removal of dangers which were thought to lurk in the gloom of deep mountain glens, perhaps to an outlook modified by the moral and intellectual changes of modern civilisation. In any event, beauty has become the "highest common denominator in the spiritual life of to-day", and the change calls for action, and speedy action, on the part of the State, if natural beauty is not to be hopelessly lost in ill-planned developments which deface the countryside. The lecture has been published by University College, price 1*s*.

Museum Service for Schools.

THE Board of Education has taken to heart the hints and recommendations made in the reports upon museums by Sir Henry Miers and by the Royal Commission on National Museum and Galleries, and has prepared a pamphlet on "Museums and Schools", which ought to be of service to both (H.M. Stationery Office, 9*d*. net). A short historical summary traces the gradual converging of the interests of museums towards education and of the schools towards making use of the treasures stored in museums; but the most useful part is the chapter dealing with possible methods of co-operation between the two. The loan of exhibits, the sale of reproductions, the use of temporary exhibitions, the visits of school children generally to be conducted by the school-teachers themselves, are described as desirable means of intercommunication, and great stress is laid upon the interest of the teacher himself. It is a strange thing that while the Ministry of Agriculture and Fisheries can publish attractive pamphlets about rats, pigs, or poultry, this Board of Education pamphlet upon museums should appear in an unusual and therefore awkward size (7¼ in. × 5 in.), in rather small print arranged in 76 numbered paragraphs, and in dingy grey covers, the whole suggestive of that depressing museum feeling against which the pamphlet tilts its final paragraph.

Andrew Balfour Memorial Fund.

AN appeal has been issued for funds to establish a memorial to the late Sir Andrew Balfour. It will be recalled that Sir Andrew died in January last year, shortly after his appointment as the first director of the London School of Hygiene and Tropical Medicine, and an appreciation of his life and scientific work appeared in our columns in the issue of Feb. 21 (p. 279). Sir Andrew Balfour will long be remembered for the work he did in the furtherance of research and study in tropical medicine and hygiene. When funds are available, it is proposed to place a simple and inexpensive monument in the School, and with the remainder of the sum received to establish an 'Andrew Balfour Memorial Fund' for the purpose of aiding students, preferably those from overseas, to pursue courses of study at the School. Contributions should be sent to the Honorary Treasurer, Andrew Balfour Memorial Fund, London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1.

Bats as Carriers of Rabies.

A RECENT report to the Legislative Council of Trinidad states that twenty persons died in South Trinidad between 1929 and 1931 of a disease considered by Dr. Hurst, of the Lister Institute, as due to the virus of rabies of a hitherto unknown type. The infection was not conveyed by dogs, as the last case of dog rabies was in 1914. The report suggests that bats may be concerned, and the *Trinidad Guardian* observes that since the issue of the report, Dr. Paman, the Government bacteriologist, says that he has found typical rabies symptoms in the brain of a Sangre Grande daylight bat—whatever species that may be. It is possible that a vampire, in attempting to suck the blood of a rabid dog, might be snapped at and escape with some injury sufficient for inoculation, when it would naturally bite and infect bats of its own and other species, the gregarious habits of bats, several different species of which often select the same retreat, being particularly favourable to the spread of such infection.

Simpler British Coinage.

THE address on simpler British coinage delivered by Mr. Harry Allcock before the Manchester Society of Chartered Accountants appears in full in the December issue of the *Decimal Educator*. He proposes to divide the shilling into 10 pence and to issue the following coins: The pound of 200 pence, ten shillings of 100 pence, five shillings of 50 pence, two shillings of 20 pence, one shilling of 10 pence, half-shilling of 5 pence, two pence, one penny, half penny, and farthing; 10 coins in all. He points out that while this system simplifies our coinage to the nations to whom we wish to sell our products, it also allows us to continue to divide the pound into halves, quarters, eighths, sixteenths, and thirty-seconds if necessary. No new names are required, and 1¼ new pence would be equal to 1½ old pence. Mr. Allcock contemplates the introduction of the new system by Government decree raising the value of the present penny and requiring each holder of pence to return one-sixth of them to H.M. Treasury, but he sees the difficulty of enforcing this in the case of private holders.

Coroner's Law in the United States.

Bulletin No. 83 of the National Research Council of the National Academy of Sciences, Washington, D.C., is entitled "A Compendium of the Statute Law of Coroners and Medical Examiners in the United States". It has been compiled by George H. Wein-

mann and is issued under the auspices of the Committee on Medico-legal Problems of the Council (Washington, D.C., 1931. 3.00 dollars). The publication appears to give an admirable summary of the law of the subject in the various States of the Union, illustrative cases being quoted when necessary. It is of interest that, as in Great Britain, in four of the States and in Hawaii there are statutes providing for the taking of inquisitions by the coroner to determine the cause and origin of fires. The taking of *ante-mortem* inquisitions by the coroner is provided for by statute in Connecticut and Rhode Island in the case of persons dangerously injured by criminal act, omission, or carelessness, and likely to die. No reforms are formulated or suggested, but the opinion is expressed that the importance of the office of coroner will be greatly enhanced to the community if and when the incumbent of the office is required to be a person skilled in the science of medicine and pathology.

Announcements.

PROF. R. W. WOOD, professor of experimental physics at the Johns Hopkins University, Baltimore, has been elected a foreign member of the Royal Swedish Academy of Sciences in recognition of his researches in the domain of physical optics.

THE Council of the Institution of Naval Architects has awarded the premium for the year 1931 to Mr. L. C. Burrill, University of Durham (Armstrong College), for his paper, "Seaworthiness of Collier Types". The premium will be presented at the beginning of the annual general meeting to be held on March 16 at the Royal Society of Arts, John Street, London, W.C.2.

THE Council of the Institution of Electrical Engineers has made the eleventh award of the Faraday Medal to Sir Oliver Lodge, honorary member of the Institution. This medal is awarded not more frequently than once a year, either for notable scientific or industrial achievement in electrical engineering or for conspicuous service rendered to the advancement of electrical science, without restriction as regards nationality, country of residence, or membership of the Institution. The Council has elected Mr. W. M. Mordey, past president, to be an honorary member of the Institution.

THE annual general meeting of the Institute of Metals is to be held in London on March 9 and 10. Whilst the ordinary business of the Institute and the reading of fourteen papers will occupy the first day and the morning of March 10, the second afternoon's session will be devoted to a general discussion on "The Testing of Castings", to be opened by Dr. W. Rosenhain. It is hoped that the discussion of such a practical question will interest all sections of the Institute's membership—those engaged in practical foundry work, engineering users of castings, and testing and investigation experts. Visitors are invited also to take part in the discussion, and cards of invitation admitting to the meeting may be obtained on application to the Secretary, Mr. G. Shaw Scott, 36 Victoria Street, Westminster, S.W.1. A membership election is due to take place on Feb. 18. Those elected then will have the privilege of membership, not for the usual twelve months, but for the extended period ending June 30, 1933, and will be able to take part in the proceedings at the March meeting. At the annual dinner to be held on March 9, the principal guest will be the Minister of Transport, Mr. P. J. Pybus.

WITH reference to the article entitled "A New Illumination Device for Microscopy" which appeared in NATURE for Dec. 12, 1931, p. 1010, we learn from Mr. J. E. Barnard that similar objectives with a ring reflector were produced some time ago by Chapman and Aldridge, and were the subject of a British patent. In no essential particular did they differ from those recently produced by Messrs. Leitz, who acknowledge the priority of the device of Chapman and Aldridge in their catalogue.

CANADA is the leading country in the production of asbestos, most of her supplies being chrysotile. A monograph on "Chrysotile Asbestos in Canada", by Mr. J. G. Ross, has been published by the Department of Mines, Ottawa. The volume, which is finely illustrated, deals with the physical and chemical properties of asbestos, its occurrence in Canada, quarrying and preparation for the market, the manufacture of asbestos products, and the commercial application of asbestos in various industries. It concludes with an extensive bibliography of the subject.

THE sixteenth annual of the Paris Academy of Sciences has recently been published. It includes a complete list of members, going back to 1795, giving brief biographical particulars; but an innovation occurs this year in the addition to entries of a letter indicating whether the Academy has records of autographs, portraits, medals, and busts of the person in question. This year the Academy is paying particular attention to portraits, and it would be glad to receive any information concerning portraits of its members which are not already noted in the annual.

PART 20 of the "Catalogue of Indian Insects", issued under the authority of the Government of India, has recently come to hand. It deals with the family Alucitidæ (Pterophoridæ) or 'plume moths', and has been compiled by Mr. T. Bainbrigge Fletcher, Imperial entomologist. Altogether 78 species are listed with full synonymy, records of their distribution, and keys to the genera. We trust that this useful work will be carried to completion notwithstanding the prevailing financial stringency.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A technical officer in the Admiralty Technical Pool for service in an Admiralty establishment, for work consisting chiefly of design and development in connexion with small precision mechanical and electrical apparatus—The Secretary of the Admiralty (C.E. Branch), Whitehall, S.W.1 (Feb. 26). A horticultural superintendent at the Swanley Horticultural College for Women—The Principal, Horticultural College, Swanley, Kent (March 18).

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.*]

FitzRoy's Hydrographic Surveys.

WITH reference to the article in NATURE of Dec. 26, 1931—pages 1065-1067—on "The Voyage of the *Beagle*", and more especially with reference to the paragraph on page 1068 on FitzRoy in "News and Views", it is not, I think, generally known either how much hydrographical surveying Capt. FitzRoy and his staff carried out during this five years' voyage from 1831 until 1836 or how long this work has stood.

First, it may be mentioned that in 1825 France and England undertook to survey the coasts of South America. The French examined the coasts of Brazil; the English those of Patagonia, Tierra del Fuego, Chile, and Peru.

The surveys carried out by the officers of the *Adventure* and *Beagle* from 1826 to 1831 embraced part of eastern Patagonia south of the Gulf of St. George, the greater part of the Strait of Magellan, Tierra del Fuego, and the west coast between Magellan Strait and Golfo de Penas. Thirty-three charts and forty-five plans of this work were received in the Hydrographic Department.

At the end of 1831, as we know, the *Beagle* again sailed from England to continue the survey and then to run a chain of meridian distances through the Pacific, Indian, and Atlantic Oceans, the ship being supplied with twenty-two chronometers for the purpose.

In 1832 three track charts (Cape Verde Islands to Bahia, etc.) and four plans (ports in the Azores, St. Paul's Rocks, etc.) were received at the Admiralty from the *Beagle*.

In 1833 seven charts of the south-east, south, and south-west coasts of Tierra del Fuego and two plans of parts of the Gulf of Penas were received of surveys made in 1832.

In 1834 nineteen charts and eight plans, also forty views of the surveys carried out in 1833, were received. These embraced the east coast of Patagonia from the south shore of the Rio de la Plata to the Gulf of St. George, including all ports.

In 1835 eleven charts, two track charts, and twelve plans were received, the areas of the surveys being mainly the east coast of Patagonia from the Gulf of St. George to Magellan Strait, the east coast of Tierra del Fuego, and the Falkland Islands, with plans of the ports and anchorages.

In 1837, after the conclusion of the *Beagle's* voyage, Capt. FitzRoy forwarded eighteen charts of the coast of Chile and thirty-four plans, eleven charts of the coast of Peru and eleven sheets of plans, embracing the whole coast from the Chonos Archipelago, 47° S., to the Guayaquil River, 3° S., and including all the ports and anchorages along the coast; also six charts and eight plans of the Galapagos Islands, and three charts and one plan of other islands in the Pacific Ocean.

It will thus be seen that during the period of this voyage no less than eighty-two coastal sheets, eighty plans of harbours, and forty views were received in the Hydrographic Department of the Admiralty from FitzRoy's surveys.

These surveys of the coasts of South America were used for the production of the Admiralty charts and are mostly still the foundation of the present-day charts of this area.

The Argentine Government surveys have superseded them between the Rio de la Plata and the Gulf of St. George, but the charts of the east coast of Patagonia southwards, with the exception of the plans of the ports, still incorporate these surveys. The charts of Tierra del Fuego are also largely founded on the *Beagle's* work. In Magellan Strait the larger portion of the *Beagle's* work has been superseded, the Main Strait being taken from later British and foreign government surveys, but the adjacent waters are still partly from the *Beagle's* surveys.

For the west coast of South America from Magellan Strait to about latitude 40° S., that is, including all the Chonos Archipelago, Chiloe Island, etc., our Admiralty charts are compiled from the Chilean Government charts, and thence northwards to Valparaiso —approximate latitude 33° S.—FitzRoy's surveys have been modified by later Chilean and other work; whilst only a few of our plans of Chilean ports and anchorages are now produced from the results of FitzRoy's work.

However, northwards from Valparaiso to the River Guayaquil, all the Admiralty charts of the Chilean coast and of all the Peruvian coast are from Capt. FitzRoy's surveys, and almost all the plans of Peruvian ports likewise.

This very large amount of work must have called for the greatest energy and zeal on the part of Capt. FitzRoy, his officers, and ship's company, more especially when one bears in mind the fact that these surveys were all carried out either from boats or from the ship under sail and with appliances which nowadays we would consider most crude.

Finally, as regards the chain of meridian distances round the world, it is recorded that these exceeded twenty-four hours by thirty-three seconds only, in a period of five years.

H. P. DOUGLAS,
Vice-Admiral and Hydrographer.

Hydrographic Department,
Admiralty,
London, S.W.1,
Jan. 18.

Specific Heats of the Diatomic Gases.

THE marked disagreement between the specific heats of the diatomic gases as found by sound velocity measurements and those calculated on theoretical grounds has for long been a source of perplexity to statistical mechanists, especially in view of the apparently simple nature of the assumptions required in the calculation. The easiest of these assumptions to attack would seem to be that of complete equilibrium between the various degrees of freedom of the molecule as the sound waves pass.

