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## Outlook of Professional Organizations

**P**ROFOUND changes in manufacturing technique and industrial organization have resulted from the modernization of industry under the influence of power production during the last twenty years. This is generally recognized, but equally important changes in the personnel of industry have largely escaped attention. The recent report of the Industrial Health Research Board, it is true, pointed out that industry is demanding a different type of worker, but apart from Prof. Carr-Saunders' and Mr. P. A. Wilson's study of the professions, the increasing importance of the technical and scientific worker in industry has scarcely received the attention it deserves. Not only have the technical and scientific staffs been immediately responsible for much of the development and reorganization involved in the modernization and rationalization of industry, but they have also assumed an increasing share of the responsibility for the administration of the larger industrial units characteristic of to-day. In fact, large-scale industry mainly depends on their activities, and in turn they find in it the fullest scope for their knowledge and skill.

The rise of virtually a new professional class or type in this way is one of the most significant results of the modern technique in industry and commerce; and its social consequences have as yet been given little attention. Certain of these questions are considered in a paper by Mr. S. W. Smith on the place and function of the administrative and technical worker in the new forms of economic structure, presented to Section F (Economic Science and Statistics) at the British Association meeting at Blackpool. One of the most important of these changes is the way in

which the functional and professional outlook in the direction of industry is replacing the purely speculative or profit-seeking motive.

This growing power of the vocational outlook is of fundamental importance in the adaptation of industry, and indeed of society to meet new conditions. In so far as industry and commerce are directed less by self-interest than by the spirit of trusteeship or stewardship and service, the dangers of exploitation and social friction tend to diminish. Moreover, the type of control required in industry to-day involves leadership rather than domination, without sacrificing authority; discipline based on intelligent co-operation, and decision reflecting the ideas of trained personnel acting freely and willingly in unity rather than the arbitrary will of a functional head.

That in certain public utility corporations the directors should, contrary to prevailing practice in limited companies, be debarred from any holding of shares, so as to secure that their dominant concern should be with the public interest, is only one example of the way in which a sense of duty and responsibility is replacing purely financial or private interests in the conduct of large undertakings. Moreover, the professional man, whether engaged in administrative work or not, finds his chief interest, when reasonably paid, in his work for its own sake; and while the professional ideal continues to pervade the control of industry, so we may expect to find the service motive increasing in influence, and professional pride in the proper and efficient conduct of business organizations strongly reinforced.

This in itself should facilitate the wider outlook which to-day is essential in the integration of



society to meet the impact of science. Industry can no longer be conducted solely with reference to its own internal efficiency and economy. It has to be considered in relation to society as a whole, and the technical ideal of fitness for a purpose must be applied in even wider spheres. No longer can we be content with a purely financial or even physical concept of the principle of economy. Social and human values are equally concerned, and industrial efficiency to-day involves the consideration not merely of chemical and physical processes but also of industrial health, psychology and the repercussions of a development on the community. What the product and process contribute to the worker and to the community are as important as what the worker contributes to the product.

The entrepreneur spirit alone is entirely inadequate to deal with such a situation and the creative forces involved. On the other hand, those scientific and technical workers whose administrative capacity and technical knowledge have placed them in such positions of trust have not invariably proved equal to the moral responsibilities involved. To this, particular attention was directed in Prof. W. Cramp's forceful address to Section G (Engineering) at the British Association. While the legal liabilities of the engineer and the loss of prestige attaching to faulty design or workmanship are the final safeguard to the community against abuse of privilege, standards of professional conduct are not infrequently honoured in the breach rather than by observance under the stress of commercial conditions.

For this, two factors may be regarded as primarily responsible. In the first place, as the instances cited by Prof. Cramp show, there is the absence of a scale of values firmly accepted by technical and scientific workers and so established by training and tradition that violation almost inevitably involves disqualification from practice. In part, this is a matter of education; in part, a question of organization. One of the main motives, in fact, in attempts to raise the status of the chemist or the engineer by establishing a legal register and closing the profession has been that of safeguarding the public from the dangers attending a low standard of professional competence or integrity.

In the second place, the disregard of professional standards of rectitude is often due to the absence of a professional organization strong enough to afford its members adequate support in the face

of economic or other forms of pressure from any source which tempts them to disregard the accepted ethical code. Nothing is more important to-day than that professional workers, whether within the ranks of science or not, should give their primary loyalty to their professional or vocational associations, and not to commercial or industrial organizations. It is only as they find in vocational organizations their permanent anchorage and shelter that professional workers can hope to make their full contribution to the shaping of organizations into instruments for the service of society and not for its mastery or exploitation.

This is indeed our crucial problem. The same factors that have increased the numbers of technical and professional workers have diminished their economic security and undermined their independence. The incidence of unemployment among their ranks on a scale undreamed of, in a class which was before the War virtually immune, has made efficient and effective professional associations essential if the full independent contribution of the professional worker is to be secured. The last fifteen years or so have witnessed a remarkable increase in the establishment of protective associations among such workers, and already an appreciable number of such organizations have negotiated collective agreements or enjoy the benefit of Whitley councils.

As yet, however, there have been few signs that such professional associations have recognized the wide orbit of their social responsibilities, nor have many of them yet advanced to a stage when they can afford a standard of professional protection commensurate with the pressure which industrial organization to-day could bring to bear if it chose. Nothing is more important than that professional organizations should address themselves to this question and consider their real place both in industry and in society to-day. Only as the professional worker gains his full independence can he make his decisive contribution to the shaping of society. Only, however, as he realizes the magnitude of that contribution is he likely to constrain the multiplicity of professional associations which at present prevents professional unity, for example, among chemists, from acting together in some way adequate to afford the members of the profession the necessary full protection.

The question of the responsibility of scientific workers for the prostitution of scientific effort for purposes of warfare, to which such repeated



attention has been given of late, is only a special but rather difficult case. It is the absence of an association of scientific workers with any effective professional code, and the weakness of the professional ties between scientific workers in different countries, which debilitate any action by scientific workers at present. While, however, for the present it is rather as individual citizens than professional men that chemists and scientific workers in general can throw their weight into the scale against the tendencies which are dragging science and civilization down and debasing our heritage of intellectual and spiritual values, the recoil from the present abuse of scientific knowledge should surely inspire some determined effort to organize professional associations.

No thoughtful person can be blind to the dangers which the present abuse of scientific effort offers to science itself as to all that is best in our civilization. It is unthinkable that scientific workers should be so deluded or perverse as to

make no attempt to preserve even the integrity of their own vocation. Towards this the first step is adequate professional organization. If that is undertaken in no mean spirit, but in a wide vision of the part which free scientific workers might play in the world of affairs, the petty loyalties and short-sightedness which in the past have prevented professional unity will surely disappear. Instead, we may see different classes of scientific workers, firmly established in their respective professional associations, presenting a united front and using their freedom to serve the community by shaping its organization in accordance with a nobler and wider concept of society. So, too, we shall find the sense of dependence and oppression which multiply so rapidly in the totalitarian State being lifted from the shoulders of men, and a measure of freedom, dignity and responsibility being given to them which once more shall prove the stimulus to creative thought, and add to the spiritual heritage of mankind.

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## World Population

### World Population:

*Past Growth and Present Trends.* By A. M. Carr-Saunders. (Published under the auspices of the Royal Institute of International Affairs.) Pp. xv+336. (Oxford: Clarendon Press; London: Oxford University Press, 1936.) 12s. 6d. net.

THE public is being very well provided with information on the admittedly important subject of population; its growth and possible decline; its age constitution and the changes of that factor; the probable lengths of our lives; the social causes and effects of changes in the birth- and death-rates; migration and the future of the European races. Quite recently there have appeared several important works in English dealing with these matters, or some of them, such as, "Length of Life, a Study of the Life Table", by Dublin and Lotka; "The Measurement of Population Growth", by R. R. Kuczynski; "The Struggle for Population", by D. V. Glass, and now the important book under review.

Prof. Carr-Saunders is one of our most distinguished authorities on the subject. He was early in the field with his well-known study, "The Population Problem", which was published fourteen years ago and is still a mine of useful information. His new book is presented in a more popular

guise and brings the facts up to date. These fourteen years have seen a great increase in the interest of the public in all population questions. One can scarcely take up a newspaper without seeing in it some letter or article on population. It is clear that the public in most Western countries is alive to its importance. There is evidence of this not only in the columns of the Press, but also in the foundation, some nine years ago, of the International Population Union and its constituent body in Great Britain, the British Population Society; in the various congresses that have been held in Geneva, in London, in Berlin; in the announcement of the Population Congress which is to take place in Paris next year; and quite recently, in the appointment, by the Eugenics Society, of a committee to investigate the fall of the birth-rate in Great Britain. All this apparatus, and the books mentioned above, will serve to keep the public provided with reliable information about these vitally important, and, in certain aspects, difficult matters.

In the author's own words, his book "attempts, though very briefly, to reconstruct population history and to describe the present population situation." He naturally begins with some account of the sources of information, and describes the early enumerations for special purposes, the



sixteenth century ecclesiastical registrations of baptisms and burials, the first satisfactory French census of 1821, the English census of 1841, and so on. Also he points out that accurate migration statistics, which would require international co-operation, are still sadly to seek.

Two chapters are devoted to a discussion of the growth of world population, and we are given three independent estimates for the present day, the figures varying from 1,988 millions to 2,028 millions, so that the man in the street will be inclined to accept the round figure 2,000 millions, though this may be considerably in error. The chief source of error is in the estimate for China. "Upon any computation Asia holds over half of the world population from 1650 onwards", and "Europeans outside Europe are spread thinly"; there are, in fact, only about 200 millions of them.

After a simple discussion of the natural increase due to the difference between the crude birth- and death-rates, we come to an important chapter on the measurement of the true death-rate. This is arrived at by considering the chance that an individual of specified sex and age will have of surviving for one year. As pointed out by Dr. R. R. Kuczynski, whose valuable work in clearing up this and other population questions deserves all recognition, 'the expectation of life' derived from the 'life table', constructed from the actual data of age constitution and deaths, gives the only satisfactory criterion of mortality. Thus, if, as at present, the expectation of life at birth in New Zealand (mean of both sexes) is 66.46, then the death-rate in a stationary population with this expectation would be the reciprocal of this figure multiplied by 1,000, namely, 15.0. Figures derived in this way are strictly comparable, whereas 'crude' or 'standardized' rates are not.

We pass to the question of birth-rates. Crude birth-rates have no value as guides to the future

or as the means of comparing the vital statistics of one country with those of another. In accordance with the method of Dr. Kuczynski, we must find out how many future mothers a thousand mothers will give birth to. It appears from Dr. Kuczynski's calculations that the net reproduction-rate for England and Wales, for 1933, was 0.73; for France, 0.82. The author remarks that "The only saving of life which can affect the trend of population is the saving of the lives of women before the end of the child-bearing period". This does not give much hope of improvement by means of a decrease in the death-rate, and if the net reproduction-rate is to be raised, the size of the family must be increased. This is the principal theme of the book in some of its later chapters. A table is given of the estimated future populations of various countries, on certain assumptions, including the well-known calculations of Dr. Enid Charles. We may take it as reasonably certain that the population of Great Britain will shortly reach a maximum, will diminish by some millions during the next generation, and may decline rapidly thereafter.

In this wise book there will be found statements of many intricate allied questions, judiciously treated. Such questions as the relation between over-population and unemployment; the effect of emigration on population; the desirability, or otherwise, of a reduction of our numbers at home. There are those who think that no harm would be done to Great Britain if the population were to come down by some few millions, provided that the downward acceleration could then be arrested. Some of these are matters upon which a general agreement is scarcely to be expected. But, whatever our opinions, we shall all value the clear presentation of these and many other difficult problems in Prof. Carr-Saunders's admirable work.

C. F. C.

## The Phases of Berkeley's Idealism

George Berkeley:

a Study of his Life and Philosophy. By Prof. John Wild. Pp. x+552. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1936.) 25s. net.

**I**N this imposing volume, which fittingly emanates from Harvard, the author proceeds on the obviously sound principle that Berkeley's own wish should be respected, and his philosophical writings be read in the order in which he had

published them. It is now generally recognized that there are two lines of thought running through Berkeley's theological idealism, which scarcely admit of being brought together in coherent fashion. On one hand, Berkeley preserved in his earlier writings, at least, a large portion of the empirical theory of knowledge; and, on the other hand, there gradually emerged in his later writings a conception of mind and of our ways of knowing mind that cannot be so much as stated in terms of the empirical theory.



The earlier phase of Berkeley's philosophizing, which Prof. Wild christens 'spiritism', 'psychologism', or 'subjectivism', leads, he insists, inevitably to 'solipsism'. It is, he conceives, to be traced back to an uncritical acceptance of Locke's causal metaphysics (p. 119). While disposing of the concept of material substance, Berkeley yet inconsistently hypostatized or reified the self into a self-existent substance; while refusing to allow that physical things are efficient causes, he yet inconsistently assumed the self to be an efficient cause, and thought of God as, in like manner, an efficient cause.

There are certainly difficulties enough in Berkeley's position, but I am by no means convinced that they are of the kind just specified. After all, the term 'substance' is excessively ambiguous, and by a 'spiritual substance', it was repeatedly asserted in the "Principles", is meant a thinking, active being, distinguishable from the inert objects of which it is apprehensive. Whether Berkeley's argument to prove that the *esse* of sensible things is *percipi* is successful may well be questioned; but I see no ground for the contention that this argument is inconsistent with his view of individual minds or spirits. Moreover, surely Berkeley is altogether misinterpreted when he is represented as having held that conscious minds can exist in abstract isolation from all objects, that these minds can will without willing anything, and perceive without perceiving anything (for example, p. 38)—a doctrine against which he was, in fact, never weary of protesting.

The later phase of Berkeley's speculation, as Prof. Wild pictures it, culminates in a transcendentalism, according to which the system of consciousness is not to be identified with an individual consciousness, but with a consciousness that includes in one system not only all empirical objects but all empirical selves as well (p. 174). Through this concept of a transcendent 'intelligible world' Berkeley was enabled, so it is maintained, eventually to grasp, to some extent, the nature of the 'world of becoming'; and at last in "Sirius" (published in 1744) to construct a system of philosophy in the strict sense of the word. Primarily through Plato he came to appreciate the significance of the 'intelligible world'; and from the Neo-Platonists he learnt not only the meaning of transcendence but also, as a consequence, the meaning of philosophy itself as a revelation of the structure of the whole of being. But, it is argued, in a sense "*Siris* was always present to Berkeley's reflection, from the rude intuitions of the *Commonplace Book* to the strict methodological queries of the *Analyst*" (p. 422, cf. pp. 68-9).

For this statement I can find absolutely no warrant. I agree that it is a mistake to look upon "Sirius" as exhibiting an entire break from the position of the early writings, but I fail to see in the latter any indication that Berkeley was then influenced by Neo-Platonic thought. Also, I confess there does not seem to me to be in "Sirius" itself the definite metaphysical system which apparently Prof. Wild has discovered imbedded there; at the most, I should say, there are but vague hints as to the form which such a system might presumably take. Admittedly "Sirius" is "so full of ancient lore that it is difficult to discern how much is Berkeley and how much is Plato or Plotinus" (p. 500); and I cannot but think that Prof. Wild has been reading into "Sirius" a great deal that is not really there.

