NATURE

SATURDAY, NOVEMBER 5, 1932

CONTENTS

	PAGE
Inland Water Survey	677
Leeuwenhoek, 1632–1723	679
The New Economics. By W. G. L. C.	680
Industrial Chemistry. By E. F. A.	682
Short Reviews	683
Consumption and the Trade Cycle	685
Canadian Polar Year Expedition, 1932–33. By J. Patterson	686
Obituary:	
Prof. J. C. Fields, F.R.S. By Prof. J. C. McLennan, O.B.E., F.R.S.	688
Mrs. G. P. Bidder. By W. B. H.	689
News and Views	690
Letters to the Editor:	
'Protective' Adaptations of Animals.—A. J. Nicholson; B. P. Uvarov	696
Hyperfine Structures of Antimony Lines and the Nuclear Moments of Antimony Isotopes.—Dr. J. S. Badami	697
Influence of Light on Paramagnetic Susceptibility.—O. Specchia	697
Crystal Structure and Dehydration Figures of Alkali Halide Hydrates.—Dr. W. A. Wooster	698
Magnetic Constants of Benzene, Naphthalene and Anthracene Molecules.—K. S. Krishnan	698
Efficiency of the Geiger-Müller Counter.—Dr. Bruno Rossi	699
Secondary Radiation Produced by Cosmic Rays.—Prof. J. M. Benade	699
Retention of Moisture by Wood.—Wilfred W. Barkas	699
Adrenal Cortical Extracts and Sex Changes.—F. G. Young and H. W. Benham	700
Natural Melody.—Sir Richard Paget, Bt.	701
Higher Vibrations of Chladni Plates.—Prof. R. C. Colwell	701
Research Items	702
Astronomical Topics	704
Fourteenth International Physiological Congress. By L. E. Bayliss and Dr. P. Eggleton	705
Co-operation in Electrical Standards	707
Building Research	707
Physics in Meteorology	708
University and Educational Intelligence	709
Calendar of Geographical Exploration	709
Societies and Academies	710
Forthcoming Events	711
Official Publications Received	711

Editorial and Publishing Offices:

MACMILLAN & CO., LTD.

ST. MARTIN'S STREET, LONDON, W.C.2

Telephone Number: WHITEHALL 8831

Telegraphic Address: PHUSIS, LESQUARE, LONDON

Advertisements should be addressed to

T. G. Scott & Son Ltd., 63 Ludgate Hill, London, E.C.4

Telephone Number: City 1266

No. 3288, Vol. 130]

Inland Water Survey

IT was a welcome and appropriate sequel to the leading article in NATURE of July 2 last, relating to "River Gauging and Flood Prevention", that a sectional meeting of the British Association at York should have been devoted to a discussion on the organisation required for the recording of water levels and river flow in the British Isles. The discussion did not arise out of, nor was it in any way consequential upon our article—it had, in fact, been arranged some time beforehand—but it served admirably to give point and emphasis to the contentions put forward in these columns on a matter which has not hitherto received the attention and consideration which it deserves.

The meeting was held under the chairmanship of Prof. L. S. Palmer and had before it an introductory memorandum prepared by Capt. W. N. McClean, through whose instrumentality mainly the discussion at York was arranged. Capt. McClean added some opening explanatory remarks in which he directed attention to the essential value and fundamental importance of reliable records of water measurements in questions relating to water supply, water power, navigation, irrigation, fisheries, drainage and pollution, flood prevention and other matters of national and civic concern. He stressed the necessity of providing an efficient organisation to make systematic observations on scientific lines. An inland water survey should cover rainfall, storage and flow. Rainfall is already to a very considerable extent adequately cared for by the British Rainfall Organization, which has an excellent system, though perhaps it is still open to improvement in certain details. But rainfall does not afford correct information as to storage and flow, and only when these are also as efficiently recorded, can estimates be made which will be of value in dealing with problems of drought and flood. Capt. McClean's conviction is that an inland water survey should be independent of conflicting interests, private or corporate; that it should be under a Water Survey Department of a Ministry, with the supervision of an expert Government inspector over large areas; and that local associations should represent the water interests and find the observers and recorders. Funds should be provided by the water interests by means of a levy.

In the ensuing discussion various suggestions were made as to the nature of the controlling authority and these were summarised at the

conclusion of the meeting by the chairman, as follows :—(1) An organisation on the lines recommended by the Water Power Resources Committee ; (2) the Geological Survey ; (3) the Ordnance Survey ; (4) the Meteorological Office of the Air Ministry ; (5) Catchment Boards, formed under the Land Drainage Act, in co-operation with the Ministry of Agriculture and Fisheries ; (6) voluntary organisations, and (7) various combinations of (1) to (6).

As regards the first suggestion, it will be recalled that the Final (1921) Report of the Water Power Resources Committee, appointed in 1918, recommended the formation of a Controlling Water Commission, to be established by Act of Parliament, the primary function of which would be "to compile proper records of the water resources and present and future water requirements of the country and to collect information on these subjects through existing Departments and other agencies, as well as through their own hydrometric staff". It is perhaps superfluous to add that nothing has been done in this direction, nor, in view of prevailing financial conditions, is anything likely to be done in the way of establishing another Government department with scope for additional expenditure. Moreover, the situation has changed appreciably since the publication of the Water Power Resources Committee's Report.

Within the last two years, the Land Drainage Act, 1930, has created a series of Catchment Boards (at present forty-six in number) to act under the Ministry of Agriculture and Fisheries, with the special duty of dealing with all matters relating to the drainage of their respective areas. As we pointed out in our previous article, although not specifically laid down in the Act, it is obviously the implied duty of Catchment Boards to gauge and survey the run-off in the streams and rivers under their jurisdiction and to obtain a reliable record of rates of flow, ranging between maxima and minima, over long periods, which will enable adequate precautions to be taken for dealing with the incidence of floods and of drought. But while the responsibility for obtaining this information, as was urged by Capt. J. C. A. Roseveare, of the Ministry of Agriculture and Fisheries, in the discussion at York, clearly lies with the Catchment Boards, the question, at once, arises : Will all these separate and distinct bodies, with their varying organisations and staffs of unequal calibre, be likely to obtain and collate the data on uniformly satisfactory and rigidly scientific lines ? We are afraid not. There must be some centralised authority of high technical standing to supervise and unify the methods and systems of measurement. Otherwise, the records will inevitably tend to be of differing values.

It will be noted that suggestions were put forward to bring the observations under the control of official technical departments, such as the Ordnance Survey, the Geological Survey and the Meteorological Office. We are of opinion that the duties of these bodies are already onerous enough for satisfactory performance, and that the additional functions proposed to be assigned to them are not sufficiently germane to their existing functions to justify the expansion of their establishments. We would prefer that a properly devised scheme should be worked out in conjunction with the Department of Scientific and Industrial Research, to which should be entrusted the inauguration and supervision of operations, under the local administration of the Catchment Boards, who would be called upon to provide the staffs and the funds for the purpose, the latter being apportioned from the rates which the Boards are statutorily authorised to levy. The proposal would not by any means exclude the assistance of voluntary workers, including university students and others, who, as in the case of rainfall gauging, might be attracted to the making of observations locally, as a scientific pursuit, or hobby. Nor would it interfere with the full exercise by the Catchment Boards of their powers and responsibilities in regard to drainage and flood protection.

The speakers in the discussion at York were unanimous in affirming their conviction of the necessity for taking steps forthwith to put an end to the anomalies and defects of the present position and, at the conclusion of the proceedings, a representative committee was formed "to inquire into the position of Inland Water Survey in the British Isles and the possible organisation and control of such a survey by central authority". This is a move forward in the right direction, and if a soundly devised and workable scheme is forthcoming as the result of the committee's efforts, it should carry weight with the Government. In a matter of such pressing national importance as flood prevention, it is in the highest degree necessary to have accurate and unimpeachable records of river flow, as it is no less imperative to have them for the successful prosecution of industrial and civic undertakings in regard to water supply and hydraulic development generally.

Leeuwenhoek, 1632–1723

Antony van Leeuwenhoek and his "Little Animals" : being some Account of the Father of Protozoology and Bacteriology and his Multifarious Discoveries in these Disciplines. Collected, translated, and edited from his Printed Works, Unpublished Manuscripts, and Contemporary Records, by Clifford Dobell. Published on the 300th Anniversary of his Birth. Pp. vii+435+32 plates. (London : John Bale, Sons and Danielsson, Ltd., 1932.) 31*s.* 6*d.* net.

OF all the great naturalists of the past, Leeuwenhoek occupies the unique and anomalous position of being the most frequently quoted and at the same time the least appreciated and understood. An estimate of his work which is commonly expressed and accepted, even by those who have devoted some attention to the history of biology, is that he was a superficial dabbler who had no conception of scientific methods, but who hurried from one topic to another without attempting to exhaust any one of them ; and that if he made important discoveries it was easy to do so, since he was early in the field, and one of the first to exploit an important new means of investigation. He is in fact compared unfavourably with his great contemporaries Swammerdam and Malpighi, both of whom successfully completed solid pieces of research involving concentrated and prolonged attention to the points at issue.

Such a criticism, however, fails to take account of the distinguishing features of most of Leeuwenhoek's work. He was not dealing with large and complex objects out of which much could be made even in those days, but with blood corpuscles, bacteria, protozoa and other small organisms which it is amazing he should have seen at all, and not that he should have failed to make more of them. His point of view was essentially that of the microscopist even when investigating the larger animals. Impressive and spectacular results, such as Malpighi's development of the chick and Swammerdam's anatomy of the mayfly, were literally impossible, and the significance of his work, to quote Capt. Bunsby, lies in the application thereof.

Against the charge of lack of tenacity, Mr. Dobell's treatise is a sufficient answer, even if we had not in mind Leeuwenhoek's laborious and long-continued attack on the spermatozoa. Then again his method of publication, or rather the lack of it, has told heavily against him. His results were communicated in the form of letters, most of them addressed to the Royal Society, which have never until recently been published in full, and have only been partly translated. The result is that much of his work is still almost unknown. For example, Mr. Dobell directs attention to Leeuwenhoek's unrecognised anticipation of the modern malariologist as to the difference in posture between Anopheline and Culicine larvæ in water, and he has translated, and now publishes for the first time, Leeuwenhoek's observations on the viviparous nature of the vinegar worm made in 1676—a discovery attributed to Sherwood in 1746.

There are inevitably many other discoveries made by Leeuwenhoek which have yet to find their place in any history of biology. The appearance of the work under review therefore is more than welcome—it is an act of justice, and the only regret we feel in respect of it is that it covers but a fraction of Leeuwenhoek's stupendous labours. Our regret is heightened by the reflection that we do not see where the completion of the task is to come from. It demands an unusual combination of linguistic and other qualifications which Mr. Dobell alone seems to possess, and, moreover, he has advanced the standard of historical research beyond the reach of most workers. He exhibits indeed to a marked degree that passion for detail and meticulous accuracy which bulks so largely in the composition of the complete scholar. It makes him a severe and occasionally a merciless critic of the work of others, but it is a guarantee of the integrity and exhaustive nature of his own inquiries.

To most zoologists, Leeuwenhoek's work on the smallest organisms, namely, the bacteria and protozoa, by its implications perhaps the most important that he did, is nevertheless not the most interesting. His observations on the blood corpuscles and capillaries, spermatozoa, Mendelian inheritance, rotifers, ants, caudal heart of the eel, *Echinorhynchus*, cestodes, compound eye, plant lice, *Cyclops*, *Hydra* and sponges, to mention only a few that come to mind, should be dealt with in the same comprehensive way as have been the bacteria and protozoa by Mr. Dobell, and until that is done Leeuwenhoek's merits can be but imperfectly appreciated by the average biologist. To complete this undertaking, however, on the scale of Mr. Dobell's investigations, and no other should be entertained, would take almost a lifetime.

May we here express regret that the Royal Society allowed to pass unnoticed the tercentenary celebrations of Malpighi in 1928, and appears to be displaying the same indifference to Leeuwenhoek in 1932. Whilst the Society deserves the highest credit for the active support it gave to these observers during their lifetime—a proceeding, be it noted, which has brought considerable honour to the Society—present councils seem to have forgotten that Malpighi and Leeuwenhoek were two of the greatest fellows the Society has ever had.

Mr. Dobell's work includes an introductory epistle to the reader, written in a quaint and charming style, all that tireless and intensive research can reveal of Leeuwenhoek's life, translations and exhaustive analyses of those of his letters which deal with bacteria and protozoa, an admirable chapter on his instruments accompanied by a plate which shows at a glance the design and manipulation of his best microscopes, and a critical estimation of his place in protozoology and bacteriology. There are minor sections on Leeuwenhoek's name, language, dwelling, draughtsmen, portraits and seals. The bibliographical chapters give details of his first twenty-seven letters, an invaluable catalogue of his MSS. and published works, which have so far been the despair of the bibliographer, but need be so no longer, and a long and exhaustive list of references and sources. The get up of the book, with its white buckram binding, sprinkled edges and title in two colours doubtless in imitation of the collected works bound in vellum, is excellent, and the plates have been beautifully reproduced. Most readers will be glad to have the admirable reproductions of Verkolje's mezzotint and oil-painting of Leeuwenhoek, of which the latter will be new to most students, and is much more convincing than the mezzotint. The enlargement of Goeree's miniature portrait has been very skilfully carried out, even to the removal of the hand of the substantial angel from the top margin. We should not have selected for reproduction the picture of de Graaf inserted at p. 40, which is apparently a somewhat poor copy of the portrait dated 1666 published in the "De Virorum", which latter has the additional advantage of being signed by both artist and engraver.

Since Mr. Dobell appeals for criticism we submit the following points for his consideration. Is not the last line but four of the Latin dedication ambiguous and liable to misinterpretation? Its meaning will be obvious to the initiated, but a literal translation of it would be libellous. P. 318: The paper by Baker dated 1740 which "must have been published considerably later" was published in 1744. P. 332: The interesting and probable suggestion that Leeuwenhoek used dark-ground illumination receives some support from the fact that Hooke described a simple type of dark-ground illumination in 1678. P. 333: Boyle, Hooke, Grew and Malpighi all made use of sections as aids to anatomical study before Leeuwenhoek. P. 350: The portrait by A. Smith is a copper and not a steel engraving. P. 364: Stelluti's plate of the bee was originally issued in 1625. Attention was first directed to this important publication by Parsons, who possessed a copy of the print and described it in 1752 as being "the first microscopical engraving that ever was made". P. 379: The term Infusoria was invented by Major in 1667 and was applied to intravenous injections. P. 379: George Adams the elder was born in 1720. P. 392 (No. 1): A second edition was published at Delft in 1694 and included letters 32, 39 and 33 in that order. P. 392 (No. 5): There *is* an edition of 1691 with the same title and publisher, but with the mispagination corrected. P. 393 (No. 13): For Londen read London. P. 413: Malpighi's "Opera posthuma" was first published at London in 1697 and this edition should be quoted. P. 415: Needham 1749 was published in 1750. P. 425, last line but one: For wo read woe. These are all small matters—of major slips the work seems to be entirely free.

We warmly commend Mr. Dobell's monograph to that section of the public, happily becoming larger every day, which is interested in the history of science. We believe that in the fulness of time this work will be recognised as one of the classics of the critical and historical literature of biology.

The New Economics

This Age of Plenty—its Problems and their Solution. By C. Marshall Hattersley. Third edition. Pp. 410. (London: Sir Isaac Pitman and Sons, Ltd., 1932.) Paper, 3*s*. 6*d*. net; cloth, 6*s*. net.

HITHERTO economics may be said to have centred largely around production, but now the centre has shifted to distribution, where the problems seem to be rather more baffling and intractable. But the world crisis, as is usually the case, has stimulated a high level of thought and

discussion, for the whole world is stirred to its depths so that the standard of emotional and intellectual activity is much higher than during the humdrum days of smooth and uneventful prosperity. Therefore we can confidently expect that a way out will be found, though some may think a return to material prosperity a doubtful blessing if accompanied by a relapse into dullness: the majority will be quite willing to run the risk. At present the mind of the nation is undoubtedly stimulated, and certain fundamental leading ideas appear to be gradually evolving out of a vast mass of animated discussion and suggestion, and are forcing their way to the front, serving, let us hope, under heaven's blessing, as a starting point for practical effort in the right direction.

Doubtless a lot of practical experiment will have to be undertaken, and possibly even a lot of mistakes made. Side by side with a firm faith that we shall ultimately succeed there must be also a high courage that will boldly try out new ideas even with the risk of temporary failure and error. It is no doubt a trite platitude to say that a nation, like an individual, that never makes mistakes and is afraid of the risk, will never achieve anything; but it seems at this time necessary to remind ourselves of the fact. More and more it becomes evident that, in the realm of economics and politics more practical experiment is urgently needed, though this cannot be faced with thoughtless light-heartedness and the difficulties are great, especially in unbiased interpretation of results. Let us hope, nevertheless, that we shall soon have a real science of experimental economics—and if the 'new' economists have their way we shall—so that the old reproach against the social sciences generally, and economics in particular, will be wiped out in triumphant ascension to the rank of true science on terms of equality with chemistry and physics, in view, too, of its increasing strength of statistical and mathematical groundwork.

On the side of production, as already suggested, the main problems appear to have been solved—if anything rather too thoroughly, largely owing to the fact that production has been placed on a scientific and rational basis. The same cannot be said of distribution and most emphatically not in regard to our financial and monetary system. This had been roundly criticised, sometimes perhaps rather wildly, but for the most part the criticism has been just, and, in view of the deplorable results of muddle-headed monetary policy, extremely restrained and moderate. A large number of interesting suggestions has been made for monetary reform, but for the present we are only concerned with those relating to Consumer Credit and the proposals made by Major Douglas, Prof. Soddy and one or two others. These have been fully and admirably dealt with in the third edition of C. Marshall Hattersley's book entitled "This Age of Plenty".

The main difficulty to-day is to increase the community's purchasing power: for production tends more and more to outstrip consumption; and with increasing mechanical and other scientific aids, increased production is consistent with constantly reduced man-power employed in industry. A careful and fairly complete analysis of the whole position, and particularly of prices and costs, leads Mr. Hattersley to support Major Douglas's proposals for Consumer Credit, which practically amount to national dividends for all. One method is to sell goods at less than cost price, the vendor recovering the balance from the State. The ethical grounds on which national dividends for all can be justified are well argued. There are not only the precedents of Old Age Pensions, Unemployment Insurance and Poor Law Relief, but there is also the further important consideration that every member of the community is entitled to a share in the rich heritage from the past, the accumulated cultural, economic and social possessions of the State. Modern production depends very largely for its efficiency on this heritage, which is something much more than capital or accumulated material savings. Every important invention, for example, has its roots in the past, and the inventor is indebted for help to hundreds or thousands of predecessors. Every member of the community therefore is entitled to some share in the product of modern industry, even if he does no work. It is not pretended that he should be idle, and this difficulty, as also that of the disagreeable menial tasks of society, and many other difficulties are ably dealt with.

Prof. Soddy, in his book on "Wealth, Virtual Wealth, and Debt" apparently agrees in principle with the Consumer Credit idea and the need for greatly increasing the supply of money, but he severely criticises the proposals of Major Douglas. Mr. Hattersley, who devotes a considerable amount of space to Prof. Soddy's ideas, is of opinion that the Douglas plan could be put into operation as a preliminary measure and that the way would then be clear for Prof. Soddy's plan to be adopted.

The whole subject is of profound interest and importance and well merits unbiased scientific examination and test. The book is well written and makes easy reading, the more so as each section is provided at the end with a synopsis of the points discussed. Many data of the statistical and blue book type are given in several appendices and there is a good and complete index.

W. G. L. C.

Industrial Chemistry

Industrial Chemistry: a Manual for the Student and Manufacturer. Edited by Allen Rogers. Fifth edition. Vol. 1: *Inorganic.* Pp. xiv + 641 + xiv. Vol. 2: *Organic.* Pp. xii + 642 – 1517. (London: Macmillan and Co. Ltd., 1931.) 30*s.* net each volume.

THIS treatise on industrial chemistry was first published in 1912, and is now in its fifth edition, being divided into two volumes. Allen Rogers, the editor, has had the co-operation of nineteen experts in preparing the inorganic volume, and of twenty-two specialists for the organic part of the subject, the division being a usual one.

The book has been modernised by addition and deletion, and fresh points of view and new subjects added. Naturally such a work can only act as a first and general introduction to each and any particular section of the chemical industry, and any one requiring to go more deeply into detail will have to study other treatises devoted to one subject only, for no one man can any longer pretend to have a knowledge of the whole field of chemical industry. Hence it serves a most useful purpose, all the more so when the summary is crisp and readable and not overburdened with manufacturing details. We have examined the book particularly from this point of view, and have found it more than fulfils our anticipation that it would provide just the right amount of information; indeed we already have the feeling that it may lie permanently on our desk.

Chemical industry has advanced probably at a greater rate than any other during the last decade. Not only has there been a very great reduction in the cost of making nearly all the standard chemicals, but also numerous substances which were formerly but chemical curiosities are now made and distributed by the car load, which is the American unit of quantity. Production and substances cost as many pence a pound as they formerly cost shillings, or even sovereigns. There is progress to chronicle most of all in the organic fields; new solvents for cellulose compounds, new resins and substances obtained by polymerisation have made rapid strides and it is safe to forecast that further advances will be made in this direction within the present decade. Most of the organic chemical industry in the past has been built upon tar as a raw material, and the layman has been made aware time and again of the bright-hued dyes, the potent drugs and the seductive perfumes wrought from this dark and evil-looking material. Whilst tar itself now plays a part in the new industry of making dustless roads, the organic chemist has developed two new raw materials for his manufactures. These are the hydrocarbons, liquid and gaseous, from crude oil, and alcohol derived by fermentation of molasses or other saccharine material. Very large quantities of both these raw materials are available, far exceeding that of tar if necessary, and it is expected that in time a very large industry will be built up in the products from each of them.

The invasion of the textile industry by the chemist is also only in its infancy, and viscose and acetate silk and cellophane are but the first of future materials derived from cellulose.

The industrial chemist has the task of making new products on the grand scale, of finding applications for them, and of cheapening the cost of production, handling and transport of materials of all kinds. Amazing is the rate at which progress is made when opportunity, including ample funds, allows experience to be gained on the large scale. The oil industry has taught us how to handle gases and liquids in very large quantities; the synthetic ammonia industry has introduced high-pressure technique; rayon has given the knowledge how to make and spin synthetic fibres; first sulphuric acid and later a whole range of organic industries have developed the potentialities of catalytic reactions, of which at present we have only barely a glimpse.