In two recent papers [1] Kneser has shown, by means of sound velocity measurements, that there is a lag in the transfer of energy between the vibrations of the CO_2 molecule and the other degrees of freedom much greater than that which has been hitherto suspected. In fact, he found that the period of relaxation for the vibration concerned was of the order of 10^{-5} of a second, in place of the usually assumed period of the order of 10^{-10} of a second. Now, if one admits a value of 10^{-5} of a second for CO_2, why should one not suppose that the period for oxygen may be of the order of 10^{-4} of a second? Unless we are to disregard the sound velocity results *in toto*, we must make some fundamental alteration to the theory, and this seems to be the easiest to make. I find that the results of

Shilling and Partington [2] for oxygen and nitrogen can be accounted for if we assume the following values for the relaxation period of the vibrations :

Temperature.	Relaxation Period in Sec.		Transparency Coefficient.	
	Oxygen.	Nitrogen.	Oxygen.	Nitrogen.
0° C.	..	..	370	8600
300° C.	$1{\cdot}0 \times 10^{-4}$	..	19·5	58
600°	1·2	$0{\cdot}88 \times 10^{-4}$	11·1	20
900°	1·1	0·92	9·4	12·5
1200°	1·0	..	7·9	10·3

At room temperature the vibration comes in so little that the expected effect is smaller than the probable errors of the sound velocity determinations, and I have not included values for the relaxation period for 0° C.

If the period really is as long as this, there must be considerable absorption of the sound energy at the frequency at which the velocity is varying most rapidly. This frequency would be round about 1400 vibrations per second for both oxygen and nitrogen, according to the above results; and in the table are given values which I have calculated for the number of wave-lengths which the sound should travel before the amplitude is reduced to $1/e$ times its initial value. It will be seen that the effect should be easily measurable at the higher temperatures, but is slight at room temperatures, so that the measurements which have been carried out at these temperatures do not tell us much.

The obvious methods of attack are the measurement at the higher temperatures of the velocity of sound over a considerable range of frequencies, and of the absorption of the sound energy. A more direct, if experimentally difficult, method depends upon photographing the ultra-violet absorption spectrum of oxygen as it is coming out of a cylinder at high pressure and temperature and noting the relative intensities of the various lines and bands. I hope to carry out this experiment shortly, and will not say more about it here.

It may be pointed out that determinations of the specific heat of oxygen carried out by means of a flow method,[3] in which the heating of the gas took about a quarter of a second, gave results nearly in agreement with theory, whilst the adiabatic expansion experiments of Eucken and Lüde,[4] where the cooling was more rapid, gave results intermediate between the theory and the sound velocity results.

Finally, it is interesting to refer to a paper by Zener,[5] in which he points the way to calculation on wave-mechanical principles of the chance that a molecule will give up its vibrational energy in a collision. At the end of the paper he states that " for a typical case of collisions between diatomic molecules, where one molecule has one quantum of vibrational energy ", the chance of transfer in a given collision is about 2×10^{-5} at 0° C. This we may compare with the value for the probability of the transformation of the vibrational energy (which should be considerably less) calculated from the relaxation period given above for oxygen at 600° C., which is $0{\cdot}5 \times 10^{-5}$.

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[1] *Ann. der Phys.*, **11**, pp. 761, 777 ; 1931.
[2] *Phil. Mag.*, **3**, p. 273 ; 1927 : **6**, p. 920 ; 1928 : **9**, p. 1020 ; 1930.
[3] *Proc. Roy. Soc.*, A, **133**, p. 492 ; 1931.
[4] *Z. physik. Chem.*, B, **5**, p. 413 ; 1929.
[5] *Phys. Rev.*, **38**, p. 277 ; 1931.

Surface Convection and the Distribution of Temperature near a Heated Surface.

LAST summer we took some temperature measurements under the steady conditions prevailing at the epoch of diurnal maximum temperature above an asphalted road where inferior mirage could be seen on any clear day. The temperature variation with height above a hot surface was shortly afterwards measured also in the laboratory. The lapse-rates were of the order of 20°-30° C. per cm. in the first centimetre, and of the order of 1°-2° C. per cm. at higher levels near a heated surface. The observations showed that there was (1) a ' skin layer ' within the first centimetre, and (2) a ' surface layer ' extending up to about 20 cm. above the hot surface. The variation of temperature above these layers is practically negligible compared to the much larger variations below.

Taking into account the balance in an elementary layer between the heat received by convection processes and the net loss of heat by radiative processes, the following expression was derived :

$$\phi = \phi_0 \frac{\sinh a(h-z)}{\sinh ah},$$

where ϕ is the variable part of the temperature, ϕ_0 and h are constants, and a is a constant equal to $\sqrt{16a\sigma\theta_0^3/k}$ involving the effective absorption coefficient of water

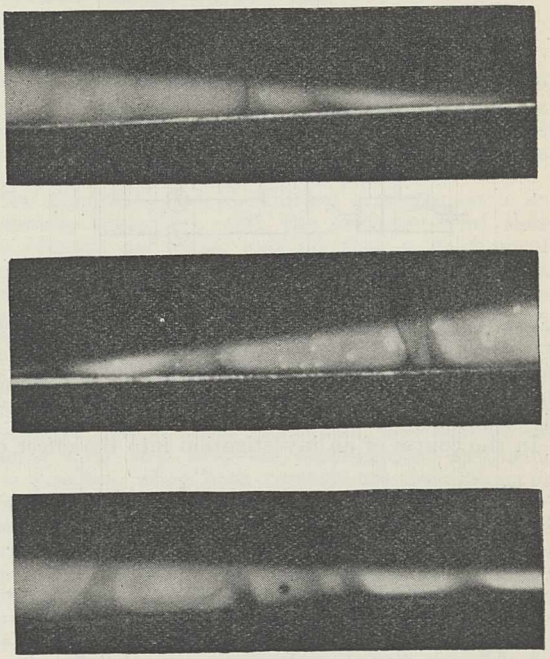

FIG. 1.

vapour a, the Stefan-Boltzmann constant σ, the convective conductivity k, and θ_0 the constant part of temperature. The temperature distribution observed above the road as well as in the laboratory experiments agreed with the above expression.

The nature of the turbulence near a hot surface was studied experimentally by us in detail. The space above a heated surface kept inside a smoke chamber provided with observational glass windows was illuminated by a concentrated beam of sunlight. Ammonium chloride or sulphur fumes were used. It was found that, just as in Aitken's and Lodge's experiments, there was a dark, dust-free layer above

the hot surface. The heated dust-free air was found to shoot up into several tongues of ascending air; these dark columns which conveyed the heat upwards travelled several centimetres upwards, but while their base near the hot surface was 1·5-2·5 cm. broad, their width very rapidly decreased towards the apex. The dark columns develop and move about in a random manner. The corresponding downward movements of the cold air can also be observed. These movements are associated with vortices excited by the uprush of the hot air. The photographs reproduced in Fig. 1 give a rough idea of this phenomenon. In the permanent dark space above the surface it is likely that the heat conductivity is of the order of molecular conductivity, as suggested by the work of Prandtl and Langmuir.

Our results are being published in two articles in the *Indian Journal of Physics*, Calcutta.

L. A. RAMDAS.
S. L. MALURKAR.

Poona, 5.

Gill-Morell and Barkhausen-Kurz Oscillations.

IN the production of ultra-high-frequency oscillations by means of triodes with positive grid, it has been apparent that there exist two distinct types, Gill-Morell oscillations, the frequency of which depends solely on the external circuit of the valve, and Barkhausen-Kurz oscillations, the frequency of which

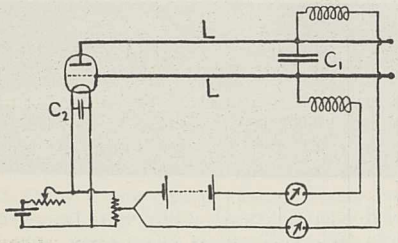

FIG. 1.—Apparatus for production of electron oscillations. *L*, *L*, Lecher wires; C_1, movable bridge; C_2, blocking condenser.

depends mainly on the operating voltages. In 1928 Hollmann [1] obtained results tending to indicate that the Gill-Morell oscillations are a modified form of Barkhausen-Kurz oscillations and are invariably of higher frequency.

In the course of an investigation into the effect of

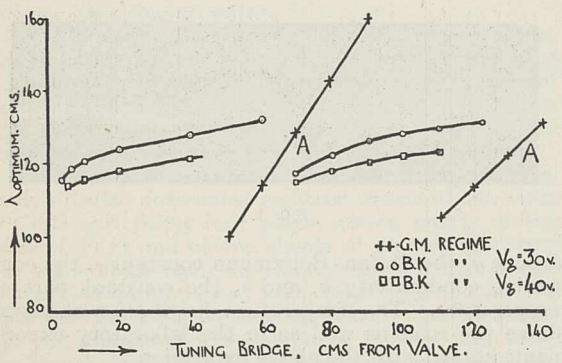

FIG. 2.—Variation of wave-length with bridge position.

varying the emission current, I have found that with one particular valve arranged in the normal way (Fig. 1) not only were Hollmann's results obtainable, but in addition true Gill-Morell oscillations as well. For most positions of the tuning bridge of the external circuit the value of the emission current decides which type of oscillation is maintained. For higher values of grid voltage there are two values of emission current for optimum maintenance of the Barkhausen-Kurz oscillations, the wave-length for the lower value of emission being slightly shorter than that for the higher value. This agrees with results recently published by Moore.[2]

A typical set of observations on the wave-lengths maintained at various bridge positions is shown in Fig. 2. For each wave-length the emission was adjusted for optimum maintenance. It will be seen that the Gill-Morell oscillations extend on both sides of the Barkhausen-Kurz range. The amplitude of both types of oscillations, as measured by the increase of plate current, reaches a maximum at points *A*, when the maintained wave-lengths of the two regimes approach equality.

It is hoped to publish further details of this investigation shortly.

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London, E.15, Jan. 10.

[1] "On the Mechanism of Electron Oscillations in a Triode", H. E. Hollmann, *Ann. Physik*, **86**, 129; 1928.
[2] "A Particular Case of High Frequency Electron Oscillations", W. H. Moore, *Can. J. Res.*, **4**, 505-516; 1931.

Air Column Resonances and Symmetrical Modes of Truncated Conical Shells (Loud Speaker Diaphragms).

IN investigating modes of vibration of truncated conical shells of paper, aluminium, and glass, the frequency of a certain resonance group was found to be dependent upon the dimensions only. Table 1 gives some of the data obtained when the cones were driven in a large, highly damped room, by a coil 2·5 cm. in radius wound on a short paper tube.

1. AIR COLUMN RESONANCES.

Material and Thickness (cm.).	Radii (cm.) and Apical Angle.	Main Frequency (~).
Paper, $2·1 \times 10^{-2}$ . .	12·2, 2·5, 90°	900
" " . .	12·2, 2·5, 60°	650
" " . .	12·2, 2·5, 30°	350
Aluminium, 8×10^{-2} .	19, 2·5, 90°	570
Glass, about $1·65 \times 10^{-1}$	12·7, 1·4, 107°	1100

The resonance is mainly due to the air column within the cone, the source of vibration being the cone itself. (The air column is stopped by the magnet at the coil end, excepting for leakage between the coil and magnet.) The problem differs, therefore, from that of a simple source (of small magnitude compared with the wave-length), situated somewhere in the air column.

The main frequency is given approximately by the formula

$$f = c/2(l + ka),$$

where c is velocity of sound in free air, l is axial length of cone plus part of paper tube, a is radius of open end, and k is an end correction factor varying from 0·6 to 0·8. This result is reminiscent of that of Wheatstone, who found (about 1870) that the fundamental of a small angle cone is *twice* that of a cylinder of equal length. Here the source was a tuning-fork near the mouth, which is different from the present case.

Experiments on the symmetrical modes of conical shells show that they occur at much closer frequency intervals than those of a circular disc.

The most definite results have been obtained with an ordinary glass lamp-shade.

2. GLASS CONE, RADII 12·7 CM., 1·4 CM. $\psi = 107°$, $t = 1{\cdot}65$ MM. (ABOUT). DRIVING COIL 2·5 CM. RADIUS.

Nodal Pattern.	Frequency (~).	Rel. Output (approx.).
One circle . .	4500	1·0
Two circles . .	5700	44
Three circles . .	7500	19

The greatest output corresponds to two nodal circles, and the three peaks are very sharp indeed. With paper cones the peaks are not clearly defined, especially if the mass of the driving coil is small.[1] In fact, over a band of frequencies the output changes but little. The definition increases with the thickness of the material.

These results indicate that the 900-cycle resonances described in a recent paper [1] are mainly due to the air column, whilst those around 2300 cycles pertain to the symmetrical modes. The relative importance of the air column resonances obviously increases with decrease in the mass of the diaphragm, since the amplitude is greater; for example, for paper they are about 0·5 that at 2300 cycles, whilst for the heavy glass cone they are negligible.

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[1] McLachlan and Sowter, *Phil. Mag.*, **12**, 771; 1931.

Propagation of Hertzian Waves in Electronic Gas under the Influence of a Magnetic Field.

WHEN an electromagnetic wave of frequency ν travels through a medium consisting of free electrons ($e/m = 1{\cdot}78 \times 10^{-7}$ e.m.u.) under the influence of a magnetic field $\vec{H}$ of suitable direction and strength ($H = 2\pi m\nu/e$), an irregularity in the propagation of the wave is predicted from the fact that the electrons, under the influence of the field, are caused to move on closed orbits with the same frequency as that of the incident wave, and therefore they are tuned to resonance and absorb a part of the energy of the wave. To this fact may be attributed the irregularity in the propagation of the wave of 214 metres wave-length ($\nu = 1{\cdot}4 \times 10^6$ hertz) travelling in the earth's magnetic field ($H = 0{\cdot}5$ gauss). This irregularity has been predicted by Appleton [1] and found by Taylor [2] in experiments made on reception from stations radiating waves of the same power and of a wave-length between 15 metres and 600 metres.