A further contention calls for notice. Prof. Wild is assured that in the "Three Dialogues", which appeared in 1713, three years after the publication of the "Principles", Berkeley perceived for the first time "the total indefensibility of the causal subjectivism" (p. 162), on which he had been proceeding; and, particularly in the third *Dialogue*, by introducing a system of eternal 'archetypes' in the Mind of God, and by regarding the finite mind as 'dependent' (p. 183 *sqq.*), he was virtually abandoning his 'spiritism'. But, again, the reasoning does not convince me. For one thing, the notion of 'archetypes' in the Divine Mind meets us already in the "Principles" (for example, § 99), and in the "Principles" also the finite mind is throughout regarded as 'dependent' (for example, § 149). Furthermore, in the third *Dialogue* the 'archetypal' ideas are expressly stated to be ideas of 'things', or 'objects', and are, therefore, quite other than the Platonic 'ideas' or 'forms' referred to in "Sirius" (for example, §§ 335-8); the finite mind is still regarded as a "substance" that is "affected from without"; and the Supreme Mind is still conceived as "the powerful cause of my ideas". In "De Motu", published in 1721, there are indications that Berkeley had been diving into Greek philosophy; but it was, I take it, in Rhode Island and in Cloyne that his more detailed researches in that field were made.

I have dwelt chiefly on matters in regard to which I cannot follow Prof. Wild's lead. I will not, however, conclude without expressing appreciation of much of his work. His treatment of Berkeley's critique of the mathematics of his time is, for example, admirable, and makes it clear that the attack on the doctrine of infinitesimals was not without justification. So, too, his account of Berkeley's attitude to natural science in "De Motu" is both judicious and suggestive. Altogether, he has produced a volume for which students of Berkeley will be grateful. G. DAWES HICKS.



## Examinations

### (1) The Marks of Examiners :

being a Comparison of Marks allotted to Examination Scripts by Independent Examiners and Boards of Examiners, together with a Section on a Viva Voce Examination. By Sir Philip Hartog and Dr. E. C. Rhodes. With a Memorandum by Prof. Cyril Burt. (International Institute Examinations Enquiry.) Pp. xix + 344. 8s. 6d. net.

### (2) Essays on Examinations

By Sir Michael Sadler, A. Abbott, Dr. P. B. Ballard, Prof. C. L. Burt, Dr. C. Delisle Burns, Sir Philip Hartog, Prof. C. Spearman and Dr. S. D. Stirk. (International Institute Examinations Enquiry.) Pp. xii + 168. 5s. net.

(London : Macmillan and Co., Ltd., 1936.)

THE important part played by examinations in the modern world, not merely in educational, but also in social organization, amply justifies the attention that is at present being directed to the manner in which they function. The International Institute Examinations Inquiry, initiated and financed by the International Institute of Education of Columbia University, has already done exceedingly valuable work in the investigation of some of the more fundamental problems involved; and recent reports published by the French, the Scottish and the English delegations present the results of such investigations. The two books under notice represent part of the labours of the English delegation.

If we assume that examinations are a useful and even necessary part of social and educational machinery, there are two main things we wish to know about the examinations we employ. We wish to know, in the first place, to what extent their results may be taken as valid, and, in the second place, in what measure they are reliable. Validity and reliability are, in fact, the two essential characteristics which examinations must possess in order to perform adequately their social and educational functions. How far do examinations test that which they are designed to test, and how far can the results of an examination be relied on as an accurate measurement of what it measures? The recent report issued by the Scottish delegation—"The Prognostic Value of University Entrance Examinations in Scotland"—is concerned mainly with the answer to the first of these questions; a report of the French delegation, and also "The Marks of Examiners", issued by the English delegation, with the answer to the second.

Validity and reliability are only partly independent of one another. It is clear that an examination may have high reliability and low validity, though it cannot have high validity with low reliability. That is to say, an examination may measure a capacity or acquisition  $x$  with great accuracy and reliability, but the measurement of  $x$  may be partially or wholly irrelevant to the real purpose of the examination. If, however, the measurement of  $x$  is highly unreliable, it does not matter whether this measurement is irrelevant to the purpose of the examination or not; the examination can obviously have no validity. While, therefore, validity is probably the more fundamental characteristic, the investigation of the reliability of an examination would appear to be logically prior to the investigation of its validity.

A detailed account of an investigation by the English delegation into the reliability of the marking of examination papers is given in "The Marks of Examiners". The main findings had already been made public in "An Examination of Examinations", published in 1935, and these findings were then regarded with rather mixed feelings by all who had to do with school or university examinations. The investigation covers all the main types and grades of English examinations, and one and all are shown to be unreliable to an alarming extent, when we consider how much may depend upon them.

In some cases the methods of investigation may be open to rather damaging criticism. For example, in the case of the School Certificate papers in Latin and in history, fifteen scripts to which exactly the same average mark had originally been assigned were submitted to a number of different experienced examiners for remarking. In such a case it is obvious that the whole suggestion of the situation is to distribute the marks—the examiners were all ignorant of the original marks assigned—and consequently chance was bound to play a large part in the distribution. Hence we should expect to find great discrepancies between the marking of the different examiners. Even setting aside, however, all cases where the findings are open to criticism of this kind, the mass of evidence is overwhelming for the conclusions which the investigators draw, and the one question with which we are left is: What are we to do about it?

Another side of the international investigation is represented by "Essays on Examinations". This is a collection of papers by different authors



on different aspects of English examinations. The work is more limited in its appeal—it is relevant mainly to English education in the narrow sense—and less important than “The Marks of Examiners”. At the same time, it contains a very valuable historical account of the development of the scholarship system in England, from the pen of Sir Michael Sadler. This occupies almost half the book. There are also valuable papers on different aspects of the examination problem by Delisle Burns, Burt, Spearman, Ballard, A. Abbott, and Sir Philip Hartog. An account of the Leaving Examination in Germany, before the

War, and under the Nazi regime, is appended. The short paper by Delisle Burns on “Examinations and the Social Needs of the Modern World” breaks new ground in the discussion of our examination system. This is an aspect of examinations demanding the most careful consideration, and it is an aspect which has up to now been largely neglected. The whole book leaves one with the impression—and the same is true of “The Marks of Examiners”—that the problems set to modern society by the role examinations have come to play are many and formidable, and the solution of these problems urgent. J. D.

## Astronomy for All

### (1) Stars and Telescopes

By James Stokley. Pp. xiv + 319 + 33 plates. (New York: Harper and Brothers; London: Hamish Hamilton, Ltd., 1936.) 10s. 6d. net.

### (2) Through the Telescope:

a Story of the Stars. By Prof. Edward Arthur Fath. Pp. vii + 220. (New York and London: McGraw-Hill Publishing Co., Inc., 1936.) 10s. 6d.

### (3) Highlights of Astronomy

By Prof. Walter Bartky. Pp. xiii + 280. (Chicago: University of Chicago Press; London: Cambridge University Press, 1935.) 11s. 6d. net.

(1) **T**HE Zeiss planetarium has done much to stimulate interest in astronomy, and it is much to be regretted that Great Britain does not yet possess one. Mr. Stokley, the director of the Fels Planetarium of the Franklin Institute, Philadelphia, has found that visitors often ask for the name of a book for study. To meet this demand he has written this volume. It contains a historical account of the development of astronomical thought and ideas from the earliest times, with a survey of the present knowledge about the solar system, stars and galaxies. The evolution of the telescope from its invention to the present time is described, and directions are given for assisting the amateur to construct his own telescope.

The book is not written for the busy layman who wishes to become familiar with the general trend of modern astronomical investigation, but it can be thoroughly recommended to the amateur who wishes to make a more detailed study of the subject. There is an excellent series of 33 plates which, instead of being scattered throughout the text, are collected together so that any particular plate is easily found.

(2) In this book, the reader is taken on an imaginary visit to the two large American observatories on Mount Hamilton and Mount Wilson, to see their instrumental equipment and to view different objects in the heavens. This provides the opportunity to describe some of the largest telescopes now being used in solar and stellar research, and to recount some of the main facts and the more interesting theories of the astronomical field of the present day. The role is that of the sightseer rather than that of the student, so that the book is mainly descriptive and the theoretical portions are brief.

The author endeavours to include no more than could be read in one evening by a reasonably rapid reader. Written for the unscientific reader, the book should help to stimulate interest in astronomy. The illustrations are numerous and well chosen; the reproductions of astronomical photographs are excellent.

(3) This book may be described as an elementary text-book that is different from other text-books. It has been written for the astronomical portion of the introductory general course in the physical sciences at the University of Chicago. This course is one of the four introductory courses of the new undergraduate curriculum, designed to give the student a general educational background before he ventures to specialize in any particular field. The ideas are presented in a novel and entertaining way; but to obtain the ‘highlight’ effect, there is often slipshod and inaccurate statements. Thus, for example, “It is gravity, that invisible force between masses, which causes us to drop and smash crockery and fall downstairs and which compels the earth to move as it does”.

The author has used considerable ingenuity in describing the geometrical ideas of spherical



astronomy without the use of geometry. The formulæ of spherical trigonometry required for connecting hour angle, declination, latitude, altitude and azimuth are sidetracked by the use of two charts; these enable many problems to be solved with an accuracy of about  $2^\circ$ .

The greater part of the volume is occupied with the geometrical ideas and with a description of the members of the solar system. The stars and the sidereal universe receive fewer than forty pages. In night study of the skies, an instrument called

a 'stellarscope' has been designed for use in conjunction with the book. The stars and constellations are viewed on motion picture film so that, by superimposing each individual film upon the appropriate portion of the sky, the exact identification of the stars is made more readily than with a star atlas.

The book is well illustrated with line drawings and photographs; many of the drawings (by Mrs. Chichi Lasley) are arresting, attractive and amusing.

## Radio Communication and Short Waves

### (1) Principles of Radio Engineering

By Prof. R. S. Glasgow. (Electrical Engineering Texts.) Pp. xii+520. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 24s.

### (2) Short Wave Wireless Communication

By A. W. Ladner and C. R. Stoner. Third edition, revised and enlarged. Pp. xvi+453+11 plates. (London: Chapman and Hall, Ltd., 1936.) 21s. net.

(3) Physik und Technik der ultrakurzen Wellen  
Von Dr. H. E. Hollmann. Band 1: Erzeugung ultrakurzwelliger Schwingungen. Pp. ix+326. (Berlin: Julius Springer, 1936.) 36 gold marks.

**A**DVANCES in the science and practice of radio communication lead to a continual supply of new books dealing with various phases of the subject. Some of these are of the nature of monographs describing in detail the technique of a particular application of communications, while others set out in revised form the fundamental principles of the subject and of the various new devices which mark the lines of progress.

(1) Prof. Glasgow's book is based upon a lecture course given for some years at the University of Washington, and the logical development of the subject, with the clear but concise style, bear evidence of the author's experience as a teacher. The more interesting part of the book begins at Chapter vi with the fundamental properties of vacuum tubes and is followed by others in a natural sequence, dealing with amplification at audio and radio frequencies, oscillation, modulation and detection. The last hundred pages of the book are devoted to a brief but adequate study of aerials, including those designed for low-angle radiation, and also to a summary of existing knowledge of radio wave propagation.

The whole work is a really up-to-date exposition of the subject, and numerous references to recent publications are made throughout the book. The

bulk of these references, however, are to papers published in the United States, and little mention is made of work in Europe. With this minor criticism, the book can be thoroughly recommended to all serious students of radio engineering.

(2) Most engineers and experimenters in the field of short-wave wireless communication are familiar with Ladner and Stoner's book, and the fact that a third edition has become necessary in about four years from the original publication is evidence of the popularity of the work. In this edition, much of the original text has been revised and some of the chapters expanded to deal with advances in all phases of the subject.

A new chapter on "Commercial Wireless Telephone Circuits" has been added, to deal with the practice in this field, which was insufficiently stabilized to warrant description in previous editions. Separate chapters are devoted to such subjects as modulation and constant frequency oscillators, which are not necessarily confined to short waves, but their inclusion makes for completeness in a book which is likely to continue to be in great demand by all those working in the wide and growing field of short-wave wireless communication.

(3) Dr. Hollmann's monograph is a detailed account of recent research on the various methods of producing electrical oscillations at frequencies corresponding to wave-lengths from a few metres down to a few centimetres. After chapters dealing with the production of such oscillations by spark excitation and by valve retroaction, about 120 pages are devoted to the positive grid type of electronic oscillator, and about half this space to the application of the magnetron valve to the problem. An appendix containing nearly 300 references indicates the vast field of literature covered, and this should help to make the book useful as a work of reference to specialists and research workers in this subject. R. L. S.-R.



**Language, Truth and Logic**

By Alfred J. Ayer. Pp. 254. (London: Victor Gollancz, Ltd., 1936.) 9s. net.

THIS excellent compendium of the views and doctrines of the new positivism derived from the scientific empiricism of the Vienna circle and an extreme interpretation of the aims of logic, will no doubt rejoice the increasing number of thinkers who have discovered lately that there is no philosophy at all. Carrying to its limits the methodological scepticism of Hume, the new positivism holds that sense-data are the primary elements of science, from which things and forces are its highly probable inferences. But as regards metaphysics, it should be put out of the way at all costs. Indeed, the imaginative and constructive functions of philosophy must give way entirely to its analytic function: thus the only real aim of philosophy is to get the propositions of science clarified and self-consistent.

The enthusiasm with which the author develops these points is evidence of the strength gained in Great Britain by these new theories. It should be pointed out, however, that such aims make the business of philosophy appallingly incomplete and uninspiring. For if sense-perceptions are the elementary data of knowledge, there are also intuitions of values and of general principles which are just as real facts as are the sense-perceptions themselves. The greatness and interest of philosophy consist in trying to harmonize such intuitions with sense-perceptions, and thus to give an adequate and systematized picture of experience as a whole. Jokes and jibes may enliven a discussion; but they cannot command an intelligent assent, especially when they are aimed at time-honoured values which are mainly responsible for the existence of philosophy, and also of logic, as such. T. G.

**Jouannet:**

*Grand-père de la Préhistoire.* Par Dr. André Cheyrier. Pp. 101+3 plates. (Publiés sous les auspices de la Société Historique et Archéologique du Périgord.) (Brive: Chastrusse, Praudel et Cie., 1936.) 15 francs. FRANÇOIS-RENÉ-BENIT VATAR, SIEUR DE JOUANNET (1765-1845), a native of Rennes, who settled in Périgord in the early years of the Revolution, is here celebrated as a forgotten pioneer in the study of prehistoric archaeology, and a precursor of Boucher de Perthes. In 1810, while investigating a Gallo-Roman cemetery near Périgueux, Jouannet discovered a neolithic station, which there is reason to believe is the first ever described. As the author shows by dated references, Jouannet was first in the discovery of palæolithic caves and of a Solutrean site, as well as of the association of worked flints with fossilized animal remains. He was also the first to classify antiquity into stone, bronze and iron ages, and to distinguish two phases of the stone age. In experimenting in working flint and in analysing chemically fossil bones and bronze axes he initiated scientific methods of archaeological investigation. His reports, which were submitted to local scientific academies or appeared in the Dordogne Calendar, are here reprinted with an account of his career.

**Eclipses of the Sun**

By Prof. S. A. Mitchell. Fourth edition, revised and enlarged. Pp. xvii+520+81 plates. (New York: Columbia University Press; London: Oxford University Press, 1935.) 25s. net.

PROF. MITCHELL'S book on eclipses of the sun is so well known that detailed notice of the new edition is not necessary, the more so because it differs from the third edition only by the addition of a new chapter dealing with the eclipses of 1932 and 1934. A few minor additions have been made, but there has been no general revision. It is odd to read, in a volume bearing the date 1935, a passage such as this: "The author is going to be rash enough to predict that the 1932 corona . . . will show the minimum type of corona". There are a number of other passages which should have been revised. It would perhaps have been better if the results derived from the observations at the recent eclipses had been given as an appendix.