An interesting chapter from the point of view of developments is that headed "Elements and Compounds", in which brief reference is made to a number of substances listed in alphabetical order. Against some of the elements is the remark "this has at present no commercial value", though in some cases the remark is already out of date. Thallium, for example, first discovered by Crookes, has now definite industrial uses, and its price has been brought down below £3 a pound. Under tungsten we read that the requirements have

increased owing to its use in automobiles and aeroplanes; tantalum has become an important factor in the modern radio set. A comparison with a similar list in the 1912 edition of the book would show the rate at which the chemist and the physicist are turning to practical use the rarest of the elements. Stone age, iron age, bronze age mark stages in the history of the world: the age when all the elements are made serviceable to man is approaching.

The American origin of the work is indicated by the fact that under the influence of the 18th Amendment the chapter on brewing was eliminated from the last edition. It is now restored, but the subject is presented strictly from a technical point of view and in no sense as an aid to home fabrication. So we read how China made its beer 3000 years before the Christian era, and how to brew temperance beer with 7–8 per cent extract and malt tonics.

Any criticism in detail of such a wide treatise is impossible—it perhaps has faults of omission and inaccuracy, but we are more concerned with the vast amount of information contained in it and the manner of its presentation in readable form, for which we accord generous praise.

E. F. A.

Short Reviews

Geology of Petroleum. By Prof. W. H. Emmons. Second edition. Pp. xi + 736. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1931.) 30*s.* net.

A DECADE of petroleum geology separates the two editions of Emmons's work, and in that time much has happened in this realm of activity. Oilfields undreamt of then have been developed in parts of the world, including America, where not even the wildest imagination had pictured them. Pools of great magnitude were located, records in depth of wells and yield of oil established, and all this time geological knowledge was being enriched. The author had no alternative but to re-write and, fortunately, to re-illustrate his book, although the grounds for criticism of the first edition have by no means been removed in the new work. It shows a sad lack of sense of proportion to accord to the descriptions of the world's oilfields four-fifths in favour of the two Americas and only one-fifth for the rest of the world. No one disputes the economic pre-eminence of the oilfields of the New World, but this should not weigh in a book of this kind purporting to establish and describe geological principles as affecting petroleum from the universal store of information now available.

Study of the smallest field in a corner of Asia may be, and frequently has been in the past, of far greater academic import than the reams of subsurface data published in connexion with a few of the giant oil-pools of the United States. Here the treatment of such fields as Germany, with its vastly informative salt bodies, Rumania, Palestine, Persia, Iraq and India, including Assam and Burma, the last six in less than twenty pages, including copious diagrams, to say nothing of the mere mention of Miri in less than a dozen lines, is futile. It does not help matters to give references alone; in a general text such as this, the international student of the subject often wants information of a field or oil district such as he would expect to find in "Emmons" comparable with this author's thorough accounts of the United States fields; that is precisely what he will not find, which is a great pity, since the book generally is an improvement on the first and, following the success of the latter, will naturally command wide attention.

The History and Work of Harvard Observatory, 1836 to 1927. By Solon I. Bailey. (Harvard Observatory Monographs, No. 4.) Pp. xiii + 301 + 23 plates. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1931.) 17*s.* 6*d.* net.

THE study of astronomy was held in considerable esteem at Harvard College from the time of its foundation in 1636. Solar eclipse and transit of Venus expeditions were undertaken even in those early days, and various miscellaneous astronomical work accomplished. It was not, however, until 1839 that the Observatory was founded, with a very meagre equipment, to be supplemented eight years later by the 'Great Refractor' (15-inch) with which so much good work was done under the Bonds. Since then the Observatory has developed rapidly (especially under the directorship of Prof. E. C. Pickering) to its present position of international fame.

The story of its development and achievements is well told by the late Prof. Bailey, whose forty-four years of service rendered him specially fitted to act as historian. The first part of his book deals with the origin and history of the Observatory, describing its progress and activities up to 1927. The second part (occupying about half the book) gives an account of the astronomical researches and discoveries made at the Observatory. These are so numerous and varied that the result rather resembles a general history of astronomy during the period considered; it is at least striking evidence of the prominent part played by Harvard in the development of modern astronomy.

The descriptions are necessarily condensed (with the result that the work of outside observers does not always appear to occupy its proper place in relation to the problems described); but nothing of importance is omitted, and the material is con-

veniently classified into chapters dealing with kindred subjects. The final section of the book gives good biographies of the directors, prominent members of the staff, and benefactors. The whole is of great interest to astronomers, both amateur and professional, and especially to students of the history of astronomy.

Das Pollersche Verfahren zum Abformen an Lebenden und Toten sowie an Gegenständen: Anleitung für Mediziner, Anthropologen, Kriminalisten, Museumspräparatoren, Prähistoriker, Künstler, Handfertigkeitslehrer, Amateure. Von Dr. Alphons Poller. Herausgegeben von E. B. Poller und E. Fetscher. Pp. xii + 216. (Berlin und Wien: Urban und Schwarzenberg, 1931.) 12 gold marks.

THIS book, illustrated with 129 text figures, is a very thorough guide to the technique of the improved methods of casting living subjects and dissected specimens, which were devised by the late Dr. Alphons Poller. By the use of the elastic materials known under the trade names 'Negocoll' and 'Dentocoll' it is possible to make very exact moulds of complicated objects such as human brains or the head and hands of living men with an ease and precision which it is difficult or even impossible to attain with plaster of Paris. From these moulds casts are made in 'Hominit' and 'Celerit'. Many scientific workers in the biological and anthropological fields are already familiar with these devices and appreciate the value of the boon Poller's methods have conferred upon them. In fact, it is only the high price of the new materials which has hitherto stood in the way of the wider adoption of these eminently useful devices for making records in the form of durable casts.

This book gives a very detailed account of the technical processes involved in casting and will be eminently useful to all, whether they are anatomists, palæontologists, zoologists, anthropologists, medical men, criminologists, museum preparators or artists, who want to preserve exact records of the form and surface details of any object.

Elements of Engineering Geology. By Prof. H. Ries and Dr. Thomas L. Watson. Second edition. Pp. vii + 411. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1930.) 18*s.* 6*d.* net.

PROBABLY the best departure from the first edition of Ries and Watson's well-known book is the inclusion of a chapter on the geology of reservoir and dam sites which, in view of the big water-impounding schemes put forward in various countries in the last few years, is quite useful. On the other hand, the new chapter on historical geology is superfluous; one cannot adequately condense even an outline of the subject into less than fifty pages, as here, and in any event the modern civil engineer receives instruction in stratigraphical geology as part of his training; if he requires information regarding the geological column of his country, he at least knows where to get it, and one cannot imagine the most elementary student of the subject ignoring the standard text-books in favour of this make-weight chapter. Neither, as a minor point, does it look well in a book published at the price of this, to include a new section the page numbers of which are 313a to 313t inclusive. For the rest, there is little to comment upon; the book is a typical Wiley production, full of the usual geological diagrams and illustrations well executed and printed.

France: a Regional and Economic Geography. By H. Ormsby. Pp. xiv + 515. (London: Methuen and Co., Ltd., 1931.) 21*s.* net.

DURING recent years a great many detailed monographs on different parts of France have been published by French geographers as well as a number of works on various aspects of the geography of France, but English students have had no comprehensive volume on the country. Mrs. Ormsby has supplied this need most successfully. Her treatment is mainly regional and written from the point of view of the geographer with economic interests, but there are also general chapters on climate, agriculture and communications.

The volume is packed with information. Every town of any size has its site and activities analysed. But the details are well arranged and the point of view so well maintained that the book reads easily and holds the attention. Numerous sketch maps are of great assistance and there are references in every chapter to the relevant sheets of French maps. There are also copious bibliographies the value of which would be enhanced if the dates of all the books were given. This volume should make a wide appeal to students of geography or indeed to any reader who wishes to understand France and French activities.

Systematic Botany of the Flowering Families in North China. By Prof. J. C. Liu. Pp. xxiv + 213. (Peiping: The French Bookstore, 1931.) 5 Mexican dollars.

PROF. LIU is to be complimented on being a pioneer in the production of a little textbook specially adapted for elementary students in North China, where greatly increased interest in the subject has been a feature in recent years. Engler's system is adopted—each family being illustrated by a drawing of a typical Chinese species which includes a floral diagram as well as dissections in every case. The descriptive part, which occupies forty pages, is lucid, terms being profusely illustrated by excellent line drawings, though the definition of a genus on p. 20 is misleading owing to an unfortunate simile. The keys to the genera are based on very simple characters, but in those families such as Gentianaceæ where flower colour has been used, they are likely to break down in some cases.

C. V. B. M.

Consumption and the Trade Cycle

AT the recent meeting of the British Association at York, Prof. Lionel Robbins, professor of economics in the University of London, in a paper read before Section F (Economic Science and Statistics) on "Consumption and the Trade Cycle", made a critical examination of the 'Social Credit' proposals associated with the name of Major C. H. Douglas. The following is a short summary of this part of his argument.

Major Douglas bases the diagnosis on which his constructive proposals depend on a survey of factory costing. Consider any article of factory manufacture, he says : a nut and bolt, for example. Part of its cost consists of wages, salaries, etc. ; but part consists of raw material charges, factory upkeep and similar 'overheads'. The sums distributed as *income*, therefore, are not sufficient to purchase current output. What is true of one factory is true of all. It follows, therefore, that, throughout the entire economic system, there is a continuous deficiency of income to purchase the product ; a deficiency which, if not made good by the continuous issue of paper money, must necessarily lead to chronic bankruptcy and confusion.

Now it is perfectly true, as Major Douglas urges, that the sums distributed as ultimate incomes—wages, salaries, rents, etc.—are insufficient to purchase the gross product of industry. *But so far from this being a cause of industrial crisis, it is in fact an essential condition of the smooth functioning of the economic system.*

This can easily be demonstrated if a capitalistic system which is in stationary equilibrium (that is, a system in which no saving is taking place) be examined with the view of discovering the conditions of the persistence of equilibrium. It should be clear that, of the total volume of payments being made at any one moment, only a comparatively small proportion is being made for the final product. The remainder goes to facilitate the movement of goods between the different earlier stages of production. That is to say, at the same time as money is being spent on bread by the wage-earner—the ultimate consumer—the baker is spending money on flour to replace the bread, the miller is spending money on wheat to replace the flour, and so on and so forth.

In order that such a system should continue in equilibrium it is necessary that these payments should be made ; yet they do not go to the recipients of ultimate income. They are costs but they are not *net* income. In any computation of the *net* value produced during the unit period, such as that made in the British census of production, they will be set off one against the other. At the end, when they are thus offset, we get the value of the goods available for consumption ; and for equilibrium to be preserved, it is necessary that the incomes of the factors of production should correspond only to this. In order that the same structure of production may persist from period to period, those payments in the gross income (to use the classical term) which cancel out *must* be made. It is undesirable, therefore, that a state of affairs other than that which Major Douglas describes should actually come to exist.

This conclusion becomes even more forcible if it be supposed that what Major Douglas thinks ought to happen has actually occurred. Suppose that, the quantity of money remaining the same, ultimate incomes were to be raised so as to equal the value of the gross product. What would this imply ? Simply that the whole fund of free capital (amortisation quotas and working capital) had been turned into ultimate income. What would happen ? Prices of ultimate commodities would probably rise ; but prices of intermediate products, raw materials and fixed plant, would collapse. There would be no free capital to buy them with ; there would occur all the symptoms of extreme crisis. Of course, such a state of affairs is not likely to occur. But, if wages are above the equilibrium point, it is possible for something disquietingly like it to begin to make its appearance. The illustration should at least make clear the fundamental point overlooked by Major Douglas : that once there exists what may be called *many-stage* production, it is undesirable that the money income in a given period should be equal to the value of the gross product of that period. Only in a system of hand-to-mouth, or single stage, production is it compatible with the requirements of equilibrium that the net income and the gross income should be identical.

Thus in the case most favourable to Major Douglas —the completely stationary state—his argument breaks down completely. If real accumulation is to take place—that is, if the system is to be progressive—then the refutation applies *a fortiori*. For, in such circumstances, not only must the gross income exceed the amount spent on consumption goods available by the difference between net income and gross income ; it must also contain a quantity equivalent to the amount of net saving. If accumulation is to take place, there must be abstention from using all the productive power available to produce current real income at a constant rate. This involves spending some of the current money income on goods which only give rise to real income in the future.

In subsequent sections of his paper, Prof. Robbins argued that not only is there no reason to attribute industrial depression to a deficiency of consumption, but also that there is, on the contrary, considerable reason to believe that the coming of depression is due to the fact that consumption has become too high for capital extensions already embarked upon to be profitably carried through. Recent investigations, he argued, seem to make it more and more probable that booms are due to forced saving brought about by inflation of credits ; and that the collapse of the

boom is due to the exhaustion of this process. It is truer to say that the depression comes because consumption is too urgent than because it is not urgent enough. We do not "starve in the midst of plenty" because we do not demand enough; we starve because, having forced the tree of prosperity, we seek to pluck its fruits before they are ripe.

It may be added that a more elaborate critique of proposals substantially similar to those of Major Douglas will be found in "The Paradox of Saving" by F. A. von Hayek in *Economica* of May, 1931.

Canadian Polar Year Expedition, 1932–33

CANADA'S part in the International Polar Year is to establish a chain of stations not more than 1400 km. apart, connecting Greenland with the United States station at Fairbanks, Alaska, and to provide special magnetic equipment at Meanook, the nearest permanent magnetic observatory to the north magnetic pole. For this purpose three expeditions have been sent out, the first to Cape Hope's Advance in Hudson Straits, 1000 km. from the nearest station in Greenland; Chesterfield Inlet on the west coast of Hudson's Bay, 1200 km. away; and finally Copper Mine on the Coronation Gulf, 1300 km. to the west, and a little more than 1500 km. from Fairbanks, Alaska. The accompanying map (Fig. 1) shows the position of these stations, as well as the regular meteorological stations in northern Canada. It may also be mentioned here that at these stations there are well-equipped wireless stations, so that communication can always be obtained with the outside world.

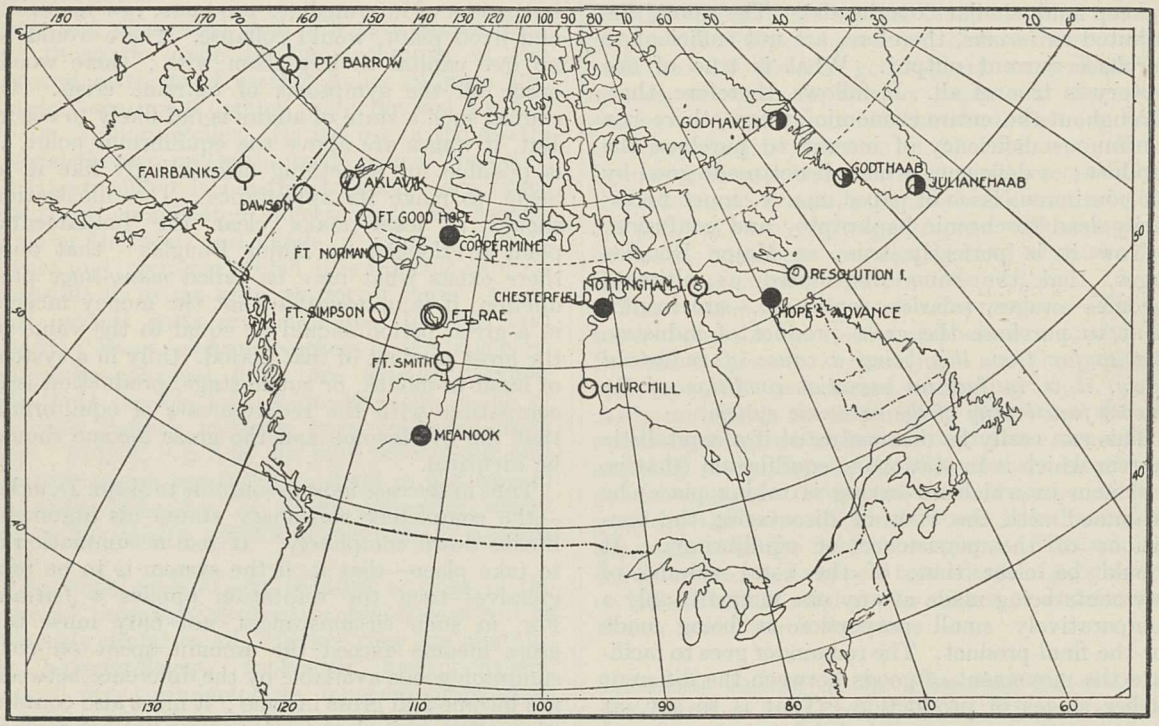

FIG. 1.—International Polar Year stations in North America and Greenland. ○, Canadian telegraph stations; ●, Canadian Polar Year stations specially equipped and manned; ◎, British expeditions; -○-, United States stations specially equipped and manned; ◑, Danish stations.

At *Cape Hope's Advance*, lat. 61° 5′ N., long. 69° 33′ W., complete surface meteorological and upper air observations, with twice-daily pilot balloon ascents, will be continued throughout the year. The auroral programme will consist of visual observations at specified hours, and as opportunity occurs photographs will be taken. The station is in charge of Mr. J. E. Lilly of Acadia University, assisted by the radio operators at the station. Cape Hope's Advance is situated on a fairly high promontory extending out into Hudson Straits, and at times very high wind velocities are obtained, the most notable being above one hundred and thirty miles an hour for one hour, and above one hundred miles an hour for several hours continuously. The temperature averages about fifteen below zero in January, while in the middle of summer it has exceeded 70°. Rainy days are frequent in June and August, frequently accompanied by fog with snow in any month of the year.

Chesterfield Inlet.—The principal Canadian station is at Chesterfield Inlet, lat. 63° 45′ N., long. 91° 50′ W., about four hundred and fifty miles from the north magnetic pole, this being the

nearest magnetic station to the pole that will be established in this international undertaking. The party is in charge of Mr. F. T. Davies of McGill University, who has had extensive experience in magnetic work on the Byrd expedition in the antarctic. He will be ably assisted by Prof. B. W. Currie of the University of Saskatchewan, Mr. Stuart McVeigh of Queen's University, and Mr. John Rea as assistant observer.

A complete set of Lacour self-recording magnetic instruments comprising nine variometers and three recorders will be installed, together with a Smith portable magnetometer, an earth inductor, and a Carnegie declinometer with absolute measurements. Advantage will also be taken of this to measure earth currents with a very complete earth current equipment. The auroral programme provides for two stations about 30 km. apart connected by radio, to measure the height of the aurora, and a McLennan night spectrograph to obtain photographs of the visible and infra-red portions of the spectrum. A complete log will be maintained of auroral phenomena, and its approximate intensity measurement with a pocket spectroscope.

As opportunity occurs, the atmospheric potential gradient will be measured by means of ionium collectors and the Patterson electrometer.

The meteorological equipment provides for full surface meteorological observations, pilot balloon ascents twice daily, kite flights as weather permits, and, on the international days, visual signalling meteorograph ascents. Continuous record of the difference in temperature between the top of the radio mast forty-five metres above the surface and the surface will be made with special thermocouples. At the same time an electrical resistance recording thermograph will give the temperature of the air at the four-foot level, and a Robitzch bimetallic actinograph and a sunshine recorder will be utilised for radiation measurements. A range-finder has been included in the outfit to obtain the height of the cloud as frequently as possible, and the cloud observations will be made according to the programme of the International Cloud Commission. The radio operators at Chesterfield Inlet are entering very enthusiastically into the work also, and are lending very valuable assistance to the party. July is the warmest month at Chesterfield, with an average temperature of about 48°, while the coldest months are January and February, when the temperature goes to an average of 26° or 27° below, the lowest recorded being 55° below zero.

At Chesterfield Inlet there is a Roman Catholic mission which has a very fine hospital attached, a radio station, Hudson's Bay Mounted Police, and at times a doctor is stationed at the Inlet.

Copper Mine.—The third station in this chain is Copper Mine, lat. 67° 42′ N., long. 115° 30′ W., and will be in charge of Mr. R. C. Jacobsen of the University of Toronto, assisted by Mr. D. R. Kinnear and A. V. Potruff, radio operators. It will be the most important meteorological station in the system, and situated as it is on the Arctic Ocean about midway between the Atlantic and Pacific, it gives an exceptionally good opportunity to observe the influx of polar air from the arctic regions. At this station the same meteorological programme will be carried out as at Chesterfield, but in addition the Moltchanoff radio meteorographs will be used on international days, and besides recording the temperature at the top of the radio mast and at the four-foot level, it is hoped to make a special study of the cooling effect of the long winter nights and the temperature inversions.

The auroral programme will be the same practically as at Cape Hope's Advance. Visual observations will be made at definite hours and photographs taken as opportunity occurs. The meteorological station at Copper Mine has been in existence for about two years; during this time, average temperature in January is about 30° below zero, and on six occasions it fell below 40° below zero. The snowfall at Copper Mine is apparently very light, only two or three inches being recorded up to the end of January, while light rainfall occurs in April, and fairly heavy rain in July and August. This station is at the mouth of the Copper Mine River on Coronation Gulf, and is slightly north of Great Bear Lake.

Fort Rae.—Fort Rae is north of Great Slave Lake. It was the only continental station in Canada operated during the First International Polar Year, and is again occupied by the British. It is about three hundred miles due south of Copper Mine, and forms with the Canadian stations a most valuable link in the network of stations across the arctic this year. Through Fort Rae the Canadian stations are also connected with the permanent magnetic observatory at Meanock, lat. 54° 37′ N., long. 113° 21′ W., where a complete set of Lacour recording instruments have been installed. This magnetic station is the nearest permanent magnetic station to the north magnetic pole, and will be in charge of Mr. Vestine of the University of Alberta, with Mr. H. E. Cook as the magnetic observer. In addition to the magnetic work, auroral and meteorological observations will be taken as opportunity occurs.

All the Canadian stations in the arctic shown in Fig. 1 will take special meteorological and visual auroral observations. They have been furnished with a Lacour pocket spectroscope, in order that the intensity of the aurora may be estimated approximately.

It is a very great pleasure to acknowledge the loan of special equipment for this purpose from the United States Weather Bureau, the Carnegie Institution of Washington, the University of Toronto, McGill University, the Topographical Survey of Canada, the Dominion Observatory, the University of Saskatchewan, and the Department of National Defence.

The Canadian stations are among the pivotal stations envisaged in the programme of the International Polar Year Commission. The observations obtained during the present twelve months in meteorology and terrestrial magnetism at these isolated outposts in northern Canada promise to supply information long desired both by Canadian scientific services and by many investigators in geophysics.