Since very short continuous waves may be obtained in the laboratory by thermionic valves, it is possible to confirm the phenomenon by direct experiment. I have used 18 cm. waves, produced by an oscillator of Pierret [3] type. As a receiver I have used a short tuned antenna in which a galena rectifier, connected with a sensitive galvanometer, is inserted. The experimental arrangement allows the wave from the oscillator to pass through the anode filament space of a diode placed inside a coil producing the magnetic field; the filament is arranged along the lines of force. Under the combined influence of the magnetic and the electric field, due to anode potential, the anodic space is filled with almost circular electronic orbits lying in planes perpendicular to the lines of force. Special precautions were taken to lessen the remarkable diffraction phenomena and to prevent the diode itself oscillating in the magnetic field.

Lighting the diode causes a distinct diminution in the galvanometer deflexion due to the arriving wave, when the strength of the magnetic field is about 600 gauss. The effect disappears at values of field strength a little greater or smaller than the above mentioned, which corresponds, to a good approximation, to the value (562·7 gauss) theoretically necessary to give to the electrons, rotating in the orbits inside the diode, the frequency of $1{\cdot}6 \times 10^9$ hertz corresponding to a wave-length of 18 cm.

I have found that the observed effect:

(*a*) Is proportional to the number of the absorbing orbits produced inside the diode;

(*b*) Increases linearly with the energy of the incident wave;

(*c*) Accompanies the incident vibration, whatever may be the plane in which this vibration is polarised with reference to the electronic orbits inside the diode.

Experiments are being carried on in order to confirm directly some consequences suggested by the theory on propagation of Hertzian waves in an ionised medium under the influence of a magnetic field.

I am indebted to Prof. Q. Majorana for his interest and advice in connexion with this investigation.

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"A. Righi" Institute of Physics,
University of Bologna, Italy,
Dec. 31.

[1] E. V. Appleton, *Proc. Phys. Soc.*, **37**, 160-230; 1925.
[2] A. H. Taylor, *Proc. Inst. Radio Eng.*, **13**, 677-685; 1925.
[3] E. Pierret, *C.R.*, **186**, 1284, 1601; 1928.

A Method of High-Frequency Stroboscopy.

AN extension of the principle used in the preliminary investigations on the modes of vibration of a quartz crystal, as indicated in a previous note,[1] has enabled the observance of the density changes within the crystal to be carried out stroboscopically.

The apparatus and the general arrangement is as previously described, with the exceptions (*a*) that two crystals are used, and (*b*) that a mechanical interrupter is arranged to intercept the light-beam just in front of the image. The two crystals in the present case are practically identical, their frequencies corresponding to Fig. 1 in the previous note, being approximately 88 kc., and 88 kc. and 42 c. respectively.

By adjusting both crystals in the manner described previously, one in each light-beam, and also by so placing them that they are superimposed optically, it is possible, when both crystals are oscillating, to adjust the speed of the interrupter (to, say, 40 interruptions a second) so that the narrow dark band normally seen changes width cyclically. Similarly, when other modes of vibration are used the periodic variations in density through various parts of the crystal may be readily followed at a convenient speed.

Not only may this method be used successfully for the density changes within the crystal, but it may also be applied to the radiated sound-field; this is effected by the superposition of the two sound-fields in exactly the same manner as the crystals were superimposed above. Again, by correct interruption, it is possible to see the brilliant striations of half-wave spacing progressing at slow speed from the active face of the crystal.

Furthermore, it is not necessary to limit oneself to two crystals exactly similar in dimensions when observing the sound-fields, as a frequency difference of up to 1 kc. may be readily corrected by a suitably designed interrupter: thus two very dissimilar crystals with resonant frequencies of 103·6 kc. and 104·5 kc. respectively have been successfully used as sources of the two sound-fields.

It is clear that the method indicated in the previous note will produce, by means of density variations, the same result as was obtained by Kerr Grant [2] by means of optical rotation, namely, the high-frequency interruption of light. Although the resultant light in this case has not been examined with a rotating mirror, it is obvious from the stroboscopic result obtained that such high-frequency interruption is occurring.

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[1] NATURE, Jan. 9, 1932, p. 59.
[2] NATURE, Oct. 22, 1927, p. 586.

Hyperfine Structure of the Mercury Line λ4916.

IN a recent note,[1] Venkatesachar and Sebaiya have repeated their measurements on the hyperfine structure of the mercury arc line λ4916 and again find a coarse octet structure as before. This contradicts the narrow quintet structure previously reported by me [2] and by Hansen.[3] Recently, two further reports have appeared, namely, that of Murakawa [4] and of Schüler and Keyston.[5] The structures given by the various observers (in $cm.^{-1} \times 10^{-3}$) are shown in the accompanying table, the central component being given the intensity 30 in all cases.

T.	H.	M.	S.K.	V.S.
				612 (3)
128 (2)	121 (15)	125 (3)	125 (2)	364 (6)
62 (3)	66 (9)	60 (3)	66 (3)	124 (9)
0 (30)	0 (30)	0 (30)	0 (30)	0 (30)
55 (4)	56 (12)	55 (7)	56 (5)	83 (6)
98 (1)	98 (6)	96 (1)	99 (1)	240 (3)
				306 (15)
				572 (6)

The sources used by the different observers are as follows:
T.—Tolansky—high frequency electrodeless discharge.
H.—Hansen—water-cooled arc (Lummer lamp).
M.—Murakawa—source unspecified.
S.K.—Schüler and Keyston—hollow cathode discharge.
V.S.—Venkatesachar and Sebaiya—branched arc.

The first four agree extremely well, there being intensity deviations only in Hansen's data.

According to the analysis given by Murakawa and by Schüler and Keyston, only the narrow quintet should be expected. It is very probable that the components 124, 0, 83 of Venkatesachar and Sebaiya are in reality the five components of the other observers, appearing as a triplet when unresolved. It seems quite certain, when the various sources are considered, that the quintet structure is the normal structure of the arc line. The 'branched arc', then, appears to give the normal structure together with five other strong components. If this coarse structure is correct, it can only be due to the source. Such an unusual dependence of fine structure upon source is quite exceptional. Collins [6] found unusual resonance fine structure in λ5461 in mercury, but in this case components were missing, whereas λ4916 appears to give new components in addition to the arc structure. The dependence of the fine structure of λ4916 upon the source employed is worth further investigation.

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Jan. 10.

[1] *Naturwissenschaften*, **19**, 1041; 1931.
[2] *Proc. Roy. Soc.*, A, **130**, 558; 1931.
[3] NATURE, **119**, 237; 1927.
[4] *Sci. Pap. Inst. Phys. Chem. Res.*, **17**, 1; 1931: *Z. Physik.*, **73**, 366; 1931.
[5] *Z. Physik.*, **72**, 423; 1931.
[6] *Phys. Rev.*, **32**, 753; 1928.

Saxifrage Crosses.

DR. F. W. SANSOME [1] questions the assertion made by me [2] that *Saxifraga potternensis* arose from a doubling of the chromosome complement at the semi-heterotype divisions in the F_1 plant of the cross *S. rosacea* × *S. granulata*, and offers the alternative suggestion that the F_1 plant was wholly or in part tetraploid in its somatic tissue.

Collections of cytological material were made in the summer of 1931 from F_1 generation plants, as well as from certain reciprocal and back-crosses. Unfortunately, time does not permit a detailed study of all this very interesting material available as a result of breeding work at the Potterne Biological Station, but sufficient re-examinations of F_1 plants have been made to confirm the opinion first put forward in 1930.

As originally stated, all pollen mother cells studied had the parental chromosome number, with very irregular divisions and marked lagging of univalents on the way to the poles during the heterotype division. There is no doubt about the presence of a certain proportion of non-reduction, either by cancellation of the meiotic division or by the fusion later of homotype plates. The general proportion of healthy pollen grains was in agreement with the number of non-reduction divisions noted in the same flower, and would be, in my opinion, sufficient to permit of a reasonable seed production.

Dr. Sansome's suggested method of origin implies that the behaviour at meiosis and the general fertility (percentage of good pollen and quantity of seed produced) in the flowers of the F_1 generation should be more or less comparable with that of the F_2 plants, as is the case with the examples quoted in his table from the genera *Nicotiana*, *Primula*, and *Solanum*. No evidence to support this contention was found in the material, nor was any part of the plants examined tetraploid in its somatic cells.

In the absence of data regarding the actual seed production of the F_1 plant as compared with the F_2 plant, and of definite evidence showing that all the seed which gave rise to *S. potternensis* came from one (tetraploid) part of the F_1 plant, there does not appear yet to be any good reason why my interpretation should not be feasible.

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[1] NATURE, Jan. 10, 1931.
[2] *J. Genetics*, **23**, pp. 93-121; 1930.

A New Autotrophic Bacterium which Oxidises Ammonia directly to Nitrate and Decomposes Petroleum.

IN connexion with the studies of the senior writer [1] on living micro-organisms in ancient rocks, an attempt was made to determine whether or not old materials other than rocks harbour living micro-organisms. Among such materials studied was petroleum. An attempt to find cellulose-destroying organisms in petroleum by inoculating the latter into a cellulose medium yielded an organism which apparently has no power to decompose cellulose but has an extraordinary physiology. It was isolated from petroleum derived from a well more than 8700 feet deep, owned by the Standard Oil Company of California.

The organism is a coccus or cocco-bacillus, variable in size and somewhat so in shape. It grows very well under strictly autotrophic conditions in an inorganic salt medium with ammonium sulphate or

potassium nitrate as the source of nitrogen. It oxidises ammonia directly to nitrate without passing it through the intermediate step of nitrite formation as do the group of bacteria known as nitrifying bacteria. The nitrate producing power, moreover, is manifest very quickly under such conditions—much more so than is true of the nitrifying bacteria. It is apparently a facultative ærobe. In addition, it possesses the power of completely decomposing petroleum without apparent gas formation aside from the end-product, gaseous carbon dioxide.

We have noticed in the literature two or three cases in which organisms isolated from soil were described as possessing the power to oxidise ammonia directly to nitrate. These reports have never been confirmed, and the other powers attributed to our organism above have not been indicated in such earlier reports. A full account of our investigation with this remarkable organism will be published elsewhere, together with a comparison of our results with those of Kaserer, Söhngen, and others whose work has a bearing on the subject under discussion.

C. B. LIPMAN.
L. GREENBERG.

University of California,
Berkeley, U.S.A., Dec. 23.

[1] *J. Bact.*, vol. 22, No. 3, p. 183 ; Sept. 1931.

Periodic Precipitation.

PROF. J. W. MCBAIN has directed attention [1] to the very beautiful experiments carried out by Dr. H. W. Morse, an account of which was published last year in the *Journal of Physical Chemistry*, together with thirty-two remarkable photomicrographs illustrating various types of periodic precipitation in aqueous solution in the entire absence of gels. As Morse points out, it follows that "no gel . . . is necessary for periodic precipitation". He further states that preliminary measurements indicate that ring formation in water follows the same rule as in gels, namely, that the ratio $\frac{d_3 - d_2}{d_2 - d_1} = k$, where k is a constant ratio of increasing distance between neighbouring rings. The two phenomena thus appear to be due to essentially the same cause.

Morse suggests as an explanation for periodicity of precipitation in aqueous solutions that there is a rapid change at the point where the ring appears, due principally to the diffusion of the reacting substance, resulting first in saturation with the substance of the precipitate ; then in a rapid increase in the degree of supersaturation ; and finally in 'release' of supersaturation, this release taking place in the absence of nuclei of the solid phase.

In 1922, when studying periodic precipitation of silver chromate in gelatin, we suggested [2] that the distance between successive rings is determined by the difference between the rates of diffusion and of precipitation in the gel ; we also showed that protective colloids tend to retard the velocity of such reactions as involve a change of state. Morse's experiments would appear, therefore, to support our view that the main effect of the gel is to retard the 'release' of supersaturation and thus to enhance the relative effect of diffusion, this resulting in an increase in the distance between successive rings, other things being equal, over that in the absence of the gel.

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[1] NATURE, **128**, 1042; Dec. 19, 1931.
[2] *J. Chem. Soc.*, **121**, 472 ; 1922.

Photoreduction of Carbonic Acid, Bicarbonates, and Carbonates to Formaldehyde.

IN these laboratories we have been carrying on experiments on photosynthesis in tropical sunlight for a number of years.[1] We have been able to obtain formaldehyde by the exposure of solutions of carbonic acid and bicarbonates to tropical sunlight in presence of various inorganic and organic photocatalysts.

Now we have been able to reduce carbonic acid, carbonates, and bicarbonates to formaldehyde by means of metallic magnesium and zinc. The yield of formaldehyde in light is considerably greater than that in the dark. Contrary to the observations of Fenton,[2] we could not detect any formic acid either in sunlight or in the dark. It should be pointed out here that Fenton carried on his experiments only in the dark, and obtained formic acid as the main product by the action of an amalgamated magnesium rod on carbonic acid. The chief importance of these experiments consists in the fact that the yield of formaldehyde obtained in our photoreduction experiments is much greater than hitherto obtained by any previous worker. Moreover, we have been able to increase the yield further by the addition of photosensitisers like zinc oxide.

We have found that the photoreduction of these substances can also be effected by ferrous carbonate. These experiments lend considerable support to the view previously announced by us that chlorophyll, besides being an optical sensitiser, also acts as a reducing agent.

From 100 c.c. of a 10 per cent solution of potassium bicarbonate with 1 gram of powdered magnesium in presence of zinc oxide after an exposure of five and a half hours to sunlight, the yield of formaldehyde is 0·0045 gm. No reducing sugar could be detected in these photoreduction experiments with powdered magnesium.

Further work in this direction is in progress.

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Dec. 21.

[1] Dhar and Sanyal, *J. Phys. Chem.*, **29**, 926 ; 1925 ; Gopala Roa and Dhar, *J. Phys. Chem.*, **35**, 1418 ; 1931 ; *ibid*, 1423 ; Dhar, Roa, and Ram, *Trans. Farad. Soc.*, vol. **27**, 554 ; 1931.
[2] Fenton, *J. Chem. Soc.*, **91**, 687 ; 1907.