Although the excellent work of Lyot, at the high-altitude station at the Pic du Midi, is for the first time making it possible to study the corona when the sun is not totally eclipsed, it seems probable that astronomers will continue to be dependent upon observations at times of total eclipse for the solution of many solar problems. Prof. Mitchell's treatise remains the best and most complete account of the methods and results of eclipse observations.

**Grundzüge der Vererbungslehre**

Von Prof. Dr. Friedrich Alverdes. Pp. viii+143. (Leipzig: S. Hirzel, 1935.) 5 gold marks.

THIS is a simply stated introduction to Mendelian inheritance with a biological background. Early chapters deal with cell and nucleus, egg and sperm, fertilization, genotype and phenotype, race and species: "Unter einer Rasse verstehen wir eine Gruppe von Individuen (Pflanzen, Tieren oder Menschen), die in ihren wesentlichen Erbanlagen übereinstimmen". The Mendelian laws are expounded, as well as sex determination, recombinations, linkage, and the basis of these phenomena in the chromosomes. The last two chapters give a short survey of heredity in man. The account is clear but occasionally oversimplified, as in the statement that there are two pairs of factors for eye-colour and three for skin-colour in man.

**The Psychology of Human Behavior**

By Prof. J. H. Griffiths. Pp. xxi+515. (London: George Allen and Unwin, Ltd., 1936.) 12s. 6d. net.

THE author of "The Psychology of Human Behavior" is to be congratulated on the production of an extremely readable and well-constructed elementary text-book of psychology. The addition of questions for discussion at the end of each chapter is a most helpful feature and adds enormously to the value of the book from a teaching point of view. The supplementary readings at the end also of each chapter will prove a great help to those who wish to pursue their study of psychology further. This is one of the very best books on the subject.



## Fibre Studies

EXCEPT in so far as Section A may regard all other sections of the British Association as subsidiary to the mathematical and physical sciences, the subject of fibre structure is by no means a prerogative of physicists sitting alone, and discussion to be most profitable is best conducted with the co-operation of one or more of the other sciences, such as chemistry and biology. This point was emphasized by W. T. Astbury in opening a brief symposium on fibre studies arranged for Section A at the Blackpool meeting of the Association, but his subsequent remarks, dealing with problems arising out of the long-range elasticity of many protein fibres, were addressed specially to physicists.

Certain natural protein fibres, in particular the hairs of mammals, are endowed with elastic properties of relatively enormous range. The effect is shown by X-ray and related studies to be due to combinations of polypeptide chain-molecules, normally in a regularly-folded configuration, from which they may be pulled out straight by the application of tension, and to which they return when the tension is released. By suitable modification of the state of cross-linkage of these polypeptide chains, both the elastic range and the driving force of elastic recovery may be varied considerably. Animal hairs, for example, may actually be contracted to a length only about half their natural length. Closely analogous, from both the X-ray and physical elastic point of view, to one of the modifications of the hair protein, *keratin*, is the chief muscle protein, *myosin*, and there is apparently some fundamental type of molecular fold common to both. The crystalline proteins, which are built from 'globular' molecules, have now also been shown to be based most probably on regularly-folded polypeptide chains. The latter are liberated from their special, and often highly specific, configuration by the change known as 'denaturation', the resulting insoluble mass being often highly elastic like keratin and myosin. X-rays suggest that this elasticity is again to be referred to groups of folded polypeptides which may sometimes be drawn out into straight chains, just as keratin and myosin may be so drawn out. By this means artificial protein fibres may be prepared from originally globular molecules.

The detailed interpretation of the deformation and unfolding of protein chain systems provides one of the most fascinating and difficult problems in molecular mechanics. At the moment, it seems to present two chief aspects: (1) Is the hexagonal

fold postulated for keratin and myosin sound? (2) Is the keratin-myosin fold—whatever it may be—a fundamental fold for proteins in general?

Dr. J. B. Speakman, accepting the X-ray picture and intramolecular stress theory of keratin structure as substantially correct, proceeded to show how the many elastic modifications that arise when strained fibres are treated with various reagents can be simply explained in terms of the reactivity of the salt and disulphide cross-linkages of the keratin 'grid'. The reactivity of these linkages depends on their state of stress, which in turn depends on the configuration of the grid. In consequence, the properties of each type of linkage influence those of the remainder: thus the reactivity of the disulphide linkage in stretched hairs is frequently at a maximum under conditions in which the salt linkages are most stable.

The concept was illustrated by the results of numerous experiments in which the stretched fibres were submitted to the action at 50° C. of a series of mixtures of sodium sulphite and bisulphite, so chosen as to vary the pH while maintaining the reducing power. The extent of disulphide breakdown was then estimated by measuring the amount of 'permanent set' produced. It is a maximum at pH 5.95, where the salt linkages are most stable, and falls off rapidly on either side of this point as their stability decreases. The interpretation put forward by Speakman is that the dissolution of the salt linkages permits a configurational rearrangement which relieves the stress on the disulphide linkages and so reduces their reactivity. In the hands of Speakman, this chemical modification and 'playing off' of one linkage against another has proved exceedingly fruitful, and the properties of hairs so modified present features of unusual interest, whether for chemist or physicist.

The rather more pragmatic side of fibre research was emphasized by the contributions of Dr. M. Mathieu on "The X-Ray Cinematography of a Simple Fibre Reaction", and of Dr. E. Griffiths and J. H. Awbery on "Apparatus for Maintaining Constant Humidity". Mathieu introduced a new example of powerful X-ray tube with rotating anticathode, the latter being shut off from the atmosphere by nothing more elaborate than a ground cone, suitably lubricated with vacuum grease and under the control of an external adjustable spring to prevent 'seizing'. The rate of rotation possible with this system is not high—one or two revolutions per second—but it has sufficed to take one-minute



photographs of the nitration of cellulose with gaseous nitrogen pentoxide, and so to follow the process step by step. The regularity of the original cellulose structure first disappears in the direction of the fibre-axis, until a stage is reached where there remain only equatorial reflections and the pseudo-period corresponding to the length of a glucose residue. The molecular chains then move farther apart and slide over one another so as to leave the effective residue thickness unaltered, whereupon the (101) reflection of nitro-cellulose appears. After this, little by little, the chains take up their final

stable configuration and the characteristic fibre-period (25.1 Å.) of trinitro-cellulose can be observed.

The whole experiment takes only an hour, and illustrates most strikingly the immediate advantages to be derived from the use of powerful X-ray tubes. Indeed, such tubes are rapidly becoming an absolute necessity. The study of unstable systems and of physical and chemical transformations, particularly those associated with life processes, still offers an enormous field to the structure analyst. We need X-ray cinematograph films of all these things.

W. T. A.

## Food Investigation: a Retrospect and the Future

THE reconstitution of the Food Investigation Board in the autumn of 1934 provided an occasion for a review of the work accomplished by the Board during the seventeen years of its existence and the determination of the lines along which further progress should be sought.\* Not only have general solutions been found, in the gas-storage of fruit and chilled meat and in the brine-freezing of fish, for the three main problems with which the Board was faced when originally established, but at the same time great advances have also been made in the science that underlies the storage and handling of foodstuffs.

Although each animal product presents its own problems of handling and storage, yet, in the final analysis, these problems may be stated more generally as those of the properties and behaviour of proteins and fats, of pigments and micro-organisms. Thus, among the main subjects of investigation have been *rigor mortis* and glycogenolysis in muscle; the identity and physical chemistry of animal proteins; the freezing of colloidal systems and tissues; the chemistry of the pigments; the constitution of the animal fats; and the identification and characterization of the micro-organisms found on animal products. The Board now considers that it would be profitable to take up other lines of work as opportunity offers, the most important being the organic chemistry of the proteins. It is now known, for example, that the protein myosin controls the changes taking place in meat and fish during *rigor mortis*, as well as the structural changes that occur during storage: in the egg, the protein mucin is the important factor. Progress has been made in determining the general physico-chemical properties of the proteins, but further advances will depend upon

an exact knowledge of the constituent amino acids and of their arrangement within the molecule. The results of such investigations will be of wide interest in chemistry, physiology and nutrition. The Board has therefore arranged for a member of the director's staff to spend a year in Prof. A. C. Chibnall's laboratory at the Imperial College of Science and Technology in order to gain experience of the specialized technique required, before undertaking research on this subject. It is also hoped to commence work on the identification of the autolytic enzymes of meat and eggs and the lipolytic enzymes of bacteria, to the action of which is often due the development of taint in animal foodstuffs. Although attention has hitherto been devoted chiefly to meat, the programme of research has now been widened to include both eggs and poultry, and the problems of their wastage and quality.

The handling and storage of fresh fruit present problems different in character from those of animal produce, since the material is living and not dead, and because the plants concerned belong to different orders and genera, and the parts used as foodstuffs comprise nearly all their chief organs. In spite of the work which has been carried out on the preservation of fruit and vegetables, the qualities after such periods of storage as are customary in commerce are, in general, inferior to those of the material at its best. The extension of control depends upon the advancement of our knowledge of the physico-chemical mechanism upon which the living processes are based. Up to the present, the Board has concentrated upon an intensive study of the respiration and metabolism of carbohydrate in the apple and potato. It is now including a study of the enzymes and the metabolism of nitrogen, and intends to investigate the metabolism of acid, the formation and

\* Department of Scientific and Industrial Research. Report of the Food Investigation Board for the Year 1935. Pp. x+232. (London: H.M. Stationery Office, 1936.) 3s. 6d. net.



breakdown of the cell wall and the nature and origin of the substances responsible for the development of colour, flavour and odour.

The Board points out the necessity of a close contact with commercial practice and describes the different steps taken to ensure the application of laboratory results in the trades concerned: thus a small laboratory is being established, in the vicinity of Smithfield Market, London, on the lines of the Covent Garden Laboratory (which is also being extended), to act as a centre for liaison with the trade. Similarly, arrangements have been made with Messrs. Crosse and Blackwell, Ltd., for the trial at Peterhead of a kiln for the smoking of fish, which is designed in accordance with the principles established at the Torry Research Station. The Board also co-operates with similar bodies in the Dominions and is stimulating research in other parts of the Empire, since it is usually essential that the problems of storage should be studied as soon as the produce has been prepared for the market, and this is not possible in Great Britain in the case of such important fruits as the orange and banana.

The report of the Board refers as usual to the changes which have taken place in its composition during the year: Prof. C. H. Lees and Sir Thomas Middleton have been appointed additional members. The Engineering Committee has been reconstituted with the following membership: Prof. C. H. Lees (chairman), Prof. E. H. Lamb, Prof. G. I. Taylor and Prof. H. E. Watson. The bulk of the report is devoted to the report of the Director of Food Investigation, Mr. E. Barnard, and is divided into sections dealing with meat, poultry and eggs, pork bacon and hams, fish, fruit and vegetables, canning and engineering. The researches at present in progress are described by the investigators who are carrying them out.

One or two may be referred to here, to indicate some of the problems involved and the results obtained.

Two effects of the treatment of the pig immediately before slaughter on the quality of the carcass have been measured. First, fasting has been shown to increase the thickness of the flank. Secondly, the muscle of pigs overheated before slaughter has a higher electrical resistance than that of rested pigs; low resistance facilitates the penetration of salt during dry salting. Farm-killed pigs were found to have a low resistance as compared with factory-killed, and this difference was traced to the shaking which the carcasses undergo during transport to the factory.

Trials of the refrigerated gas-storage of Conference pears have been made with good results: flavour, texture and appearance are retained after long periods of storage. If soft fruits are given a preliminary heating, there is little loss of the power to set, during storage in the frozen state at  $-7^{\circ}\text{C}$ ., a temperature which inhibits the growth of moulds, or during storage with sulphurous acid. Without the preliminary heating, the power to set in jam-making is more or less rapidly lost. Apples and plums, however, do not suffer this loss under the same conditions. It has been shown that the amount of ethylene evolved by ripe apples and bananas is sufficient to initiate the ripening of green, unripe bananas. The passage of air containing one part per million of ethylene over the green fruit also causes it to begin ripening after 24 hours, but with fruit that has just started to ripen the mixture has little effect. These experiments suggest that the efficiency of ripening rooms for bananas heated with coal gas burners may be due to a slight leakage of the gas supply permitting a low concentration of ethylene in the air surrounding the fruit.

## The Upper Palæolithic in the Light of Recent Discovery\*

By Miss D. A. E. Garrod

THE last twelve years have seen a new impetus given to prehistoric studies by the multiplication of researches outside Europe. Excavations in Africa, the Near East, Asiatic Russia and China have opened up a new field for speculation, and at the same time have revealed the unsuspected complexity of many problems which to De Mortillet and other pioneers seemed relatively simple. Gone for ever is the straightforward succession of

Palæolithic cultures from Chellian to Magdalenian as laid down in the Musée Préhistorique. Even so early as 1912, when Breuil produced his classic paper on the subdivisions of the Upper Palæolithic, its foundations were sapped, and the discoveries of the last decade have merely completed its demolition as a system of world-wide application.

In the old system the Palæolithic cultures appeared as a straightforward succession with clear-cut horizontal divisions, as in a diagrammatic geological section. The main outline of a new

\* From the presidential address to Section H (Anthropology) of the British Association, delivered at Blackpool on September 10.



pattern is, however, already beginning to appear. We can distinguish in the Old Stone Age three cultural elements of primary importance. These are manifested in the so-called hand-axe industries, flake industries and blade industries, and we know that the first two, at any rate, run side by side as far back as we can see, and we are beginning to realize that the origins of the third may have to be sought much farther back than we had suspected. Only a moment of reflection is needed to see that we have here the old divisions of Lower, Middle and Upper Palæolithic, but with a new axis.

These general considerations are necessary to clear the ground for the subject with which I am going to deal—those cultures the appearance of which in Europe towards the close of the Pleistocene marks the extinction of Neanderthal man and the arrival of *Homo sapiens*. In the main these are essentially blade cultures, though in certain areas industries of Mousterian tradition lingered on into Upper Palæolithic times. Now it is clear that these blade cultures must have passed through the early stages of their development somewhere outside Europe, during Middle or even Lower Palæolithic times, but we have at present only the faintest clues as to how and where that development took place.

The general conclusions which can be drawn from the material at our disposal may be summarized as follows. A point which stands out at once, and very clearly, is the diversity of the strains which have so far been grouped together under the name Aurignacian. So long as we were dealing only with Western Europe this did not matter very much, as everyone knew what was meant by the Lower, Middle and Upper Aurignacian, but when we come to regions in which the sequence is not the same, the use of these terms, with their chronological implications, is definitely misleading. Peyrony proposes to retain the label Aurignacian for the culture so far known as Middle Aurignacian, and to group all the industries characterized by the blunted-back blade under the heading Perigordian. This undoubtedly corresponds with a first, very important distinction, which has been recognized for some time, but it does not go far enough. Perigordian, like the former Aurignacian, is made to cover too much. In spite of fundamental resemblances which certainly suggest relationship, it is doubtful if the passage from the Chatelperron to the Gravette level is the simple evolutionary process supposed by Peyrony. The blade cultures, after all, have an immensely wide distribution, and it is unlikely that the key to their development is to be found in southern France.