J. PATTERSON.

Obituary

PROF. J. C. FIELDS, F.R.S.

IN the death of Prof. John Charles Fields on August 9 the University of Toronto lost one of its most renowned members and probaby its most gifted mathematician. Prof. Fields was born on May 14 at Hamilton, Ontario, in the year 1863. When quite young he displayed unusual skill in mathematics and in his university course at Toronto his brilliancy attracted much attention. Though his doctorate was taken at Johns Hopkins University, Baltimore, it was to Germany that he, like many another student from the American continent in the early days, turned for stimulus to mathematical research. There it was that he found his chief inspiration for his subject. He studied at Paris for a time but it was at Göttingen and Berlin, where he came under the influence of such leaders as Wierstrass, Klein, Fuchs and Schwartz, that his imagination was fired and the foundations laid for the creative side of his life's work.

In 1906, Fields published his famous treatise on "Theory of the Algebraic Functions of a Complex Variable", a work which at once received world-wide acclaim and won for its author immediate recognition as a mathematician of the first rank. In his conversations with me he often spoke with pride and with deep affection of the friendly part played by the late Mittag-Leffler, the renowned Swedish mathematician, in the negotiations that led up to the publication of this work.

Prof. Fields was called to the University of Toronto in the opening year of the present century. Since that time his researches and those of workers associated with him have been among the outstanding contributions to knowledge made by that institution.

In all his academic relations Fields strenuously advocated and promoted in every way open to him the claims of research. Soon after his appointment to Toronto he openly expressed the view that students desiring to specialise in mathematics came to universities in America handicapped by defective mathematical training in the secondary schools. Another handicap to which he considered the students of a generation ago were subjected both in Canadian universities and in American universities generally was that involved in the use of defective mathematical texts, more particularly of texts on the calculus. It was his considered opinion that one would not be far wrong in attributing the almost complete sterility of the mathematicians of the last generation in America to inadequate and ineffective teaching of the calculus. But all this was gradually changed. Through the efforts of Fields and of those of other leaders holding similar opinions, new life was breathed into the teaching of mathematics in Canada and the United States, with the result that an ever-increasing stream of research achievement is becoming so great as to tax severely the facilities available for publication.

During the period of the War and for some time afterwards Prof. Fields was president of the Royal Canadian Institute of Toronto. Throughout his term of office he never ceased to advocate scientific research as the ideal of the Institute and to emphasise the opportunity its organisation afforded for the advancement of scientific thought. He initiated a movement in the direction of having research professorships attached to this institute similar to those now administered by the Royal Society, the Royal Institution and the Franklin Institute. From the way in which he laid his plans for the success of this project and from the manner in which he was quietly working them out I believe that had he lived but a few years longer he would have achieved his aim.

Prof. Fields was president of the International Mathematical Congress held in Toronto in 1924. It was a very successful meeting and it was largely through the financial aid personally secured by him that it and the meeting of the British Association for the Advancement of Science held at the same time were made possible. The fact that the Press of the University of Toronto was able to handle such a difficult typographical task as that involved in the printing of the "Proceedings of the International Mathematical Congress" was somewhat of a surprise to foreign mathematicians. It was only made possible, however, through the close co-operation that was maintained between Mr. R. J. Hamilton, director of the Press, and his staff on one hand and Prof. Fields with his associate editors on the other.

What I consider to be Fields's greatest achievement in advancing the cause of research in Toronto was the institution of the special annual finance grant that is made by the Legislature of the Province to the University of Toronto and ear-marked for research. The first of these grants, which amounted to more than 75,000 dollars, was made on the recommendation to the Government of Ontario of the Hon. Dr. H. A. Cody, then Minister of Education and now president of the University. I do not think I am revealing any secret in stating that this grant was secured very largely as a result of the most earnest solicitation by Prof. Fields.

One of Prof. Fields's last activities was the establishment of a fund with which to provide two or more gold medals, to be awarded by a Committee of the International Mathematical Congress at stated intervals for outstanding achievements in mathematical research. The initial sources of the fund were the cash balances remaining in the hands of the organisation committees of the 1924 Toronto meetings of the British Association and the International Mathematical Congress. His great interest in this fund

is shown by the fact that according to the provisions of his will the residue of his estate after certain annuities are paid will pass to the medal fund, which it gave him such pleasure and satisfaction to inaugurate.

Of late years Prof. Fields's life was more strenuous than the state of his health warranted. He frequently related with evident pleasure how he had just caught a tram, or train, and he often travelled by aeroplane in order to economise his time. Some twenty years ago an attack of rheumatic fever left him with health impaired, and in 1924, through carrying his luggage to the station on one of the numerous journeys made in organising the 1924 meetings, he overstrained his heart. In spite of this disability the last eight years of his life were crowded with activities. Two years ago he suffered a slight cerebral hæmorrhage and in May of this year he had a violent heart attack. He recovered sufficiently to sit up at times in a reclining chair from which he dictated letters at intervals to some of his intimate friends.

Prof. Fields was the recipient of numerous honours, but the one he valued most was his fellowship in the Royal Society of London. Quite recently the Italian Government expressed a desire to confer upon him an honour of rare distinction but this he was compelled to decline through the existence of self-denying legislation enacted in Canada at the close of the War. I should like to mention one outstanding mental gift possessed by him. It was his remarkable memory. It was my privilege to be present at a lecture given by him some years ago on "The Evaluation of π". To my astonishment he went to the blackboard in the course of the lecture and without hesitation wrote out the value of π correct to 200 decimal places.

Prof. Fields's life was spent in the cause of research. He was devoted to his friends, and I never knew anyone more pure in heart and thought or more generous in his judgments of others. With the words of one of his admirers I agree: "He has, I am sure, left behind him sweet memories with people the world over, and lucky, I think, are those who passed his way." I was fortunate in being one of that happy band.

J. C. McLENNAN.

MRS. G. P. BIDDER

THE life of Mrs. Bidder, who died on September 25 at seventy years of age, was full of beneficient activities—scientific, social and domestic. I am competent to touch only upon the earlier scientific period before her marriage when, as Marion Greenwood, she was well known to many scientific colleagues. She went to Girton from Bradford Girls' Grammar School with an entrance scholarship in 1879, when she was seventeen years old. She obtained a first class in both parts of the Natural Sciences Tripos for 1882 and 1883 and was at once appointed demonstrator in physiology to the science students of Newnham. In those days there were no lecturers in science at that college. In 1888 she was awarded by Girton College the Gamble prize for a dissertation.

In 1890 she was appointed the head of the Balfour Laboratory in Downing Place—a queer, ugly block of a building, once a chapel. How it came by so surprising a change I never heard. Some contraction in the spiritual life of Cambridge must have thrown it, a spiritual derelict, on to the market. At any rate it became the laboratory for women science students and, as Cambridge was still stirred by the genius and the tragic death of Francis Maitland the most brilliant of the Balfour brothers, it bore his name. There, until her marriage to Mr. George Bidder in 1899, Marion Greenwood was responsible for the teaching of the women science students, and herself taught.

Her research work, however, was carried out in Foster's laboratory, where physiologists and biochemists, still undivorced, habited adjacent rooms to their mutual comfort and benefit. The rooms, in order, down the little dark passage, were the homes of Sheridan, Lea, Walter Gaskell, Marion Greenwood, and beyond and through her room, in a cupboard of a place, Langley. Miss Greenwood was in a small passage room, and I shared the one bench with her. No modern Ph.D. aspirant could or would compress his or her activities into the space we were contented with in those days.

At that time women were rare in scientific laboratories and their presence by no means generally acceptable—indeed, that is too mild a phrase. Those whose memories go back so far will recollect how unacceptability not infrequently flamed into hostility. The woman student was rather expected to be eccentric in dress and manner; she was still unplaced, so far as the male in possession was concerned. Miss Greenwood, it so happened, was not only a woman of quite unusual intellectual distinction but she had also great personal charm and a great gift of comradeship. Science by no means absorbed all her interest which covered a wide knowledge of literature. She worshipped Meredith, and was a lover of Jane Austen and Peacock.

She took her share, and it was a large one, in the government of Newnham and Girton, but I am inclined to think that the best she did for women was just being her gracious and kindly self in those early days of hostility, touched as it was sometimes by a spice of active persecution.

Miss Greenwood made solid contributions to science. Her first scientific paper was on the gastric glands. The amazing story of the secretory granules, which revealed so much of the inner working of the living cell, was then being deciphered by Langley. Miss Greenwood was a histologist, and it was natural for her to join in that quest. Her paper of 1890 on the action of nicotin upon certain invertebrates also reflected

Langley's interests, but she soon struck out her own line, the physiology of the protozoa. Her papers on that subject are few but well worth reading now for she was above all an accurate observer.

Two stand out, that on the rôle of acid in protozoan digestion and that on the resting nucleus of protozoa. In the former, published jointly with Miss Saunders, an observation made at the Institut Pasteur by le Dantec was followed up and extended. He had found acid present in the food vacuoles. Vacuolar digestion the authors found always to be preceded by the secretion of acid and the acidity decreased to neutrality as digestion proceeded. The paper is in fact a noteworthy treatise on protozoan digestion (*J. Physiol.* 5, 1884).

The paper which interested me most at the time and which I still find colouring my views was on structural changes in the nucleus of protozoa. Not only can gross structure be changed but also the distribution and quantity of iron be altered by putting a 'metabolic strain' on the organism through diet or partial starvation from oxygen (*J. Physiol.* 20, 1896). Her active research career ended when she married. W.B.H.

WE regret to announce the following deaths:

Dr. William Garnett, secretary and educational adviser to the London Technical Education Board, 1893–1904, educational adviser to the London County Council, 1904–15, and formerly principal and professor of mathematics in the Durham College of Science, Newcastle-upon-Tyne, on November 1, aged eighty-one years.

Prof. Thomas Gray, professor of technical chemistry at the Royal Technical College, Glasgow, a well-known authority on fuels, on September 26, aged sixty-three years.

Sir Bernard Mallet, K.C.B., Registrar-General from 1909 until 1920, president since 1929 of the Eugenics Society and a past president of the Royal Statistical Society, on October 28, aged seventy-three years.

News and Views

Nobel Prize for Physiology and Medicine for 1932

WE note with pleasure the honour conferred on British science by the award of the Nobel Prize for 1932 for physiology and medicine to two of our leading investigators of the physiology of the nervous system, namely, Sir Charles Sherrington, past-president of the Royal Society and Waynflete professor of physiology in the University of Oxford, and Prof. E. D. Adrian, Foulerton research professor of the Royal Society and lecturer in physiology in the University of Cambridge. In recent years it has generally been the practice to divide the prize into two parts and give them to two workers in a selected branch of medical science, but it is a rare fortune for both to fall to the lot of a single country. The chief contribution to our knowledge of the functions of the central nervous system has come to us through the researches of Sir Charles Sherrington, who by his great skill in experiment has brought the immense complexities of this subject within the range of objective analysis, revealing fundamental plan and orderly sequence in the numerous reflex actions by which the central nervous system controls the activities of the body and continually adjusts them to the environment. Some of these experiments have been presented in masterly fashion in his book on "The Integrative Action of the Nervous System" which is universally recognised as the standard work among neurologists. Until recently the mode of working of our sense organs was shrouded in mystery and capable of discussion only in psychological terminology. Prof. Adrian has performed a signal service to science in subjecting so elusive a problem to laboratory treatment. Using biophysical methods, he has, for the first time, been able to bring the sense organs and associated nerves into line with other nervous organs the function of which is better known. His book on "The Basis of Sensation" has provided us at least with a reasonable view based on laboratory experiment.

Nobel Awards in Great Britain

SINCE the foundation of the Nobel Trust in 1901, seventy-six prizes for physics, chemistry and physiology and medicine have been awarded, of which fifteen have gone to scientific men working in Great Britain. The latter are distributed as follows: *Physics*:—Lord Rayleigh (1904); Prof. (now Sir) J. J. Thomson (1906); Prof. (now Sir) William Bragg, jointly with Prof. W. L. Bragg (1915); Prof. C. G. Barkla (1917); Prof. C. T. R. Wilson (1927, jointly with Prof. A. H. Compton, then at the University of Chicago); Prof. O. W. Richardson (1928). *Chemistry*: Sir William Ramsay (1904); Prof. Ernest (now Lord) Rutherford (1908); Prof. Frederick Soddy (1921); Dr. Francis W. Aston (1922); Prof. Arthur Harden (1929, jointly with Prof. von Euler). *Physiology and Medicine*: Sir Ronald Ross (1902); Prof. Archibald V. Hill (1922, jointly with Prof. Otto Meyerhof); Sir Frederick Gowland Hopkins (1929, jointly with Dr. Eijkman); Sir Charles Sherrington and Prof. E. D. Adrian (1932).

Julius von Sachs

THE annual reception given by the president of the Linnean Society, Prof. F. E. Weiss, on October 20, was this year of special interest as it was the occasion of the presentation to the Society on behalf of a number of subscribers of a portrait of the distinguished botanist, Julius von Sachs, painted by his artist daughter Maria Sachs. It is particularly appropriate that this portrait of one of the most eminent of its foreign members should come into the possession of the Society at the present moment,

as this month has seen the centenary of Sachs' birth. In commemoration of this event, two former pupils of Sachs, Dr. D. H. Scott and Prof. F. O. Bower, delivered appreciatory addresses and gave some personal reminiscences of the great plant physiologist. Another former student in Sachs' laboratory, Prof. S. H. Vines, was unfortunately prevented by ill-health from being present but in a written address, which was read at the meeting, he dealt more particularly with the stimulus which Sachs' "Lehrbuch der Botanik" gave to the development of botany in Great Britain. There can be no doubt that, distinguished as he was for his contributions to plant physiology, Sachs was a great all-round botanist and an inspiring teacher, whose influence through the many pupils he attracted to his laboratory from all countries was felt wherever botany was studied.

Industrial Depression and Gold Reserves

A LECTURE by Dr. H. Levinstein on "World Problems of the Chemical Industry" at the Imperial College of Science and Technology on October 27 formed the first of a series of addresses in which men who have won distinction in various fields will present views on industrial affairs to students of the College. Taking the ratio of external trade to population as a measure of the standard of living of a community, Dr. Levinstein showed that more than half the world has a standard which is very much below that of Europe, although the latter is itself far from luxurious. Modern industry has been built up on the assumption that people can be persuaded to buy things which their forefathers did without, and there is no reason for believing that industrial expansion is approaching a limit. The recent setback in the development of world trade, which started with the fall in prices of primary commodities, thereby reducing the purchasing power of the agricultural community and eventually of the whole population, is, in Dr. Levinstein's opinion, a temporary condition brought about mainly by abnormal shifting of gold reserves. There is no actual shortage of available gold deposits. The trouble is due to the removal of gold from where it can perform its proper service to industry. Although the State took charge of the production of munitions during the War, it made no attempt to meet the gold payments demanded by the United States by undertaking extraction of the metal from ore, although this might have been done by working deposits of lower grade than private companies would exploit. Actually, the gold required was taken from reserves and a collapse of trade followed. It was as if a demand to be paid in bricks was met by pulling down houses.

Progressive Chemical Industry

Although gold production is of great importance to industry, as was shown years ago by the effects of the introduction of the cyanide process, Dr. Levinstein said that the human factor is always of vital significance in any consideration of industrial problems. Political economists are apt to forget that men do not always behave in a manner best suited to the furtherance of their economic interests, but are often influenced by fear and prejudice. Science alone builds continuously upon the work of previous investigators, and has a unique record of progressive development. To young men now entering the chemical industry it may seem that opportunities for making profitable discoveries and improvements are becoming less numerous, but Dr. Levinstein said he had heard such views expressed thirty years ago and considers them as false to-day as they were then. There is certainly great scope for fresh ideas and discoveries in the dye-stuff industry, and he believes that the fine chemical industry as a whole offers extensive opportunities to young chemists. Finally, further advances in biochemistry may be expected to open up vast new fields for chemists to explore. Indeed, more precise knowledge of the factors governing the growth of the living cell will undoubtedly lead to great developments in medicine.

The Aircraft Industry and Chemical Engineering

THE value of research in chemical engineering formed the substance of the first Hinchley memorial lecture delivered before the Institution of Chemical Engineers by Mr. H. T. Tizard on October 28. At first sight the aircraft industry seems very remote from the chemical industry, but developments in aeronautics have already been of great value to the chemical industry. Perhaps the most striking example of this may be found in the development of cellulose paints. The possible uses of solutions of nitrocellulose and cellulose acetate were explored on a small scale before the War, but they were first used on the large scale for the protection of the fabric of aeroplanes and balloons. During the War scientific knowledge of cellulose esters accumulated rapidly, and the manufacture of cellulose acetate was begun. The shortage of the usual solvents forced upon us the necessity of trying substitutes, so enlarging our knowledge of cellulosed solutions and preparing the way for the economic production of modern cellulose finishes. The manufacture of cellulose esters and solvents is now one of the most important branches of chemical industry.

THE strong incentive to obtain the highest thermal efficiency in aircraft engines has led to the manufacture and use of lead tetra-ethyl on a large scale. There is now an equally strong incentive to develop heavy oil internal combustion engines for aircraft. It is quite possible that this will only be satisfactorily accomplished if a suitable synthetic chemical compound can be found to promote the smooth combustion of oil when injected into the engine cylinder. Again, the economic success of air transport depends largely on the working life of an engine between overhauls, and this depends mainly on the stability of lubricating oil. The study of lubricants becomes more and more a chemical problem and in future

chemical engineers will have to produce them to precise specifications. One of the most vital problems of the aircraft industry to-day is that of the production of light alloys and prevention of the corrosion of metals and alloys. This is a matter of the widest industrial importance. There are many other ways in which the aircraft industry has already influenced the chemical industry. This influence is bound to persist, since the aircraft industry is not a self-supporting industry, and can only be made self-supporting by intensive scientific investigation of all its problems.

Site of Newcomen's Engine

As is fully recognised to-day, it was the invention of the atmospheric steam pumping engine by Newcomen that saved many mines from closing down and provided for the first time an engine capable of dealing with water in mines of any considerable depth. The first engine of which we have any record is that delineated in the print bearing the inscription "The Steam Engine near Dudley Castle. Invented by Capt. Savery and Mr. Newcomen. Erected by ye latter 1712. Delin: & Sculp: by T. Barney 1719." Two copies of this print are preserved, one in the Birmingham Public Library and the other in the Salt Library, Stafford. There is little contemporary evidence as to the site on which this engine was erected, but in a paper read to the Newcomen Society on October 19, at the Science Museum, Dr. T. E. Lones described how with the aid of documents, local histories, parish registers, rate books, etc., and a study of the geology of the district, he has been led to the conclusion that the engine stood in the parish of Tipton, under which is an inclined seam of coal some 24 ft. thick. On the Birmingham print, besides the many printed references at the side of the drawing of the engine, is the significant manuscript note: "The beam vibrates 12 times in a minute and each stroke lifts 10 gallons of water 51 yards perpendicularly." This appeared to eliminate much of the area in which the coal is found at greater depths than about 150 ft., while further considerations made it possible to determine the position of the engine relative to Dudley Castle. It is, however, probable that unless further documentary evidence, such as might be found in a copy of an old lease, is forthcoming, the exact site will remain unknown. At the conclusion of the meeting it was announced that the next meeting of the Society, on November 16, will be devoted to the reading of a newly discovered diary of the eminent engineer Joshua Field (1787–1863), while the meeting in December will be the Arkwright bicentenary meeting.

Empire Broadcasting

IT is now nearly five years since the experimental short-wave transmitter, operating on a wave-length of 24 metres, was established at Chelmsford primarily for two-way working with America. The station has since been in constant use by the British Broadcasting Corporation for experimental broadcasting to various parts of the world to enable data to be collected on the possibilities of a regular Empire broadcasting service. Following the consideration of a scheme submitted to the Imperial Conference of 1930, it was decided that the British Broadcasting Corporation should establish an Empire broadcasting station at Daventry. The construction of this station is now well advanced and it is expected that the first transmissions will take place about the middle of December. This new station is intended to provide a programme service which will reach the whole Empire at a reasonable listening time, and for this purpose the Empire has been divided into five zones comprising Australasia, India, Africa, West Africa and Canada. The present arrangements provide for a two hours' programme between 6 P.M. and midnight in each zone. Two transmitters of about twenty kilowatts rating are being installed at Daventry; these will be capable of operation on any one of a series of eight selected wave-lengths varying from 14 metres to 50 metres. These transmitters will supply a number of directional aerial systems, the actual wave-length and direction of transmission in use at any time depending upon the zone to which the programme is being sent, and the prevalence of daylight or darkness along the route. The inauguration of the service is now awaited with much interest. It is anticipated that for a period of about six months the service will be experimental and arrangements will be made to collect reports of reception from selected listeners in all parts of the Empire.

College and Faculty Dissociations

MR. A. MOORE HOGARTH, founder and chairman of the College of Pestology (Incorporated), referring to the paragraph entitled "A 'College' in an Office" in NATURE of October 22, informs us that H. W. Blood Ryan is no longer associated with this institution, and that it has had for a considerable time a laboratory, a reading-room and a museum. The registered office of the College is at 52 Bedford Square, W.C.1, and the laboratory for "Pyorrhœa and Skin Clinics" is at 233 Pentonville Road, N.1. Since receiving the above information, the Hon. Secretary of the International Faculty of Sciences has sent us extracts from the records of meetings of the Council of the Faculty held on September 19 and October 10. At the former meeting, a motion was brought forward relating to the professorial title and academic distinctions of H. W. Blood Ryan, and at the special meeting held on October 10 it was resolved that as evidence of these qualifications had not been furnished to the Council, "his resignation from the office of president and fellowship was unanimously accepted by the Council".

IN reply to an inquiry relating to this communication, Mr. Blood Ryan writes as follows: "Although I resigned all connection with the Faculty on October 10th, and the College of Pestology on September 22nd, I am bound to say that I still consider that there exists no other world-wide body attempting to do those things set forth in the prospectus of the Faculty. I was largely responsible for the addition

of the word 'International' to the title, to avoid the obvious danger of misconception which was inherent in title at the time I became associated with the body. In regard to the references to criticisms in *Truth* of the Faculty of Sciences and in your journal some years ago, of The College of Pestology, allow me to say that I am unaware of any such statements, having only joined these bodies early this year."