Helmholtz or Kelvin Cloud Waves.

IT is of some historical interest to notice that the habitual use of the phrase 'Helmholtz Waves' to describe parallel rolls of cloud produced in the transverse direction by a wind in an upper region blowing over stationary air below is only partly justified ; and many students of hydrodynamics are unaware of Kelvin's work in this connexion. It is true that Helmholtz in 1889 [1] worked out the theory of these waves and applied it to clouds. But, as he pointed out in a footnote, the general theory of such waves between two media in relative motion had been given by Kelvin in 1871 [2] ; so while the meteorological application was due to Helmholtz, it was Kelvin who provided the essential hydrodynamical explanation.

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Jan. 19.

[1] *Sitz. Ak. Wiss. z. Berlin*, 761-780 ; or *Wiss. Abh.*, **3**, pp. 309-332.
[2] *Phil. Mag.*, **42**, pp. 368-370 ; "Math. and Phys. Papers", **4**, pp. 76-79.

Research Items.

Ethnic Pathology.—Some interesting personal observations are recorded by Prof. V. Suk in the course of a discussion of possible lines of research in ethnic pathology in *Pub.* No. 141 of the Faculty of Science, of the Masaryk University, Brno. In dealing with the incidence of tuberculosis among the Eskimo of the north coast of Labrador, he states that in examining about a hundred children, pure and mixed, the cutaneous tuberculin test gave 9·8 per cent positive reactions among Eskimo children of pure blood (51 cases) and 56·2 per cent among mixed breeds (32 cases), that is, an overwhelming preponderance of infection among those who live in an Eskimo climate on European food such as tinned meat, tinned margarine and bad flour, as opposed to the Eskimo diet of raw seal blood, meat, and entrails. Yet on the other hand, tuberculosis is very fatal to the Eskimos when once they are attacked. They succumb in a few weeks. Among them it is a new disease, whereas among Europeans it is of long standing, progress of the disease is normally slow, and evidently partial immunity has been established. Prof. Suk has also some interesting observations to make on the subject of cretinism. He finds that in cretinism characteristic racial features may be blurred beyond recognition and 'cosmopolitan' cretinous features established. Thus one case in Carpathian Ruthenia he found, to his surprise, was not a Ruthenian but a Jewess, while in other cases in which several cretins occurred in one family, there were different degrees of development in which particular racial features were blurred to a varied extent. In discussing other lines of investigation, Prof. Suk points out the need for inquiry not only among primitive peoples but also among the civilised. Relatively little precise and well documented evidence is available for the incidence of disease in nordic, alpine, and Mediterranean races.

The Flight-speed of British Birds.—Further data supplementing the records by T. H. Harrisson (NATURE, Oct. 3, 1931, p. 586) have been published (*Brit. Birds*, Jan.). The records were made by B. B. Roberts from a motor car with reliable speedometers, when there was no appreciable wind and when at least sixty yards and usually more than a hundred yards had been travelled parallel to the birds' course. The fastest of the times was 51 miles per hour recorded for a wood-pigeon, chased up from its average of 47 m.p.h., which was exactly the speed of a red grouse; the slowest, a striking record, the 15 m.p.h. of a common tern. On the whole, wherever they can be compared, the readings of the two independent observers are very similar. According to one, the rook ranges from 24 to 35 m.p.h., according to the other, 27 to 35 m.p.h.; the starling, 25 to 30·5 and 28 to 41; the chaffinch, 25 to 29 and 27 to 35; or of the more rapid fliers, the wood-pigeon, 27 to 51 and 23 to 47. The one migration record of this series, that of a flock of lapwings, indicates, as the former series suggested, that migration flight is distinctly more rapid than normal flight; for the lapwing's average was only 28-33 m.p.h., whereas the flock travelled at 41 m.p.h. The result of the records as a whole is to confirm the impression that the earlier notions about the speed of bird flight were much exaggerated.

Regulation of the Blood in Fishes.—In fresh water a fish, because of the salt content of its blood, is osmotically superior to its environment, so that it excretes a solution more dilute than its blood—hypotonic excretion. In salt water the condition is reversed and the fish must get rid of a solution more concentrated than its blood—hypertonic excretion (Homer W. Smith, *Copeia*, Dec. 1931, p. 147). The vertebrate kidney at any stage lower than mammals is incapable of excreting a hypertonic urine, and, amongst fishes, teleosts and elasmobranchs have solved the problem in two different ways. The teleost 'drinks' sea water, and absorbs the water and most of the salts from the gut. The salts it excretes for the most part extrarenally (by the gills), thus leaving water osmotically free for the formation of urine in compliance with the osmotic limitations of its kidneys. The elasmobranch does not require to drink sea water, since it conserves urea by reabsorbing it from the urine, so that a natural uremia results, the urea concentration of the blood rising to as much as 2·5 per cent. The raising of the osmotic pressure of the blood above that of sea water means that water is directly absorbed, probably through the gill membranes, while salts are partially or wholly excluded. So in the sea the teleost retains for itself the relative balance with its environment which is characteristic of fish life in fresh waters.

Composition of the Body Fluid of Animals.—C. F. A. Pantin has discussed (*Biol. Rev.*, vol. 6, pp. 459-481; 1931) not only the origin of the body fluids in animals, their approximate similarity in composition and relation to sea water, but also the mechanism whereby in some organisms the composition of the body fluid may be maintained, though quite different from that of the external solution. It is shown that there are all gradations, from the simplest case, in which the body fluid closely resembles the external solution (sea water) both with regard to total osmotic concentration and to the relative proportion of the salts, to the more complex, in which, not only does the composition deviate from that of sea water (particularly in a tendency to increased potassium and decreased magnesium and sulphate concentrations), but also the total osmotic concentration no longer equals that of the surrounding medium and an increased osmotic independence of the environment is obtained. Both the osmotic gradients and the ionic concentration gradients are discussed and interpreted as actively maintained by a steady state in which work is done, and are not regarded as determined by equilibrium conditions.

Larvæ of Leaf-mining Beetles.—In the course of his studies "On the Structure of Larvæ of Hispine Beetles" (*Proc. Zool. Soc.*, London, part 3, 1931, pp. 1137-1162), Mr. S. Maulik directs attention to the fact that the conception of an adult insect as being the end-stage or completion of a species is pure presumption. He looks upon the adult as but one stage in a continuous cycle. "While", he says, "the adult stage is being formed, the next stage is also taking form, and so the observed sequence of events goes on". The view that the "adult stage is the end result to which the organism is attaining" has directed attention away from the study of larval characters. Nevertheless, he points out that the larvæ described in this paper are generally more adaptable, and therefore their characters more plastic, so that in doubtful cases of relationship more reliance should be placed on adult characters. This is the generally accepted view in other groups of insects, but Mr. Maulik thinks it should not be accepted in any group until it has been proved in that group also. Altogether seven species of larvæ are described in detail, all of them beautifully figured by Mr. Terzi;

in two of them the complete life history is worked out. The special adaptation of the spiracular organs of these larvæ to the leaf-mining habit is particularly interesting.

Stone Cells of Pear Fruits.—Stone cells were described by Nehemiah Grew so early as 1682, but their practical significance from the point of view of fruit quality has only just been studied by J. W. Crist and L. P. Batjer (*Tech. Bull.* No. 113, Michigan State College Agricultural Experiment Station. "The Stone Cells of Pear Fruits, especially the Kieffer Pear", pp. 55, 1931). The authors have tried the effect of various cultural treatments, propagation influences, size and vigour of tree, and different times and methods of ripening on the number of stone cells present in the pear fruit. They have been unable to reduce the number of stone cells by any such treatments, and conclude that improvement of the Kieffer pear must be through genetics. They publish some striking photographs showing varietal differences in stone cell content, and have made chemical studies of the fruits. There is a difference in the seasonal hydrogen ion concentration of the tissue of Kieffer and of Bartlett pears which seems to bear some relation to the stone cell content. The former is relatively more acid than the latter in May, but towards the end of June the position is reversed. A similar reversal in the number of stone cells is also observed, Bartlett having more than Kieffer in May and less in June.

Recent Scottish Earthquakes.—Dr. G. W. Tyrrell has published a very valuable account of four earthquakes felt in Scotland in 1925 and 1927 (*Trans. Glasgow Geol. Soc.*, vol. 19, pp. 1-41; 1931). The Oban earthquake of Dec. 23, 1925, is of great interest from its probable connexion with the Great Glen fault, along which most of the strongest earthquakes in the country originate. This shock was of intensity 6 (Rossi-Forel scale). The boundary of the disturbed area cannot be traced with exactness. Excluding isolated records, it appears to have contained about four thousand square miles, though it may have been four times as much. The most interesting of the other earthquakes was the North Sea earthquake of Jan. 24, 1927, one of the strongest ever felt in Scotland. The disturbed area included practically the whole of that country with the exception of the Western Islands. Within a small district near Peterhead the intensity was 7. The shock was also felt at Warkworth in Northumberland, and over a large district in southern Norway. The epicentre, as determined from seismographic records by Dr. N. H. Kolderup, lay in lat. 59° N., long. 5° E., that is, under the North Sea not far from the coast of Norway, between Haugesund and Stavanger. The focus is thus asymmetrical with reference to the isoseismal lines, and this raises the question whether there may not have been a second focus nearer the Scottish coast, for the shock in Great Britain was distinctly double.

Oilfields of Zante.—Zante is the southernmost of the Ionian Islands, and its association with petroleum goes back a long way in history. Both Pliny and Herodotus have referred in their writings to the 'pitch' of the island, and local tradition assigns the ancient well of Herodotus to this place. Occurrences of oil in the island have been described by Redwood, and Dr. A. Wade gave the Institution of Petroleum Technologists an interesting account of its geology and ancient oilfields on Dec. 8 last. The island may broadly be regarded as a remnant of a rectangular block of resistant Cretaceous Eocene limestone orientated north-west–south-east, tilted slightly to the north-east, overlain by Miocene and Pliocene sediments. The Miocene deposits include gypsiferous deposits with associated clays and bituminous marls; there are also nummulitic limestones and bituminous limestones of Eocene age. The author leans to the view that the oil originated in the Miocene series in which it occurs, but he also points out that there may be, by analogy with the bituminous limestones of Cretaceous-Eocene age in the Grecian archipelago, deeper and totally independent oil-bearing strata in the underlying rocks of that age in the island. Actually the so-called 'pitch' of Zante is a very heavy crude oil, and Herodotus's 'pitch' well at Keri Marsh was evidently a seepage of this material. The well is a brackish water spring carrying oil and inflammable gas; stimulated by the latter, several unsuccessful attempts have in the past been made to obtain the oil in commercial quantity, failure being due, according to the author, to lack of knowledge and inexperience on the part of the early operators. Results of physical examinations of two samples indicate that the oil is of asphaltic base, specific gravity 1·010-1·0046, about 1 per cent petrol, 14 per cent kerosene, 30-40 per cent lubricating oil, and 40-50 per cent asphalt; there is apparently some 6 per cent of sulphur.

Aerial Phototriangulation.—One of the difficulties in measuring the arc of meridian which passes through the Balkan peninsula and eastern Africa is to bridge the gap afforded by the Mediterranean. The chief problem lies between Crete and Egypt, a distance of about two hundred miles at least. The heights on the opposite sites, despite the considerable altitudes in Crete, are not sufficiently great to allow sights to be taken across the sea. An ingenious method is suggested by Prof. D. Lampadarios (*C. R. Acad. Athènes*, April 6, 1931). He suggests the use of three known points in Crete and another three in Africa. From these points brilliant lights would be shown and recorded simultaneously on one plate exposed by an aeroplane roughly midway between the two coasts. This would enable six horizontal angles to be fixed from the developed plate. In fact, the aeroplane would thus serve as an intermediate station between Crete and Africa. Prof. Lampadarios explains in his paper the apparatus required and the necessary precautions to be taken.

Measurement of High Temperatures.—The accuracy and reproducibility of the high temperature scales in use in various laboratories appear very clearly in an account of an intercomparison of scales given by Dr. W. E. Forsythe, of the Lamp Development Laboratory of the American General Electric Co., in the second September issue of the *Physical Review*. A number of tungsten lamps were carefully aged and calibrated at Nela Park, and were then sent to the Physikalisch-Technische Reichsanstalt in Berlin, Philips' lamp works in Eindhoven, the Laboratoire Central in Paris, and the Osram works in Berlin. In each place the temperatures of the lamps were measured for specified currents with a disappearing filament optical pyrometer, using red glass as the monochromatic screen. After making certain necessary alterations to the temperatures recorded directly, excellent agreement was found, the maximum difference being only a few degrees for any part of the range between 1400° K and 2700° K. Similar concordance was found with lamps made at Berlin and at Eindhoven. A typical case is that of the lamp F-117-C, made at Nela Park, which when taking a current of 16 amp. was estimated to give a temperature of 2041° at the place of origin in September 1924, 2039° when tested at the Berlin Osram works in June 1925, and 2043° when again returned to Nela Park in

January 1926. The actual discrepancies, small as they are, are believed to be due partly to a lack of constancy of the lamps.

Absolute Measurement of Voltage.—In connexion with astronomy, electrostatics, hydrodynamics, and mathematics, the properties of the ellipsoid have been studied very assiduously for the last two hundred years. Examination questions on them must have been set hundreds of thousands of times. It is interesting, therefore, to learn from Prof. W. M. Thornton and W. G. Thompson's paper to the Institution of Electrical Engineers on Jan. 21 that these properties are utilised in their new method of measuring voltages up to 200,000 and of finding the ratio of the electromagnetic to the electrostatic unit of charge. At present the most practical method of measuring very high voltages is to find the maximum sparking length at which discharge takes place at this voltage between spherical electrodes. Knowing the radii of the electrodes, the temperature, and the atmospheric pressure, the voltage can then be computed or found from tables. In the authors' method, a small metallic ellipsoid is suspended by an insulating fibre between vertical circular pole plates. When these plates are electrified by the given voltage, its value can be deduced either by a deflexion or an oscillation method. The values found for the voltage in this way agree very closely with the values found by sphere-gap methods. A drawback to the latter method is that several observations have to be made and a mean taken. The accuracy claimed by either method is 0·3 per cent. The authors also made an experiment with the ellipsoid method to measure the ratio of the units, which they give as $2{\cdot}9996 \times 10^{10}$. The mean of the best previous methods is given by Abraham as $3{\cdot}0001 \times 10^{10}$ and by Sir Frank Smith as $2{\cdot}998 \times 10^{10}$. In making the determination, they assume the values found for the voltages by the spark gap methods.