If we take more distant regions into account, it becomes clear that the French sequence is the

result of successive immigrations, superimposed, perhaps, on a certain amount of local variation and development in place. Since, however, this sequence is so familiar, and has for so long been accepted as a standard, I propose to make it my point of departure, and to examine its various stages in the light of the evidence now available, trying to trace each one back to its original centre. Afterwards it will be possible to shift our point of observation, and taking a wider view of the distribution map thus plotted, to see what general pattern emerges.

The first blade industry to reach Western Europe is that of the Chatelperron stage, Peyrony's Perigordian I, which is the former lower Aurignacian. The distinctive implement of this industry is, of course, the curved blunted-back blade, or Chatelperron point. The Chatelperron level—which, for convenience, I shall provisionally call Chatelperronian—has not so far been found in Central and Eastern Europe, but a similar though not identical industry occurs at the base of the Upper Palæolithic sequence in Palestine. This, however, is less primitive in appearance than that of France, and seems already to be in process of evolution towards something resembling the La Gravette stage. The Lower Capsian, which is characterized by curved points, was formerly regarded as the parent of the Chatelperron industry, but Vaufray demolished this theory by demonstrating that it is later in time. On the other hand, the Lower Kenya Aurignacian appears to be more or less Chatelperron type, and may be in part contemporary with this stage in France. We thus have at the beginning of the Upper Palæolithic three areas which may in a wide sense be called Chatelperronian, two of which, Palestine and East Africa, may have been in touch with each other through Arabia and across the Bab-el-Mandeb, while the third remains apparently isolated. The problem of how the Chatelperronian entered Western Europe without leaving any traces on the way is one that awaits solution.

Although the Chatelperronian only appears as a distinct industry at the beginning of the Upper Palæolithic, we can trace its essential features much farther back than this. The Levallois-Mousterian of Palestine, which covers a very long period, has yielded throughout a small proportion of well-made curved points, burins and end-scrapers, and in the Tabun cave on Mount Carmel, typical Chatelperron points, end-scrapers, and blades with abrupt retouch were relatively abundant all through a well-determined zone within the Final Acheulean. In Kenya also Leakey has found backed blades associated with the Upper Acheulean, and he suggests that the so-called Lower Aurignacian—the Chatelperronian—may have



developed from the contact of the Acheulean and Levalloisian cultures, the makers of the Acheulean hand-axes borrowing from the Levalloisian the idea of making use of long narrow blades. This is not impossible, of course, but it should be noted that in the Upper Acheulean of Palestine, as in Western Europe, the flake industry which is actually associated with the hand-axes is in the Clactonian tradition, and the Chatelperronian tools look markedly out of place and intrusive, while in the Kharga Oasis, where a Levalloisian flake industry actually forms part of the late Acheulean, no Chatelperronian forms have been found.

I should like to put forward the alternative suggestion that the Chatelperronian already had an independent existence at this time, having developed in some centre still unknown, and that it is an intrusive element in the Acheulean. In trying to trace this centre, we must take into account the fact, which seems to me significant, that the two regions in which the presence of backed blades in the late Acheulean is clearly established are precisely those in which a distinct Chatelperronian industry appears at the beginning of the Upper Palaeolithic. If—as I am inclined to do—we reject the theory that the Chatelperronian developed within the Acheulean, we cannot accept either Palestine or East Africa as its original home, but must place this somewhere within reach of both. An Asiatic centre seems inevitable, but it is impossible at present to be more precise.

After the early stages of the Upper Palaeolithic, the Chatelperronian proper apparently ceases to exist. In Palestine, however, the Chatelperron point reappears unexpectedly in the final stage, which must be roughly contemporary with the Magdalenian, and it is present in the Lower Capsian at approximately the same moment. Now, Vaufray's theory of the late arrival of the Capsian still leaves us in the dark as to its origin. In its general lines it is unlike either the Sabylian or the blade industries of Palestine. We have seen, however, that the Upper Kenya Aurignacian is a nearly typical Capsian, which seems to have developed in place from the so-called Lower Kenya Aurignacian. I would suggest that East Africa may possibly be the centre of origin of the Capsian, which would thus enter Little Africa already fully developed by way of the Sahara. The Capsian would thus derive many of its features direct from the Chatelperronian, though outside influences may also have played their part, especially in the development of the microlithic element. It is, for example, unlikely that so specialized a type as the micro-burin should have developed independently in the Sabylian and the Capsian.

As for the peculiar industry which closes the Upper Palaeolithic sequence in Palestine, it is quite definitely Aurignacian rather than Capsian, in spite of the presence of Chatelperron points, and it may conceivably be a local development, arising on the fringes of our hypothetical Chatelperronian centre and the Aurignacian province of the Near East.

Turning back to the Western European sequence, we now reach the Aurignacian proper, the former Middle Aurignacian. Peyrony claims that this does not represent a real break in the sequence, but that the Perigordian continued to develop in certain sites side by side with the neighbouring Aurignacian. The stratigraphical evidence for this is, however, insufficient. Even if there is a certain overlap, as is probable, all the known facts are in favour of a general separation of the Chatelperron and La Gravette levels by the layers containing the Aurignacian.

This industry can be traced right across Europe, through Lower Austria, Hungary, Rumania, the Crimea, Transcaucasia and Anatolia into Palestine, where it is very abundant and covers a much longer period than in the West. This suggests that the East Mediterranean coast is not very far from the Aurignacian centre of dispersion, and I would suggest tentatively that this should be sought somewhere in the Iranian plateau.

It is an open question and a very difficult one, how far the Aurignacian and Chatelperronian have ultimately a common origin. Certain forms, such as the burin and end-scrapers, are found in practically all blade industries, but the Aurignacian, with its use of types derived from cores and consequent development of a fluting technique, has distinctive features which point at least to independent evolution from an early date.

The next stages in the French sequence are those of La Gravette and Font-Robert, formerly grouped together as Upper Aurignacian, which Peyrony has labelled Perigordian IV and V. This industry has clear affinities with the Capsian, and in view of the possibility that the Lower Capsian may be roughly contemporary with it, the question of African influence must be re-examined at this point. For various reasons, however, I think it must be ruled out. Already in the Lower Capsian two very distinctive forms, the micro-burin and the microlithic lunate, are present, and if this industry were the parent of the Gravette-Font-Robert stage of Europe it would seem inevitable that these should occur there also. In fact, however, they enter Western Europe only with the Tardenoisian culture at a much later date. Again, if the Lower Capsian passed into France it must have been through the Iberian Peninsula, and we have seen that in that region Capsian influences



appear only at the close of the Upper Palæolithic sequence. Finally, the Gravette-Font-Robert industry has a very wide distribution in central and eastern Europe, and its remarkable development in this region points rather to a Eurasiatic origin. If further evidence were needed, one could cite the complete absence in Little Africa of the very distinctive female statuettes which are constantly associated with this culture in Europe. It does not follow that there is no link between the Caspian and the Gravette-Font-Robert industry; I would suggest that both are derived from the Chatelperronian, but that their common features are due in part to convergent development, certain forms, such as the Gravette point, being evolved almost necessarily from their Chatelperronian prototypes.

I have suggested that an Eastern origin is indicated for the Gravette-Font-Robert industry, and we must now examine this rather more closely. In France the distinction between the Gravette level with its typical blunted-back blades, and the overlying Font-Robert level with tanged and shouldered points is quite clear, but the two are nevertheless very closely related. In Central and Eastern Europe the shouldered point stage predominates and is associated with a distinctive decorative art and apparently a great development of the cult of which female statuettes are the expression. I would suggest for these two very closely related levels the names of Lower Gravettian and Upper Gravettian respectively, the label Grimaldian being reserved for the special development and prolongation of the Upper Gravettian in the Italian Peninsula.

The theory of an eastern centre of dispersion for the Gravettian is based, of course, on this exceptional development in Central and Eastern Europe. I am influenced also by the fact that the female statuettes, the close connexion of which with the Upper Gravettian is incontestable, are very abundant in Russia, but occur only sporadically in Western Europe, where they have an unmistakably alien appearance in comparison with the indigenous naturalistic animal art which had already begun to develop in the Aurignacian.

Assuming an Eastern origin, we cannot regard Central Europe as the centre of dispersion, because we have clear evidence that the Gravettian is there preceded by the Aurignacian proper. In South Russia it is indeed the oldest blade industry so far found, but the geological evidence does not suggest that it is necessarily very early, though it may quite well be contemporary with the Aurignacian of the West. I do not think, however, that the centre of dispersion can lie very much farther to the east, because the lithic industry of Malta, which must be approximately contemporary, is

not Gravettian at all, though the presence of statuettes and certain decorative motifs suggests either that Siberia was reached by influences from South Russia or that the particular cult of which female statuettes were the expression came to the Gravettian from the Far East.

We must now consider by what route an industry ancestral to the Gravettian could have passed into North-east Europe from our hypothetical Chatelperronian centre. We have seen that in Palestine the true Gravettian is absent, and that in southern Kurdistan it probably represents a relatively late migration from Russia. In Palestine, however, the Chatelperronian level which lies at the base of the Upper Palæolithic sequence already shows signs of evolution towards the Gravettian type, and it is possible that an industry of this character had already penetrated into the neighbourhood of the South Russian plain before the westward moving Aurignacian invasion had reached the Mediterranean coast.

I need not dwell on the Solutrean episode, which forms the next stage in the French sequence, as this is already well known and understood. The only addition to our knowledge in recent years has been the demonstration that the Solutrean penetrated farther to the east than was originally supposed from its Hungarian centre.

With the Magdalenian we reach a stage when migration on a wide scale gives way to local variations of the cultures already in possession. Apart from the Magdalenian itself, which is undoubtedly the most interesting and the most vital of these variations, we have the Grimaldian in Italy, in South Russia a degenerate industry of Gravettian tradition, in Palestine a kind of hybrid Aurignacian which may extend into the Crimea, in Egypt the Sabylian, in England the Creswellian, while the retreat of the ice sheet in northern Europe made way for the Hamburg culture which is apparently derived from the Upper Gravettian. To round off completely the story of the Palæolithic blade cultures it would be necessary to pursue a number of these branches into the Mesolithic, but the close of the Pleistocene, for general purposes, marks the end of an epoch in human history, and although no catastrophic change is visible, with the dawn of the Mesolithic a new order is already on its way.

If we now take a last general view of this theoretical picture, we see the Chatelperronian, the earliest identifiable phylum of the blade cultures, already emerging in Lower Palæolithic times, in some as yet unidentified Asiatic centre. Ultimately it sends out two branches, one into East Africa, to give rise to the Caspian, the other into North-east Europe, to develop into the Gravettian. Meanwhile another stock, the



Aurignacian, pushes westward, and separates these two great provinces. From the Aurignacian and Gravettian centres migrations pour into Central and Eastern Europe along the southern edge of the ice-sheet, and cultures which in their homelands tend to remain distinct and exclusive succeed and influence each other, until at the extreme limit of their journey we get the characteristic French sequence, which for so long was used as a standard for the rest of the world. Meanwhile, along the fringes of the original provinces interpenetration necessarily takes place, and we find the Upper Gravettian filtering along the valleys of the Zagros Arc into southern Kurdistan, while the Aurignacian penetrates northward into the Crimea. Finally, at the close of the Pleistocene, migration

on a large scale comes to an end, and numerous local variations spring up all over the Palæolithic world.

Outside all this, meanwhile, lies the still mysterious Far Eastern province, with its mixed flake and blade culture. In its early stages this may conceivably have played a part in the evolution of the Aurignacian proper, and in this connexion it is perhaps significant that Gordon Childe reports the presence of a slit-base bone point at Malta.

The picture which I have outlined is admittedly largely speculative. I am prepared to be accused of domination by a *mirage orientale*, but to that I would reply that some of my colleagues seem to me at the moment to be unduly influenced by a *mirage africain*. Only further discovery will make it possible to decide between us.

## Obituary

Dr. George Forbes, F.R.S.

DR. GEORGE FORBES, who died at Worthing on October 22 at eighty-seven years of age, was a well-known electrical engineer in the early days of electric lighting and electrical transmission of power. He was a man of great versatility, and in addition to electrical engineering work he did much useful physical research and was also greatly interested in astronomy. He was an intimate friend of the late Sir David Gill, formerly H.M. Astronomer at the Cape of Good Hope.

After taking his degree at Cambridge, Forbes was appointed professor of natural philosophy at Anderson's College, Glasgow, and occupied the chair from 1872 until 1880. One of his chief pieces of physical work was an extensive research on the velocity of light, carried out in conjunction with Dr. T. Young, between 1876 and 1880 and described in the *Phil. Trans. Roy. Soc.* of 1882. They used a modified form of Fizeau's method and an arc lamp as a source of light, working over a Scotch loch for a distance of about 3-4 miles. The result they obtained was 301,382 kilometres per second, which is rather in excess of the best results of Michelson and others. The chief novelty of their work was that they found a supposed greater velocity for blue light than red by about 1.8 per cent. Astronomical observations give, however, a denial to such a conclusion and it has not been held to be valid. Forbes also took part in astronomical expeditions, and when only twenty-five years of age he conducted a British party to Hawaii to observe a transit of Venus with the object of determining the solar parallax and distance. He wrote an excellent small book in Benn's Sixpenny Library Series on "The Earth, the Sun, and the Moon".

When electric lighting work began in England in the early 'eighties of last century, after the invention of the carbon filament electric lamp by Edison and Swan, Forbes came to London and was adviser or

manager of one of the then formed electric manufacturing companies. He made improvements in an arc lamp and invented an electric meter for alternating electric currents. One of his most permanent improvements was the application of hard graphitic carbon as brushes for electric motors. Before that time it was usual to employ brushes of brass or copper gauze or wire; but these caused unnecessary wear of the commutator. Forbes suggested brushes made of graphitic carbon in the same fashion as arc lamp carbons, and this was a great improvement and is used almost entirely at the present day.

When the great scheme of utilizing the power of Niagara Falls for production of electric current was under consideration, Forbes was one of those (and also the writer of this notice as well) consulted by the projectors as to the system of generation to be employed. In 1891 there was an electrical exhibition at Frankfort-on-Main, and one of the most interesting features was the transmission of power electrically over a distance of 110 miles from Lauffen to Frankfort by means of three-phase alternating electric currents. This transmission comprised the use of 300 h.p. generated at 55 volts and a frequency of 40 cycles. The voltage was raised by transformers to 8,500 volts and reduced again at the receiving end. The success of this performance gave a great impulse to the vaster scheme of utilizing Niagara, and the Cataract Company was formed to carry it out. After taking numerous opinions, it was decided to employ two-phase alternating currents, and generators driven by turbines were constructed of 5,000 h.p. to generate at 5,000 volts for transmission at 11,000 volts to Buffalo and other cities. Forbes went to Niagara to superintend the electrical work. At present, nearly a million horse-power is taken from the Falls.

Forbes travelled extensively, and in 1877 acted as special correspondent of *The Times* during the Russo-Turkish War. He was the recipient of many



distinctions for his scientific work. He was elected a fellow of the Royal Society of London in 1887 and received the honorary degree of LL.D. from the University of St. Andrews. He was a Chevalier of the Legion of Honour of France and an honorary member of the Franklin Institute of America.

Forbes invented a range-finder for military work used in the South African War, and a gun-sight for the Navy. He was granted a Civil List Pension in 1931 for his services. Of late years he had not been seen much in scientific society, except for occasional visits to the Athenæum, but in the later years of the nineteenth century he was a well-known member of various British scientific societies and often seen in social and scientific gatherings. He was at one time a vice-president of the Institution of Electrical Engineers. An obituary of him appeared in the *Daily Telegraph* of October 26 last from which by permission some of the above statements are taken and acknowledgement is here made for the courtesy.