The Deterioration of Paper on Ageing

THE article on "The Deterioration of Paper on Ageing", which appeared in NATURE of Aug. 27, p. 320, has occasioned some comments from Mr. James Strachan, who is well known in paper-making circles. Mr. Strachan's communication is of particular interest in that it refers to the paper on which NATURE itself is printed. Before 1882 this contained a fairly large proportion of rag, but was replaced from about 1892 onwards by a mixture of esparto and wood. Mr. Strachan points out that the volumes containing rag have a marked tendency to turn brown at the edges of the sheet, whilst the issues for 1892 and 1893 are entirely free from this sign of deterioration. The latter have in fact, even now, as great a bursting-, tensile- and folding-strength as the paper used at the present time. On first consideration these facts appear to make a case for paper containing esparto as distinct from rag. As emphasised in the article, however, the methods of manufacture and storage must also play important parts, and in connexion with the former Mr. Strachan emphasises the formation of hydrochloric acid by the inter-reaction of aluminium sulphate and residual chlorides. So far as the latter is concerned, it may be stated that two sets examined by the writer of the article show distinct signs of browning at the edges even after 1893, and in one case it is extremely difficult to distinguish in this way the rag paper from that containing esparto; these happen to be volumes which are very frequently consulted. Those who possess long runs of NATURE may find some interest in making the comparison for themselves.

"A History of Fire and Flame"

IN reference to the review of this book which appeared in NATURE for October 15 (p. 562), Dr. O. C. de C. Ellis writes to say that it was impossible for him to include the many thousands of references that he had at hand. In doubtful controversies he had had regard to inherent probability, and often, in the absence of definite information, weight was given to accumulations of evidential suggestion. Dr. Ellis considers that, though we do not know that the alchemists experimented with oxygen, we can understand many otherwise incomprehensible passages, in no way interrelated, if we believe that they did. As to the tentative identification of Boyle with "Eirenæus Philalethes", Dr. Ellis still thinks that it is inherently possible that Boyle may have issued treatises under a pseudonym. Upon the material nature of phlogiston, he says that Cavendish and his contemporaries thought at first that hydrogen was phlogiston, and quotes the authority of Stillman for the statement that Stahl approved Becher's characterisation of phlogiston as of an "earthy nature". Dr. Ellis's hypothesis that the alchemists experimented with oxygen is certainly an interesting one, but we feel that more and weightier evidence is required to substantiate it. The problem of the identity of "Eirenæus Philalethes" is extremely obscure, but he was not the same as Eugenius Philalethes (Thomas Vaughan), with whom Dr. Ellis has apparently confused him. Bibliographical references on this point are to be found in Ferguson's "Bibliotheca Chemica", vol. 2, 190–7 (1906).

New International Psychological Journal

Character and Personality is the title of the most recent addition to the number of psychological journals, and it is unique in that it is to appear in English and in German (London: George Allen and Unwin, Ltd., 2*s*.). In the first number, Prof. W. McDougall has an article on the meaning of the title words. He points out the confusion in meaning attached to the word character, and discusses the more common usages. The problem has for the most part been neglected by psychologists. There is also a difference between the English and German use, the former tending to look upon it as representing the single distinctive feature of an individual, the latter as the sum total of those features, properties, or qualities of an individual organism which are peculiar to it and serve to distinguish it from other individuals. Closely allied to, and in popular use frequently indistinguishable from, character is temperament; Prof. McDougall has for years insisted on the use of temperament for the sum total of the effects on the mind of the functioning of the bodily processes, a use which is in accordance with the tradition of centuries (although that does not justify the generalisations of some enthusiasts to the effect that all mental life is entirely dependent on such processes). Workers in applied psychology have been, however, almost forced to use temperament for emotional organisation, but there is no doubt that it would be useful if we did not use character, personality, and temperament as synonyms, but made clear and scientific the implied differentiation; and for this, McDougall's article is excellent.

Physics in Psychical Research

IN the *Hibbert Journal* for October, Prof. D. F. Fraser-Harris contributes an article on what he calls the new era in psychic research. It is an account of the recent experiments with the medium, Rudi Schneider, and a summary of the results which are said to have been obtained in Paris when infra-red rays were interrupted through some agency which appeared to be connected with the medium. Prof. Fraser-Harris, in his description of some of the more startling phenomena that he has himself observed, does not seem to have cherished many doubts as to the 'super-normal' character of the occurrences. He states that there have never been suspicions of the medium himself when examined outside the latter's

home, although the facts are that the surreptitious freeing of one hand from the controllers was made the subject of heated controversy in 1924 and has been suggested many times since as the means whereby certain of the minor 'phenomena' were produced. Prof. Fraser-Harris concludes by the plea that these occurrences are worthy of scientific examination and that this demonstration of exteriorised energy opens up a new era in psychical research. He appreciates the difficulties both from the point of view of the physiologist and that of the physicist, but is of the opinion that the way is now open for the independent verification of the disputed phenomena. Certainly if the recent claims made by MM. Osty on behalf of the medium can be substantiated, then an important step forward has been made.

Life-Saving Appliances on Merchant Ships

THE Royal Society of Arts has several times given awards for inventions in connexion with life-boats and in 1878 it appointed a committee to consider marine life-saving apparatus. Its interest in nautical affairs is also shown by the Thomas Gray lectures, which were this year given by Capt. O. A. Barrand and Mr. G. A. Green on life-saving appliances on merchant ships, reports of which have now appeared (*J. Roy. Soc. Arts*, Sept. 16, 23, 30, Oct. 7). The lectures were divided into sections dealing with life-buoys and life-jackets, coastal life-boats, ships' boats, boat stowage and buoyant apparatus. The credit for the design of the "Standard" life-jacket, we learn, belongs to certain officers of the Board of Trade, but jackets can be manufactured by anyone if permission is obtained. The best jackets are now of 'kapok', which when suitably packed has a buoyancy value of 3½ times that of cork. Kapok is the seed-hair of a plant growing in the East, but only Java kapok is permitted in life-jackets. The tests for jackets are stringent and the Standard jacket has to contain 24 oz. of the best Java kapok and to be capable of supporting 20 lb. of iron after floating in fresh water for 24 hours with 16½ lb. of iron attached. The loss of buoyancy of Java kapok has been shown to be only 10 per cent in thirty days' immersion.

Annual Weather Report

THE recently published annual volume of the *Weekly Weather Report* (London: H.M. Stationery Office) is the fifty-fourth annual summary of weather recorded at official weather stations or stations maintained by private individuals in co-operation with the Meteorological Office, in which the week is made the unit of time. Until recent years, summaries of individual weeks were printed within a short time after the conclusion of each week, but since that was discontinued, advantage has been taken of the opportunity thereby afforded of presenting a whole year's data in a form that should be extremely handy for the statistician who seeks to relate agricultural statistics of crops with the weather. The week has for long been held by many meteorologists to be the ideal unit of time in agricultural meteorology, and the *Weekly Weather Report* has always aimed at being the farmer's weather report. This explains why in this latest volume the period begins on March 1, 1931, and ends on February 27, 1932, so as to cover a farmer's year. The main features of the weather of the whole year for any one of the twelve 'districts' into which the British Isles are divided are readily seen by the inspection of a few columns of figures, occupying only one-third of a page. Where the progress of events for a single place are of more interest, recourse has to be made to the weekly figures for the sixty individual representative stations, which are set out so that one page shows all the figures for one station only. In this particular volume the widespread incidence of abnormally cold and wet weather during the harvest period of 1931 over England is one of the most striking features; the general character of the phenomenon is shown by the weekly deviations of temperature and rainfall for English 'districts', and one can compare its severity at places so far apart as Durham and Jersey. The corresponding figures for Scotland and Ireland show the varying extent to which the northern parts of those countries escaped this visitation.

Radium in Great Britain

IN the Third Annual Report of the National Radium Trust and Radium Commission, 1931–1932 (H.M. Stationery Office. Price 9*d*. net), details are given of the purchases of radium by the Trust, and of the distribution of the supply by the Commission. We gather that the supply of national radium amounts to about 19 gm., excluding 4 gm. formerly comprising the 'bomb', now acquired by King Edward's Hospital Fund for London. The cost of this supply with the necessary containers has amounted to £217,937. It is noted that in spite of the stress laid by the Commission upon the necessity for the observance of the approved precautions for the safe custody of radium, avoidable losses have occurred at three of the national centres, which the Commission regards as resulting from breaches of the radium regulations. The reports deal only with administrative matters and no details of treatment are included.

Seeding of Frog-bit in Great Britain

MISS GLADYS V. HOARE writes from the Royal Holloway College, Egham, Surrey, that plants of frog-bit (*Hydrocharis Morsus-ranæ*) under observation in the Botany Garden of the College have recently set seed. This is worthy of note since the plant usually reproduces itself vegetatively by means of turions, and reproduction by seed has not been reported for Britain by such well-known authorities as Sir Joseph Hooker and Mrs. Arber. In fact, it is frequently stated that the fruit is rare in Great Britain. Mr. Wilmott of the Natural History Museum showed Miss Hoare four seeds sent to him by Miss Corfe from Glastonbury in 1926. Miss Hoare suggests a connexion between this seedling and the special condition of the summer weather, and would be glad to know whether any other naturalist has collected seeds this year.

Inhalation of Oxygen

SIR LEONARD HILL described in NATURE of September 10, p. 397, some interesting experiments bearing upon "Altitudes to be Reached by Air Pilots by Breathing Oxygen". Dr. Elihu Thomson, General Electric Company, Lynn, Mass., writes to direct attention to a paper communicated by him to the *Medical Times*, Philadelphia, of November 15, 1873, entitled "Inhalation of Nitrous Oxide, Nitrogen, Hydrogen and Other Gases and Gaseous Mixtures", dealing with the same or similar subjects. Dr. Thomson was one of the first to realise the principle, which Paul Bert experimentally and successfully tried at about the same date, of using oxygen for high altitudes.

Chance-Parsons Optical Glass

ARRANGEMENTS have been made whereby in future there will be very close co-operation between the firm of Messrs. Chance Brothers and Co., Ltd., Birmingham and the Parsons Optical Glass Company. For some time it has been evident that considerable saving in the manufacture of optical glass could be effected by pooling the knowledge of the two firms and by concentrating the production in one establishment. Under this arrangement all optical glass will be made at Messrs. Chance's Smethwick Works under the joint supervision of the present manager, Mr. W. N. Wheat, and of Mr. H. C. Rands, who, under the leadership of the late Sir Charles Parsons, has been largely responsible for the development of the Parsons Optical Glass Company.

Announcements

LORD MACMILLAN has agreed to succeed Lord D'Abernon as president of the National Institute of Industrial Psychology. Lord D'Abernon, who has had to resign owing to pressure of other engagements, succeeded Lord Balfour in 1930.

THE eighth annual Norman Lockyer lecture of the British Science Guild will be delivered by Sir Frank Smith in the Goldsmiths' Hall, Foster Lane, London, E.C.2, on November 22, at 4.30 P.M. Sir Frank will speak on "Industrial Research and the Nation's Balance Sheet".

THE Priestley Medal of the American Chemical Society has been awarded to Dr. Charles L. Parsons, formerly chief mineral chemist and chief of the Division of Mineral Technology of the United States Bureau of Mines, Washington. Dr. Parsons has been secretary of the Society for twenty-five years.

SIR ARTHUR EDDINGTON will deliver an address on "Physics and Philosophy" under the auspices of the British Institute of Philosophy at University College, Gower Street, W.C.1, on Tuesday, November 15, at 8.15 P.M. The chair will be taken by Bertrand Russell. Tickets can be had on application to the Director of Studies, University Hall, 14 Gordon Square, W.C.1.

THE fourth Liversidge lecture founded in accordance with the will of the late Prof. A. Liversidge, of the University of Sydney, will be given before the Chemical Society in the Medical Lecture Theatre, The University, Edmund Street, Birmingham, on November 25, at 5.30 P.M., by Dr. F. W. Aston. The title of the lecture is "Physical Atomic Weights". Admission is free, without ticket.

AT the annual general meeting of the Cambridge Philosophical Society held on October 24, the following officers of the Society for the ensuing session 1932–33 were elected : *President :* Prof. A. Hutchinson ; *Vice-Presidents*, Mr. F. T. Brooks, Dr. F. H. A. Marshall, Dr. F. W. Aston ; *Treasurer*, Mr. F. A. Potts ; *Secretaries*, Mr. F. P. White, Dr. J. D. Cockcroft, Dr. H. Hamshaw Thomas ; *New Members of the Council*, Prof. D. Keilin, Mr. J. A. Steers, Mr. M. H. A. Newman, Mr. P. M. S. Blackett.

AT the annual general meeting of the North-East Coast Institution of Engineers and Shipbuilders which was held on October 28, the following awards were made, among others : Institution Gold Medal in engineering to L. J. Le Mesurier and R. Stansfield for a paper entitled "Combustion in Heavy Oil Engines" ; and the Institution Gold Medal in shipbuilding to Dr. F. H. Todd for a paper entitled, "Some Measurements of Ship Vibration".

MESSRS. W. HEFFER AND SONS of Cambridge have issued a new catalogue (No. 393) which will be a useful reference list for libraries, institutions and collectors. It includes transactions of learned societies, library editions and standard books in literature, historical, scientific, oriental and general, English and foreign ; and its 154 pages comprise 2786 entries.

A COMPLETE Index of twenty volumes of the *Transactions and Proceedings of the Geological Society of South Africa* (vol. 14 (1911) to vol. 33 (1930) inclusive) has been prepared under the auspices of the council of the Geological Society of South Africa and is now available on application to the Assistant Secretary, Geological Society of South Africa, Box 1071, Johannesburg, Transvaal, South Africa, at a cost of 25*s*. a copy.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—A chemist and manager of the Wood End Sewage Disposal Works—The Borough Engineer and Surveyor, Town Hall, Burnley (Nov. 7). A senior assistant civil engineer for steel and reinforced concrete structures and a junior and a senior civil engineer for civil engineering works in the Government of Northern Ireland—The Principal Establishment Officer, Ministry of Finance, Stormont, Belfast (Nov. 10). A lecturer in physics and mathematics at the College of Technology and Art, Rotherham—The Director of Education, Education Offices, Rotherham (Nov. 12). A lecturer in mathematics at the Huguenot University College (University of South Africa), Wellington —The Registrar (Dec. 15). A junior assistant metallurgist at the Research Department, Woolwich—The Chief Superintendent, Research Department, Woolwich, S.E.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.*]

'Protective' Adaptations of Animals

IN a recent issue of NATURE,[1] "B. P. U." makes the following challenging statement: "The whole of the book is full of examples—most carefully collected and thoroughly analysed, and represents an array of arguments of which selectionists will find it very difficult to dispose." Unfortunately, the book[2] to which reference is made is not yet available here, but it would appear from the information given by "B. P. U." that the claim made in this quotation is not supported by the facts. While it is evident that the book contains a vast array of statistical data on the contents of birds' stomachs, no mention is made of a similarly exhaustive survey of the food that was available to the birds, and, in fact, it is inconceivable that such a survey could be made adequately. When the statistical data deal only with the contents of birds' stomachs, and there is no quantitative information about the available food, how is it possible to claim that "The principle of proportional predation is exhibited so clearly and forcefully that a discrimination in the choice of prey by birds—is shown to be simply non-existent"? The examination of the stomach contents of birds, by itself, can give no evidence for the existence of "proportional predation", and so such work can throw no light upon the process of natural selection.

The arguments given by "B. P. U." appear to be based upon the generally accepted hypothesis that an adaptation must confer a general benefit upon a species if it is to be selected. Some years ago I showed[3] that this hypothesis is not only unnecessary, but is misleading, and is the cause of much of the criticism to which the theory of natural selection has been subjected. For selection it is necessary that mutant individuals should possess an *immediate* advantage when competing with their normal fellows, but this is all. For example, let us suppose that 'warning coloration' appears as a mutation. For the displacement of the original by the mutant type it is merely necessary that some one of the many species of natural enemies should occasionally fail to attack an individual on account of its 'warning coloration'. So long as the original and mutant types competed, this *relatively* greater survival value would be maintained, so that eventually the original would be displaced by the mutant type. After this displacement, the reduction in the intensity of the attack of the natural enemy that acted as selective agent would tend to increase the density of the species. Thus it is likely that natural selection would increase the number of individuals of the prey-species available to those natural enemies that are unaffected by the 'warning coloration'. Why, then, claim that the presence of 'warningly coloured' insects in the stomachs of large numbers of birds proves that this 'protective adaptation' could not have been preserved by natural selection?

When the selection of improved adaptation reduces the severity of the action of one of the controlling factors, this merely *tends* to increase the population density. Actually, such selection disturbs a complex system of interacting equilibria, and the position at which balance is re-established may be quite different from what one would expect from a knowledge of the direct effects of the adaptation. For example, suppose that a population of foxes is held in check by the availability of rabbits, and that mutation causes the appearance of some foxes that are more efficient in finding rabbits than are their normal fellows. Clearly, the mutant type will eventually displace the original type of fox, but what is the result? The fox population now searches with increased efficiency, thus reducing the population density of rabbits. But the individual foxes need just as much food as before, so, since there are less rabbits to eat, the population density of foxes must be less than it was originally. So natural selection itself may reduce populations.

This view of natural selection is clearly dependent upon the belief that animal populations exist in a state of balance, which, it may be remarked, does not necessarily mean that animals maintain constant population densities. This belief is often disputed, but it is supported by general observation, and by such experiments as have been carried out under suitable conditions (c.f. Chapman,[4] Holdaway,[5] Pearl[6]). Also, we know that competition is of the greatest importance in limiting populations, and in a forthcoming publication I shall show, with much more evidence than I have already[3] given, that this necessarily leads to balance. Natural selection merely selects; it does not produce the 'balance of Nature' by causing the properties of each species to balance those of the environment, as appears often to be supposed. Nor does it necessarily favour the success of a species, but merely gives an *immediate* advantage to the more perfectly adapted individuals over their less perfect brethren.

A. J. NICHOLSON.

Division of Economic Entomology,
Council for Scientific and Industrial Research,
Canberra.

[1] NATURE, vol. 130, pp. 66–67, July 9, 1932.
[2] Smithsonian Miscellaneous Collections, vol. 85, No. 7.
[3] *Australian Zoologist*, vol. 5, part 1, pp. 10–104, Nov. 1927.
[4] *Ecology*, vol. 9, No. 2, pp. 111–122; 1928.
[5] *Ecological Monographs*, vol. 2, pp. 261–304.
[6] "The Biology of Population Growth". Williams and Norgate, Ltd., London, 1926. Chaps. i and ii.

MY review[1] of McAtee's work[2] on the effectiveness of so-called 'protective' adaptations in animals was written to direct the attention of naturalists to a unique accumulation of facts bearing on a problem which it has become customary to regard as solved in accordance with certain preconceived dogmas. That the paper in question does deserve this attention is proved by the replies and comments aroused by my review. Although the review contained only a brief and almost verbatim representation of the chief facts and conclusions reached by McAtee and not of my own views (which, I admit, are close to his), the critics did me the honour of addressing their replies to me, and I feel bound to answer them, while I hope that McAtee himself will not fail to express his views on the criticisms offered.

Prof. Poulton's[3] comments refer to a particular point (birds' attacks on butterflies), which is scarcely touched upon by McAtee and not discussed at all by me. The allegation that I am "willingly misrepresenting" the opinions of others is based on a

sentence in my review which was taken almost verbatim from the original paper.

Prof. Huxley[4] commits a fundamental fallacy in ascribing to me the views I have never held or expressed. He discusses the problem of adaptations in general and maintains that each particular adaptation is partial and relative. I have given Prof. Huxley no reason for thinking that my views on this point are different, but these obvious generalities have nothing to do with our problem, namely, whether the so-called 'protective' adaptations in animals deserve that name by protecting the animals from being attacked by enemies and to what extent. Figures quoted by McAtee supply some most interesting data in this direction and they show that the numbers of insect species found in birds' stomachs are roughly proportional to their numbers in Nature. This is a definite fact and one cannot dispose of it by quoting an imaginary example of the number of would-be wrecked ships, which, in Prof. Huxley's opinion, should be in proportion to the number of ships of the respective type.

With reference to ants as a classical example of "specially protected" animals, Prof. Huxley appears to have overlooked the figures I have quoted, namely, that more than three hundred species of American birds (out of the total number of about eight hundred species including non-insectivorous ones) feed on ants and some of them consume thousands of individuals. This cannot be interpreted to mean that "most birds" reject ants and that ants are particularly immune from their attack. It is interesting in this connexion to quote another paper by Cott[5] who has found that ants constitute more than 90 per cent of the food of frogs. In face of such facts, the whole elaborate theory of 'ant-mimicry' as a protective adaptation assumes the aspect of a beautiful fairy-tale.

Much more serious and well-founded criticism of McAtee's statements and conclusions can be found in the first paragraph of Mr. Nicholson's letter above, in which it is pointed out that a mere accumulation of data on the contents of birds' stomachs, without a similarly exhaustive survey of the food that was available to birds, cannot be considered as evidence of proportional predation. It is fair to state that Mr. Nicholson's letter was based only on my review and not on the original paper by McAtee, who himself stresses the same point and admits the approximate value of his figures, which serve merely to indicate roughly the correlation between the 'protective' adaptations of animals and the degree of protection they confer on their bearers. No such correlation appears to exist and this fact cannot be ignored.

The rest of Mr. Nicholson's letter represents a most typical example of attempting to solve biological problems by logical reasoning based on purely theoretical assumptions. This type of argument, starting with "let us suppose" and continuing with what would happen as a logical result, does not appeal to a naturalist who values facts more than philosophical discussions. The great problem of natural selection has always served as a favourite subject for such discussions, but it is time that attempts were made to elucidate it by an unbiassed accumulation of facts.

To conclude, I should like once more to direct the attention of biologists to McAtee's paper. Not all of his conclusions will be found acceptable to everybody, but an immense amount of valuable facts is there. These facts can be analysed from various points of view and perhaps different conclusions will be reached, but to disregard them would be unscientific.

B. P. UVAROV.

Imperial Institute of Entomology,
British Museum (Natural History),
Cromwell Road,
London, S.W.7.
Oct. 7.

[1] NATURE, vol. 130, p. 66, July 9, 1932.
[2] Smithsonian Miscellaneous Collections, vol. 85, No. 7. Washington, 1932.
[3] NATURE, Aug. 6, p. 202.
[4] NATURE, Aug. 6, p. 203.
[5] *Proc. Zool. Soc. Lond.*, p. 471; 1932.