Temperature of Molecules in a Discharge Tube.—A recent paper by C. W. W. Read (*Proc. Roy. Soc.*, Jan.) contains an account of an investigation of the distribution of intensity in some bands (λ6100—λ6500) of the molecular spectrum of helium. In addition to being an important contribution to the data of band spectra, this is also of interest from the fact that it yields a measure of the temperature of the particular group of molecules involved. The intensities were found by the now well-established method of photographic spectrophotometry, with the aid of the new Cambridge form of densitometer, and were shown to conform to theory if the populations of the various energy levels were controlled by a Boltzmann factor, the temperature equivalent of which was 785° abs. This is in accord with temperatures of the helium molecules found from the width of the lines in the spectrum, and is, as might be expected, intermediate between the probable temperature of the bulk of the gas in the tube and the electron temperatures which have been found in other discharge tubes by Langmuir's probe method, although it is much nearer to the former.

Astronomical Topics.

Parallax of Eros.—Dr. H. Spencer Jones has published a paper on methods of reduction of Eros observations (*Mon. Not. Roy. Ast. Soc.*, Nov.). He notes that to obtain the necessary accuracy the second order terms in differential refraction must be applied; also if there are several images of the planet on a plate, the parallax factors must be computed separately for each image. Also, since the mass of the moon is to be found as well as the solar parallax, all plates should be measured both in Right Ascension and Declination. He also gives the formulæ for aberration, and asks that these should be applied in the manner stated, for the sake of uniformity. He also asks that observers should note which of the secondary stars on the list have been used in their measures; stars that have not been used anywhere need not be observed further, which will save time.

Selenographical Tables and Co-ordinates.—Prof. T. Banachiewicz, director of the Cracow Observatory, has published these tables and co-ordinates as *Cracow Reprint* No. 2. He notes that there is now a great increase in the number of occultations of stars by the moon that are observed: this is in response to a request from Prof. E. W. Brown; the accuracy of the observations is increased by the distribution of wireless time-signals. The present work directs attention to an improvement that can be made in the reduction of the observations, by taking into account the irregularities on the moon's surface. Many points on it are above the mean level by a second of arc; others are as much below this level.

The tables in this little book give the means of calculating the selenographical co-ordinates of the point on the moon where the occultation takes place. Studies of the contours of the moon in different librations have been made, and give some idea of the height of the particular point of the limb.

The method of reduction advocated by the author is according to the Cracovian system, which he introduced some years ago; it is an abridged method of indicating sums of products, analogous to the determinant notation. It is explained in the introduction.

The tables are based on Brown's lunar tables, Newcomb's formula for the obliquity of the ecliptic, and Hayn's value of the inclination of the moon's equator, which is 1° 32′ 6″.

A New Canon of Ancient Solar Eclipses.—An important work by R. Hiller and P. V. Neugebauer has been published as an Erganzungshefte (Band 8, No. 4) to *Astr. Nach.* (6 gold marks). It is a special canon of eclipses visible in western Asia and in Egypt between 4200 B.C. and 900 B.C. There is an overlap of three centuries with Oppolzer's canon; this was advisable, since improved determinations of the secular accelerations, both in longitude and in other elements, have been made since that canon was published; special acknowledgment is made to the late C. Schoch for his useful contributions to the study of the moon's motions. There are three separate tables; the most important one gives the elements of 1034 eclipses, also the magnitudes and times of greatest phase at six selected stations: Assur (near Nineveh), Babylon, Ur, Boghaskoi (in Asia Minor), Memphis, and Thebes. The second table gives more approximate details of 440 smaller eclipses. The third gives the dates of 350 small eclipses that were not examined in great detail. Finally there is a series of maps, one for each period of fifty years, covering the region 23° to 52° east longitude, and 20° to 45° north latitude; these show the central lines of all total and annular eclipses that crossed the region. The eclipse of −1062 July 31 is given as total at Ur, magnitude 11·2 digits at Babylon. It would seem that a similar canon for China would be useful: several eclipse records have come down to us, notably the famous one of Ho and Hi. The authors promise a canon of lunar eclipses in the near future.

Progress in Gas and Electric Welding.

THE art of welding iron has been practised for thousands of years, and specimens of ancient welded work, such as chains, are to be found in many museums. Such work was, of necessity, done in the smithy, with a fire, anvil, and hammer. To-day, thanks to the use of gas and electricity, welding can be done wherever it is required, and even bridges, buildings, and ships can be welded instead of riveted. The progress in the art has indeed been remarkable, and only last March the American Society for Testing Materials had a symposium on welding.

In Great Britain the subject is the special study of the Institution of Welding Engineers, at a meeting of which, held at Birmingham on Nov. 13, a paper was read on "Boilerworks' Practice", by Messrs. E. W. Thompson and A. Jeavons. The flues and furnaces of Lancashire and Cornish boilers were among the first parts to be welded and much work of a similar nature is now done by the aid of water-gas welding machines. An interesting development on the Continent and in the United States is the use of welded drums for water-tube boilers. Such drums cannot, at present, be used in Great Britain owing to the regulations of the insurance companies. The cost of a riveted drum may be £40-£50 a ton, a forged drum £60-£150 a ton according to size, while a welded drum might cost less than £40 a ton. If electric welding is used for pressure vessels a special X-ray radiograph machine is desirable, so that any slag inclusions, gas spots, or incomplete penetration can be detected.

Like so many other industries, that of electric welding traces its history back to Faraday's discoveries, and in the first number of *Electric Welding*, the new house journal of Messrs. The Quasi-Arc Company Limited, is an article on the Faraday Centenary by Mr. H. M. Sayers. Much of the issue, however, is devoted to the use of electric welding for ships. Descriptions are given of the electrically welded lighter *AC. 1320*, built for the Inland Waterways Section of the Royal Engineers in 1918, the *Fullagar*, now the *Shean*, the first completely welded sea-going ship, and two partly welded Japanese vessels. The *Fullagar* was built by Messrs. Cammell Laird and Co. in 1920. During her service she has been aground several times, but is still in good condition. She is motor driven and is now engaged in the cement trade in British Columbia.

Another aspect of the subject is presented by the pamphlet "Welding of Structures", by Mr. V. A. Prince, published by the Association of Engineering and Shipbuilding Draughtsmen. Welding, says Mr. Prince, ranks eighth on the list of industries of the United States. As usual, when new processes are applied to production work, it is difficult for the draughtsman to obtain trustworthy data. Mr. Prince's pamphlet contains notes on the methods of electric welding, the plant required, the training of welders, types of welds, and on factors of safety. He then gives designs for a crane girder, a roof truss, and a welded stanchion base. Tests made by the United States Bureau of Standards show that welded stanchion bases are practically as strong as the heaviest types of riveted bases. Welded work will often show a considerable saving in weight and cost over riveted work. The various gas welding methods are: water-gas, oxy-acetylene, oxy-coal gas, oxy-hydrogen, and a combined gas and electrical method known as the atomic hydrogen process.

Much research is being carried out in Great Britain, America, Germany, Switzerland, and elsewhere, and methods are becoming standardised and rules formulated. One of the great advantages of using welding for buildings being erected in cities is the absence of noise, such as accompanies riveting.

Lecture Experiments on the Migration of Ions and the Passivity of Iron.

THE following details of demonstrations successfully made throughout the recent Faraday Exhibition at the Albert Hall may be of use to those who wish to show the migration of ions and the periodic passivity of iron on the lecture table.

Migration of Ions.

The migration of ions under the influence of an electric current is generally demonstrated by passing a current through an agar-agar gel having in it an electrolyte with a coloured ion, such as copper sulphate, and contained in a glass tube bent into the form of a U. The drawback of this method is that, in order to obtain a good colour, a considerable quantity of electrolyte is necessary, and this increases the conductivity of the gel to such an extent that when more than a small voltage is applied the current produces sufficient heat to melt or in some cases even to boil the gel. Now, as the rate of migration of the ions is proportional to the potential gradient, this small voltage will cause only a slow movement of the coloured boundary, and it is generally found that at least an hour is necessary for any change in position to be observed.

To overcome this difficulty and to make the demonstration more suitable for a lecture experiment, the conditions must be somewhat modified. The electrolyte used is a very small quantity of sodium sulphate, and to render the moving boundary visible an acid alkali indicator, bromo-cresol purple, is also added. The U-tube is made in the form of a lantern slide, so that the image of the moving boundary can be projected on to a screen. The slide is made by cutting a lantern plate along the dotted lines as shown in Fig. 1 and removing the shaded portions. This plate is then cemented between two other plates, using Canada balsam or Coates's cement, thus forming a U-tube in which each limb is $\frac{1}{4}$ in. wide and the limbs are $\frac{1}{2}$ in. apart. The thickness of the U-tube is, of course, the thickness of the glass plate, about 1/20 in. It is advantageous to cement another plate to one side of the slide, inserting two narrow strips of glass between this plate and the slide. This provides an air space between the actual slide and the lamp of the lantern, thus reducing the heating effect from this source.

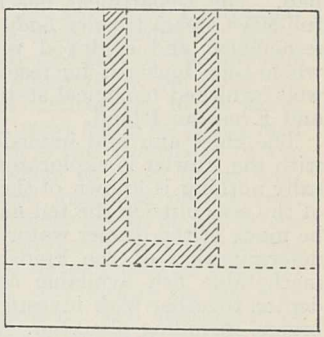

FIG. 1.

The U-tube is nearly filled with the following solution: Water 100 ml., agar-agar 0·8-1·0 gm., sodium sulphate 0·1 gm. approximately, and sufficient bromo-cresol purple solution to give a good red colour.

When the gel has set, a few drops of very dilute sodium sulphate solution are placed on top of it in each limb and a potential of 200 volts d.c. is applied across the U-tube, connexion being made by means of platinum wires dipping into the sodium sulphate solution. A purple colour will then move down one limb and a yellow colour down the other, and this movement can be readily observed on the screen, expecially if the screen has horizontal lines ruled across it. When the images of the moving boundaries have moved out of the field of view, the current can be reversed so that a yellow colour will move down one limb, obliterating the purple, while the yellow in the other limb will be obliterated by purple. J. L. BUCHAN.

PERIODIC PASSIVITY OF IRON.

A convenient and effective method for the demonstration of the periodic electrochemical passivity of iron is shown diagrammatically in Fig. 2. *B* is a two-volt accumulator; *A* an ammeter reading up to 3 amp.; *V* a voltmeter reading up to 3 volts; *R* a variable resistance of 16 ohms; *D* an electro-magnetic relay having two sets of contacts, *a*, *a*, and *b*, *b*, such that one of two circuits is completed according to the position of the moving arm. The coils of the relay take approximately 0·3 amp. *C*, the cell, is a 6-oz. bottle fitted with an ebonite top carrying two brass rods and having two vent holes. A platinum gauze is used for the cathode and an iron plate ($1\frac{1}{4}$ in. × $\frac{1}{2}$ in. × $\frac{1}{8}$ in.) for the anode, these being attached to the brass rods with set screws. 85 ml. of sulphuric acid (35 ml. conc. H_2SO_4 to 100 ml. water) are placed in the bottle; the anode is then half immersed. The entire cell is maintained at a temperature of 45°–50° C. in a water bath.

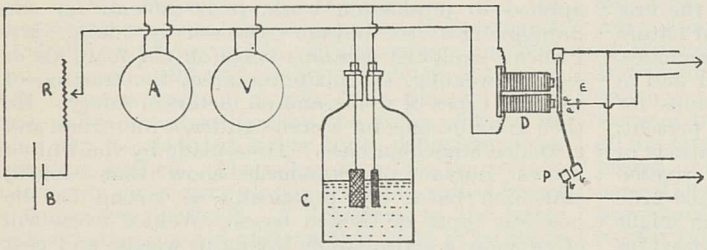

FIG. 2.

Periodicity may be started as follows:

The iron anode is dipped in nitric acid (1 : 2) and allowed to dissolve freely for 10 seconds. It is then removed from the acid, washed, dried, and attached to its appropriate brass rod. The circuit having been completed, the resistance is adjusted to a point when on immersion of the electrodes in the sulphuric acid the current attains a value of 2·2 amp. This is obtained as soon as the acid has overcome the passive film due to the treatment with nitric acid. Thereupon the electrodes are removed from the warm sulphuric acid and immersed in cold saturated solution of ferrous sulphate rendered decidedly acid with sulphuric acid with the current still running; the passive condition now appears. This state is maintained for 1 or 2 minutes, and finally the electrodes are returned to the warm cell. Periodicity will begin and, under the existing conditions, will be maintained until the anode is dissolved.

An adjusting screw *E* attached to the moving arm of the relay by a spring is provided to overcome the magnetic effect produced by the coils when the anode is in the active condition; that is to say, when the amperage is 2·2 and the voltage 0·7. Further, the contact pillar *P* must be so placed that when the amperage drops to 0·3 and the voltage rises to 1·8 (the passive state) the moving arm does not touch the magnets.

In either of the conditions, passivity or activity, one of the relay circuits is completed, whereby it is possible to light up coloured lamps in an alternating manner. J. G. N. GASKIN.

Madras Fisheries.*

IN the Administrative Report of the Madras Fisheries Department for the year ending June 30, 1930, the director, Dr. Sundara Raj, records a general improvement in almost every quarter, especially with regard to research work, in spite of the fact that the fishing season on the west coast was exceptionally bad. The Department has now at its disposal the full-sized steam trawler *Lady Goschen*, which has been remodelled and equipped with a laboratory and a whole-time biologist for research on board, and two well-furnished biological stations on shore at Calicut and Krusadai Island.