J. A. F.

### Sir George Hampson, Bt.

SIR GEORGE HAMPSON, who died on October 15, at Thurnham Court, near Maidstone, at the age of seventy-six years, came of an ancient Oxfordshire family, the baronetcy having been created in 1642; he succeeded to the title on the death of his uncle in 1896. He was born on January 14, 1860, the eldest son of the Rev. W. S. Hampson, rector of Stubton, Lincolnshire. He was educated at Charterhouse and at Exeter College, Oxford, where he graduated.

Already in 1883 Hampson was collecting Lepidoptera, as a side-line to planting tea, in the Nilgiri Hills in southern India, and his serious interest in entomology appears to have been born during the five years which he spent in these surroundings. The latter half of the nineteenth century was a kind of golden age in the history of entomological discovery in India, when Marshall and de Nicéville, Moore, Swinhoe, Bingham, Butler and others were constantly extending and gradually reducing to some sort of order our knowledge of the Indian Lepidoptera. But whereas these workers were principally concerned with the butterflies, Hampson, no doubt largely inspired by their activities, after producing a "Catalogue of the Butterflies of the Nilgiris" (which remained in MS.), turned his attention to the moths, in the study of which he was later to achieve a world-wide and unique reputation.

By 1889, Hampson was busily engaged as a voluntary worker in the Insect Room of the British Museum, both upon the general arrangement of the Heterocera and, more particularly, the Indian moths. In 1891 and 1893 the Trustees of the Museum published his first considerable works, namely, his accounts of the Heterocera of the Nilgiris and of Ceylon, which formed Parts 7 and 8 of the "Illustrations of Typical Heterocera in the British Museum". The four volumes, and supplements, of the "Moths of India" appeared between 1892 and 1896, forming part of the Fauna of India series issued by the

Government of India; these set the seal upon his reputation and remain still the only comprehensive work on the subject.

Meanwhile Hampson had been offered an appointment as assistant under Dr. Günther in the Department of Zoology in the British Museum. He accepted this post, and took up his duties in January 1895. This placed him in charge of the whole of the collection of moths, and immediately he concentrated his attention almost exclusively upon the production of his truly monumental "Catalogue of the Lepidoptera Phalænæ in the British Museum". Between 1898 and 1923 fifteen volumes were published. This was, in fact, an attempt at a fully documented and illustrated descriptive catalogue of the moths of the world, and manifestly too great a task for any one man to perform. Yet it is amazing how much Hampson achieved, and how much more he had achieved than was ever published, for on his retirement in 1920 he left a great quantity of manuscript, of which the bare bones were issued in 1926 as a single volume entitled "New Genera and Species of Noctuidæ in the British Museum". The catalogue included the Syntomidæ, Arctiidæ, and the major part of the Noctuidæ, that is to say, perhaps one third of the moths which are usually called Macrolepidoptera. Yet during the progress of this work, Hampson found time to publish many valuable and extensive papers dealing with the large and important family of Pyralidæ, notable among which is his account of the Phycitineæ and Galleriineæ (in continuation of Ragonot's work) which formed vol. 8 of the Romanoff "Memoirs".

Times have changed greatly in entomological circles since Hampson took up his task. His working equipment consisted of a hand lens, benzene (for temporarily clearing the wings) and a pair of dividers. It is scarcely a matter of surprise that more recent investigations have brought to light many facts which escaped him. He was always more inclined, too, to concede a far greater range of variation in species than was customary at the time his early volumes appeared, possibly as a reaction to the obviously unjustified hair-splitting of such workers as Butler, Moore and Swinhoe, and in consequence, especially in the "Moths of India", some of his "species" have been shown to be compact of many. There can be few systematists, however, against whom such a charge cannot be levelled.

The present writer remembers well, as a very young man, his first introduction to Hampson. He had some foreign moths to name, and on asking for help, was firmly but courteously told that "he would find them over there—" a wave of Hampson's arm indicating the entire collection of Heterocera in the Museum. This was very characteristic; but it had some advantages. It enabled the speaker to proceed uninterrupted with his work, and it forced the inquirer to learn something about the moths in such a way that he would remember it. Hampson's methodical industry was amazing, and his "Catalogue" is not only a worthy testimony to it, but also a mine of information that will not be exhausted for many years.

N. D. R.



### Sir George Buchanan, C.B.

THE death, on October 11, of Sir George Buchanan, a devoted public servant in public health, will be regretted by a wide circle of friends. George Seaton Buchanan was born on February 19, 1869. He was the eldest son of the late Sir George Buchanan, F.R.S., who was principal medical officer to the Local Government Board from 1880 until 1892. The younger Buchanan graduated at the University of London with the degrees M.B. (gold medallist), 1891; M.D., 1892; M.D. (State medicine), 1893; and B.Sc.; and became later a fellow of the Royal College of Physicians. In 1895, at the age of twenty-six years, he was appointed to a post of medical inspector in his father's old Department, then under the leadership of Sir Richard Thorne-Thorne. After serving for nearly forty years in this Department and the Ministry of Health, which was created from it, he retired at the age limit of sixty-five years in 1934, but continued to hold the office of president of the Permanent Committee of the Office International d'Hygiène publique in Paris (which carries with it the vice-presidency of the Health Committee of the League of Nations in Geneva) to which he had been elected in 1932. His soul was devoted almost exclusively to the public service, and he thus, after leaving the British Government service, was able to continue public health work of international importance.

When first appointed to the Local Government Board and for many subsequent years, Sir George was occupied in making epidemiological inquiries into outbreaks of infectious disease in England and Wales. He became president of the Epidemiological Section of the Royal Society of Medicine in 1918 and 1919. His first published report in 1897 on an inquiry into enteric fever in some districts of East Anglia provided an early proof of the disease being due to polluted oysters. A few years later, his epidemiological inquiry into the manner in which smallpox spread during an epidemic in Essex supported the view (first brought to notice by Power in 1881 and again in 1884) that smallpox can be spread, from hospitals receiving acute cases of this disease, by distal atmospheric convection, apart from personal contact.

From 1901 until 1903, Sir George Buchanan acted as secretary to Lord Kelvin's Royal Commission on food contaminations, which led in 1905 to the organization by the Local Government Board of a new section with Buchanan at its head with the title of 'Chief Inspector of Foods'. In 1912 he became first assistant medical officer under Sir Arthur Newsholme, then chief medical officer of the Board. Two years later, by his appointment as official delegate for Great Britain on the Permanent Committee of the Office International d'Hygiène publique in Paris, he entered the field of international public health affairs, which thereafter formed his chief public health work. During the Great War, he served on special commissions which visited Gallipoli, Egypt, Salonica and Mesopotamia, and the honour C.B. (Military) was conferred upon him for these services. When peace came, his services on the Army Sanitary

Committee and the Inter-Allied Sanitary Commission in Paris were retained, and he continued to take an active part in international arrangements for preventing the spread of typhus, dysentery and other diseases which affected troops and refugees returning from the war areas.

His valuable services in solving various international health problems cannot be enumerated here, but special mention must be made of the large share Sir George took in designing and drafting the International Sanitary Maritime Convention which was agreed upon and signed at the International Sanitary Conference held in Paris in 1926. Later he took similar action in drawing up international rules for the prevention of transmission of yellow fever and other infectious diseases by aircraft. These rules were embodied in the "International Sanitary Convention for Aerial Navigation" which is now in force. The activities of the international health organizations in Paris and Geneva are given in full in the Milroy Lectures on "International Co-operation in Public Health, its Achievements and Prospects" delivered by Buchanan before the Royal College of Physicians of London on February 27 and March 1, 1934.

The honour of knighthood was conferred on Buchanan in 1922. He was appointed master of the Society of Apothecaries of London for 1934-35, and in the same year was awarded the Mary Kingsley Medal by the Liverpool School of Tropical Medicine and the Jenner Medal by the Royal Society of Medicine in London for his work in the control and prevention of epidemic diseases.

DR. JAN BAŠTA, a distinguished Czechoslovak engineer and member of the Masaryk Academy of Work, died in Prague on October 13 aged seventy-six years. He was the first student to graduate from the Prague Technological University in 1902. Later he had a distinguished career as a railway engineer, but never lost his keen interest in pure science. His last publication, dealing with the relationship of force with matter, was referred to in NATURE of July 11 last p. (83).

WE regret to announce the following deaths:

Prof. H. R. Britton-Jones, professor of mycology in the Imperial College of Tropical Agriculture, on November 3.

Dr. Kurt W. Franke, chemist at the South Dakota Agricultural Experiment Station, known for his work on enzyme action and nutrition, on September 15, aged forty-six years.

Mr. C. E. Haselfoot, fellow (formerly dean) of Hertford College, Oxford, lecturer in mathematics in Wadham College, from 1888 until 1913, on October 28, aged seventy-two years.

Prof. Henry Landes, professor of geology and dean of the College of Science, University of Washington, an authority on the mineralogy of Washington, on August 23, aged sixty-eight years.

Mr. A. E. Hodge, founder and editor of the *Aquarist and Pond-Keeper*, aged fifty-eight years.



## News and Views

### Medal Awards of the Royal Society

HIS MAJESTY THE KING has approved of the following awards this year by the president and council of the Royal Society in respect of the two Royal Medals: to Prof. R. H. Fowler, for his work on statistical mechanics and allied departments of modern mathematical physics; and to Prof. E. S. Goodrich, for his work on the morphology of the excretory organs of the invertebrata and for his work on the comparative anatomy and embryology of the vertebrata. The following awards of medals have also been made by the president and council: Copley Medal to Sir Arthur Evans, in recognition of his pioneer work in Crete, particularly his contributions to the history and civilization of its Minoan Age; Rumford Medal to Prof. E. G. Coker, for his researches on the use of polarized light for investigating directly the stresses in transparent models of engineering structures; Davy Medal to Prof. W. A. Bone, for his pioneer work on contact catalysis and his researches on the mechanism of combustion of hydrocarbons and on the nature of flames and on gaseous explosions; Darwin Medal to Dr. E. J. Allen, in recognition of his long-continued work for the advancement of marine biology, not only by his own researches but also by the great influence he has exerted on very numerous investigations at Plymouth; Hughes Medal to Dr. W. Schottky, for his discovery of the Schrot effect in thermionic emission and his invention of the screen-grid tetrode and a super-heterodyne method of receiving wireless signals.

### New Officers of the Royal Society

THE following is a list of those recommended by the president and council for election to the council of the Royal Society at the anniversary meeting on November 30: *President*, Sir William Bragg; *Treasurer*, Sir Henry Lyons; *Secretaries*, Sir Frank Smith and Prof. A. V. Hill; *Foreign Secretary*, Sir Albert Seward; *Other members of Council*, Prof. A. J. Allmand, Dr. G. T. Bennett, Prof. J. Chadwick, Prof. A. S. Eve, Prof. W. G. Fearnside, Prof. L. N. G. Filon, Dr. J. Gray, Sir Daniel Hall, Prof. C. R. Harington, Prof. D. Keilin, Prof. J. Graham Kerr, Dr. R. H. Pickard, Mr. H. R. Ricardo, Prof. W. Stiles, Prof. W. W. C. Topley, Mr. W. Trotter.

### Frederick Wollaston Hutton, F.R.S. (1836-1905)

ON November 16, the centenary occurs of the birth of the distinguished geologist Frederick Wollaston Hutton, who together with Ferdinand von Hochstetter (1829-84), Sir John F. J. von Haast (1824-87) and Sir James Hector (1834-1907), laid the foundations of our knowledge of the geology of New Zealand. Hutton was born at Gate Burton,

Lincolnshire, being the second son of the Rev. H. F. Hutton. Educated at Southwell Grammar School and the Naval Academy, Gosport, he spent three years as a midshipman in the India Mercantile Marine and then entered the Army. He served in the Crimean War and the Indian Mutiny, and afterwards at Sandhurst gained a liking for geology from Prof. Thomas Rupert Jones (1819-1911). Leaving the Army in 1866, he went to New Zealand. In 1871 he became an assistant on the New Zealand Geological Survey, and two years later was made Government geologist of Otago. In 1877 he was appointed professor of natural science at the University of Otago and in 1880 settled in Christchurch as a professor in the University of New Zealand. Besides a large number of scientific papers, he published "Darwinism and Lamarckism" (in 1899), "The Lesson of Evolution" (in 1902) and "Animals of New Zealand" (in 1904). After an absence of nearly forty years, he revisited England, and was on his way back to New Zealand in the S.S. *Rimutaka* when he died at the Cape on October 27, 1905. After his death, a subscription was raised for the endowment of a bronze medal in his honour, and for the furtherance of research.

### The Background to Harvey

IN his Harveian Oration delivered before the Royal College of Physicians on October 19 and published in the *British Medical Journal* of October 24, Sir Walter Langdon-Brown, emeritus professor of physic in the University of Cambridge, described the background to Harvey as represented by contemporary thought, of which Francis Bacon, Robert Burton, the author of "The Anatomy of Melancholy", John Donne, the Dean of St. Paul's, Sir Thomas Browne, Thomas Hobbes, the author of "Leviathan", and the Cambridge Platonists were the chief exponents. Like Sir William Hale-White in his Harveian Oration of 1927, Sir Walter maintained that the "Novum Organum", in which the new spirit of England found its clearest expression, had a deep influence on the mind of Harvey who, as his medical adviser, came in close contact with Bacon. A striking contrast was offered by John Donne, who represented a transition from the sixteenth to the seventeenth century, being in certain aspects the most medieval and in others the most modern writer of his time. In conclusion, Sir Walter showed how the turmoil of thought in Harvey's time is being repeated to-day. In both instances a phase of great and rapid expansion both in thought and wealth was followed by disillusionment on the intellectual side and greater stringency on the financial; old standards were destroyed before new ones could take their place and a new form of art and literature appeared.



### The Chemical Exploration of the Stratosphere

FOR his Friday evening discourse at the Royal Institution on November 6, Prof. F. A. Paneth took as his subject "The Chemical Exploration of the Stratosphere". Prof. Paneth pointed out that while the temperature and the electrical state of the stratosphere have been the object of many investigations, its chemical composition has seldom been studied. If winds are absent, or at least rare in the stratosphere, we should expect a partial separation of the atmospheric gases under the gravitational field of the earth. In order to decide this question of the stillness of the stratosphere, samples of air have to be collected. For this purpose, the sending up of automatic devices in unmanned balloons is the most efficient method. In collaboration with the Meteorological Office of the Air Ministry, Prof. Paneth and Dr. E. Glückauf, working at the Imperial College of Science and Technology, have developed methods for the automatic collection and subsequent analysis of air samples from the stratosphere. From the first results, published a year ago, it was concluded that up to 18 km. no definite change in the chemical composition of the stratosphere occurred, but that at a height of 21 km. the relative amount of the light gas helium has already distinctly increased. During the last few months, this has been confirmed by further successful flights reaching more than 23 km.

SIMILAR investigations have lately been started by Prof. E. Regener, in Stuttgart, using larger balloons; in one of his samples, from a height of more than 28 km., he found an oxygen deficit, in good agreement with the helium surplus detected in the London flights. The only two air samples obtained by manned stratosphere balloons confirm these findings: Prokofiev's sample collected over Russia in 1933 at a height of 19 km. showed no variation in its composition; but the air brought back by Capt. Stevens and Capt. Anderson from 22 km. over the United States already revealed a slight oxygen deficit. All this supports the conclusion that from about 20 km. onwards the stratosphere is quiet enough to permit a partial separation of its constituents by gravity. Neither the London nor the Stuttgart samples show a gradual change in the composition of the atmosphere in proportion to altitude. This is of special interest as it proves that in spite of their relative quietude, the air masses even of higher layers of the stratosphere are liable to disturbances, probably corresponding to weather conditions.