Hyperfine Structures of Antimony Lines and the Nuclear Moments of Antimony Isotopes

THE hyperfine structures of a number of Sb II lines in the visible region have been investigated by me. As a light-source was used a lamp of the mercury arc type, and Fabry-Perot etalons, silvered by Dr. Ritschl's process,[1] in conjunction with a Zeiss three glass prism spectrograph served to resolve the fine structures. Aston[2] has found that antimony has two isotopes of mass numbers 121 and 123. The hyperfine structures lead to the assignment of a nuclear moment corresponding to $I = 5/2$ to the more abundant isotope Sb^{121} and $I = 7/2$ to the isotope Sb^{123}. No relative shift in the fine-structure patterns of the two isotopes has been observed.

The splittings of the terms show a similarity with those of terms of corresponding configurations of other spectra and indicate that in the gross structure the coupling is more of the J–J type. Of all the configurations the (sp^3) seems to have the largest interaction with the magnetic nucleus, since of all the observed terms the $(5s\ 5p^3)\ ^3D_3$ term shows the largest splittings, namely, 3·05 cm.$^{-1}$ and 2·23 cm.$^{-1}$ for Sb^{121} and Sb^{123} respectively. Prof. R. J. Lang very kindly allowed me the use of his unpublished data on the gross structure of the spectrum Sb II, and the interpretation of the hyperfine structures has been helpful in modifying and extending these to some extent.

The structures of some of the arc lines in the ultraviolet have also been investigated using a Hilger reflecting echelon in addition to Fabry-Perot etalons silvered by Dr. Hochheim of the I. G. Farbenindustrie. Details are being sent in for publication in the *Zeitschrift für Physik*.

J. S. BADAMI.

Laboratorium des Präsidenten,
Physikal-Technische Reichsanstalt,
Berlin-Charlottenburg,
Sept. 23.

[1] Ritschl, *Z. Phys.*, **69**, 578; 1931.
[2] Aston, *Proc. Roy. Soc.*, A, **132** 487; 1931.

Influence of Light on Paramagnetic Susceptibility

RECENTLY C. J. Gorter,[1] continuing the experiments of Bose and Raha on the change in the susceptibility of paramagnetic ions under the action of light, has demonstrated, in a manner which may be considered definitive, that the observed diminution in paramagnetic susceptibility is to be attributed, according to the Curie-Weiss law, to the rise of temperature of the solution produced by the absorption of light.

In an analogous research carried out last year by me,[2] by Quincke's method of capillary ascension, and measuring the displacement of the liquid column under the influence of the magnetic field by means of an arrangement including a photoelectric cell connected with a galvanometer through an amplifying audion circuit, I predicted the difficulty of separating the Bose effect from the thermal effect, both in the same sense, and the latter certainly stronger.

Experiment confirmed this prediction, since the change in susceptibility which I observed when the light of a mercury arc was concentrated on a solution of chromic sulphate, *a change which increased with the time*, could not but be interpreted, as I interpreted it, as due to pure thermal effect.

I also succeeded, however, in bringing to light another fact: a very small increase of magnetic susceptibility of the solution, which manifested itself immediately the solution came under the influence of light, and rapidly disappeared, to give place to the variation of opposite sense due to thermal effect. Of this increase in susceptibility it is difficult to give a plausible explanation: given the characteristic of variability in the magnetic moment of the ions of the first transition series, a characteristic which is bound up with the presence in the solution of complex ions, the facts might perhaps point to some influence of light on the concentration of such ions.

O. SPECCHIA.

Istituto Fisico A. Righi,
Bologna.

[1] C. J. Gorter, NATURE, **130**, 60, July 9, 1932.
[2] O. Specchia, *Nuovo Cimento*, **8**, 291; 1931.

Crystal Structure and Dehydration Figures of Alkali Halide Hydrates

MEASUREMENTS of the cell dimensions of sodium bromide and sodium iodide dihydrates have been made by means of Weissenberg and oscillation photographs about the crystallographic axes. The results are as follows:

$NaBr.2H_2O$. Monoclinic. $a = 6{\cdot}59$, $b = 10{\cdot}20$, $c = 6{\cdot}51$ A.u. $\beta = 112{\cdot}5°$. $a : b : c = 0{\cdot}646 : 1 : 0{\cdot}638$. The probable error is about 0·5 per cent. The axial elements given by Groth[1] are $a : b : c = 0{\cdot}6469 : 1 : 0{\cdot}6335$, $\beta = 113°\ 13'$. The number of molecules per cell is 4. The density calculated from these values is 2·28; in the literature[2,3], the values given are 2·34 and 2·165 at 16·8°C. The halvings observed are $(h01)$ when h is odd and $(0k0)$ when k is odd. Hence, the space-group is $C_{2h}^5 - P2_1/a$.

$NaI.2H_2O$. Triclinic. $a = 6{\cdot}85$, $b = 5{\cdot}76$, $c = 7{\cdot}16$ A.u. $\alpha = 98°$, $\beta = 119°$, $\gamma = 68\frac{1}{2}°$. Hence $a : b : c = 1{\cdot}190 : 1 : 1{\cdot}243$. The probable error is about 0·5 per cent. The number of molecules per cell is 2 and the space-group $C_i^1 - P\bar{1}$. The density calculated from the above values is 2·67, whilst that given in the literature[3] is 2·448 at 20·8°C.

Both substances are deliquescent, and it is difficult to free the crystals from adhering mother liquor. This probably explains why the formula given by Favre and Valson[3] was $NaI.4H_2O$. The X-ray measurements show that this formula is improbable, because the minimum volume occupied by all the atoms in the unit cell would be 266 cubic A.u., whereas the actual volume is 230 cubic A.u. The density determination by these authors is also probably in error because of the same difficulty.

The structure of $NaCl.2H_2O$ has not yet been investigated because it decomposes rapidly at ordinary temperatures but work on it is in progress.

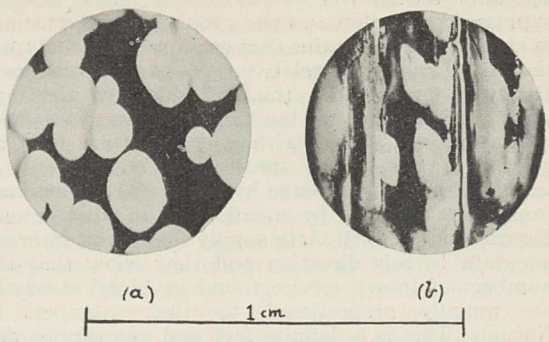

FIG. 1.—Dehydration figures of (*a*) $NaBr.2H_2O$ (20 hours over calcium chloride) and (*b*) $NaI.2H_2O$ (4 weeks over calcium chloride).

Both the hydrates show well developed dehydration figures when allowed to stand over calcium chloride for about twenty hours in the case of the bromide and for four weeks in the case of the iodide. The dehydration starts at points on the surface and spreads out forming very shallow white elliptical patches. Photographs are shown in Fig. 1. It is hoped that a full account of this work, together with the relation of the dehydration figures to the crystal structure, will shortly be published in the *Zeitschrift für Kristallographie*.

W. A. WOOSTER.

Department of Mineralogy and Petrology,
Cambridge,
Sept. 28.

[1] Groth, "Chemische Krystallographie", vol 1, p. 234.
[2] Playfair and Joule, *Mem. Chem Soc.*, 2, 401.
[3] Favre and Valson, *C.R.*, **77**, 579.

Magnetic Constants of Benzene, Naphthalene and Anthracene Molecules

IN a recent communication[1], I have shown how, by a correlation of the principal susceptibilities of a diamagnetic crystal, with those of the constituent molecules, it is possible to determine the orientations of the molecules in the crystal. Conversely, where the orientations are already known from X-ray measurements, we can calculate the molecular magnetic constants from those of the crystal. The principal susceptibilities of naphthalene and anthracene molecules, calculated in this manner, are given in the following table. Two of the magnetic axes of the molecules lie in the plane of the benzene rings, one along the line joining the centres of the rings and the other perpendicular to this line. The third axis is normal to the plane of the rings. The susceptibilities along these axes, per gram molecule, are denoted by K_1, K_2 and K_3 respectively. The values for the benzene molecule, which are also included in the table, have been calculated (in the absence of magnetic data for the crystal) from

Molecule	$-K_1 \times 10^6$	$-K_2 \times 10^6$	$-K_3 \times 10^6$
Benzene	37·3	37·3	91·2
Naphthalene	39·4	43·0	187·2
Anthracene	45·9	52·7	272·5

measurements on magnetic double refraction and on light scattering in the liquid state; the calculation is possible since the molecule may be assumed to have an axis of symmetry.[2]

It is remarkable that the numerical increase in susceptibility as we proceed from benzene to naphthalene and from naphthalene to anthracene is practically confined to one direction, namely, that which is normal to the plane of the molecules.

Also the normal to the plane is an axis of approximate magnetic symmetry; the ratio of the susceptibility along this axis to that in perpendicular directions increases from 2·4 in benzene to 4·5 in naphthalene and 5·5 in anthracene. It would be of interest to verify by measurements on molecules with continually increasing number of benzene rings in a plane, whether this ratio would reach a limiting value; and whether the limiting value would coincide with the observed value (about 10) of the ratio for carbon in graphite.

K. S. KRISHNAN.

Physics Laboratory,
University of Dacca,
Sept. 23.

[1] NATURE, **130**, 313, Aug. 27, 1932.
[2] C. V. Raman and K. S. Krishnan, *Proc. Roy. Soc.* A., **113**, 511; 1927.

Efficiency of the Geiger-Müller Counter

WITH reference to the letter by Dr. J. C. Jacobsen in NATURE of October 15, I am glad to note that the experiments referred to confirm results obtained by me two and a half years ago by the same method[1], namely, that the efficiency of the Geiger-Müller counter increases at first as the voltage is increased and finally approaches unity.

To this previous result I may now add that the efficiency of the counter does not vary when the thickness of the wall is very markedly reduced; which proves that the discharge in the tube is actually due to the direct ionisation of the primary cosmic rays and not to some softer secondary radiation generated by the primary rays in the wall of the tube.

This was shown by the following experiment: three Geiger-Müller counters were placed one above the other with their axes in the same vertical plane; the middle counter had its wall formed by an aluminium leaf only 7 μ thick and was enclosed in a glass cylinder (in which the air was exhausted to a pressure of 7 cm. Hg) of large diameter, so that a secondary particle generated in the glass had but a small probability of entering in the counter. A brass tube 1 mm. thick could be brought to cover the counter or be moved away by inclining the whole apparatus. The frequency of the triple coincidences was in both cases practically the same.

BRUNO ROSSI.

Laboratorio di Fisica della
R. Università, Arcetri, Firenze.
Oct. 16.

[1] *Rend. Lincei*, **11**, 831; 1930.

Secondary Radiation Produced by Cosmic Rays

ON August 12, the date on which Regener obtained his very high-altitude cosmic ray data, using self-recording apparatus carried by a balloon,[1] measurements were made on a mountain-top in the Himalaya at an altitude of about 19,500 ft. The results of these measurements indicate clearly that the ionisation of gas in an ionisation chamber is due at least in part, if not entirely, to a secondary radiation produced in the walls of the chamber and other surrounding media, by cosmic radiation.

The apparatus used consisted of a Lindemann electrometer with a thin-walled aluminium ionisation chamber and six screens of different materials. The screens were made as nearly as possible of equal size and weight so that the mass per unit area was the same for all. The screens should, therefore, according to the usual assumption, have had equal absorption effects. Readings taken with and without screens surrounding the ionisation chamber show that the presence of a thin screen of heavy metal actually increases the rate of ionisation, while the effect of a paper screen is to decrease the rate of ionisation.

The following table gives the results obtained for the six screens used:

Various Shields Used.	Time for Given Voltage Drop.
With no Shield	100 seconds
Paper Shield	104·4 ,,
Aluminium Shield	100·6 ,,
Zinc Shield	92·3 ,,
Iron Shield	100·5* ,,
Iron Shield	92·1 ,,
Copper Shield	92·8 ,,
Lead Shield	82·0 ,,
Iron over Lead (Double) Shield	79·0 ,,
Lead over Iron (Double) Shield	82·3 ,,

* The iron shield was the first to be used so that the first value, 100·5 sec., may have been obtained before the sensitivity of the electrometer became steady. The lower value is probably more nearly correct.

It will be noticed that the heavier metals produce the greater positive effects. Presumably increasing the thickness of the screens would increase the effect, though of course in each case within definite limits. The mass per unit area of the screens used is about 0·9 gm./cm.

The above results may help to explain the discrepancies between the high altitude curves obtained by Kolhörster, Regener, and Piccard, for it is obvious that the density and thickness of the ionisation chamber walls must have a considerable effect on the shape of the curves obtained by different instruments. This is probably especially true at very great altitudes.

J. M. BÉNADE.

Physics Department,
Forman Christian College,
Lahore. Oct. 2.

[1] NATURE, **130**, 364, Sept. 3, 1932.

Retention of Moisture by Wood

IN many respects, wood behaves as a hydrophilic swelling gel. Thus, the specific volume of the wood water aggregate at various moisture contents has been measured on extracted spruce wood flour by Volbehre[1] and found to be less than that given by the simple volumetric proportions of the two components, from the dry state up to about 20 per cent moisture content (based on the dry weight of the wood). That is to say, volumetric contraction is observed as nearly as experimentally possible up to the fibre saturation point. Again, Pidgeon and Maass[2] have measured the vapour pressure isothermals of spruce and found the typical curves for a swelling gel. While the former experiment points to the existence of a loose

chemical bond between the water and the wood, the latter authors draw the conclusion that all the moisture above about 2 per cent is held by capillary forces due to the curvature of the water menisci in the micellular structure.

Experiments are being carried on at this Laboratory in the hope of distinguishing between these two effects. If the moisture below the fibre saturation point is retained by capillary action, then, when wood flour is completely flooded by water under a high vacuum, the capillary menisci will no longer exist and, on this hypothesis, any experiment designed to detect an attraction between the wood and the water would yield a nul result. If, however, the retention is due to surface adsorption, it should be observable even in this case of complete immersion.

Sitka spruce flour (60–80 mesh) is dried to constant weight in a high vacuum over phosphorus pentoxide and flooded with evacuated sucrose solution of known concentration. (In certain cases, the wood, after evacuation, was given an initial moisture content by being put in vapour communication with distilled water.) The amount of water leaving the solution in favour of the wood is calculated from the change in refractive index of the solution as measured, by comparison of the solutions before and after being mixed with the wood flour, on a Rayleigh interference refractometer. Changes in refractive index occurring in the sixth place of decimals may be measured, the adsorption usually affecting the fourth place. The corresponding concentration changes may be measured accurately to about 0·002 per cent, the adsorption affecting the concentration by an amount in the order of 0·1 per cent.

This method, details of which will be published later, has the advantage over cryoscopic methods such as that of Newton and Gortner[3] in that it is applicable over a range of temperatures and that changes in concentration required for measurable results are very small.

The preliminary results, carried out at room temperature (19°—21°C.) and corrected as accurately as possible for the refractive index of the wood extractives are as follows.

Solution Concn. (gm. water in 100 gm. solution).	Initial moisture content of flour.	Adsorption as per cent of dry weight of flour.
70·3	zero	19·5
	11·4 per cent	19·1
81·0	zero	21·3
84·4	zero	20·2
	12·2 per cent	20·4
90·5	zero	19·0
	13·5 per cent	20·0

Average, 19·9 per cent.

The figures from which these averages are taken range from 18·2 to 21·6 per cent adsorption, though with improvement in technique this variation is being reduced.

If sugar is adsorbed as well as water, the true water adsorption will be greater, not less, than the apparent adsorption calculated above. Since no sensible difference has been found between the results for varying proportions of solution and flour, or for varying concentrations of solution, the adsorption of sugar may be taken as very small—this point is receiving further attention. Sucrose was chosen as control solution because, since the natural extractives of the wood frequently contain carbohydrates, the probability of further chemical action between the wood and the solution is remote.

A few adsorption experiments have also been made on Whatman filter paper, which show an adsorption of 10·0 per cent. These adsorption measurements will be repeated on standard cotton cellulose.

The fibre saturation point is that point on the vapour pressure isothermal above which the moisture content becomes independent of the external vapour pressure, that is, the point at which the curve becomes virtually parallel to the moisture content axis. On the isothermals of Pidgeon and Maass, this point is reached at about 24 per cent for spruce and at about 12 per cent for cotton cellulose (both measured in vacuo at 23°C.). For spruce these are probably the most reliable measurements available.

The results of the present experiments are of interest in indicating that, under complete immersion, a quantity of water, almost equal to that held at the fibre saturation point, is retained by the wood under the action of non-capillary forces which are great enough to overcome the attraction of sugar for water in solution. From this we may infer that wood, holding water against a lowered vapour pressure, and not immersed, will also do so by the same forces. That these non-capillary forces are due to true surface adsorption appears most probable from these experiments.

When the capillary radii, required to account for capillary adsorption, are calculated for spruce, the values obtained[2] run from about $4·5 \times 10^{-8}$ cm. to $3·8 \times 10^{-6}$ cm. according to the vapour pressure. Since the lower of these values is so near the radius of the hydrogen molecule, there seems to be some doubt about the applicability of thermodynamical capillary laws in this instance and the explanation of the vapour pressure isothermals in terms of surface adsorption up to, or near, the fibre saturation point seems preferable.

WILFRED W. BARKAS.

Forest Products Research Laboratory,
Princes Risborough,
Bucks.
Oct. 7.

[1] Volbehre G. B., Dissertation for Doctorate, Kiel, 1896.
[2] Pidgeon and Maass, *J. Amer. Chem. Soc.*, **52**, 3, 1053–1069; 1930.
[3] Newton and Gortner, *Bot. Gaz.*, **74**, 442–446; 1922.

Adrenal Cortical Extracts and Sex Changes

THAT there is a relationship between the adrenal cortex and the sex functions has long been inferred from clinical observations, although until recently there has been little direct experimental evidence to support this view.

Corey and Britton[1] found that precocious maturation of sex glands of young albino rats followed the injection of extracts of the adrenal cortex, prepared by the method of Swingle and Pfiffner.[2]

Connor[3] with the rat, and more recently Cleghorn[4] with the mouse have been unable to confirm this, however.

We have also been unable to demonstrate any effect of the injection of Swingle and Pfiffner's extract on the sex function of the mouse. The extract used (which was kindly supplied by Mr. N. Evers), was 'Eucortone', prepared by Messrs. Allen and Hanbury. As has been shown in this laboratory, Eucortone is capable of keeping completely adrenalectomised cats alive for long periods.

We found that the daily injection of 0·5 c.c. of Eucortone subcutaneously failed to produce precocious maturity in female mice as judged by the weight of the animal and time of opening of the vagina, compared with that of controls, and also did not affect the normal course of œstrus in the adult female. No difference was observed between male mice receiving injections of Eucortone, and controls receiving the same amount of saline.

In view of the evidence of Connor[3], Asher and Klein[5] and others that aqueous adrenal cortical extracts are potent to produce experimental sex changes, the suggestion that the adrenal cortex secretes two distinct hormones must be seriously considered.

Dept. of Physiology and Biochemistry, University College, Gower Street, W.C.1.

F. G. YOUNG.
H. W. BENHAM.

[1] Corey, E. L., and Britton, S. W., *Amer. J. Physiol.*, **99**, 33; 1931.
[2] Swingle, W. W., and Pfiffner, J. J., *Amer. J. Physiol*, **96**, 153; 1931.
[3] Connor, C. L., *Proc. Soc. Exp. Biol. Med.*, **29**, 131; 1931.
[4] Cleghorn, R., *J. Physiol.*, **76**, 193; 1932.
[5] Asher, L., and Klein, O., *Klin. Woch.*, **10**, 1076; 1931.

Natural Melody

ON the evening of October 8, I was at Angmering-on-Sea, and my host, Mr. Kenneth Barnes, called me to listen to the wind playing, and took me to the bathroom, which faced down wind. The wind was blowing hard and gustily, and was producing a most amazing effect—exactly as though a flageolet were being played by a human performer.

The melody was in E. major, with A♯ substituted for A♮, and it ranged over five semitones, of approximate frequency 1290, 1448, 1625, 1824, 1932. The melody did not slur up and down, as when the wind whistles through a cranny, but changed by sharply defined steps from note to note. The melody included runs, slow trills, turns and grace notes, and sounded so artificial that I felt bound to open the window and make sure that the tune was not being played by a human performer out of doors.

The sounds were traced to the overflow pipe of the bath, through which air was rushing in at the rosette (of six holes, each 9 mm. diameter, set in a circle) covering the inner end of the pipe where it joined the bath.

Next morning I examined the pipe. It was about 3 cm. in diameter, and about 3 ft. 5 in. long, in the form of an S-bend, of which the lower portion passed through the outer wall, and ended in an open mouth. The natural frequency of the pipe when blown into by mouth was about 161—that is, three octaves below the keynote of the scale previously indicated. Evidently the wind was playing on the 7th, 8th, 9th, 10th and 11th overtones of the pipe, and the melody was being produced by the rapid fluctuations of wind-pressure.

I wonder whether such an effect can ever have occurred in Nature?—a broken bamboo stem, for example, partially obstructed at its windward end, and so 'shielded' by vegetation, soil, etc., as to produce a pressure difference between its open ends?

The effect of elaborate melodies thus produced without human intervention would be highly magical and suggestive.

R. A. S. PAGET.

1 Devonshire Terrace, W.2.
Oct. 12.

Higher Vibrations of Chladni Plates

THE Chladni plates in use at the present time for producing nodal lines are ordinarily made of brass, ten inches square (or ten inches in diameter if circular) and one eighth or one sixteenth of an inch thick. They are set in vibration by drawing a violin bow along the edge perpendicular to the plate. If the plates are any thinner than one sixteenth of an inch, the pressure of the bow will tend to distort the plate and the resulting figure will be unsymmetrical. Using a slight modification of a valve oscillator described before[1], I have succeeded in getting symmetrical figures upon brass plates one thirty-second and one sixty-fourth of an inch thick. The plate is balanced at the centre upon a small cone attached to the vibrating diaphragm of a loud speaker. A brass plate any thinner than these will bend under its own weight and distort the figure.

The two symmetrical sand figures shown in the illustration (Fig. 1) were produced upon a brass plate

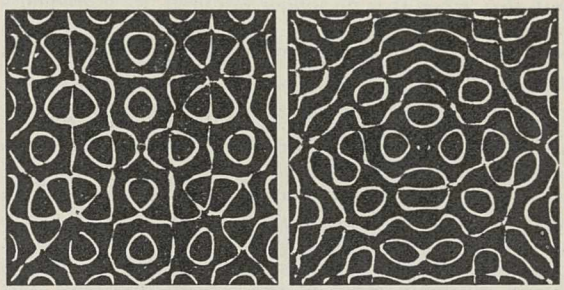

FIG. 1.

one thirty-second of an inch thick. It is possible to obtain hundreds of symmetrical nodal patterns by varying the note of the electric tube. The patterns become more and more complicated as the pitch of the note is raised. These thin plates will break into nodal patterns at very high frequencies.