The chief aim and immediate work in connexion with the trawler is exploratory, as at present practically nothing is known of the contents and character of the seas outside the ten-mile limit. A survey will be made of the deeper water fishing grounds and the determination of the kinds and quantities of the marketable fish available at different seasons and depths together with investigations into the invertebrates, including plankton. Such research naturally involves the use of the best-known methods of capture, and drift and seine nets were on order with a motor boat for working the Danish seine net. At first the systematic survey will be limited to the offshore belt to 100 fathoms, up to which the local fishermen with slightly improved boats and nets may be persuaded to extend their operations. The systematic survey of the deep-sea fishing grounds by the *Lady Goschen* began in 1927. During the period between Oct. 31, 1927, and March 10, 1928, she explored the extensive trawling ground within the 100-fathom line which lies to the west, south, and east of Cape Comorin, known as the Cape Comorin Bank. Details of the hauls are given in three appendices to Report No. 3, including the most important fishes and invertebrates, and three charts of the area investigated.

Researches on the Madras oyster show that it flourishes in low salinities and that the freshets in rivers, instead of damaging oyster beds as was formerly supposed, apparently provide the most favourable conditions for spawning and development of the local oyster. A field study of the extensive natural beds at Gokulapalli showed three zones; the first, which is dry for part of the summer except for a few hours during high tide, and on which are only small and yearling oysters and where much spat falls; the second, washed frequently by daily tides and exposed for much less time, where only small oysters grow as their feeding hours are limited, the size increasing with the depth, but where a good deal of spat also falls; lastly, a third zone well below the low-tide level where the oysters are large and the spat scarcely settles at all. It is

* Madras Fisheries Department. Administrative Report for the Year 1929–30 by Dr. B. Sundara Raj, Director of Fisheries. Report No. 1 of 1931. *Madras Fisheries Bulletin*, Vol. 25; 1931. Report on a Systematic Survey of Deep-sea Fishing Grounds by S.T. *Lady Goschen*, 1927–28. Report No. 3 of 1929, *Madras Fisheries Bulletin*, Vol. 23; 1931.

suggested that the spat from the first zone should be collected and transferred to the second zone in spring and finally to the third zone in summer, and that the oysters should be collected and marketed from zone three.

Experiments in deep-water tank fishing at Mopad shows that there is an increase in size in the fish. The tank had been stocked with fingerlings of local carp, including catla, which is the quickest growing and attains a large size. Catla are probably bottom dwellers as they are only caught with the Ennur nets and cast nets which descend to the bottom. Investigations into the growth of the catla show that fish 4-9 in. long may grow to 13-17 in. in four months and that they attain a length of 13-14 in. in a year and 23 in. in two years, weighing 6 lb. after the first year and 15 lb. after two years. Thus it is very suitable for rural pond culture. Several pieces of water have been stocked with these and other fish.

Part of the Report relates to various problems in marine, estuarine, and inland fisheries, including scientific and technical research, administration, pearl and chank fisheries, socio-economic work and publications: part 2 relates to finance: part 3 to the staff. Appendices deal with statistics.

The University of Edinburgh.

EXTENSION OF DEPARTMENTS OF GEOLOGY AND ENGINEERING.

ON Jan. 28, the Prime Minister opened two recently completed extensions of the University of Edinburgh—the Grant Institute of Geology and the Sanderson Laboratories of Engineering—erected on the West Mains site, on the southern edge of the city, adjacent to the Departments of Chemistry, Zoology, and Animal Genetics, all of which are post-War extensions. The new Institute of Geology has been provided by Sir Alexander Grant, who gave £50,000 for this purpose; the new Engineering Laboratories have been built from a bequest of £50,000 by Mr. James Sanderson of Galashiels and a gift of £2000 by the Carnegie Trust. The chancellor of the University, Sir James M. Barrie, presided at each of the opening ceremonies, and his brief introductory remarks were characterised by his usual charm and humour. Among those present at the ceremony in the Geology Department were the Lord Provost of Edinburgh, Sir Thomas Holland, the Right Hon. Sir A. Sinclair (Secretary of State for Scotland), Lord Elgin, Sir Alexander and Lady Grant, and a number of well-known geologists, including Sir John Flett, Profs. W. W. Watts, W. T. Gordon, O. T. Jones, E. B. Bailey, and P. G. H. Boswell.

In opening the building, the Prime Minister spoke in a manner which revealed his own interest in geology and his pleasure in recalling his study of "Vestiges of Creation", and of Hugh Miller's "Footprints of the Creator" and the "Testimony of the Rocks", and of "the wonderful Saturdays spent in trying to discover in the Tynet Burn, where Hugh Miller and others worked, those nodules which split to reveal their secrets.... That extraordinarily characteristically Scottish controversy on the six days of creation has contributed more than any other controversy to stimulating the general intellectual curiosity of the generation to which I belong and of the generation immediately preceding. . . . Those who enter these walls now will perhaps not find in the study of geology such an invigorating background."

"I am not at all sure", Mr. MacDonald continued, "that scientific investigation can be adequately carried out, can receive the stimulus required for its continued progress, unless those who are experts manage somehow or other to keep in contact with the young men of the street and the market-place. In a conversation I had not long ago with Einstein, I accused him of destroying elementary science. He defended himself with the vigour you can imagine. I laid down the proposition that scientific knowledge must not be so far ahead of common interest that it becomes isolated from the ordinary intellectual life and curiosity of its generation. That is a problem for you to solve. Surely, dull must be the human mind when it ceases to take an interest in the world, its structure, its evolution, the forces that have made it and that may in time destroy it. When we cease to take an interest in that, when we cease to feel the inspiration of that which is on the border-line of the known and the unknown, the knowable and the unknowable, then I think everything that characterises human intelligence will have gone out of it."

Prof. T. J. Jehu expressed the thanks of the University to the Prime Minister and to Sir Alexander Grant.

A similarly distinguished gathering which assembled in the Engineering Department included also representatives of the Sanderson Trustees, Sir Murdoch MacDonald, representing the Institution of Civil Engineers, and Prof. J. D. Cormack, the University of Glasgow. The Prime Minister, in opening the Department, referred to the evolution in the meaning of the term engineering—once purely a military process but now become mainly a civil process—a point which he will carry with him to Geneva. He observed how the University of Edinburgh is equipping itself for the future—a future of skill, of adaptation of the powers of scientific discovery to commercial operations upon the success of which and the international free flow of which depend the well-being and the wealth of every individual nation on the face of the earth. "You are not going to establish", he said, "the greatness of a State or the greatness of a people on material achievements alone. The more we advance in our engineering achievements the more must we be careful of the soul and the spirit of things. Edinburgh turned into a factory only would not be the Edinburgh that inspired us all and made us proud that it is our capital city. Nor must the city be a dead museum. The ghosts of the past must never be banished from the streets of Edinburgh. But while preserving that, while planning our Edinburgh that these ghosts are not laid by the efficient brutalities of up-to-date materialism, we must see that our Edinburgh in its institutions, in its work, above all in its University, must equip its young men and its young women with a full knowledge of the past and yet able and efficient to make future contributions to the glory and greatness of our city. Brains, knowledge, and capacity are to be put at the disposal of what I am convinced is a developing nation. In these days the development of a nation and its prosperity depend very largely on the way that it uses mechanical power. The adaptation of driving power to new forms of material, the capacity to apply scientific discovery, are the lines upon which this nation is going to move out of the past into the future. All things pass away, everything becomes new, and that text cannot be better applied to anything than to the evolution of power to transport."

Sir Thomas Hudson Beare offered to the Prime Minister and to the Sanderson Trustees the thanks of the University.

Senility in Plants.

IT is a very old subject of controversy whether a vegetatively propagated 'clone' can be maintained in cultivation indefinitely or whether, in the course of time, quite apart from the incidence of disease, the individuals of the clone would 'degenerate' because of their increasing age. It is true that time after time a new piece is separated, by some recognised horticultural method, and started into growth anew in some fresh location, but it is argued that such a new start does not compare with the new start made by the plant which emerges from the seed.

Any comparison is difficult, of course, because the seed results from fertilisation, and in this case the new individual is inevitably a new beginning, a fresh combination genetically; but it is still not clear that this new piece, which forms a fresh link in the series in the vegetatively propagated clone, is not just as vigorous and fresh in its growth as any average seedling of the same stock, and certainly there is still wanting definite evidence that such new individuals ultimately prove 'senile' because of the long period of time since this vegetatively propagated material emerged from a fertilised egg.

'Degeneracy' in the potato has now been traced in many cases to the cumulative effects of a transmissible virus disease, handed on with the new piece, in the process of vegetative propagation, so that its effect in successive vegetatively propagated generations begins to be exerted earlier and with more disastrous results. In many such cases, now that the etiology of the virus is better understood, it has been possible to isolate from amongst such degenerate strains healthy plants, free from virus, which seem as vigorous and productive as ever.

Nevertheless, the doctrine of senility still has advocates. A very clear and valuable summary of the literature in this controversial field is given by A. P. C. Bijhouwer, with a comprehensive bibliography, in the *Journal of Pomology and Horticultural Science*, vol. 9, June 1931; one noticeable omission, however, is the lack of reference to the work of Dr. A. B. Stout, of the New York Botanic Garden.

University and Educational Intelligence.

CAMBRIDGE.—Dr. C. E. Wynn-Williams, of Trinity College, has been elected to a moiety of the Clerk Maxwell scholarship vacated by W. H. Watson.

Sir F. Gowland Hopkins has been granted leave of absence for such one term as the General Board may approve in each academical year in which he holds the office of president of the Royal Society.

NOTICE is given by the Royal Society that applications for the Government Grant for Scientific Investigations must be made upon forms, obtainable from the Clerk to the Government Grant Committee, Royal Society, Burlington House, London, W.1, and returned by, at latest, March 31.

THE eighth annual Report of the Ella Sachs Platz Foundation for the advancement of scientific investigation has recently been published. During 1931 twenty-six grants were made, nineteen of which were outside the United States. At present, researches in scientific subjects with a bearing on problems in medicine and surgery are favoured. Applications for grants for 1932 should be sent to Dr. Joseph C. Aub, Collis P. Huntington Memorial Hospital, 695 Huntington Avenue, Boston, Mass., before May 1.

AN American International Fellowship, value 1500 dollars, is being offered to women graduates by the American Association of University Women, and a Spanish International Fellowship, value 4000 pesetas, by the Cultural Relations Committee of the Spanish Ministry of Foreign Affairs. Information with reference to the fellowships and application forms are obtainable from the British Federation of University Women, Crosby Hall, Cheyne Walk, S.W.3. The completed forms must be returned by Feb. 14.

THE University of Leeds report on the year 1930–31 records substantial additions to its resources and an increase in the number of its students. A bequest of £100,000 by Lord Brotherton, who died during the year, brought the total amount of his benefactions to the University up to about a quarter of a million sterling. A new residential hall for students opened at the beginning of the year was continuously occupied to its utmost capacity and proved an unqualified success. A new building providing ample accommodation for the teaching of physics under ideal conditions was nearly completed, and good progress was made with an extensive block of buildings for the chemistry department and with a pathological institute. Other notable happenings of the year were the introduction of a system of grading of salaries and scale increases of salaries for the members of the academic staff, the celebration of the hundredth anniversary of the commencement of the medical school, and the recognition of courses at University College, Hull, leading to success in the first M.B. examination of the University of London, as qualifying for exemption from the first M.B. examination in Leeds.

'GENERAL science' courses and the teaching of biology in schools are discussed from various points of view in the January number of the *New Era* by Prof. Winifred Cullis, who contributes a general introduction to the other articles by Prof. Julian Huxley, whose subject is "Biology: a Cultural Subject", and half a dozen other writers. Mr. S. A. McDowall, chaplain and senior science master at Winchester College, describes the aims and content of his five-years continuous course in general science for boys from 13 + to 18 + years of age, beginning with physical geography and proceeding, through hydrostatics and heat, chemistry, sound and light, electricity and magnetism, and molecular physics, to biology in the fifth year, linked with the principles and history of science. He describes also how the course was gradually evolved from a discontinuous and imperfectly correlated course in which no biology was included. Miss Drummond, headmistress of the North London Collegiate School and president of the Association of Women Science Teachers, deals with some of the practical problems arising in connexion with teaching biology in girls' secondary schools. Miss von Wyss concludes a paper on "Nature Study as an Approach to Biology" with an outline of a scheme of work. Mr. S. R. Slavson, sometime director of science and industrial arts education in the Walden School, New York, contributes a paper on "Integrated Science for Young Children", in which he declares his conviction, based on ten years' experience of science teaching with children from four to sixteen years of age, that the unified science programme is superior to specialities as a means of developing scientific attitudes, arousing interest, and vitalising knowledge. There are also papers on science in South African high schools, 'rural science' in a village elementary school, and broadcast science for schools, all pointing in the same direction.

Calendar of Geographical Exploration.

Feb. 11, 1864.—Central Arabia.

A Levantine Italian, Carlo Guarmani, reached Teima on a mission to buy stallions for the French. From Teima onwards Guarmani passed as a Turk. He ranged the steppe south of Teima, and was the first European to reach the ancient and famous oasis of Kheibar, with its negro population. He was sent as a prisoner to Aneiza, but from that point onwards met with no difficulties. He crossed to Jabal Shammar, where the Emir was anxious to do business with him. He went in and out of Hail, to Teima and back, visited nearly all the oases of the Jabal, and finally crossed the Nafud. Guarmani took a compass with him, and took so many bearings that he may be considered to be the pioneer of scientific cartography in central Arabia. His many cross journeys gave him opportunity to record the orography of the country, and he noted the great westward and south-westward extent of the oases and wells on which the Shammar depend. Guarmani had prepared himself for the journey by a long study of the Arab tribes, and in 1851 he had conducted an expedition to Jauf.

Feb. 12, 1541.—Exploration and Conquest of Chile.