### The Royal Society of Arts

FOR his inaugural address delivered on November 4 to the Royal Society of Arts, Sir Henry McMahon, chairman of the Society, took as his subject "One Hundred and Eighty Years of Pioneer Work by the Royal Society of Arts". The Society was founded in 1754 "for the Encouragement of Arts, Manufactures and Commerce" at a time when there were no departments of Government, societies or institutions to deal with such matters as Colonies, agriculture, forestry, fine arts, health, trade or industry.

In the early days, the field of work was divided into six sections, each being left to the charge of a separate committee. Money prizes, or premiums as they were called, and in some cases gold and silver medals, were then offered for specific objects, and in this way a very great stimulus was provided for improvements in all directions. The agricultural industry in particular derived much benefit from such a policy. At the time of the foundation of the Society, agricultural methods were largely based on medieval practice. In the second half of the eighteenth century, the Society took an important share in developing a more scientific outlook. The prizes offered by the Committee on agriculture covered a very wide range, including the improvement in the quality and yield of established crops, such as wheat, barley, oats and rye, the introduction of new grasses and roots for cattle feeding, better methods of cultivation, the invention of new types of agricultural machinery and the improvement of existing models, the use of manures, soil analysis, the management of sheep and cattle, and indeed almost every aspect of what is now understood by the term 'scientific agriculture'.

THE offer of rewards did not always produce results. For example, a handsome reward was offered and renewed for no less than forty-six years (1774-1820) for an effective corn-reaping machine, without success. One of the most useful pieces of work for which the Society can claim credit was the introduction of the swede and mangel-wurzel into Great Britain. Remarkable results were also achieved by the Society in connexion with afforestation carried out in the period 1758-1835, anticipating in fact the work of the present Forestry Commission, which was not founded until 1919. Much attention has also been paid by the Society to the polite arts, the importance of encouraging the art of drawing in many employments, trades and manufactures being recognized from the start. The introduction of industrial exhibitions was a feature of the pioneer work in this direction, and the success of the Exhibition of British Art in Industry in 1935 was an indication of the desire on the part of both designers and manufacturers of the present time to increase this spirit of co-operation.

### Prevention of War

THERE can be no doubt of the general and passionate determination of the great majority of the thinking youth of the world to prevent another world war. This desire is strongly expressed by the New History Society, of 132 East 65th Street, New York, and illustrated by its offer of prizes amounting in the whole to five thousand dollars for the best papers submitted on the subject of "How Can the People of the World achieve Universal Disarmament?" The essays are to be of not more than two thousand words in length, and the prizes are variously graded from one thousand dollars downwards, so that there seems abundant opportunity for any helpful contribution sent in from any part of the world to receive some recognition. We recommend all



sympathizers to obtain the necessary further particulars from the address above. The last date for the posting of the essays is May 1, 1937, so that ample time is allowed for all inquiries and for the writing of so short a composition. It will not be the length, however, but the pregnancy of what is said that will arouse attention, and one hopes most sincerely that something may be said which will bring light and hope to this most perplexing and dangerous question. Everyone knows, and most people admit, for example, that Great Britain in this matter of rearmament is acting most unwillingly and feels herself compelled to her present action by what is being done by others. If this is to go on, the vicious circle is complete. How to break it? That is the question to which the essayists will have to address themselves.

It is not for us here to sketch an essay for the competition, but it does seem possible that after our darkest moment light may appear. The appalling business which now absorbs our attention in Spain may prove the turning point for an upward movement of peace. It is clearly seen that this conflict is a reflection, in a distorted form, of the greatest underlying conflict which is threatening the peace all over the world, that between what is called 'fascism' or an authoritarian and comprehensive nationality, and 'communism' or the organized power of the manual workers. Men see now the hideous excesses and dangers of extinction which threaten civilization, if such a conflict is pushed to extremes. They must see also that, as in England, there is no essential reason why the conflict should not be avoided by rational compromise and goodwill. There is an honest and widespread movement on foot to avoid extreme courses in the case of Spain. Clearly something must be done there, to save that country from extinction. This may be the lesson which the world so badly needs. It is at least plainly written in the events of the last three months. The friends of science will also reflect that the crisis has occurred in the one land in Western Europe where science had taken least root, the one place where there was no renaissance of science in the seventeenth century. That was the proper scene for the play of the forces of unreason. No other Western land has been torn by such an internecine strife; no other was so unfortunately free from the pacifying influences of scientific education.

#### Spawning of the Common Toad

It is only during recent years that biologists have realized that they are far from a complete understanding of the influence of external factors on the spawning of even the commoner amphibians. The common toad (*Bufo bufo bufo*) is an 'explosive breeder', that is to say, all the sexually mature individuals in a district migrate from their diverse hibernation quarters to their breeding sites within a few days of one another, and within even large areas there is singularly little deviation from the normal of the year. There have been occasional records of

isolated pairs found spawning long after the normal time, but some observations made by Mr. G. Shrubsole, who writes from the Victoria Court Hotel, Eastbourne, made during the last two years, seem to indicate the existence in Sussex of an area which is exceptional. A series of small ponds on Beachy Head were visited at intervals for conchological work, and on July 30 and August 1, 1935, unhatched toad spawn was found in at least three of them. One pond was kept under observation and unmetamorphosed tadpoles were still found at the beginning of December. In 1936 tadpoles were first found in the same, and one other pond, at the beginning of May, but never throughout the year were they ever observed in any of the others. The development of the tadpoles was apparently very slow, for even in September the majority still had mere rudiments of hind-limbs. But whether these very late tadpoles were of the same brood as those found early in May is uncertain (the normal larval period is only 12-14 weeks), for although no fresh spawn was found, adult toads were discovered in the water in July. Their presence at a time so long after tadpoles had been observed is unusual, for the whole of the breeding operations are normally concluded within a week or so, and the adults then leave the water for the rest of the year. Their presence certainly suggests the possibility that there may have been a July spawning in 1936, as there was in 1935, and, if this proves to be a regular occurrence, a detailed investigation of the physical conditions of the district should be of importance.

#### Native Labour from Nyasaland

THE announcement by the Colonial Office that the Governments of Southern Rhodesia, Northern Rhodesia and Nyasaland have entered into a provisional agreement regulating the employment of emigrant labour from the last-named has come shortly after Mr. Ormsby-Gore's recent insistence on the importance of the labour problem in its effect on the well-being of the native community (see NATURE, Oct. 31, p. 735). It is an assurance that the conditions to which the report of the Committee on emigrant labour from Nyasaland has directed attention will not be allowed to continue without a serious endeavour to eliminate those factors which have been shown to be the cause of hardship and suffering, as well as a danger to the future prosperity of the Protectorate. The agreement is to remain in force for four years as from August 21 last, and thereafter is terminable at twelve months notice. Under its terms, identification certificates are to be issued to all male natives seeking employment, and those leaving their own territories for that purpose will bear evidence to that effect, as well as a notification of physical fitness. In future, so far as native and industrial conditions permit, only such certificated labour will be admitted by the employing Governments. Not only will the flow of labour be controlled, if necessary, but also—a matter of much greater importance—labourers are to be returned to their own territory after an economic period of employment, which is not to exceed two years. This



provision, even if it does not entirely remove the evil of a permanent loss in population, will at least lessen the numbers of those who do not return to their homes after a period of extra-territorial employment. A further important provision sets up a standing committee of representatives of the three Governments to secure co-ordination and to consider problems in connexion with the supply of labour as they arise.

#### Population Investigation Committee

It is announced in *The Times* of November 5 that a committee has been formed to investigate the fall in the birth-rate in Great Britain and its probable consequences. The committee, which has been appointed by the council of the Eugenics Society, is presided over by Prof. A. M. Carr-Saunders, and has among its members, Lord Horder, Mrs. Hubback, Dr. Julian Huxley, Prof. L. Hogben, Dr. R. R. Kuczynski, Lady (Rhys) Williams, Prof. J. Young, and other authorities on various aspects of the subject. Dr. C. P. Blacker, the general secretary of the Eugenics Society, is honorary secretary of the Committee, and Mr. D. V. Glass is research secretary. Mr. Glass has recently published a useful book on this subject, entitled "The Struggle for Population". The committee has already held two meetings, and its investigations are gradually taking shape. The main object is, in the first place, to ascertain the facts of the case and the causes of the decline in the number of births per family; and for this purpose it invites the co-operation of institutions and individuals engaged upon relevant lines of research. Inquiries may be addressed to the Secretary, Population Investigation Committee, 69 Eccleston Square, London, S.W.1.

#### New Discharge Bulb Lamps

THE new discharge bulb lamps are already in use on the Continent, and judging from the fact that they were shown at a meeting of the Illuminating Engineering Society on October 13, they will probably be soon on sale in Great Britain. In appearance, they are like the ordinary 'pearl' lamp but they have no filament. They contain a small quartz mercury vapour discharge lamp "about the size of half a cigarette" and they are corrected for colour. Internally the bulb is coated with a fluorescent powder, in the same way as the lower area of the inside of the cathode ray tube, where the picture is shown in television reception. According to the *Electrical Contractor* of November, the lamps are available in two sizes, 80 watts and 125 watts. The light output of these lamps is about 40 lumens per watt. This compares with the 12 lumens per watt of the ordinary coiled-coil incandescent lamp. The life is stated to be about 1,500 hours. The 'colour correction' of these lamps is effected by the fluorescent powder used. The human complexion when illuminated by the lamps shown at the meeting was very little altered, the change being scarcely noticeable. Owing to the fact that the internal film transforms the invisible ultra-violet light emitted by the mercury

vapour lamp into light of visible wave-length, the loss of light by the absorption of the bulb is compensated for by this fluorescence. No details are yet available as to the price of the lamp, but we seem to be on the eve of a new development in house lighting.

#### Recent Acquisitions at the Science Museum

THE Oxford heliometer of 1848 has been placed on exhibition in the Astronomy Collection (Gallery LXIV). This instrument was made for the Radcliffe Observatory, Oxford, by Messrs. A. and G. Repsold of Hamburg on the advice of the famous German astronomer F. W. Bessel, who had in 1838 with a similar instrument obtained the first satisfactory measure of the parallax of a fixed star. The distance of the star, 61 Cygni, was found to be some 400,000 times the sun's distance of 93,000,000 miles. The Oxford heliometer was for many years one of the most powerful and accurate instruments of its kind in the world. It is notable among other things for the first application of electrical illumination to an astronomical instrument. It was dismantled and taken to pieces in 1906, and so remained until its removal in 1935 to the Science Museum, where it has been renovated and set up as it was originally, a striking testimony to the nineteenth century instrument-maker's art. In the Chemistry Collection (Gallery LXVI), an original tube of the metal rhodium prepared by its discoverer, Dr. William Hyde Wollaston, about 1825 has been placed on exhibition. Rhodium has recently become of interest as a non-tarnishing substitute for silver in electroplating.

#### Zoological Survey of India

THE report of the Zoological Survey of India, recently issued, covers the years 1932-35, coinciding with a period of retrenchment in civil expenditure and consequent restriction of activities. It records the retirement of Lieut.-Colonel R. B. Seymour Sewell in 1933, and his subsequent extensive biological investigations as leader of the Murray Oceanographical Expedition to the Indian Ocean, and is written by his successor, Dr. Bains Prasad. The investigations of the Survey include detailed work upon the *Trochus* shell fisheries of the Andaman Islands; identification of animals of economic importance from the medical or sanitary point of view, carried out for various institutions and public bodies; identification of human and animal remains excavated at various chalcolithic sites in Sind; and anthropological work connected with the census. Unfortunately, the abolition of the post of zoological collector and the necessity of restricting expenditure has greatly reduced the field-collecting and observations which used to be so desirable and characteristic an activity of the Survey.

#### Bibliography of Seismology

THE last two quarterly numbers of the "Bibliography of Seismology" prepared by Mr. E. A. Hodgson and printed in the Publications of the Dominion Observatory, Ottawa (12, 159, 181;



1936), complete the record for the year 1935 and begin that for the present year. The general impression that one receives in reading over the titles is that references are gathered from more varied sources and that the bibliography is increasing much in usefulness. The last number for 1935 contains an index classified according to the subjects of the various memoirs catalogued during the year. A useful feature of both numbers is the list of references to notes or short articles that have appeared in various journals, such as *NATURE*, *Science*, etc. The first number for 1936 shows that Great Britain is represented among the collaborators by Dr. E. Tillotson, 23 Roseville Road, Leeds, 8, who will be glad to receive notices of papers on any seismological subjects published in Great Britain.

#### Veterinary Education

THE following Committee has been appointed by the Secretary of State for Scotland and the Minister of Agriculture and Fisheries "to review the facilities available for veterinary education in Great Britain in relation to the probable future demand for qualified veterinary surgeons and to report thereon, and in particular to make recommendations as to the provision which should be made from public funds in the five years 1937-42 in aid of the maintenance expenses of institutions providing veterinary education": The Right Hon. Sir Thomas Molony (chairman), Sir James Currie, Dr. Thomas Loveday, Sir John Robertson, Mr. John Smith, Mr. V. E. Wilkins, of the Ministry of Agriculture and Fisheries, and Mr. W. N. McWilliam, of the Department of Agriculture for Scotland, have been appointed joint secretaries of the Committee.

#### Poultry Mortality Committee: New Chairman

ARISING out of a recommendation of the Eggs and Poultry Reorganisation Commission for England and Wales, a Committee was set up some months ago by the Secretary of State for Scotland and the Minister of Agriculture and Fisheries "to consider the present methods of supply and distribution of hatching eggs, day old chicks, and breeding stock, both generally and with particular reference to the reduction of poultry mortality; and to make recommendations for the improvement of those methods". The Committee's proceedings were however suspended by the illness, recently followed by death, of its chairman, the late Mr. F. N. Blundell. Sir Duncan Watson has now been appointed chairman of the Committee. The secretary of the Committee is Mr. V. E. Wilkins, of the Ministry of Agriculture and Fisheries.

#### Rat Control Film

THE Ministry of Agriculture and Fisheries has recently produced a new cinematograph film dealing with the loss and damage caused by rats and mice and the measures which may be taken for their destruction. The film, which is entitled "Your Enemy—The Rat", is available in two versions—a short sound film for display in public cinemas, and a longer silent version designed for display at exhibitions, conferences, etc. Copies of the film will be

loaned free of charge. Applications for bookings should be addressed to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

#### Royal Prowess in Ancient Egypt

No little interest and some amusement has been aroused by the inscribed stela of Amenhotep II discovered at Giza, on which the monarch transcends the customary royal assumption of credit for achievement by an intimate personal touch in his description of his prowess as an oarsman and athlete. The stela, which was found in the course of Prof. Selim Hassan's excavations in the neighbourhood of the Sphinx at Giza (*The Times*, Nov. 7), records that Amenhotep, when visiting Giza as a young man to pay homage to his ancestors Khufu and Khephren, had rowed a boat for three miles against the stream with an oar twenty ells long without fatigue, while his boatmen were tired after rowing for half a mile. As a horseman and archer he was no less remarkable. He had trained his horses to draw his chariot at a gallop without sweating, and shooting from his chariot he had pierced with an arrow copper targets which were as thick as his hand. The stela upon which is the inscription also bears above a representation of the king making offerings to a figure which is said to be identifiable as the god Ra. It was set up in the second year of Amenhotep's reign (1447 B.C.). The expedition of which Prof. Selim Hassan is in charge is engaged in clearing the whole area adjacent to the Sphinx, and with this purpose in view additional land, at present encumbered with refreshment booths, has been purchased to obviate interference with the work of excavation.