Prof. Andrade has also invented a vacuum tube oscillator for Chladni plates.[2] He uses a magnetic coupling instead of the mechanical coupling described here.

R. C. COLWELL.

West Virginia University,
Morgantown, W. Va.
Sept. 30.

[1] *Phil. Mag.*, **12**, Suppl. 320, Aug., 1931.
[2] Andrade and Smith, *Proc. Phys. Soc.*, **43**, 405–411, July, 1931.

Research Items

Medicine Men in Nyasaland.—The Rev. T. Cullen Young describes in *Man* for October the contents of lists of the materia medica of three medicine men, two belonging to the Tumbuka-Kamanga and one to the Tonga tribe of Nyasaland. The material is all written, two-thirds of it by men of education, the 'changing' African. It is to be noted that even in the case of the educated, the spell, which it might have been expected would be eliminated by education, continues to exist side by side with remedies, herbal and other, of a more material nature. The practitioners recognise and treat ordinary disease, such as pneumonia, epilepsy, syphilis, colic, rheumatism, etc., as well as others which we should call extraordinary, such as averting the death of a child if the mother becomes pregnant while nursing, or the evil effects of intercourse with a menstruating woman. The number of ailments or matters treated in the respective lists are 20, 21 and 97, the larger figure in the third list, however, being due to a great extent to method of arrangement. In the last list, also, matters connected with sex, prominent in all, largely preponderate, more than fifty per cent being connected with this subject. Methods in the prescriptions vary widely. Medicines may be taken externally or internally, worn inside the clothing, around the neck, smeared on an inanimate object or concealed in the ground. They may be held beneath the tongue and spat out as certain words are uttered. Sunrise or sunset is the favourable time for taking them. In only one prescription is there any reference to invocation—in connexion with the ceremony of "closing the grave". For a person lying under bewitchment, the remedy is not only applied to the body by rubbing, and worn, but also, when it is no longer required, its ingredients must be bound up in the cloth in which it is worn and "thrown away into running water along with a piece of iron".

Sex Affiliation.—Mr. F. E. Williams, Government anthropologist in the Territory of Papua, discusses in the *Journal of the Royal Anthropological Institute*, vol. 62, pt. 1, a form of social classification by which male children are classified with the father's group and female with the mother's group. At present this classification has been found only among the Koiari-speaking group of the central division; but its distribution may be wider, though this is not at present known. Racially the Koiari, though speaking a Papuan language, are mixed with the Melanesians. The names of the groups are related only to the group and not to villages. Nor are the groups totemic or exogamic. They are best described as local groups, of which the membership is ultimately decided by residence and by participation in group life. Within the family and local group descent is virtually patrilineal. Property is inherited by sons from their fathers. With the female offspring, the position is not so clear. They are brought up by and reside with their fathers, and in some cases are spoken of as belonging to their father's group, while there is evidently a strong tendency to patrilineal descent. Nevertheless they are constantly said to belong to their mother's group; and they inherit their mother's property. The affiliation, however, with the mother's group only holds good for one generation back, and really means that a daughter belongs to her maternal uncle's group. Her mother may belong to quite a different group. If marriage is by purchase the price goes to the father, but is shared with the maternal uncle, unless the *nubagha* (that is, cross-cousin in any degree) has been married, when no purchase price is paid. Exchange and purchase marriage are both practised, though the former is regarded as the ideal. It is possible, therefore, that sex affiliation means that the return of the girl to her mother's group was the normal course when marriage was by exchange with a cross-cousin, and that it still persists, although marriage is no longer restricted by the cross-cousin relation.

Coat Colour and Eye Colour in Rabbits.—Further interesting studies of coat colour and eye colour in rabbits have been made by Prof. W. E. Castle and Dr. Paul B. Sawin (Carnegie Inst. Publ. No. 427). From crosses between the English and Dutch types of colour marking, Castle has produced the French breed known as Blanc de Hötot, which is entirely white, except for a ring of coloured fur around the eyes, and has brown eyes. His experiments indicate that the breed was originally produced from such crosses by a cross-over between the closely linked genes for English and White-Dutch pattern in an individual which was heterozygous for both. It is further concluded that rabbit genetics do not support the conception of step allelomorphism. In the general coat colour series six allelomorphs are now recognised, including three shades of chinchilla. Breeding from blue-eyed chinchillas and various other types it is found that the iris colour and coat colour series are parallel except that the darkest chinchillas have the lightest blue eyes. It is not yet determined whether in dark chinchilla the blue eye is due to the same allelomorph as the coat colour, or to a separate but closely linked gene mutation. The presence of independent modifying genes affecting only iris colour and producing in some cases a 'pseudo-brown' eye is also shown. These experimental results should be of considerable help in the analysis of the inheritance of eye colour in man.

The Primordial Germ-cells of *Sphenodon*.—A contribution to the history of the germ-cells in Reptilia is made by M. Tribe and F. W. Rogers Brambell (*Quart. J. Micr. Sci.*, 75, Pt. II, pp. 251–282, 11 text-figs., 2 pls., 1932) who have examined the embryos of *Sphenodon* collected by the late Prof. Dendy. The primordial germ-cells originate in this animal in the yolk-sac endoderm of the area opaca all round the embryo but chiefly in a crescentic area in front of it. They are recognisable before the differentiation of the medullary plate, being characterised by their large size (as compared with all the other embryonal cells) and by their contained yolk-spherules. These germ-cells migrate through the yolk-sac endoderm and mesoderm, apparently by amoeboid movement, and many of them enter the blood-islands and the sinus terminalis. They enter the embryo either passively in the venous blood-stream or actively by migration through the extra-embryonal endoderm and splanchnic mesoderm into the lateral walls and the mesentery of the mid-gut. The germ-cells in the

vessels penetrate the walls of the latter and migrate, along with those from the lateral walls and mesentery of the mid-gut, to the germinal ridges. Many germ-cells, especially those travelling in the blood stream, are carried to other parts of the embryo and ultimately degenerate and disappear. The primordial germ-cells enter the forming germinal ridges before the single-layered coelomic epithelium covering the latter has begun to proliferate. Having reached this position the germ-cells lose their yolk-spherules and enter on the prophase of the heterotypic division.

A New Family of Coleopterous Insects.—Mr. Charles Oke has described a new family of small beetles from specimens found in nests of an ant at Belgrave, Victoria, where they appear to be living as inquilines (*Proc. Roy. Soc. Victoria*, vol. 44, 1932, pt. 1). The name *Aculagnathus mirabilis* gen. et. sp. nov. is given, while the title of Aculagnathidæ is applied to the new family which they represent. The most peculiar feature respecting these insects is seen in the highly specialised mandibles, each with a long thin process on its outer edge. When the jaw is moved, the process protrudes beyond the labrum, and is evidently used for piercing the prey. The labrum is also in the form of a process, and, with the labium below, forms a kind of open sheath for the processes of the mandibles. The affinities of the family are obscure, but in their tarsal characters they bear resemblance to the Lathridiidæ.

Formation of Dungeness.—The theory that the foreland of Dungeness was formed by the deposition at the meeting of opposing tidal currents has long held sway. Mr. W. V. Lewis has now challenged this tidal current explanation (*Geog. J.*, October) and explains at length his theory of the formation of the headland, based on both historical evidence and observation on the ground. He finds that the last considerable depression of the land in the neighbourhood of Dungeness was the Neolithic depression. At that time there was no headland and the area of Romney Marsh was an inlet of the sea. Mr. Lewis traces the growth of Dungeness to elevation of the land accompanied by the heaping up of shingle ridges by the prevalent south-west waves. He shows how the seaward end of the hard resistant Battle Ridge to the west of Dungeness marks the beginning of these shingle ridges, which formed first in its lee. Each new ridge as elevation continued swung round more to the south to face the waves. From the thirteenth century onwards, depression seems to have set in but so gradually that the ridges were built up as the sea level rose and at the same time driven inland. These are the main points in the explanation, which enters very fully into the history of the various ridges and the shoreline.

Vowels in Italian Words.—When it is recalled that the same phrase spoken by different voices can be clearly distinguished as different, the complexity of even the physical phenomena of speech is not surprising. The necessity for dividing them into the simplest elements is apparent, and since the vowels can be non-transient they have been the first elements of speech to be studied in detail. By the aid of oscillograph and electrical apparatus, studies similar to those made of the vowels of English, American, German and French have been made of Italian vowels by A. Gemelli and G. Pastori in the Psychological Laboratory of the Catholic University of Milan and have recently been reported to the Congress of Psychology at Copenhagen (August, 1932). In addition to the study of single vowels spoken, whispered or sung by various voices either intermittently or continuously, special attention has been given to the modification in a vowel when it forms part of a word or phrase. When a person emits a vowel continuously in a normal tone of voice, oscillograms are obtained in which the same wave-form may be repeated unchanged several hundred times. When the production is intermittent the central part of each vowel record is formed of repetitions of the same characteristic wave-form. When the vowel forms part of a word the oscillogram of the vowel contains a variable number of repetitions of the characteristic wave-form depending on the importance of the vowel in the particular word, together with repetition of a less complex wave-form similar to the same vowel sung. It is suggested that in natural speech the typical wave-form of each vowel is repeated only the smallest number of times necessary for recognition. When all other conditions are unchanged this is found to vary with the same vowel in different words. It is well known that the number of vibrations necessary for the perception of pitch of a pure tone depends on the frequency and the intensity, but it is not easy to apply these results to the recognition of a vowel or other complex sound.

New Experiments on Superconductivity.—McLennan and his co-workers have recently found that the temperature at which superconductivity appears is lower for high-frequency alternating currents than for direct currents. Further experiments on these lines have now been described (*Proc. Roy. Soc.*, October). The substances used were lead, lead-bismuth alloy, tantalum, and tin. The new feature of the present work is the superposition of high frequency and direct currents in the same specimen. A small resonant circuit made entirely of tantalum, or of tin wiped upon constantan wire, was immersed in a helium bath, alternating current of frequency 12×10^6 was induced in the coil and direct current was led in by wires. The resistances to high frequency and direct current disappeared simultaneously at a temperature which lay between the high frequency and direct current critical temperatures. The critical temperature for direct current was thus lowered by the superposition of the high-frequency current, and the critical temperature for high-frequency current was raised by the superposition of direct current.

Settling of Colloidal Suspensions.—The settling of colloidal suspensions under gravity was first studied by Perrin, who obtained a simple logarithmic law for the equilibrium distribution; and his law when modified by a repelling force of van der Waals' type between the particles was in good agreement with later experimental results. More recent work led to the conclusion that the equilibrium concentration became uniform with increasing depth. In the experiments reported by McDowell and Usher (*Proc. Roy. Soc.*, October) the principal feature is a very close temperature control for the avoidance of convection currents. The necessity of this was shown by the fact that the gold sols which had 'settled' in the thermostat became apparently uniform again when removed to an ordinary room.

The experiments indicate that the equilibrium distribution agrees with the simple Perrin law even when the settling layer is 9 mm. deep and the greatest concentration of particles is 10^{12} per c.c.

Mixtures of Ferrous and Manganese Silicates.—A paper by J. H. Andrew and W. R. Maddocks read before the Iron and Steel Institute in September showed that the equilibrium diagrams of the systems $MnSiO_3$—Fe_2SiO_4 and FeS—Fe_2SiO_4 are of the eutectiferous type with limited solubility at each end. The melting point of $MnO.SiO_2$ is given as 1305°C. and this substance can hold at the eutectic temperature of around 1170°C. not more than about ten per cent of the iron silicate in solid solution. The eutectic contains about sixty per cent of $2FeO.SiO_2$. From the pure iron silicate to the mixture with ten per cent of the silicate of manganese the melting point appears to rise, but the exact constitution of the mixtures in this range of composition still awaits further elucidation. It is of interest that mixed silicates of the composition referred to have very definite crystallisation temperatures, and do not, as is often assumed, pass through a semi-viscous or plastic state at any stage during the solidification. The $FeS-2FeO.SiO_2$ diagram is also eutectiferous. The eutectic melts at around 1000°C. and contains some fifty per cent of each constituent. The solubility of Fe_2SiO_4 in ferrous sulphide is extremely small, being given as approximately one per cent. About twelve per cent of ferrous sulphide, on the other hand, may dissolve in the silicate. The melting point of the latter is 1130°C., that of ferrous sulphide 1160°C. and of manganese sulphide 1620°C.

Astronomical Topics

Origin of the Solar System.—*Scientia* for September and October contains articles on this subject by Dr. A. C. Gifford of the Dominion Observatory, Wellington, New Zealand. He begins with a résumé of previous work on the subject. In reviewing that of Sir James Jeans, he should have explained that the suggestion that the sun at the time of appulse was highly distended, nearly filling the present orbit of Neptune, was afterwards withdrawn, and replaced by the view that the sun was not much larger than at present, and that the other star approached within the distance of Mercury. There is also an erroneous statement that Jeans dated the approach of the other star as millions of millions of years ago; this should read thousands of millions.

Dr. Gifford is an enthusiastic follower of the late Prof. A. W. Bickerton, who advocated stellar impacts to explain novæ and the birth of planetary systems. Most astronomers consider that such impacts would be far too infrequent to explain novæ, of which some forty or fifty are observed in a century, and probably many faint ones are missed. But this objection is of less weight when the impacts are invoked to explain planetary systems, as these may, for all we know to the contrary, be extremely rare in the universe. Indeed, both Dr. Jeffreys and Prof. Luyten have in recent years adopted the view that the approach of the two stars was so close that their outer portions actually collided. Dr. Gifford prefers to go a stage further, and to assume that the impact was so nearly central that the greater portion of the two stars coalesced to form our present sun, while the tidal filaments raised on both of them would be the origin of the planets. More exact computations are needed than those given in the articles, but some the theory of a nearly full impact seems to have advantages, compared with that of a grazing one.

The Distance of Nova Persei and Nova Ophiuchi.—Dr. Spencer Jones's researches on the distance of Nova Pictoris encouraged him to investigate the two novæ mentioned above. The parallax 0·011″ is often quoted for Nova Persei; this was deduced by assuming that the large expanding nebulosity seen some months after the outburst was due to the spread of illumination from the nova. In the *Observatory* for September Dr. Spencer Jones points out (as Newcomb had done before) that the above parallax involves the assumption that the nebulosity is at the same distance from us as the nova; if the nebulosity is nearer than the nova a smaller parallax results. He deduces a new parallax from the much smaller expanding nebula discovered by Barnard in 1916; this is assumed to be an actual expansion of a shell of gas with a speed (deduced from the spectroscopic measures) of 1110 km./sec. A parallax of 0·00205″ is found, implying a distance five times as great as previously assumed, and an absolute magnitude at maximum of −8·3. A different method was used for Nova Ophiuchi. The interstellar calcium lines in this star gave a velocity differing by 24 km./sec. from that resulting from the usual supposition that this gas is at rest in space. This assumption only holds for regions not very distant from the sun; beyond this region galactic rotation produces a differential velocity. The mean distance of the intervening gas is taken to be half the distance of the nova; a parallax of 0·00029″ results for the latter, so that it is seven times as remote as Nova Persei. This seems to be the most distant nova observed (except those in the spiral nebulæ) and the only one for which this method can be applied. The absolute magnitude at maximum comes out −5·5, which is considered reasonable.

New Minor Planets EA_1 and HA.—E. de la Villemarque, S.J., who has constructed tables for calculating the perturbations of minor planets by Jupiter, has now published (*Astr. Nach.*, No. 5898) coefficients of the perturbation terms in the case of the planet EA_1, now named Amor. It belongs to the same group as the planet Hungaria, so the tables for this group could be utilised; these tables should aid in the recovery of the planet when it again approaches the earth.

A telegram from the I.A.U. Bureau reported the following observation of the planet 1932 HA at Königstuhl; Oct. $7^d2^h42{\cdot}4^m$ U.T.; R.A. $8^h22^m0^s$; N. Decl. 23° 36′, mag. 15·5. Daily motion $+1^m36^s$ 0′ in Decl. The telegram asked for the observation to be controlled, but as the position and motion are close to the predicted values, it seems likely to be right; if so, the observation will be valuable for improving the orbit, as the arc of observation in April and May was too short to give very exact elements; the brightness should remain nearly constant for some time, as the planet though receding from the sun is approaching the earth.

Fourteenth International Physiological Congress

THE members of the Fourteenth International Physiological Congress assembled at Rome on August 29 in circumstances embarrassing to the law-abiding scientific worker. The approaches to the Campidoglio, where the inaugural session was to take place, proved to be guarded by several cordons of police. After passing a close inspection by a civilian official and, at the doors of the Sala di Giulio Cesare, a final check by two imposing flunkeys, those delegates who had not forgotten their cards of membership were able to hear speeches of welcome by the Governor of Rome, the Minister of Education, and others. An inaugural address by Prof. A. V. Hill should have closed the proceedings, but the Congress was unexpectedly honoured by the appearance of Signor Mussolini, who, in a few graceful phrases, extended to the Congress the welcome of his Government.

Prof. Hill, relying on the existence of advance printed copies of his address, earned the gratitude and admiration of many by curtailing severely the academic sections of his speech; bringing incidentally into deservedly greater prominence some timely comments on the "intolerable burden of the literature" under which physiologists, no less than other scientific workers, sweat and groan. "The days are already too short, to read all that appears in print." With bluntness tempered by his usual good humour, he discussed the unnecessary multiplication of papers and pointed to the two major causes of the nuisance —self-advertisement by younger men, whose advancement depends all too often on the weight of paper they have sullied with printer's ink; and, in some countries, profit-making by publishers and owners of scientific journals. All journals should be owned and controlled, he insisted, by scientific societies, and he recommended that the Congress should appoint an international committee forthwith to consider the publication and cataloguing of physiological and biochemical papers. Not only in writing about our work, but also in speaking about it, he further insisted, we too often waste our opportunities and the time of our colleagues at scientific meetings. "There is no excuse for telling busy people in fifteen minutes what they could perfectly well read in five. . . ."

The inaugural meeting finished before lunch, and the remainder of the day was spent in visiting the excavations at Ostia and bathing at the famous Ostia Lido; the serious work of the Congress began on Tuesday, when four parallel sections were held morning and afternoon, each session being composed of six to twelve papers having some central theme in common. A reception offered by His Highness the Governor of Rome at the Palazzo dei Conservatori concluded the activities of the second day. On Wednesday, in addition to the morning and afternoon sessions devoted to the presentation of original papers, Prof. P. Karrer delivered an address to the Congress entitled "Uber Carotinoide und Vitamin A"; and the evening was the occasion of a banquet given by the organising committee of the Congress at the Hotel Excelsior. At the banquet, consisting mainly of Italian dishes, excellently served, and admirably adapted to the heat of the evening, speeches were made by prominent physiologists from all parts of the world, congratulating the Organising Committee on the excellence of its arrangements.

Thursday was a holiday from all scientific discussion and the Congress journeyed to Tivoli, where it spent a peaceful day in the delightful parks of the Villa Adriana and the Villa D'Este. The Friday afternoon sessions were preceded by a lecture given by Prof. I. P. Pavlov on the more recent work of his school ("La Physiologie de l'activité nerveuse supérieure"). He spoke in German to a large and deeply interested audience.

On Saturday morning a party of members of the Congress was received in audience by the Pope, and, in the afternoon, the concluding session was held in the Royal Academy of the Lincei. After a short speech of welcome by the president of the Congress (Prof. Bottazzi), Profs. Barger and Mansfeld (the former in Italian, to the envy of his colleagues, and the amazement of those who were unaware of his linguistic reserves) conveyed the thanks of the members of the Congress to Prof. Bottazzi and the Italian Organising Committee, and the appreciation of the magnitude of their task. Prof. Pavlov, in the name of the Russian physiologists, then invited the International Physiological Congress to hold its fifteenth meeting in Russia: this invitation was accepted with acclamation. Prof. Frank then proposed that the succeeding Congress, in 1938, should be held in Germany: this also was agreed to. Members of the Congress then visited the picture galleries until it was time to cross the road to the Farnesina Palace, where the Royal Academy of Italy held a reception. In the absence of the president, Senator Marconi, the vice-president received the guests.

On Sunday, a party left for a three days' visit to Naples, and its Marine Biological Station. Excursions were arranged for those who were unable to take part, but wished to remain in Rome another day.

Any detailed description of the subject matter of the four hundred papers communicated to the Congress would be out of place here, and is rendered unnecessary by the publication of the *Proceedings* in book form by the Organising Committee. Some notion of the activity of physiologists in different fields during the past three years may be obtained from the following summary of the subject matter of each of the thirty-one sessions of the Congress.

2	Sessions each:	Circulation, muscle, central nervous system.
1½	Sessions each:	Carbohydrate metabolism, general chemistry, internal secretions, vitamins, physical chemistry.
1	Session each:	Respiration, enzymes, fat metabolism, general metabolism, nerve, blood, digestion, pharmacology, special senses, reproduction, plants and bacteria, cellular physiology.
½	Session each:	Kidney, immunity.

(4 Sessions unclassified. Two half-sessions counted as one session throughout.)

An analysis of the nature of the communications reveals two interesting characteristics: the relative predominance of work of a chemical or physical nature, and the absence of any advance of a notable

kind in any quarter. Consequently, if we are to mention any particular paper rather than any other, the choice must, of necessity, be made more or less at random, and be influenced as much by our own personal interests, as by the intrinsic merit of the work itself. Indeed, the great difficulty that we found in preparing a review of the scientific proceedings which should be of interest to physiologists in general—we very early abandoned the attempt to make it of interest to workers in other branches of science—has convinced us that the wrong type of paper was presented. An international congress, meeting triennially, besides giving opportunity for personal contacts and private discussion—as was emphasised by Prof. A. V. Hill, in his opening address—should consist mainly, if not entirely, of reviews of the progress made in the last three years. These should be of interest to workers in all branches of physiology. Such a limitation in scope would do much to relieve the present congestion of space-time.