Pedro de Valdivia founded the town of Santiago, whence he proceeded to establish fortified settlements north and south of that centre, and east of the Andes. The country was opened up as far south as Valdivia, founded in 1552, and beyond it to 40° S. An expedition was sent by sea to Magellan Strait, and a land expedition to that region was planned, but not carried out owing to the death of Valdivia. East of the Andes, Valdivia may have reached the Negro or the Colorado River. The province of Cuyo which he conquered is now included in the Argentine.

Feb. 13, 1500.—Cumana and the Island of Margarita.

Alonso Niño of Moguer, who had accompanied Columbus as a pilot, left Cumana for Spain. During his voyage, Niño had sailed to the Gulf of Paria, and his men were the first Spaniards to land on the island of Margarita, the centre of the pearl fishery. The party then proceeded to Cumana and explored the mainland to the west; gold and pearls in some quantity were obtained on this voyage and thus helped to attract other vessels to the region.

Feb. 13, 1858.—Sources of the Nile.

R. F. Burton and J. H. Speke reached Lake Tanganyika. They had set out to ascertain the limits of the Sea of Ujiji (Tanganyika) and to study the economic and ethnographic conditions of the region round it. They also hoped to reach 'the reputed' Lake Nyasa. They were obliged to give up the latter quest, but Speke on the return journey left Burton for a northward expedition, during which he discovered Lake Victoria Nyanza, which he was convinced was the source of the Nile. In 1860, Speke and J. A. Grant set out from Zanzibar and reached the outlet of the lake, where the Ripon Falls, the birthplace of the Nile, were discovered, on July 28, 1862. Speke also discovered the Kagera River, now known to be the most remote headstream of the Nile, though he was uncertain of this fact. Stanley, in 1875, circumnavigated Victoria Nyanza, confirming Speke's statement that it was one large lake and not five small ones as Schweinfurth had thought. He also explored part of the Kagera.

Societies and Academies.

LONDON.

Royal Society, Jan. 28.—**T. M. Lowry and H. K. Gore**: Optical rotatory power of vapours. The optical rotations of the vapours of camphor and of camphor quinone are $(M)_{5893} = 83°$ at 180° C., and $-146°$ at 200°, respectively. The curve of rotatory dispersion of camphor vapour shows a sharp maximum $(\alpha)^{180°} = 2000°$ at 3200 A., followed by a reversal of sign at 3020 A., and a negative maximum $(\alpha)^{180°} = -1860°$ at 2800 A. A 'step-out' on the short wave-length side of the positive maximum is in harmony with the fact that the curve of circular dichroism of a solution of camphor in hexane extends over only a part of the absorption band, on the side of longer wave-lengths. A solution of camphor in cyclohexane shows a positive maximum $(\alpha)^{20°} = 2600°$ at 3200 A., followed by a step-out, a reversal of sign, and a negative maximum $(\alpha)^{20°} = 2100°$ at about 2720 A. The curve of rotatory dispersion of camphor quinone passes through a negative maximum $(\alpha)^{200°} = -500°$ at 4950 A. for the vapour and $(\alpha)^{20°} = -450°$ at 4940 A. in cyclohexane, followed by a reversal of sign at 4740 A. and a positive maximum $(\alpha) = +300°$ at 4440 A.—**H. W. B. Skinner**: The excitation potentials of light metals (1). Lithium. There are critical potentials and also, apparently, some bands of radiation in the voltage region less than 20 volts. These must be associated with the conduction electron system. But the more important aspect of the work is concerned with the emission of the K-radiation of lithium metal. The radiation was found to consist of a band with a maximum frequency corresponding to 54 volts. It is shown that the ionisation of the K-shell alters the levels in the metal in such a way that there are empty levels around the ionised atom into which the K-electron can switch.—**E. G. Cox**: The crystalline structure of benzene. By consideration of the intensities of the X-ray reflections from a number of lattice-planes it has been found possible to decide on the arrangement of the molecules in the lattice, and in addition it is found that the experimental results are strongly in favour of a flat-ring molecule.

LEEDS.

Philosophical and Literary Society, Dec. 8.—**J. Blakey**. The Schur quadrics of the trinodal cubic surface.—**R. Whiddington and J. E. Taylor**: Preliminary note on the photographic action of electrons. The law of blackening of a photographic film by electrons of speed within the region 50-300 volts has been studied quantitatively. The law is similar to that in the case of light. The photographic effect for a given number of electrons falling on the film is independent of their energy within the region examined.—**J. Ewles**: The measurement of ionisation currents by means of an alternating current bridge and valve amplifier. The ionisation chamber is used as a capacity in one arm of an alternating current capacity bridge. The balance is detected by a multistage thermionic valve amplifier in conjunction with an output transformer and alternating current detector. After a balance has been obtained and the ionisation current then allowed to disturb it, it is possible to restore the balance by a series resistance in an arm adjacent to that of the chamber, when the value of this series resistance is proportional to the ionisation. Since a compact multistage amplifier may be used, the method is capable of very great sensitivity.—**G. W. Brindley**: On the intensity of reflection of X-rays by perfect crystals. The observed intensities of reflection of X-rays from highly perfect diamond crystals agree

with Ewald's theory only for angles of reflection less than 45°; at greater angles there is a large divergence between the observed intensities and the theoretical predictions. Ewald's theory does not take into account the atomic structure factor. When this factor (corrected slightly for zero point energy in the diamond lattice) is taken into account in the manner suggested by the work of Darwin, the theoretical predictions are then of the same general form as the experimental results both at large and small angles of reflection.—**F. W. Spiers**: The diffusion of mercury drops on rolled tin-foils. Elliptical areas of amalgam (11·8 atomic per cent mercury) are formed, the crystal structure of which is found to be hexagonal.—**H. M. Dawson** and **G. V. Hall**: Comparison of the catalytic effects produced by acids in aqueous and in aqueous alcoholic solutions. Observations on the acetone iodine reaction show that the catalytic effects produced by buffer mixtures of the constant acid, variable salt type, are precisely the same for aqueous and aqueous alcoholic solutions.—**H. M. Dawson** and **A. Key**: Determination of ionisation constants of acids in aqueous alcoholic solutions on the basis of catalytic effects. The catalytic effect of chloroacetic acid on the acetone iodine reaction in 75 per cent alcohol has been used to determine the ionisation constant of the acid and also the catalytic activity of the chloroacetic acid molecule. The observed dependence of the reaction velocity on the concentration of the acid indicates that the ionisation of the acid conforms closely to the requirements of the mass law.—**F. J. Garrick**: Note on the use of acidimetric indicators in argentometry. Quite accurate results may be obtained in silver titrations by the use of bromphenol blue, methyl orange, or methyl red as adsorption indicators. The method possesses no advantage in respect of accuracy over those usually employed, but is particularly convenient in the special case where both an acidimetric and an argentometric titration of the same solution are required.—**E. T. Everingham** and **W. H. Pearsall**: The effects of tartaric acid and of glucose on the metabolism of vine leaves. Both tartaric acid and glucose reduce the rate of hydrolysis of protein in vine leaves. Tartaric acid appears to reduce the rate of deamination of amino-acids, and apparently tends also to reduce the rate of carbohydrate loss. These effects are more marked in young leaves or in leaves illuminated by weak light. When glucose is supplied, there is a tendency towards protein synthesis.

PARIS.

Academy of Sciences, Dec. 28.—**Maurice Hamy**: A property of the equation obtained on equating to zero the distance of two planets, P, P_1, which do not meet at real points.—**Marcel Brillouin**: The development in harmonic functions on the sphere of a function the value of which is given at each point of the continental seashore. Conformal representation.—**H. Deslandres**: Simple relations between the molecular spectrum and the structure of the molecule.—**L. Cayeux**: The secondary origin of the radiating structure of old marine ooliths. Arguments are given in favour of the view that the radial structure of ooliths is a secondary acquirement, and is independent of the concentric structure.—**Charles Nicolle, Charles Anderson**, and **Jean Laigret**: Study of the spirochætes of the first three cases of recurrent Spanish-African fevers met with in Tunis.—**T. Levi-Civita**: Surfaces admitting a triangular network of parallel lines.—**J. Drach**: Remarks on the preceding communication.—**E. Mathias**: Lightning formed of a series of luminous lines.—**Lucien Daniel**: Natural layering of the aerial rhizomes of *Tanacetum Balsamita* grafted on *Chrysanthemum frutescens*.—**N. Aronszajn**: The decompositions of uniform functions.—**B. de Kerékjárto**: The existence of square roots in continued groups.—**B. N. Prasad**: The summability of a conjugated series of a Fourier's series.—**C. Visser**: The angular derivative.—**J. Le Roux**: The rôle of the group of relativity in classical mechanics.—**J. Haag**: The gravity pendulum.—**D. Barbier**: The probable eccentricities of the visual double stars the orbits of which are still unknown.—**Émile Sevin**: Concerning binary systems.—**F. Holweck**: A new model of the Holweck-Lejay pendulum. The value of gravity at points in continental France and in Corsica.—**Henri Abraham**: The maintenance of a room at constant temperature. The room was electrically heated and the temperature controlled by a toluene thermostat. Artificial ventilation was found to be necessary. With the precautions described, the average daily temperature was kept constant within 0·001° C.—**Henri Chaumat** and **Edouard Lefrand**: Electrostatic machines.—**Duffieux** and **G. Trotel**: The luminous phenomena produced by the rolling of amalgams on glass in a vacuum. The experiments with mercury described in a previous note have been repeated with mercury containing known amounts of impurities (zinc, cadmium, sodium).—**R. de Mallemann** and **P. Gabiano**: The magnetic rotatory power of argon. The Verdet constant of argon at 0° C. and 760 mm. pressure is $9{\cdot}2 \times 10^{-6}$. The magnetic rotatory power of argon is higher than that of nitrogen, oxygen, or hydrogen.—**J. Cabannes** and **Mlle. Osborne**: Theoretical considerations on the anomalous depolarisation of the Raman lines in uniaxial crystals.—**Mme. Irène Curie**: The nuclear γ-radiation excited in beryllium and in lithium by the α-rays of polonium.—**F. Joliot**: The excitation of the nuclear γ-rays of boron by α-particles. The quantic energy of the γ-radiation of polonium.—**P. Lecomte du Noüy**: The measurement of the hydrogen ion concentration of liquids by means of a rotatory electrode. With the form of electrode described, equilibrium is attained in less than one minute and the quantity of liquid required is 1 c.c. or less.—**A. Girard** and **G. Chaudron**: Contribution to the study of ferromagnetic ferric oxide. Four specimens of ferromagnetic ferric oxide were studied, one natural lepidocrocite and the others prepared by laboratory methods. Curves showing the changes produced in the magnetisation by rise of temperature are given.—**Hikoichi Shiba** and **Tokunosuké Watanabé**: The structures of crystals of northupite, bromonorthupite, and tychite.—**Mlle. Foret**: Calcium chromo-, selenio-, and sulphoaluminates.—**E. Carrière** and **Juillard**: Evolution of the system iodine, excess of soda.—**R. Paul**: Some derivatives of the tetrahydrofuryl series.—**Marcel Godchot** and **Pierre Vièles**: The dilactic acids.—**Léon Enderlin**: Researches on the chemistry of the rubrenes. The chemical properties of rubrene and its homologue dimethylrubrene were compared and found to be closely parallel.—**R. Delaby, R. Charonnat**, and **M. Janot**: The radioactivity of the waters from some summits of the Vosges. The waters examined were collected at heights between 700 metres and 1315 metres above sea-level. It was found that the radioactivity of the granites and that of the waters flowing from them varied in the same sense.—**P. Idrac**: A submarine temperature recorder. An electrical recording thermometer modified to meet the special conditions, and capable of an accuracy of 0·01° C. A typical record is reproduced.—**Frank A. Perret**: The new dome of Mt. Pelée.—**R. Lami**: The geographical distribution of some marine algæ in the northern region of the coasts of Portugal.—**P. Choux**: *Stapeliopsis Madagascariensis*, a cactus-shaped *Ceropegium* of Madagascar.—**E. Bigeard**: The *Pediastrum*

of France.—**Pierre Lesage**: Contributions to the study of the exchange of seeds of the same species of plant between two different stations.

(*To be continued.*)

ROME.