#### Institute of Physics: London and Home Counties Branch

THE inaugural meeting of the London and Home Counties Branch of the Institute of Physics was held on November 4 under the chairmanship of Mr. E. R. Davies, director of the Kodak Research Laboratory. This, the third branch of the Institute to be formed in Great Britain, has been created in response to the desire expressed by some three hundred members resident in London and the surrounding districts. The formation of these branches serves to demonstrate the growing number of physicists in industry who wish to have opportunities for social intercourse and discussion of problems of mutual interest. At the meeting numerous suggestions were made for activities that the branch might usefully undertake; these included visits to works and industrial research laboratories, discussions on professional matters, and short groups of lectures on recent advances in physics. It was emphasized that it is not intended to hold meetings for the reading of original papers, as this is the function of the Institute's participating societies, namely the British Institute of Radiology, the Faraday Society, the Physical Society, and the Royal Meteorological Society. Full particulars of the new branch may be obtained from Dr. H. Lowery, honorary secretary of the branch, North-Western Polytechnic, Prince of Wales Road, N.W.5.



### Science and War

THE Association of Scientific Workers is organizing a public meeting and discussion on "Defence and the Responsibilities of the Scientist", to be held in the mathematics lecture theatre, Huxley Building, Royal College of Science, Exhibition Road, South Kensington, on Thursday, November 19, at 8 p.m. The chair will be taken by Prof. J. B. S. Haldane, and the speakers will include Prof. S. Chapman and Air Commodore L. E. O. Charlton. It is the purpose of the meeting to provide a forum for the full discussion of problems arising out of the increasing application of science to war. Measures that might be adopted by scientific workers as an organized body to further the cause of peace will also be considered.

### Announcements

IT is announced in *The Times* of November 6 that Dr. Edward Bohane, director of the Royal Dublin Society, is retiring from this post on a pension of £1,900 a year and a gratuity of 7,500.

MR. M. A. C. HINTON, deputy keeper of zoology in the British Museum (Natural History), has been elected zoological secretary of the Linnean Society for the remainder of the present session, in succession to Dr. Stanley Kemp, who has resigned.

PROF. L. A. ORBELI, of Leningrad, has been appointed a member of the Permanent International Committee of the Physiological Congresses in succession to Prof. I. P. Pavlov, who died last February. The Committee therefore is now constituted as follows: Profs. F. Bottazzi (Italy), W. B. Cannon (U.S.A.), O. Frank (Germany), A. V. Hill (Britain), secretary, B. A. Houssay (Argentina), Y. Kuno (Japan), L. Lapique (France), G. Liljestr nd (Sweden), and L. A. Orbeli (U.S.S.R.).

THE following have been elected as officers of the Cambridge Philosophical Society for the year 1936-37: *President*, Dr. F. W. Aston; *Secretaries*, Dr. J. D. Cockcroft, Mr. A. H. Wilson, Dr. O. M. B. Bulman; *New Members of Council*, Prof. E. V. Appleton, Mr. G. E. Briggs, Dr. A. N. Drury, Mr. A. E. Ingham, Dr. D. Stockdale.

THE centenary of the foundation of the Army Medical Library of the United States, generally known as the Library of the Surgeon-General's Office, will be celebrated at Washington, D.C., on November 16, when Sir Humphry Rolleston will deliver an oration on its history with special reference to Billings, Fletcher and Garrison.

PROF. A. BUTENANDT, director of the Institute of Organic Chemistry of the Technical University at Leipzig, has been appointed director of the Kaiser Wilhelm Institute of Biochemistry at Berlin-Dahlem, and has been awarded the Rinecker Gold Medal by the University of W rzburg.

THE recent decline in the birth-rate in Japan is shown by the following figures: 1932, 100,688 births; 1933, 927,209 births; and 1934, 809,224 births.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

An agricultural organizer for Gloucestershire—The Clerk of the County Council, Shire Hall, Gloucester (November 16).

Two district officers in the Forestry Commission—The Secretary, Forestry Commission, 9 Savile Row, London, W.1 (November 17).

A research bursar in physiology in the National Institute for Research in Dairying, Shinfield, near Reading—The Secretary (November 20).

A divisional engineer to the London County Council—The Clerk of the Council, County Hall, Westminster Bridge, London, S.E.1 (November 20).

A principal scientific officer, a senior scientific officer, a scientific officer (quote C.E. 6634/36) and a junior scientific officer (quote C.E. 6873/36), with qualifications in chemistry, physics, mathematics or engineering in the Admiralty Scientific Pool—The Secretary of the Admiralty (C.E. Branch), Whitehall, London, S.W.1 (November 21).

An assistant lecturer in engineering in the Brighton Technical College—The Education Officer, 54 Old Steine, Brighton (November 23).

A principal of the Luton Technical Institution—The Director of Education, Shire Hall, Bedford (November 24).

Two assistants (Grade II) (physics or chemistry) and one assistant (Grade III) (physics or chemistry) in the Explosives Directorate; and two scientific officers (mathematics), one scientific officer (engineering or mechanical sciences), one scientific officer (physics or electrical engineering), one assistant (Grade I) (physics or electrical engineering), one assistant (Grade II) (mathematics) and two assistants (Grade III) (physics or electrical engineering) in the Ballistic Directorate of the Research Department, Royal Arsenal, Woolwich, S.E.18—The Chief Superintendent (November 24).

A demonstrator in physics in the London (Royal Free Hospital) School of Medicine for Women—The Warden, 8 Hunter Street, Brunswick Square, W.C.1 (November 25).

A Stokes student for research in mathematical or experimental physics in Pembroke College, Cambridge—The Master (December 1).

A Tweedie exploration fellow in archæology and anthropology in the University of Edinburgh—The Secretary (May 12).

Mechanical and electrical engineers in the Royal Army Ordnance Corps—The Under-Secretary of State (A.C. 9), The War Office, London, S.W.1.

An economic geologist in the Mineral Resources Department (Intelligence Section) of the Imperial Institute, South Kensington, London, S.W.7—The Establishment Officer.

Veterinary officers in the Colonial veterinary service (vacancies in Malaya, East Africa and West Africa)—The Director of Recruitment (Colonial Service), 2 Richmond Terrace, Whitehall, S.W.1.

Assistant civil engineers in the drawing office of the Civil Engineer-in-Chief's Department, Admiralty, London, S.W.1.



## Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 846.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

### Rates of Cleavage of Sea Urchin Eggs in Different Latitudes

THE oxygen consumption of various kinds of poikilothermal marine animals in English waters is higher, at the temperatures at which they live, than that of northern and arctic species of the same genera at their lower sea temperatures, although the arctic animals seem to move about just as fast in their cold habitat as do the English forms in our own waters<sup>1</sup>. The same relation holds for ciliary movement on the gills of scallops: the cilia beat more rapidly in the English species. On the other hand, the respiratory movements of English Crustacea are no more rapid at, say, 15° than those of arctic species at 5°. The same rule applies also to the rates of heart-beat of most of the species studied. I have now measured the rate of cleavage of eggs, and find that this behaves like the respiratory movements and hearts, not like oxygen consumption and cilia.

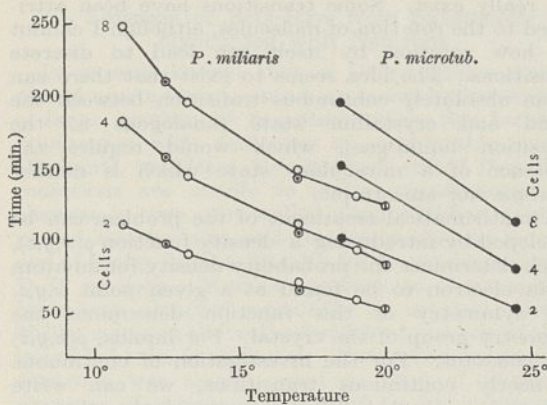


FIG. 1. Time for cleavage of sea urchin eggs. O, Plymouth; ⊕, Millport; ⊙, Roscoff; ●, Tamaris.

I have compared the rates of cleavage of the eggs of two species of sea urchins, *Psammechinus miliaris* from Roscoff in Brittany<sup>2</sup>, Plymouth, and Millport in Scotland, and *P. microtuberculatus* at Tamaris in the south of France. The results are shown in Fig. 1. The points giving the times after fertilization, for the first three cleavages at different temperatures in *P. miliaris* from the various localities fall, on smooth curves, but the eggs of the Mediterranean species at a given temperature, say 20°, cleave much more slowly than those of the northern species. The rate for the southern species at 20° is no faster than that for the northern species at 12°-13°.

From data in the literature, it is evident that the same phenomenon occurs within a single species of sea urchins, namely *Paracentrotus lividus*. At Roscoff the 2-, 4- and 8-cell stages are reached in

66, 100 and 147 minutes at 20°. At Rovigno, in the Adriatic, the respective times are 105, 135 and 182 minutes at the same temperature<sup>3</sup>. Indeed the cleavage rates of *P. lividus* at Naples differ at different times of the year. At 13°, 71 and 91 minutes elapse between one cell division and the next in winter and in summer respectively, while at 26°, 31 minutes are taken in winter and 25 minutes in summer<sup>4</sup>.

The results described above will be published in full in the *Proceedings of the Zoological Society*.

H. MUNRO FOX.

Institut de Biologie, Tamaris,  
and Birmingham University.  
Oct. 19.

- <sup>1</sup> H. Munro Fox, NATURE, 137, 903 (May 30, 1936).
- <sup>2</sup> B. Ephrussi, C. R. Soc. Biol. Paris, 89, 928 (1923).
- <sup>3</sup> O. Koehler, Arch. Zellforsch., 8, 272 (1912).
- <sup>4</sup> S. Hörstadius, Biol. gen., 1, 522 (1925).

### Physical Nature of the Vibrating Elements of the Internal Ear

THE sensation resulting in the human subject from a change of phase of  $\pi$  (180°) occurring in the course of a continuous musical tone has been the subject of a number of earlier publications<sup>1</sup>. Under certain conditions, the sensation has been found to resemble the beat produced by two pure tones slightly out of unison, and has been described as a "phase-change beat"<sup>2</sup>. As stated by Hartridge<sup>1</sup>, it is demanded by the Helmholtz resonance theory that the physiological event which corresponds to such a phase-change must be a transient arrest of the resonant elements of the internal ear brought about by the opposition of the impressed forces following the change of phase to the after-swings enforced by resonance.

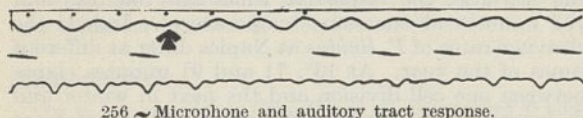
An experiment is described below in which direct evidence is adduced that an event of this kind does in fact take place.

For the purpose of acoustic stimulation, the phase-reversing photo-electric siren to which reference is made elsewhere<sup>3</sup> has been employed. By means of this device, tone frequencies of 256 ~ and 1,024 ~ and of 40-80 phons intensity were generated and led by means of thick-walled rubber tubes to the ear of an animal preparation (decerebrate cat).

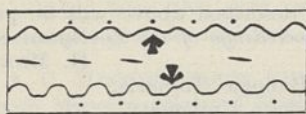
Employing suitably disposed electrodes and an amplifying system of conventional resistance-capacity type to feed a cathode ray oscillograph, the electrical response of the cochlea (Wever and Bray phenomenon), and also the auditory action-potentials of the mid-brain, were recorded photographically upon fast-moving cine-bromide. In addition, arrangements were made for the simultaneous recording of the sound stimulus by means of a piezo-microphone feeding a separate amplifier and oscillograph.



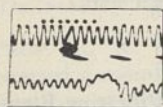
The records depicted in Fig. 1 show that in the case of the auditory tract potentials, the response is of the resonant type, in that it exhibits a well-marked 'silent period' in correspondence to the change of phase occurring in the stimulating tone. This finding is considered to provide clear evidence of the occurrence under the conditions described of a transient arrest of the vibrating elements responsible for the initiation of the auditory action potentials. As stated by Hartridge, this phenomenon is explicable only upon the hypothesis of Helmholtz that these elements are resonant structures. The widely held view that the elements in question are the fibres of the basilar membrane is accepted.



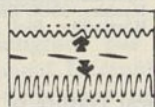
256 ~ Microphone and auditory tract response.



256 ~ Microphone and cochlear response.



1024 ~ Microphone and auditory tract response.



1024 ~ Microphone and cochlear response.

Fig. 1. Oscillograph records of auditory tract and cochlear responses to  $180^\circ$  phase changes. In all the records, the upper tracing represents the microphone response; arrows indicate the position of the phase-changes. Time marker,  $1/200$  sec.

In the case of the cochlear response, the records displayed in Fig. 1 show that no such silent period occurs, and that further, the change of phase in the stimulating tone is reproduced with considerable fidelity. This finding provides evidence which enforces the view that the cochlear response differs fundamentally in its mode of origin from that of the auditory action-potentials recorded, as in the present experiment, from the tracts of the mid-brain. The fidelity of reproduction of the impressed phase change must be taken as indicating the light, but heavily damped, character of the moving parts responsible for the generation of the cochlear response, and is in clear accordance with the membrane hypothesis of its origin put forward in a previous publication<sup>4</sup>. This hypothesis regards the potential changes in question as originating in movements occurring in a polarized membrane. Reissner's was considered to be such a membrane, and a possible mechanism of polarization was suggested, based upon the known differences of origin of the endolymph and perilymph.

The more widely accepted hypothesis of Davis and his collaborators<sup>5</sup>, that the cochlear phenomenon originates in the manner of a piezo-electric effect from the hair-cells of Corti's organ, must in the light of the present findings be regarded as untenable, in view, first, of the direct attachment of these cells to the basilar fibres, and secondly, of the failure of the phenomenon to exhibit any silent period in

response to a phase-reversal such as is now shown to be imposed by the resonant character of these fibres upon other anatomically associated elements, namely, the terminal fibrils of the cochlear nerve.

C. S. HALLPIKE.

H. HARTRIDGE.

A. F. RAWDON-SMITH.

Ferens Institute of Otology,  
Middlesex Hospital,  
London, W.1.  
Oct. 19.

<sup>1</sup> H. Hartridge, *Brit. J. Psychol.*, **12**, 142 (1921).

<sup>2</sup> C. S. Hallpike, H. Hartridge and A. F. Rawdon-Smith (in the press).

<sup>3</sup> C. S. Hallpike, H. Hartridge and A. F. Rawdon-Smith, *Proc. Physiol. Soc.*, Feb. 15, 1936. *J. Physiol.*, **86**.

<sup>4</sup> C. S. Hallpike and A. F. Rawdon-Smith, *J. Physiol.*, **86**, 406 (1934).

<sup>5</sup> H. Davis, A. J. Derbyshire, M. H. Lurie and L. J. Saul, *Amer. J. Physiol.*, **107**, 311 (1934).