A number of new technical methods have been introduced since the last Congress. In the realm of cellular physiology there is the centrifuge-microscope of Newton Harvey (Princeton), with which he has been able to measure the interfacial tension at the surface of living organisms by observing a cell being pulled into two parts by a known centrifugal force after injecting a drop of oil. Then, in the realm of muscle physiology, there is the method of von Muralt (Heidelberg) for observing the changes in the anisotropic properties of striated muscle during a single twitch by recording the Fizeau-Foucault bands: further developments of this technique will be awaited with great interest. Lastly, in the realm of cardiology, there is the di-electrograph of Atzler and Lehmann (Dortmund). This is an instrument for recording the output of the heart in human subjects. Two plates are placed, one on the subject's chest and the other on his back; they thus act as a parallel plate condenser and the capacity between them is greater at the end of diastole, when the heart is full of blood, than it is at the end of systole. These changes in capacity are arranged to affect the frequency of an oscillating circuit, and the changes in frequency are recorded as deflections of an oscillograph after suitable detection and amplification. No suggestion is made that the records are quantitative, since much of the blood expelled at each systole is retained in the pulmonary circulation, but the shape of the di-electrograph record appears to be constant for any given subject under given conditions, and it seems probable that variations in this shape may have diagnostic significance.

The number of communications concerned with muscle physiology reflected the unusual activity which has characterised this field of work during the last few years. E. Lundsgaard (Copenhagen) reported the results of a more exact study of the phosphagen breakdown during activity of muscles poisoned with iodoacetic acid. The strict proportionality between phosphagen breakdown and energy released in a series of isometric twitches (ΣTl) earlier reported by him, is confirmed in all cases where the muscle is not too severely fatigued. The energy released never exceeds that which would be derived from the chemical reaction in question. In later stages of fatigue, extra energy is released and this has now been traced by Lundsgaard to the hydrolysis of adenylpyrophosphoric acid.

F. O. Schmidt (St. Louis) reported measurements on the effect of stimulation on the oxygen consumption of nerve, leading to the important result that stimuli too small to produce an action current also fail to produce an increase of oxygen consumption. A neat demonstration of this was achieved by choosing stimuli within the range of magnitude over which reversal of the direction of the current affects considerably the magnitude of the action current induced. The extra oxygen consumption was found to be proportional to the action current.

Kato and his co-workers (Tokyo) reported their successful isolation of single nerve fibres from a nerve trunk such as the peroneal or sciatic, and their observation that the effect of stimulation depends upon the size of the fibre. The contractions of muscle fibres innervated by such a fibre obey the all-or-none relation.

The study of 'chronaxie' continues steadily. Lapicque (Paris) read a paper introducing the term 'metachronosis' to indicate the changes in the time relations of excitable tissues in the same way that metamorphosis indicates the changes in their anatomical form. Such metachronosis may be due to toxic agents, such as curare; or it may be physiological, for example, as a result of iterative stimulation of the sympathetic system. Such metachronoses have recently been the chief study of Lapicque's disciples. This paper provoked Rushton to remind us that many workers (notably Keith Lucas) have failed to observe any metachronosis as a result of curarisation, and that one of the most certain ways of changing the apparent time relations of an excitable tissue is to change the size and disposition of the stimulating electrodes.

Representing the physiology of the circulation and respiration, we may instance the communications of Anrep and his co-workers (Cairo), who reported the results of their investigations on the respiratory variations in the heart frequency, using innervated heart-lung and similar preparations. They have come to the conclusion that these variations have both a central and a reflex origin, and their papers were followed by a discussion, which was all the more welcome in comparison with the apathy of the audience on most occasions, and in which Prof. Hering (Cologne) took a prominent part.

Among the more interesting contributions in the field of metabolism were three from R. A. Peters and his school (Oxford) on the nature of the function of vitamin B in nervous tissue. Different parts of the brains of pigeons were minced and incubated in phosphate buffer at *p*H 7·4, and the rate of oxygen consumption measured. In the absence of added substrate, or if the substrate were succinic acid, no significant difference could be observed between the oxygen consumption rate of the tissues of normal and of avitaminous birds. The ability of the tissue to oxidise added glucose was, however, markedly less in the case of avitaminous birds and the difference was even more apparent when lactate was the added substrate. The pathological tissue had in this case only 60–70 per cent of the respiration rate of the normal. Not all parts of the brain appeared to be affected: the optic lobes gave the most striking results, whilst cerebellar tissue seemed to be unaffected. That the effect is directly related to the vitamin deficiency and is not merely the result of a lowered vitality, was clearly demonstrated by the observation that within 24 hours of the administration of a curative dose of vitamin B_1 concentrate to birds showing serious polyneuritic symptoms, the tissues in question proved to be normal once more.

Of similar significance is the demonstration that the administration of the concentrate to the minced tissue *in vitro* abolishes at once the difference between the avitaminous and the normal tissue.

H. E. Himwich and others (New Haven) contributed the results of a careful study of alcohol metabolism in dogs and men. Clear evidence has been obtained of a state of acidosis during the twenty-four hours following the oral administration of ethyl alcohol equivalent in amount to eight 'double whiskies'. The bearing of this finding on the measurement of the respiratory quotients of human subjects needs no emphasis.

In the physiology of digestion, mention may be made of the accounts given by Soula and co-workers (Toulouse) on the relation between the blood sugar concentration and the secretion of the digestive juices, and of the studies on the effect of fat on gastric secretion and motility by Lim (Peiping) and Ivy and Zettelman (Chicago).

L. E. BAYLISS.
P. EGGLETON.

Co-operation in Electrical Standards

A FACTOR which has greatly facilitated the rapid development of the electrical industry throughout the world is the close agreement which exists in practically all countries as to the units in terms of which the various electrical quantities are measured. The international adoption of the units of current and voltage, for example, has been a great help to international trade. It is a pity that a similar simplification has not been introduced into the various national units of length, mass and money. Luckily, the agreement in electrical matters is based upon measurements of the highest precision made in the leading laboratories of the world. The close co-operation which exists between the scientific workers and standardising institutions of all nations has made this possible. A brochure recently published from the National Physical Laboratory (H.M. Stationery Office, 2s.), containing Papers 2 and 3 of its "Collected Researches", vol. 24, is an admirable illustration of this co-operation. Part 2 gives the intercomparison of the capacitance (capacity) and power factor of a mica capacitor (condenser). The tests were made by H. L. Curtis and C. Matilda Sparks of the Bureau of Standards and Dr. L. Hartshorn and N. F. Astbury of the National Physical Laboratory. Part 3 gives an international determination of the electromotive force of the normal Weston cell by P. Vigoureux of the National Physical Laboratory.

A mica condenser was transported on four occasions between the U.S. Bureau of Standards and the National Physical Laboratory. Seven sets of measurements were taken. During the first transportation a change occurred in the capacitance but no subsequent changes were observed. The change in capacitance of a mica condenser with barometric height is normally about 0·2 parts in ten thousand. The differences in the barometric pressure due to the relative altitudes of the two laboratories and ordinary atmospheric variations probably produced a change of less than one part in ten thousand. When due allowance was made, the measurements carried out in the two countries agreed to about the hundredth part of one per cent. This is quite satisfactory seeing that the methods of measurement adopted by the two laboratories were quite different.

Mr. Vigoureux's paper gives an account of new determinations of the international units of current and voltage which were made in Berlin in the summer of 1931 by members of the staffs of the National Physical Laboratory, the U.S. Bureau of Standards, Washington, and the Physikalisch-Technische Reichsanstalt, Germany. The measurements were made by weighing the amount of silver deposited when the current flows through a solution of silver nitrate. In the experiments described the same current was passed in succession through the apparatus belonging to the three national representatives, who each made weighings of the silver deposited. The mean results of a number of experiments agreed to about one five-hundredth part of one per cent. Standard cells used at the various laboratories as standards of voltage were measured in terms of the current so determined, and certain small discrepancies which had been suspected between measurements made in the different countries were accounted for satisfactorily.

Building Research*

MANY developments in the work of the Research Station near Watford are described in the Report of the year's work of the Building Research Board recently published, and in spite of necessary economies evidence of useful activities for the improvement of materials and construction are no less apparent than in former years.

The cost of building is influenced by the regulations enforced in connexion with construction, and the modification of these regulations so far as London is concerned has called upon the work of the Station. At the request of the London County Council, a committee has been set up to review the present methods and regulations for the use of reinforced concrete and a considerable part has been taken in the work of the Steel Structures Research Committee, resulting in revised regulations by the Council on the subject of steel-framed buildings which should appreciably assist the steel industry and help to reduce building costs.

Tests on building materials are naturally a large item in the list of the researches undertaken by the Station and the increasing number of requests for such tests from outside has made some definite policy on this matter imperative. It has been decided to enlist the services of approved firms of testing engineers and institutions in carrying out this work under the supervision of the Station rather than incur large capital outlay, and this effort to reduce overlapping and utilise existing agencies is to be commended. The tests thus made will be to the approval of the Station, which will issue certificates upon them.

* Department of Scientific and Industrial Research. Report of the Building Research Board, with the Report of the Director of Building Research, for the year 1931. Pp. ix+158. (London: H.M. Stationery Office, 1932). 3s. net.

The London County Council has approached the Building Research Station on the subject of fire risks, and the testing of materials for fire resistance, necessarily a matter involving considerable capital cost, is being debated with firms interested in the production of such materials. For experiments on the heating of buildings it is proposed to construct a special house where walls, floors and ceilings would be capable of thermal control, while for the prediction of sunlight obtainable by any room in a proposed house a simple instrument, the 'helidon', has been designed. The difficult problem of excluding damp from dwellings has been further investigated, and it would appear that a large number of specifics for treating walls to prevent the entrance of moisture are of very small value. Much remains to be done on this subject, but it seems likely that some means of allowing moisture to evaporate externally is more promising as a solution than attempts to render walls wholly impervious.

In connexion with the weathering of stones, the work of the Station on the selection of stone for repairs to the Houses of Parliament will be remembered, and now a survey of building stone resources is being undertaken in collaboration with H.M. Geological Survey, nearly 150 samples of Portland stone having been examined during the past year. The selection of suitable stone for building has, as is too well known from examples of decay, a very marked bearing on the ultimate cost of upkeep, and as this decay is due to many diverse agencies which operate very unequally in different localities, the acquisition of adequate knowledge requires prolonged investigation.

This survey by no means exhausts the account of the work done during the year by the Building Research Board, as indicated in the 150 pages of the Report, but is sufficient to show the contribution which the Research Station is making to bring the appreciation of the fruits of science home to the architect and industrialist and to indicate how such knowledge can be turned to practical account.

Physics in Meteorology

THE eighteenth lecture of the "Physics in Industry" series founded by the Institute of Physics was delivered on November 2 by Dr. G. C. Simpson, Director of the Meteorological Office, who took as his subject "Physics in Meteorology." Dr. Simpson said that meteorology is mainly applied physics; every branch of physics finds an application in it and he described five recent meteorological investigations which have respectively depended on an application of sound, light, heat, magnetism and electricity.

When large and violent explosions occurred it was noticed that the sound was loudest near the origin and then decreased, as one would expect, until at a certain distance, about sixty miles, it could no longer be heard. The surprising observation, however, was made that at still greater distances, more than 120 miles, the sound was again audible. After the War, much work was done to try to find an explanation of this curious effect. In Great Britain, Dr. F. J. W. Whipple of Kew Observatory organised an investigation and records were obtained at Sheffield, Birmingham, Bristol, Nottingham and Cardiff of the sounds made when large guns were fired in Shoeburyness, near the mouth of the Thames. The result of this work has shown that the old idea that the upper atmosphere—the stratosphere—is cold throughout, can no longer be held. The stratosphere is cold up to a height of about 25 miles and then it becomes warm again and at great heights becomes even warmer than at the surface.

The theory of optics has been used very much in meteorology especially to determine whether clouds are composed of water or ice, but recently spectroscopy has been used by Dr. G. M. B. Dobson, of Oxford, to investigate the amount of ozone present in the upper atmosphere. He finds that, while there is practically no ozone lower than 30 miles above the surface, at greater heights there is a relatively large quantity and it is the presence of this ozone which makes the upper atmosphere warm. A very unexpected result has come out of this work, for Dr. Dobson shows that the ozone is not uniformly distributed, but is concentrated in the neighbourhood of cyclonic depressions and is relatively weak in the neighbourhood of anticyclones. How cyclones and anticyclones, which are known to be phenomena of the lower atmosphere, can effect the amount of ozone 30 miles up in the atmosphere, or whether it is the other way about and the ozone causes the cyclones, are problems which cannot yet be solved.

For his example of the application of the physics of heat to meteorology, Dr. Simpson described some of his own work on the balance of incoming and outgoing radiation. Heat reaches the earth as short-wave radiation from the sun and leaves again as long-wave radiation from the upper atmosphere. The incoming radiation is much greater in equatorial than in polar regions, thus accounting for the difference of temperature between the equator and the poles. Calculations, however, show that the outgoing radiation is practically the same from all parts of the earth, and the poles send as much radiation into outer space as do the equatorial regions. As the polar regions send out much more heat than they receive from the sun, the loss has to be made up by transfer of heat from low to high latitudes. It is the transfer of this heat which is the driving force of the winds.

Magnetism has not much direct effect on the atmosphere and, therefore, does not enter much into meteorology: but in most countries the study of the natural magnetism of the earth—terrestrial magnetism—is part of the duty of meteorologists, and in Great Britain two of the chief observatories where terrestrial magnetism is studied are under the control of the Meteorological Office. Terrestrial magnetism is known to be greatly affected by the activity of the sun and so is the atmosphere, but it has always been difficult to find any relationship between terrestrial magnetism and the atmosphere. Recently, however, Mr. J. M. Stagg, who is at present in charge of the British Polar Year Expedition to Fort Rae in Canada, has found an interesting relationship at Aberdeen between magnetic activity and the barometric pressure. This relationship, however, must be examined further before it can be shown to be real.

Electricity, unlike magnetism, plays an important part in meteorology, especially in thunderstorms. Dr. Simpson, however, discussed another aspect of

atmospheric electricity and described the electrical field which always exists even in fine weather near the earth's surface. He said that this field is probably due to the fact that the conducting layers in the upper atmosphere, the so-called Kennelly-Heaviside and Appleton layers, are maintained at a potential of several million volts above ground potential. How the difference of potential is maintained is one of the main problems of atmospheric electricity. Prof. C. T. R. Wilson considers that thunderstorms are the cause, while others consider that some solar effect is responsible because the potential is highest each day when the earth's north magnetic pole points most directly towards the sun. In conclusion, Dr. Simpson described some recent experiments at Kew Observatory which indicate that the ionisation of the lower atmosphere is not uniform, but that the ions occur in parcels. This observation is likely to have an important bearing on the theory of the ionisation of the atmosphere.

University and Educational Intelligence

BRISTOL.—Mr. N. F. Mott, lecturer in mathematics in the University of Cambridge, has been elected to the Melville Wills chair of theoretical physics in the University of Bristol in succession to Prof. J. E. Lennard-Jones. By agreement with the University of Cambridge, Prof. Lennard-Jones will give assistance to the Wills Laboratory during the present session and Mr. Mott will not take up his duties until next autumn.

Dr. C. M. Yonge, of the Marine Biological Laboratory, Plymouth, has been appointed to the chair of zoology in the University.

CAMBRIDGE.—Dr. Drury has been appointed Huddersfield lecturer in special pathology. J. S. Turner, of Selwyn College, has been appointed to the Frank Smart University studentship in botany.

Sir James Jeans will deliver the Henry Sidgwick memorial lecture on November 26 at 5 P.M. in the College Hall, Newnham College. The subject of the lecture is "The Furthest Depths of Space".

LONDON.—In consequence of the announcement that Major the Hon. John J. Astor, M.P., was the anonymous donor in 1920 of the gift of £20,000 for the endowment of the University chair of physiology at the Middlesex Hospital Medical School, it has been decided that the title of this chair shall now be the "John Astor Chair of Physiology tenable at the Middlesex Hospital Medical School". As recently announced, a gift of £1,500 a year for seven years has been promised by the Prudential Assurance Company for the endowment of the chair of public health tenable at the London School of Hygiene and Tropical Medicine; it has been decided that the chair shall be known as the "Prudential Chair of Public Health" for the duration of the gift.

The title of emeritus professor of mathematics in the University has been conferred on Prof. S. A. F. White, on his retirement from the chair of mathematics at King's College.

MANCHESTER.—Dr. John Hollingworth has been appointed to succeed Prof. Miles Walker, who has held the chair of electrical engineering in the University and College of Technology since 1912. Prof. Miles Walker's many services to electrical engineering are well known; in Manchester he will be remembered for the close association of the engineering industry and the University which he has been instrumental in bringing about. Dr. Hollingworth was educated at Bradfield College, University College (London), Peterhouse (Cambridge) and the City and Guilds Engineering College. He was a wrangler at Cambridge in 1907, and has since held various appointments both industrial and academic. Prior to 1917 his experience was all in heavy engineering; since that date he has been engaged in radio research.

The following appointments have also been made: Demonstrator in anatomy, Mr. A. N. Birkett; demonstrators in pharmaceutics, Dr. Kenneth Bullock and Mr. S. L. Prescott; lecturer in mathematics (College of Technology), Mr. James Topping; assistant lecturer in metallurgy and assaying (College of Technology), Mr. E. A. Fowler; demonstrator in physics (College of Technology), Mr. Joseph Bor.

Mr. C. J. P. D. La Touche has resigned his post as research assistant in mycology on his appointment as lecturer in botany in University College, Dublin.

The Council has accepted from Mrs. R. W. Williamson a portrait in oils of her father-in-law, the late Prof. W. C. Williamson, who was in charge of the teaching of zoology, botany and geology in Owens College from 1851 until 1892.

THE thirty-third annual meeting of the Science Masters' Association will be held at the University of Bristol on January 3–6, 1933, under the presidency of Prof. A. M. Tyndall, who will deliver an address on "Gaseous Ions". Several lectures have also been arranged to be given by members of the staff of the University. Further information can be obtained from the Annual Meeting Secretary, Shirley Hill, Boden Road, Hall Green, Birmingham.

Calendar of Geographical Exploration

Nov. 8, 1903.—An Antarctic Rescue

Capt. Irizar rescued Otto Nordenskiöld and his party. Dr. O. Nordenskiöld, nephew of the hero of the *Vega* expedition, with C. A. Larsen and J. Gunnar Andersson, left Göteborg on October 16, 1901, for research work in the antarctic. His vessel was off the South Shetlands in 1902 and proceeded down the west coast of Louis Philippe Land, discovering that the Orleans channel did not reach Weddell Sea, but was merely a part of Gerlache Strait. On February 12 Nordenskiöld, three scientific workers and two sailors, landed on Snow Hill Island in 64° 25′ S. and established winter quarters. The ship went north to carry on researches in the open sea. She did not return in spring as expected and the party was compelled to spend a second winter, during which the insularity of Ross Island was established. In October, 1903, Nordenskiöld encountered Andersson and a companion, black from head to foot and with long black hair and bushy beards, so that they were at first not recognisable. They had left the ship when it became clear that she could not reach the winter camp and had set out on foot, eking out their scanty diet with seal oil. On November 8, Capt. Irizar of the Argentine naval vessel, *Uruguay*, reached Snow Hill Island and, that night, by an extraordinary coincidence, Larsen and the crew also arrived. The ship had been caught in the ice in Erebus and Terror Gulf in January and so

damaged that she sank; the crew had wintered on Paulet Island. Capt. Irizar's timely arrival thus saved the whole party.

Nov. 10, 1898.—Sir Charles Hose in Sarawak

Sir Charles Hose, with Drs. McDougall and C. S. Myers, set out for the hitherto unexplored regions between the headwaters of the Batang-Kayan, Rijang and Baram Rivers in the Madang territory of Borneo. Between 1884 and 1892, Hose explored most of northern Sarawak and opened up much previously unvisited country in the valley of the Baram River.

Nov. 12, 1799.—Alexander von Humboldt

On the night of November 12–13, Alexander von Humboldt observed in Cumana, Venezuela, that meteor shower which forms the starting point of our knowledge of the periodicity of the phenomenon. Humboldt and A. Bonpland, the botanist, had sailed from Corunna in 1799, stopped at Teneriffe and ascended the peak, and thence proceeded to Cumana. From Cumana they went to Caracas and in 1800 Humboldt left that town to explore the Orinoco River. He covered 1725 miles of wild and uninhabited country and confirmed the fact that the Cassiquiari links the Amazon to the Orinoco. Teixeira had been told of the probability of this when he explored the Amazon in 1637–39, but the statement was received with incredulity. On November 24, 1800, Humboldt and Bonpland went to Cuba and, after a stay of some months, recrossed to Cartagena. They ascended the Magdalena, crossed the Cordilleras and reached Quito on January 6, 1802. They climbed Pichincha and Chimborazo and made an expedition to the sources of the Amazon. At Callao, Humboldt observed the transit of Mercury. Humboldt contributed much to the purely exploratory side of geography, but his more important work was the laying of the foundation of the broad outlines of physical geography and meteorology. He discovered the decrease in intensity of the earth's magnetic force towards the equator; he worked out a formula relating decrease in temperature to elevation above sea level; he introduced the idea of isothermal lines. He was also interested in the relation between plant and animal life and its environment. Humboldt's example was a powerful stimulus to the development of the scientific side of subsequent explorations.

Nov. 12, 1882.—Kishen Singh's Famous Journey

"A–K", Kishen Singh, arrived at Darjeeling after the last and most remarkable of his memorable explorations. He set out from Darjeeling in 1878, reached Lhasa, travelled across Tibet, crossed the Altyn Tagh and reached Sa-Chow, his northern limit. He then crossed eastern Tibet, entered China and journeyed through Batang. He could not get a passage to Assam, so he turned northwards and made a great bend round the Brahmaputra River, which he ultimately touched at Tsetang. This magnificent feat included the crossing of a vast area of entirely unknown country, from which he brought back details of atmospheric conditions, population and trade possibilities. His survey suggested the belief, confirmed later by the travels of Kinthup, a native of Sikkim, that the Brahmaputra, the Dihang and the Tsang-po were all one river. In a previous journey in 1871, Kishen Singh had solved the geography of the region between Shigatse and the great lake Tengri Nor, north of Lhasa, and had thoroughly explored a northern tributary of the Brahmaputra.