Royal National Academy of the Lincei: Communications received during the vacation.—**G. Armellini**: A new cosmogonic interpretation of the equipartition of energy among the stars. If the cosmogonic hypothesis of Sir Norman Lockyer and R. Du Ligondès—according to which nebulæ and stars were originally formed by the union of large numbers of pre-existing meteorites—is accepted, the equipartition of energy among the stars follows as a mathematical consequence. This result throws doubt on the conclusion of Jeans, who, by comparing the movements of the stars with those of gas molecules, calculated that impacts of stars over a period of at least five to ten million million years would be necessary to effect equipartition of their energies.—**F. Zambonini** and **Silvia Restaino**: Double sulphates of rare earth and alkali metals (14). Sulphates of praseodymium and sodium. Study of the isotherm of the system $Pr_2(SO_4)_3 : Na_2SO_4 : H_2O$ for 25° shows the existence of two crystalline compounds of the formulæ $4Pr_2(SO_4)_3 5Na_2SO_4 8H_2O$ and $Pr_2(SO_4)_3 Na_2SO_4 2H_2O$.—**L. Cambi** and **A. Cagnasso**: Manganic dithiocarbamates. Manganic *N*-piperidyl-, *N* : *N*-isodibutyl-, and *N* : *N*-dibenzyl-dithiocarbamates are described.—**G. Rovereto**: Folds with inclusions (*a trucioli*) and two-way folds.—**G. Barba**: Generalised parallelism in a V_3.—**C. Miranda**: Asymptotic properties of Newtonian potentials due to illimited distribution of masses.—**P. Clemente**: Majoration of the periodic solutions of an ordinary linear differential equation of the second order.—**A. Rosenblatt**: The stability of the laminar movements of incompressible viscous liquids.—**A. Masotti**: The centre of hydrostatic pressures.—**G. Occhialini**: A magnetic spectrograph for β-rays emitted by feebly radioactive substances. A description is given of a simple magnetic spectrograph which allows of the use of a wide irradiating surface and is especially useful for the examination of feebly radioactive substances like rubidium and potassium.—**C. Dei**: A dynamic arrangement for comparing the constants of two triodes.—**Zvi Jolles**: Study of the oxidising properties of normal diazo-hydrates. Various reactions indicate that the oxidising properties of diazo-hydrates are very general in character.—**F. De Carli**: Viscosity of mixtures of stannic chloride with aromatic hydrocarbons. The viscosity isotherms of mixtures of stannic chloride and toluene show that, unlike benzene, toluene is able to associate appreciably with stannic chloride at temperatures between 20° and 30°, but the data obtained are insufficient to prove the existence of a definite compound between the two substances.—**E. Parisi**: The presence of a new sugar in dextro-rotatory honeys. Conifer honeys contain, in addition to the sugars of other honeys, a glucobiose which has a molecular weight, determined cryoscopically, varying from 280 to 340 according to its degree of purity, and a specific rotatory power of +90° to +110°. The sugar may occur ready-formed in the tree or may result from an enzymic action similar to that which gives rise to Croft Hill's revertose.—**G. B. Cacciamali**: Orogenic conflicts.—**A. Debenedetti**: A method of measuring the maximum birefringence of biaxial minerals with the help of the Federow plate. The method described allows of the determination of the maximum birefringence of a mineral from the two refractions corresponding with two positions of a section maintained normal to a principal plane of optical symmetry.—**G. Tallarico**: The volume of the caryopses of grain in relation to their nutritive value. The results of experiments with turkeys show that small-corned grain has a greater nutritive and biological value, at any rate during the development and growth of the birds, than grain with large corns.—**M. Curzi**: A new species of *Helminthosporium* in a disease of the banana encountered in Italian Somaliland. This disease, manifested by spots on the stems, leaves, etc., is due to the organism *Helminthosporium gibberosporum* n. sp.—**Giulio Cotronei** and **Aldo Spirito**: Zoological constitution and grafting: New experiments between Anura and urodeles.—**Aldo Spirito**: Grafting from the triton to the edible frog (2).

Forthcoming Events.

Societies.

FRIDAY, FEBRUARY 5.

ROYAL SOCIETY OF MEDICINE (Laryngology Section), at 5.—Discussion on Common Colds and their Sequelæ.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Prof. A. R. Hobbs: Puerperal Sepsis, with an Account of the Treatment of Puerperal Infection by Glycerine Drainage (Hunterian Lecture).

GEOLOGISTS' ASSOCIATION (in Botany Theatre, University College) (Annual General Meeting), at 7.30.—Prof. W. W. Watts: Fossil Landscapes (Presidential Address); and presentation of Foulerton Awards to F. Gossling and Dr. S. W. Wooldridge.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Dr. G. C. Simpson: Weather Forecasting.

MONDAY, FEBRUARY 8.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Prof. J. A. Ryle: The Natural History of Duodenal Ulcer (Hunterian Lecture).

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—H. Clutterbuck: The Oxford Expedition to Akpatok Island.

TUESDAY, FEBRUARY 9.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Dr. G. Shearer: Research Work on Crystal Analysis (1).

INSTITUTION OF ELECTRICAL ENGINEERS (North-Western Centre) (at College of Technology, Manchester), at 7.30.—Prof. J. K. Catterson-Smith: Everyday Uses of Electricity (Faraday Lecture).

QUEKETT MICROSCOPICAL CLUB (at 11 Chandos Street, W.1), at 7.30.—Annual General Meeting.

PHARMACEUTICAL SOCIETY OF GREAT BRITAIN, at 8.30.—Dr. H. E. Archer: Biochemistry, Chemical Pathology, and Pharmacy (Address).

WEDNESDAY, FEBRUARY 10.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Prof. H. A. Harris: The Comparative Anatomical Aspect of Pre-Natal, Infantile, and Adult Disease in Man and Animals, with special reference to Bone Growth (1) (Hunterian Lecture).

ROYAL SOCIETY OF ARTS, at 8.—J. A. R. Stevenson: The Craft of the Decorative Iron Worker (Lecture).

THURSDAY, FEBRUARY 11.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Prof. H. G. Cannon: Feeding and Digestion in Invertebrates (4).

INSTITUTION OF MECHANICAL ENGINEERS (at Leeds), at 7.30.—Ll. B. Atkinson: The Mechanical Aspects of Electricity (Thomas Hawksley Lecture).

INSTITUTION OF WELDING ENGINEERS (at Institution of Mechanical Engineers).—Declaration of name of prize winner; Award of Prize and Gold Medal; Paper by or on behalf of prize winner: Welding and Cutting on Railways and Tramways.

FRIDAY, FEBRUARY 12.

ROYAL ANTHROPOLOGICAL INSTITUTE (Sociological Research Committee) (at 52 Upper Bedford Place), at 4.—

Mrs. Seligman: The Method of Exhibiting Genealogical Data.—C. W. M. Hart: Is it correct to regard all Australian Tribes as on the same Economic Level?

ROYAL ASTRONOMICAL SOCIETY, at 5.—Anniversary Meeting.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Prof. H. A. Harris: The Comparative Anatomical Aspect of Pre-Natal, Infantile, and Adult Disease in Man and Animals, with special reference to Bone Growth (2) (Hunterian Lecture).

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Sir John Cadman: Petroleum: A Record of Achievement in Applied Science.

Public Lectures.

FRIDAY, FEBRUARY 5.

UNIVERSITY COLLEGE, at 5.30.—H. N. Gresley: High Pressure Locomotives.—Prof. H. A. R. Gibb: The Climax of Arab Culture.

SATURDAY, FEBRUARY 6.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Prof. J. R. Ainsworth-Davis: Shell-Fish in relation to Man.

MONDAY, FEBRUARY 8.

GUY'S HOSPITAL (in Physiological Theatre), at 5.—Prof. H. A. Harris: The Use of X-Rays in Physiological Investigations (2).

ST. BARTHOLOMEW'S HOSPITAL MEDICAL COLLEGE, at 5.30.—Dr. L. Findlay: The Feeding and Nutritional Disease of the Infant (1).

KING'S COLLEGE, LONDON, at 8.—C. J. Gadd: Babylonian Myth and Ritual.

TUESDAY, FEBRUARY 9.

UNIVERSITY COLLEGE HOSPITAL MEDICAL SCHOOL, at 5.15.—Prof. A. E. Boycott: Hypertrophy and Atrophy (1). (Succeeding Lecture on Feb. 16.)

WEDNESDAY, FEBRUARY 10.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Dr. M. B. Ray: The Prevention and Treatment of Industrial Rheumatism.

SCHOOL OF ORIENTAL STUDIES (jointly with Royal Anthropological Institute), at 5.—Dr. R. S. Rattray: Hausa Poetry.

UNIVERSITY COLLEGE, at 5.30.—Dr. R. S. Hutton: The Field of Industrial Librarianship.

BELFAST MUSEUM AND ART GALLERY, at 8.—O. Davies: The Great Days of Egypt.

THURSDAY, FEBRUARY 11.

ST. BARTHOLOMEW'S HOSPITAL MEDICAL COLLEGE, at 5.30.—Dr. L. Findlay: The Feeding and Nutritional Disease of the Infant (2).

KING'S COLLEGE, LONDON (at 16 Russell Square, W.C.1), at 6.—S. P. Turin: Economic Conditions in Russia To-day: Accumulation of Capital and Savings under the Five-Year Plan.

FRIDAY, FEBRUARY 12.

ST. BARTHOLOMEW'S HOSPITAL MEDICAL COLLEGE, at 5.30.—Dr. L. Findlay: The Feeding and Nutritional Disease of the Infant (3).

UNIVERSITY COLLEGE, at 5.30.—Prof. Sir Reginald Fleming Johnston: China in the Ancient World.

SATURDAY, FEBRUARY 13.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Mrs. Olwen Brogan: Town-Life in the Roman Empire.

Conferences.

SATURDAY, FEBRUARY 6.

SCHOOL NATURE STUDY UNION (in Botanical Theatre, University College), at 3.—Sir Arthur W. Hill: The Andes of Bolivia, with some Account of the Archæology and Botany of the Region.

TUESDAY, FEBRUARY 9.

CONFERENCE ON MECHANISATION AND BRITISH AGRICULTURE (at Rothamsted Experimental Station, Harpenden), at 11.30 A.M.

J. E. Newman: Engineering Developments and Possibilities.

Prof. J. A. S. Watson: Combination of Livestock with Systems of Mechanised Farming.

Sir John Russell: The Maintenance of Soil Fertility under Mechanised Farming Systems.

Official Publications Received.

BRITISH.

Department of Scientific and Industrial Research: Water Pollution Research. Summary of Current Literature. Vol. 5, No. 1, January. Abstracts Nos. 1-123. Pp. 36. (London: H.M. Stationery Office.) 2*s.* net.

Winchester College Natural History Society. Report 1927–1931. Pp. 63+8 plates. The British Palmate Orchids. By H. Cary Gilson. Pp. 36+35 plates. 3*s.* (Winchester: P. and G. Wells, Ltd.)

War Office. Report on the Health of the Army for the Year 1930. Vol. 66. Pp. iv+151. (London: H.M. Stationery Office.) 2*s.* 6*d.* net.

The Journal of the Institution of Electrical Engineers. Edited by P. F. Rowell. Vol. 70, No. 421, January. Pp. 105-188+xxvi. (London: E. and F. N. Spon, Ltd.) 10*s.* 6*d.*

Proceedings of the Royal Society of Edinburgh, Session 1930-1931. Vol. 51, Part 2, No. 22: An Operational Method for the Solution of Linear Partial Differential Equations. By W. O. Kermack and W. H. McCrea. Pp. 176-189. 1*s.* Vol. 51, Part 3, No. 23: An X-ray Examination of *d*-Mannitol and *d*-Mannose. By Dr. George W. McCrea. Pp. 190-197. 1*s* (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.

Biological Reviews and Biological Proceedings of the Cambridge Philosophical Society. Edited by H. Munro Fox. Vol. 7, No. 1, January. Pp. 87. (Cambridge: At the University Press.) 12*s.* 6*d.* net.

FOREIGN.

Library of Congress. Report of the Librarian of Congress for the Fiscal Year ending June 30, 1931. Pp. vii+463+19 plates. (Washington, D.C.: Government Printing Office.)

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 76: The Buckling of a Cylindrical Shell under Torsion. By Katsutada Sezawa and Kei Kubo. Pp. 251-314. (Tôkyô: Koseikai Publishing House.) 0.53 yen.

Science Reports of the Tokyo Bunrika Daigaku. Section A, No. 14: On the Zero-Points of a Limited Function. By Sôichi Kakeya. Pp. 159-165. (Tokyo: Maruzen Co., Ltd.) 15 sen.

Ministry of Public Works, Egypt: Physical Department. Meteorological Report for the Year 1925. Pp. xiii+176. (Cairo: Government Press.) 40 P.T.

Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia. Verhandelingen No. 24: Regenval in Nederlandsch-Indië (Rainfall in the Netherlands Indies). Door Prof. Dr. J. Boerema. Deel 1: Gemiddelden van den Regenval voor 3293 Waarnemingsplaatsen in Nederlandsch-Indië, berekend uit Waarnemingen verricht in het tijdvak 1879–1928 (Mean Rainfall Figures for 3293 Rainfall Stations in the Netherlands Indies, calculated from Observations made during the period 1879–1928). Pp. iv+244. Deel 2. 14 kaarten. (Batavia: Landsdrukkerij.)

Annual Report of the Board of Regents of the Smithsonian Institution, showing the Operations, Expenditures and Condition of the Institution for the Year ending June 30, 1930. (Publication 3077.) Pp. xii+650. (Washington, D.C.: Government Printing Office.) 2.00 dollars.

State of Connecticut. Public Document No. 24: Fifty-fourth Report of the Connecticut Agricultural Experiment Station, New Haven, for the Year 1930. Pp. xii+764+68. (New Haven, Conn.)

Collection des travaux chimiques de Tchécoslovaquie. Rédigée et publiée par E. Votoček et J. Heyrovský. Année 3, No. 12, décembre. Pp. 563-593+xxiv. (Prague: Regia Societas Scientiarum Bohemica.)

Special Publication of the American Committee on International Wild Life Protection. Vol. 1, No. 1: Report on the available Evidence showing the relation of Game to the spread of Tsetse Fly borne Diseases in Africa. By Richard P. Strong, Joseph C. Bequaert and L. R. Cleveland. Pp. 46. (London: Society for the Preservation of the Fauna of the Empire.)

Institut de France: Académie des sciences. Annuaire pour 1932. Pp. 402. (Paris: Gauthier-Villars et Cie.)

U.S. Department of Agriculture. Circular No. 196: The Blueberry Maggot and its Control in Eastern Maine. By F. H. Lathrop and L. C. McAlister, Jr. Pp. 14. 5 cents. Miscellaneous Publication No. 126: Fertilizers for Cotton Soils. By J. J. Skinner. Pp. 10. 5 cents. (Washington, D.C.: Government Printing Office.)

Smithsonian Institution: United States National Museum. Report on the Progress and Condition of the United States National Museum for the Year ended June 30, 1931. Pp. ix+223. (Washington, D.C.: Government Printing Office.) 25 cents.

CATALOGUES.

Moll Recording Microphotometer. (MF. 29.) Pp. 8. (Delft: P. J. Kipp and Zonen.)

Standard Meteorological Instruments. (List M2.) Pp. 140. (London: Negretti and Zambra.)

Fine Chemical Products for Laboratory Use. Pp. 60. Catalogue of Scientific Text Books, Dictionaries and Encyclopaedias. (List No. 98.) Pp. 24. (London: A. Gallenkamp and Co., Ltd.)

A Catalogue of Book Bargains. (No. 533.) Pp. 16. (London: William Glaisher, Ltd.)