Societies and Academies

CAPE TOWN

Royal Society of South Africa, Aug. 17.—E. Newbery: Electrolytic rectifiers. The theory that the behaviour of a valve electrode can be accounted for by assuming the formation of a semi-permeable membrane on the surface is fully justified by further investigation with the aid of the cathode ray oscillograph. A valve electrode is capable of rectifying an alternating current only when the anodic membrane is not reducible by atomic hydrogen, and further, in the case of aluminium, the membrane consists of the oxide only and not the hydroxide.—G. M. Dreosti: A method of measuring the pressures on oranges during and after the process of packing. The pressure upon an orange has been found to vary with the details of packing. A few measurements of the change of pressure with time in a cold store indicate that the pressure falls roughly 0·35 per cent an hour during the first hundred hours. Making a few assumptions, simple formulæ have been set up for the derivation of the forces between two oranges in contact and between an orange and the faces of the box with which it is in contact.—F. G. Cawston: Native medicines in Natal. An account is given of investigations into South African native and Indian herbal remedies used and sold in Natal for medical purposes.—Sir Thomas Muir: Note on a set of equivalent determinants connected with a 3-by-6 array.—I. Schrire and H. Zwarenstein: Protein metabolism and the effects of injection of testicular extracts on castrated animals. It has previously been shown that after castration there is a marked increase in creatinine excretion in male rabbits. Following the injection of testicular extracts into castrated animals, there is a drop in the high creatinine excretion to pre-castration levels. This drop is only transient, and in a day or two after the injection, the creatinine excretion is once more at the normal castration level.

ROME

Royal National Academy of the Lincei, May 15.—V. Nobile: Laws of central force corresponding with fixed trajectories, and a noteworthy particular case. The problem considered, which is a particular case of that stated and resolved by Sakellariou (1929), is as follows: Given a family of curves by means of a polar equation containing k parameters, $f(r,\theta ; a_1 a_2 \ldots a_k)=0$, to determine the most general law of central force (with intensity a function of the point and vector velocity) with which the given lines correspond as trajectories.—A. Sommerfeld: Asymptotic integration of the Thomas-Fermi differential equation.—Giacinta Andruetto: The Saint-Venant formulæ for the varieties V_n with constant curvature. The simple procedure recently given for obtaining the Saint-Venant formulæ for any variety with three dimensions is now extended to the case of a variety V_n with n dimensions, supposing a constant Riemannian curvature.—A de Mira Fernandes: The unitary theory of physical space.—A. Kolmogoroff: The general form of a homogeneous 'stocastic' process (a problem of Bruno de Finetti).—B. Manià: A theorem of existence in the calculus of variations.—M. L. Dubreil-Jacotin: Waves of permanent type in heterogeneous liquids. Various rigorous properties of these waves are established for the case in which the movement is the same in parallel vertical planes,

so that it may be studied in one of these planes as a two-dimensional movement.—Z. Pycha: Relativity in the microcosm.—A. Desio: Presence of the Eocene in Eastern Fezzan (Tripoli).—Silvia Colla: Investigations on the movement of the stamens in certain Berberidaceæ. Action of multiple subliminal stimuli of low frequency.—Z. Danin: Investigations on the gaseous content of certain Algæ. The gases contained in *Enteromorpha compressa* Ag.

SYDNEY

Linnean Society of New South Wales, July 27.—C. Deane: Trichopterygidæ of Australia and adjacent islands. Descriptions of two new genera and eighteen new species. A key to genera dealt with by the author in this and the two previous papers is also given with a table showing the numbers of known species from various parts of the world.—F. A. Craft: The physiography of the Shoalhaven River valley. (5) The upper valley and the stream system. Two peneplain levels are recognised towards the head of the Shoalhaven—one of a composite nature with its principal development between 2400 ft. and 2600 ft., in which was developed the Shoalhaven Plain farther to the north at a slightly lower level, and an older feature which rises from 3000 ft. in the middle valley to 4000 ft. at the head of the river. The stream system appears to have developed on this older surface, although some variation has taken place as a result of limited captures by streams cutting back from the south-east along lines of weakness.—A. Burges: Notes on the mosses of New South Wales. (1) Additional records and description of a new species of *Buxbaumia*. This is the first paper of a series intended to bring up to date the census of New South Wales mosses published by Watts and Whitelegge in 1902 and 1905. A list is given of records in the subclass Bryales, order group Eubryinales, and a new species of *Buxbaumia* is described from the Williams River, N.S.W.—G. A. Waterhouse: Australian Hesperiidae. (2) Notes and descriptions of new forms. Two new species and fifteen new subspecies are described. In addition, one new species is recorded from Australia for the first time. It is shown that in the Australian region many of the genera of the subfamily Pamphilinæ have pairs of closely related species. Notes are given on a number of subspecies, showing their relationship to the typical species found in the oriental region.

Aug. 31.—J. R. Malloch: Notes on Australian Diptera (32). Three new species are described and a key is given for the species of the genus *Fergusonina*, family Agromyzidæ. A new genus and species of the family Ochthiphilidæ are also described. All the species described as new are probably of economic importance.—F. A. Craft: The physiography of the Shoalhaven River valley. (6) Conclusion. The master peneplanation recorded in the area preceded the deposition of the Permian Upper Marine series, and later gentle uplift at intervals has allowed the invasion of the elevated plateau mass by streams, which have carved a series of terraces on a large scale, finally giving the incomplete peneplain which comprises a great part of the area, and has extensive deposits of Tertiary drift and basalt on its surface. The original divides were aligned east and west, and streams flowed from them to ancient depressions; there was a tendency towards capture from the eastern coast as the various uplifts took place.—F. A. Craft: Notes on erosional processes and stream gravels. Negative forms in granite areas are correlated with well-developed stream systems. The widening of valleys in the horizontal rocks of the Blue Mountain plateau are dealt with; the conditions of formation of ellipsoidal and flattened stream gravels in terms of stream power and motion and the climate indicated by Tertiary drifts of the Shoalhaven Valley are described.—A. Jefferis Turner: Revision of Australian Lepidoptera. Oecophoridæ (1). A key is given for indentification of the twenty-four genera. This part deals with sixteen genera, and includes descriptions of three genera and thirty species as new.

Forthcoming Events

MONDAY, Nov. 7

NATIONAL INSTITUTE OF INDUSTRIAL PSYCHOLOGY—(at the London School of Economics and Political Science).—Dr. George H. Miles: "The Human Factor in the Marketing and Distribution of Goods", at 6 P.M. (succeeding lectures on Nov. 14 and 21).

ROYAL INSTITUTE OF BRITISH ARCHITECTS—(Inaugural Meeting).—Presidential Address, at 9 P.M.

TUESDAY, Nov. 8

KING'S COLLEGE, LONDON.—F. H. Preece: "Boiler House Economics", at 5.30 P.M.

ILLUMINATING ENGINEERING SOCIETY—(at the Laboratories of the General Electric Co., Ltd., Wembley).—C. C. Paterson: "Luminous Discharge Tube Lighting", at 7 P.M.

ROYAL ANTHROPOLOGICAL INSTITUTE—(at the School of Hygiene and Tropical Medicine, Keppel Street, W.C.1).—Maj. P. H. G. Powell-Cotton: "Benin Brass Casting and Handicrafts in the Cameroons", at 8.30 P.M.

PHARMACEUTICAL SOCIETY OF GREAT BRITAIN.—C. H. Hampshire: "The British Pharmacopœia, 1932", at 8.30 P.M.

ROYAL INSTITUTION.—Prof. E. N. da C. Andrade: "Rays and Radiations", at 5.15 P.M. (succeeding lectures on Nov. 15 and 22).

WEDNESDAY, Nov. 9

ROYAL SOCIETY OF ARTS.—T. Thorne Baker: "New Developments in Colour Cinematography", at 8 P.M.

THURSDAY, Nov. 10

KING'S COLLEGE, LONDON.—Dr. J. A. Hewitt: "The Influence of Ductless Glands on Metabolism", at 5 P.M. (succeeding lectures on Nov. 17, 24 and Dec. 1).

Official Publications Received

GREAT BRITAIN AND IRELAND

The Scientific Proceedings of the Royal Dublin Society. Vol. 20 (N.S.), Nos. 21–27: Report of the Irish Radium Committee for the Year 1931 (including Reports by Oliver Chance, John A. Geraghty, Oswald J. Murphy, C. Conor O'Malley, Dr. Bethel Solomons, Sir Robert Woods); The Inhibition of Chemical Reactions, Part 5: The Influence of Pyridine and other Substances on the Absorption of Ethylene by Sulphuric Acid, and on the Surface Tension of Sulphuric Acid, by William Sydney Eagar Hickson and Dr. Kenneth Claude Bailey; A Method for automatically recording the Oxygen Intake of Living Tissues, by Dr. T. A. Bennet-Clark; The Respiratory Quotients of Succulent Plants, by Dr. T. A. Bennet-Clark; On the Cultivation in Artificial Media of *Catenaria anguillulæ*, a Chytridiacean Parasite of the Ova of the Liver Fluke, *Fasciola hepatica*, by Prof. J. Bayley Butler and Annie Humphries; Factors which Determine the Nutritive Value (Stock-carrying and Fattening Capacity) of Untreated Natural Pastures, by E. J. Sheehy; A Comparison of some European and American Virus Diseases of the Potato, by Dr. Paul A. Murphy and Robert McKay. Pp. 249–358+plates 13–18. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 10*s*.

Annual Report of the Director of the Meteorological Office presented by the Meteorological Committee to the Air Council for the Year ended 31st March, 1932. (M.O.348). Pp. 54. (London: H.M. Stationery Office.) 1*s*. net.

Department of Scientific and Industrial Research. Building Science Abstracts. Vol. 5 (New Series), No. 8, August. Abstracts Nos. 1352–1529. Pp. 251–290. (London: H.M. Stationery Office.) 1*s*. net.

Journal of the Institute of Actuaries Students' Society. Vol. 4, No. 1. Pp. 90. (London: Charles and Edwin Layton.) 3s.

Philosophical Transactions of the Royal Society of London. Series A, Vol. 231, A697: A New Apparatus for Determining the Relationship between Wave-lengths of Night and the Fundamental Standards of Length. By J. E. Sears, Jr., and H. Barrell. Pp. 75–145. (London: Harrison and Sons, Ltd.)

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1461 (T.2945, A, B, and C): Design and Test Data for Aircraft Radiators. By C. Anderton Brown. Pp. 56+24 plates. (London: H.M. Stationery Office.) 3s. net.

Aeronautical Research Committee. Report for the Year 1931–32. Pp. iv+96+5 plates. (London: H.M. Stationery Office.) 2s. net.

Journal of the Chemical Society. September. Pp. vi+2281–2504+x. (London: Chemical Society.)

The Proceedings of the Physical Society. Vol. 44, Part 5, No. 245, September. Pp. iv+529–624+xxii. (London: Physical Society.) 7s. net.

Proceedings of the Linnean Society of London, Session 1931–32. Part 4. Pp. 73–150. (London: Linnean Society.) 2s. 6d.

Transactions of the Institute of Marine Engineers, Incorporated Session 1932. Vol. 44, No. 8, September. Pp. 375–426+xxxiv (London.)

Quarterly Journal of the Royal Meteorological Society. Vol. 58 No. 247, October. Pp. 377–498+viii. (London: Edward Stanford. Ltd.) 7s. 6d.

Proceedings of the Royal Society. Series A, Vol. 138, No. A834, October 1. Pp. 258. (London: Harrison and Sons, Ltd.) 13s.

Mathematical Notes published by the Edinburgh Mathematical Society. Edited by Dr. A. C. Aitken. Pp. xix. (Edinburgh.)

Proceedings of the Edinburgh Mathematical Society. Edited by Prof. H. W. Turnbull and Dr. E. T. Copson. Series 2, Vol. 3, Part 2, July. Pp. 77–150. (London: G. Bell and Sons, Ltd.)

The Botanical Society and Exchange Club of the British Isles. Report for 1931 (with Balance Sheet for 1930). By Dr. G. C. Druce. Vol. 9, Part 5. Pp. 535–816+plates 5–16. 10s. Report for 1931 of the Botanical Exchange Club. By P. M. Hall. Vol. 9, Part 6. Pp. 817–847. 4s. (Arbroath: T. Buncle and Co.)

Tenth Scientific Report on the Investigations of the Imperial Cancer Research Fund. Pp. viii+203+55 plates. (London: Taylor and Francis.) 30s.

Journal of the Royal Statistical Society. New Series, Vol. 95, Part 4. Pp. 607–788. (London: Royal Statistical Society.) 7s. 6d.

Report of the Council of the Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne, intended to be presented at the Annual Meeting of the Society, 25th October, 1932. Pp. 40. (Newcastle-upon-Tyne.)

The Journal of the Royal Horticultural Society. Edited by F. J. Chittenden. Vol. 57, Part 2, September. Pp. 157–378+li–cxli+xxiv+62 plates. (London: Royal Horticultural Society.) 7s. 6d.

Philosophical Transactions of the Royal Society of London. Series B, Vol. 221, B478: Analyses of Agricultural Yield. Part 4: Water-Table Movements on a Farm in Egypt. By Dr. W. Lawrence Balls, in collaboration with M. A. Zougloul. Pp. 335–375+plate 33. (London: Harrison and Sons, Ltd.)

The Hannah Dairy Research Institute. Bulletin No. 4: The Engineering Aspects of the Condensing and Drying of Milk. By Dr. A. W. Scott. Pp. 120. (Auchincruive.)

Biological Reviews and Biological Proceedings of the Cambridge Philosophical Society. Edited by H. Munro Fox. Vol 7, No. 4, October. Pp. 275–381. (London: Cambridge University Press.) 12s. 6d. net.

Leeds Studies in English. Outline of a Theory of Language. By Alan S. C. Ross. Pp. 14. (Leeds.)

Notes from the Botanical School of Trinity College, Dublin. Vol. 4, No. 4, August. Pp. 145–251. (Dublin.)

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1378 (T.2955): Theory of Airscrew Body Interference. By C. N. H. Lock. Pp. 23+7 plates. 1s. 3d. net. No.1465 (Strut. 90): Distortion of Thin Tubes under Flexure. By Dr. A. J. Sutton Pippard. Pp. 5+4 plates. 6d. net. (London: H. M. Stationery Office.)

Empire Cotton Growing Corporation. Report of the Executive Committee to be submitted to the Meeting of the Administrative Council on October 12th, 1932. Pp. 8. (London.)

Board of Education. Educational Pamphlets No. 91 (Industry Series No. 11): Trade Schools on the Continent. Pp. 110. (London: H.M. Stationery Office.) 2s. net.

Proceedings of the Linnean Society of London, Session 1931–32. Part 5: Presidential Address by Prof. F. E. Weiss, A Re-Examination of the Stigmarian Problem. Pp. 151–166. (London: Linnean Society.) 6d.

The Journal of the Institution of Electrical Engineers. Edited by P. F. Rowell. Vol. 71, No. 430, October. Pp. 541–684+xvi. (London: E. and F. N. Spon, Ltd.) 10s. 6d.

Other Countries

Trinidad and Tobago: Forest Department. Administration Report of the Conservator for the Year 1931. Pp. 23. (Trinidad: Government Printing Office.)

Technical Books of 1931: a Selection. Compiled by Donald Hendry. (Twenty-fourth Issue.) Pp. 28. (Brooklyn, N.Y.: Pratt Institute Free Library.)

Field Museum of Natural History. Botanical Series, Vol. 8, No. 6: Revision of the Genus Cosmos. By Earl Edward Sherff. (Publication 313.) Pp. 399–447. (Chicago.) 50 cents.

Smithsonian Institution: Bureau of American Ethnology. Bulletin 111: The Village of the Great Kivas on the Zuñi Reservation, New Mexico. By Frank H. H. Roberts, Jr. Pp. ix+197+64 plates. (Washington, D.C.: Government Printing Office.)

The Science Reports of National Tsing Hua University. Series A: Mathematical and Physical Sciences. Vol. 1, No. 5, July. Pp. 159–214. (Peiping.)

South Australia: Department of Mines. Mining Review for the Half-Year ended 31st December, 1931. (No. 55.) Pp. 98. (Adelaide: Harrison Weir.)

Ibero-Americana. 1: Aztatlán, Prehistoric Mexican Frontier on the Pacific Coast. By Carl Sauer and Donald Brand. Pp. 92 (14 plates). 2 dollars. 2: The Comparative Ethnology of Northern Mexico before 1750. By Ralph L. Beals. Pp. vi+93–226. 1.35 dollars. 3: The Road to Cíbola. By Carl Sauer. Pp. iv+58. 75 cents. (Berkeley, Calif.: University of California Press.)

Indian Journal of Physics, Vol. 7, Part 3, and Proceedings of the Indian Association for the Cultivation of Science, Vol. 16, Part 3. Conducted by Sir C. V. Raman. Pp. 165–283. (Calcutta.) 3 rupees; 4s.

Kenya Colony and Protectorate: Forest Department. Annual Report, 1931. Pp. 27. (Nairobi: Government Printer.) 1s.

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 59, Radio Research Board Report No. 2: i. The State of Polarisation of Sky Waves, by A. L. Green; ii. Height Measurements of the Heaviside Layer in the Early Morning, by A. L. Green. Pp. 80. Bulletin No. 60, Radio Research Board Report No. 3: i. The Influence of the Earth's Magnetic Field on the Polarisation of Sky Waves, by W. G. Baker and A. L. Green. Pp. 32. Bulletin No. 63, Radio Research Board Report No. 4: i. A Preliminary Investigation of Fading in New South Wales, by A. L. Green and W. G. Baker; ii. Studies of Fading in Victoria, a Preliminary Study of Fading on Medium Wave-lengths at Short Distances, by R. O. Cherry and Dr. D. F. Martyn; iii. Studies of Fading in Victoria, Observations on Distant Stations in which no Ground Wave is Received, by R. O. Cherry. Pp. 60. (Melbourne: H. J. Green.)

The Quarterly Journal of the Geological, Mining and Metallurgical Society of India. Edited by K. K. Sen Gupta. Vol. 3, No. 4, April. Pp. 153–193+xii. (Calcutta.)

Memoirs of the Indian Museum. Vol. 10 (continued): The Copepoda of Indian Seas—Calanoida. By Lieut.-Col. R. B. Seymour Sewell. Pp. 223–408+6 plates. (Calcutta: Zoological Survey of India.) 9.10 rupees; 16s.

Records of the Indian Museum. Vol. 33, Part 2, June. Pp. 71–210+plates 5–6. 2.12 rupees; 5s. Vol. 33, Part 3, October. Pp. 211–325+plate 7. 2.12 rupees: 5s. Vol. 33, Part 4, December. Pp. 327–516+plates 8–15. 2.12 rupees; 5s. Vol. 33, Appendix: List of Literature referring to Indian Zoology (excluding Insecta) received in Calcutta during the Year 1931. Pp. xii. 4 annas; 5d. Vol. 34, Part 1, March. Pp. 79+7 plates. 2.12 rupees; 5s. Vol. 34, Part 2, June. Pp. 81–228+plates 8–17. 2.12 rupees; 5s. (Calcutta: Zoological Survey of India.)

Outline History of the Victorian Bush Nursing Association. By Sir James Barrett. Pp. 26. (Melbourne.)

Southern Rhodesia: Geological Survey. Bulletin No. 20: The Geology of the Country around Que Que, Gwelo District. By A. M. Macgregor. Pp. 113+14 plates. (Salisbury.) 2s. 6d.

Southern Rhodesia. Meteorological Report for the Year ended 30th June, 1931, together with Hydrographic Report for the Years ended 30th September, 1931, by the Department of Agriculture. Pp. 32. (Salisbury: Government Printer.)

Publications of the Observatory of the University of Michigan. Vol. 4, No. 12: Variations of Emission Lines in Three Be Spectra. By Ralph H. Curtiss. Pp. 163–174. Vol. 4, No. 13: A Spectroscopic Survey of the Brighter Be Stars. By Dean B. McLaughlin. Pp. 175–198+2 plates. (Ann Arbor, Mich.)

U.S. Department of Commerce: Bureau of Standards. Research Paper No. 460: Theory of Voltage Dividers and their Use with Cathode Ray Oscillographs. By Melville F. Peters, George F. Blackburn and Paul T. Hannen. Pp. 81–114+10 plates. 10 cents. (Washington, D.C.: Government Printing Office.)

U.S. Treasury Department: Coast Guard. Bulletin No. 21: International Ice Observation and Ice Patrol Service in the North Atlantic Ocean, Season of 1931. Pp. iii+52+19 plates. (Washington, D.C.: Government Printing Office.)

The Memoirs of the Imperial Marine Observatory, Kobe, Japan. Vol. 5, No. 2, July. Pp. 51–103. (Kobe.)

Bulletin of the Imperial Agricultural Experiment Station in Japan. Vol. 3, No. 3, March. Pp. 157–242+plates 3–15. (Nishigahara, Tokyo.)

The Science Reports of the Tôhoku Imperial University, Sendai, Japan. Fourth Series (Biology), Vol. 7, No. 3, August. Pp. 313–455+plates 11–12. (Tokyo and Sendai: Maruzen Co., Ltd.)

The Medical and Scientific Archives of the Adelaide Hospital. No. 11 (for the Year 1931). Pp. 59. (Adelaide: Harrison Weir.)

Commission Internationale de la Haute Atmosphère. Comptes rendus des jours internationaux 1924. Première partie: Tableaux des sondages réussis, cartes synoptiques. Pp. iv+161. Deuxième partie: Diagrammes indicateurs, folio des tephigrammes des sondages par ballons-sondes, tables de chiffres pour le calcul de l'entropie de l'air. Pp. 24. (London: International Commission for the Exploration of the Upper Air, c/o Royal Meteorological Society.)

Gold Coast Colony. Report on the Survey Department for the Year 1931–32. Pp. ii+16. (Accra: Government Printing Office; London: The Crown Agents for the Colonies.) 2s.

Catalogues

An Illustrated Catalogue of Old Prints in Colour and Line, chosen chiefly for their Decorative Charm, including Plates of Flowers, Birds, Sporting Subjects, Swiss and English Views, Costumes and Maps. (No. 181.) Pp. 28+16 plates. Catalogue of Botanical Literature in all its Branches, including Books on Gardening and Floriculture, Regional Floras, Cryptogamic Botany, Serial Publications, etc. (No. 201.) Pp. 36. (London: Dulau and Co., Ltd.)

Zenith "Vit-Bond" Wire Wound Resistance Units. Pp. 8. (London: Zenith Electric Co., Ltd.)

Ephedrine B.D.H. Pp. 4. (London: The British Drug Houses, Ltd.)

Catalogue de Livres anciens et modernes rares ou curieux relatifs à l'Orient. (No. 22.) Pp. 118. (Paris: Libr. Adrien-Maisonneuve.)

Catalogue of New and Special Apparatus. (List No. 90a.) Pp. 20. (London: A. Gallenkamp and Co., Ltd.)

A Modern Library, mainly English Literature and Criticism. (No. 464.) Pp. 28. (Cambridge: Bowes and Bowes

British Super Protex Glass for X-Ray Purposes. Pp. 8. (London: Cuthbert Andrews.)