### The Theory of Phase Transitions

THE only phase transitions which up to the present time have been thoroughly investigated are transitions between the liquid and gaseous states. As regards transitions between liquids and crystals or between different crystalline modifications, their treatment has not always been quite satisfactory. For example, one sometimes hears not only of transition points (with jumps of energy) and Curie points (with jumps of specific heat), but also of transition points of the  $n$ th order, as if there were reason to assume that such generalized transitions can really exist. Some transitions have been attributed to the rotation of molecules, although I cannot see how rotation by itself can lead to discrete transitions. The idea seems to exist that there can be an absolutely continuous transition between the liquid and crystalline state (analogous to the transition liquid-gas), which would require the existence of a miraculous state which is neither isotropic nor anisotropic.

A mathematical treatment of the problem can be developed by introducing a density function  $\rho(x, y, z)$ , which determines the probability density for an atom or an electron to be found at a given point  $x, y, z$ . The symmetry of this function determines the symmetry group of the crystal. For liquids,  $\rho(x, y, z)$  is a constant. For the investigation of continuous or nearly continuous transitions, we can write  $\rho(x, y, z) = \rho_0(x, y, z) + \delta\rho(x, y, z)$ , expand the thermodynamic potential in powers of  $\delta\rho$  and investigate the minimum properties of this expression.

Such an investigation in the most general form, the details of which will appear elsewhere, leads to the following results. There exist only two kinds of transition points (more exactly lines in the  $p$ - $T$  diagram), namely, phase transition points and Curie points. Curie points are only possible when the symmetries of both modifications are different and the symmetry group of one modification is a certain sub-group of the symmetry group of the other. Thus, for example, the symmetry of the ammonium chloride molecule changes at the Curie point from  $O_h$  to  $T_d$ , which is a sub-group of  $O_h$ . In alloys the change of symmetry consists generally in a doubling of the lattice constant.

If the relation between the more symmetrical group and the sub-group does not satisfy certain conditions, no Curie point line in the  $p$ - $T$  plane is possible. But there is still a possibility of a continuous



transition (without a jump in the energy) at a single point in the  $p$ - $T$  plane. The  $p$ - $T$  diagram near this point has in the simplest case the form shown in Fig. 1. Here I denotes the region of the more symmetrical phase. II $a$  and II $b$  are two different phases with the same symmetry, which is that of a subgroup of I. At the point O all the three phases become identical.

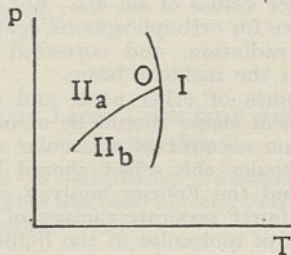


FIG. 1.

It can be shown that the transition crystal-liquid belongs to this class. No Curie point line can therefore exist for melting, and the only possible type of continuous transition crystal-liquid is that shown in Fig. 1, where in this case I refers to the liquid and II to the crystalline state.

L. LANDAU.

Ukrainian Physico-Technical Institute,  
Kharkov.  
Sept. 7.

#### Emission of Beta-Rays from Substances bombarded with Neutrons

It is well known that a Geiger-Müller counter placed near a target containing heavy hydrogen gives a large number of responses when the target is bombarded with deuterons of considerable energy. Oliphant<sup>1</sup>, and later Alexopoulos<sup>2</sup>, stated that these radiations are unable to induce simultaneous discharges in two thin-walled Geiger-Müller counters placed side by side, and concluded that no gamma-ray of energy higher than  $1 \times 10^6$  ev. accompanies the D-D reaction. Results contrary to these authors have been obtained repeatedly by us<sup>3</sup> using Geiger-Müller counters the walls of which were made of aluminium 0.1 mm. in thickness. But as the energy of the electrons was nearly equal to that of secondary electrons of gamma-rays excited by fast neutrons in several elements, we consider that they might have been due to the gamma-rays excited in several parts of the apparatus by the action of neutrons emitted not only from the target but also possibly from different parts of the accelerating tube bombarded by stray deuteron beams.

We have now performed the experiments with a different arrangement in which the secondary effects are minimized, and confirmed that the radiation in question cannot be ascribed to any secondary origins. From the ratio of the number of coincident discharges to the number of responses of the single counter, it is estimated that the greater part of the discharges taking place in the single counter is due to the electrons, which are also responsible for the simultaneous discharges. The absorption curve of the beta-rays indicates that most of the electrons had energy lower than 1.0 mv., while a small portion of them had somewhat higher energy extending up to 1.5 mv. (In the single counter experiments, the

counter was in most cases covered with a sheet of lead 0.5 mm. in thickness to protect it from the electrons, which might be emitted from the walls of the boron box in which the counter was placed. In the case of double counter experiments, semi-cylindrical lead covers 1.0 mm. thick were attached to the outer sides of the counters.)

Now, we can consider two possibilities: (1) the gamma-rays are emitted in the D-D reaction; or (2) the beta-rays are emitted under the action of fast neutrons from the substances of which the counter, including lead covers, is constructed. To decide between these alternatives, lead and aluminium absorbers 2 cm. in thickness were inserted between the target and the counter. The effect of the gamma-rays excited in the absorbers was allowed for. The decrease in the rate of discharge of the counter was conclusively in favour of the second alternative.

We further investigated the change in the number of responses when the lead cover 0.5 mm. in thickness was replaced by the sheets of carbon, aluminium, iron, nickel, copper, zinc, silver, cadmium and platinum of about 0.5 gm./cm.<sup>2</sup> thickness, which was sufficient to stop the beta-rays of energy lower than 1.3 mv. A similar effect was observed in each case, and the effect seems to increase rather smoothly with the atomic number, while the energy of the electrons remains constant within the experimental error.

In explaining this phenomenon, the effect of ordinary induced radioactivity is excluded, for we could observe no activity remaining after the bombardment. It was easily proved impossible to explain the observed large effect by the gamma-rays excited in the walls of the counter and its cover, which were comparatively small. The only possible explanation in terms of the reaction hitherto known is the excitation of the nucleus by the fast neutrons, and subsequent emission of the extra-nuclear electrons through internal conversion. If this be true, the coefficient of the internal conversion must be very large, that is, nearly equal to unity for all the elements investigated, including light elements such as carbon and aluminium. Further, the smooth dependence of the effect on the atomic number seems to indicate also the inappropriateness of the assumption.

We must then assume some new types of interaction of the neutron with atoms, such as the direct interaction of neutrons with the bound electron, or the disintegration of a neutron into an electron and a proton in the nuclear field. The cross-section of the process was estimated to be of the order of  $10^{-26}$  cm.<sup>2</sup> for the light elements and  $10^{-24}$  cm.<sup>2</sup> for the heavy elements. These values are very much higher than those expected from existing theories. The observed energy of the electrons is what might be expected from the disintegration of neutrons. If this assumption be correct, we should have to find trident tracks, consisting of an electron, a proton and a recoil atom, in a Wilson chamber traversed by neutrons in amount well above the error of observation.

A detailed account of the experiments will be published in the *Proc. Phys.-Math. Soc. Japan* soon.

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<sup>1</sup> International Conference on Physics (1935), p. 159.

<sup>2</sup> *Helv. Phys. Acta*, 8, 601 (1935).

<sup>3</sup> *Proc. Phys.-Math. Soc. Japan*, 18, 35 (1936); 18, 115 (1936).



### An X-Ray Study of Sulphuric and Orthophosphoric Acids

THE study of X-ray diffraction patterns of liquids is one of the least indirect means of obtaining information concerning their structure, but the amount of information is restricted by the limitations of the theory. The straightforward application of the original Debye theory<sup>1</sup> leads to an expression for the intensity of scattering

$$I = I_0 \frac{e^4}{m^2 c^4} \cdot \frac{P}{R^2} F^2 \left[ 1 + \int_0^\infty 4\pi r^2 [g(r) - \rho] \frac{\sin sr}{sr} dr \right] \quad (1)$$

where  $I_0$  is the intensity of the incident beam,  $P$  is the polarization factor,  $R$  the distance from specimen to point of observation;  $4\pi r^2 g(r) dr$  represents the number of atoms or molecules lying within radii  $r$  and  $r + dr$ ;  $\rho$  is the mean density in atoms or molecules per c.c.,  $e$ ,  $m$  and  $c$  have their usual significance, and  $s = 4\pi \sin \theta/\lambda$ , where  $\theta$  is half the scattering angle.

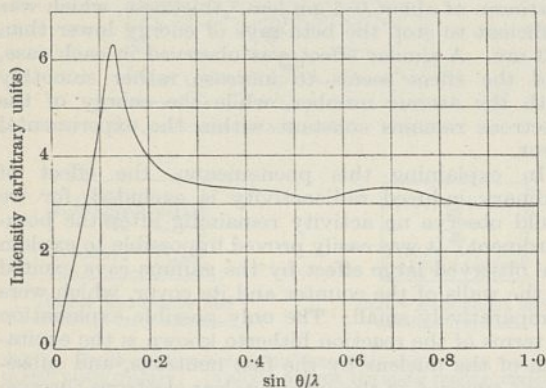


FIG. 1. Scattering of molybdenum  $K\alpha$  radiation by orthophosphoric acid.

In the simple case of an atomic liquid, such as sodium,  $F^2$  is identical with  $f^2$ , the square of the atomic scattering power. By the use of Fourier inversion, it can be shown that:

$$4\pi r^2 g(r) = 4\pi r^2 \rho + \frac{2r}{\pi} \int_0^\infty s \varphi(s) \sin rs ds \quad (2)$$

where

$$\varphi(s) = \frac{(I/kP - f^2)}{f^2} \quad \text{and} \quad k = \frac{I_0 e^4}{m^2 c^4} \cdot \frac{1}{R^2}$$

$\varphi(s)$  can be derived from a knowledge of  $f^2$  and the experimental scattering curves, and it is therefore possible to obtain a Fourier analysis of the distribution of matter in the liquid<sup>2,3</sup>.

For a molecular liquid

$$F^2 = \sum_p \sum_q f_p f_q \frac{\sin sr_p q}{sr_p q}$$

and a knowledge of the internal structure of the single molecule is necessary before (2) can be applied.  $g(r)$  then gives the distance apart of molecular centres.

In the case of sulphuric and orthophosphoric acids, the rigid tetrahedral nature of the  $\text{SO}_4$  and  $\text{PO}_4$  groups is beyond question, and it was thought to be of interest to determine the arrangement of molecules in the liquids. (When  $f^2$  becomes  $F^2$ ,  $g(r)$  refers to molecules and not to atoms.) Strictly speaking,

orthophosphoric acid is a sticky solid, but a trace of water, about 1 per cent, is sufficient to turn it into a liquid.

The Fourier analysis is not yet complete, but it is clear that the scattering curves for the two liquids are almost identical, each having one main sharp diffraction band at an equivalent spacing of 3.85 Å. There are, however, minor differences between the curves at larger values of  $\sin \theta/\lambda$ . Fig. 1 shows the scattering curve for orthophosphoric acid, taken with molybdenum radiation, and corrected for lack of polarization in the incident beam.

Further studies of other acids and molecules of roughly spherical shape should be of interest. The theory takes no account of molecular rotation; in spherical molecules this effect should be of minor importance, and the Fourier analysis can be relied on to give a fairly accurate picture of the average distance apart of molecules in the liquid.

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<sup>1</sup> Debye, *Ann. Phys.*, **46**, 809 (1915).

<sup>2</sup> Debye and Menke, *Phys. Z.*, **31**, 797 (1930).

<sup>3</sup> Tarasov and Warren, *J. Chem. Phys.*, **4**, 236 (1936).

### Specific Heat of a Liquid at Different Temperatures

IT is possible to measure the specific heat of a liquid at a number of different temperatures by determining the power required to hold the temperature of a calorimeter and its contents stationary at different temperatures above that of the surroundings. The power is supplied electrically to a coil immersed in the liquid, and we have

$$-(Ms + W) d\theta/dt = E^2/RJ.$$

If a cooling curve is now taken, it can be shown that within the limits of experimental error,

$$-d\theta/dt = K\theta^n,$$

where  $n$  is nearly, but not exactly, equal to 5/4,  $K$  and  $n$  being determined by the use of a least-square or some equivalent method. We thus have

$$(Ms + W) K\theta^n = E^2/RJ,$$

giving the specific heat  $s$  in terms of the 20° calorie, if an experiment be performed with water at 20° C.

The method has proved to be surprisingly sensitive, and gives results which are reproducible with a very high degree of consistency. We have used the method to determine the specific heat of water over the range 15°–45° C., and, by the very great kindness of Imperial Chemical Industries Ltd., we were able to conduct an experiment with heavy water of 99.2 per cent purity over the same range. The sample of heavy water lent to us was 375 gm. in mass, and, although this is relatively a large quantity of a rare liquid, it is small compared with the quantity demanded by a continuous-flow experiment. The accompanying table gives results in terms of the 20° calorie:

Temp.	Water	Heavy water
15° C.	1.0010	1.009 <sub>0</sub>
20° C.	1.0000	1.007 <sub>5</sub>
25° C.	0.9991	1.005 <sub>5</sub>
30° C.	0.9986	1.004 <sub>5</sub>
35° C.	0.9984	1.003 <sub>5</sub>
40° C.	0.9984	1.002 <sub>5</sub>
45° C.	0.9986	1.001 <sub>5</sub>



It will be seen that the results for deuterium oxide are consistently higher than the values for water, and that a minimum value is shown at about 41° C.

These values, which were announced at the Black-pool meeting of the British Association, are preliminary in character, and may be subject to small corrections.

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Effect of Large Centrifugal Forces on  
*Paramecium*

THE effect of subjecting *Paramecium* to large centrifugal forces has been investigated and has given some encouraging results.

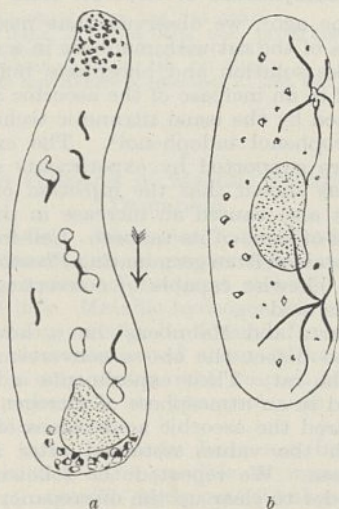


FIG. 1. (a) Centrifuged, (b) control *Paramecium*. The arrow indicates the direction of the force.

Fig. 1 illustrates the effects produced. The animal becomes elongated. The nucleus and crystals are moved to the centrifugal side, the excretory mechanism is fragmented, the canals being torn away from the pore and enlarging to form vacuoles. In addition, there is a collection of small granules visible after the Golgi methods, both osmic acid and silver. These granules are moved towards the centripetal pole, and it is thought that they may be Golgi bodies of a rudimentary type.

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Diffraction of Light by Ultra-sonic Waves

WE have recently given a theory of the diffraction of light by ultra-sonic waves, which is quite general and leads to numerical results for the diffracted intensities<sup>1</sup>. In this paper, we considered normal incidence only; we have now calculated some diffraction patterns at oblique incidence. We found these

in good agreement with the experimental results of Parthasarathy<sup>2</sup>.

Parthasarathy apparently explains the observed asymmetry of the diffraction pattern by the "characteristic reflection" of light on the ultra-sonic wave, although we know from the theory of diffraction of X-rays in crystals that this reflection is simply a consequence of the equations of propagation. In fact, even for X-rays, as Ewald has shown<sup>3</sup>, Bragg's angle of reflection is not sharp, but spreads out over a region which covers a few seconds of arc, and our theory shows that for ultra-sonic and light waves this region is much larger and may cover as much as a few degrees.

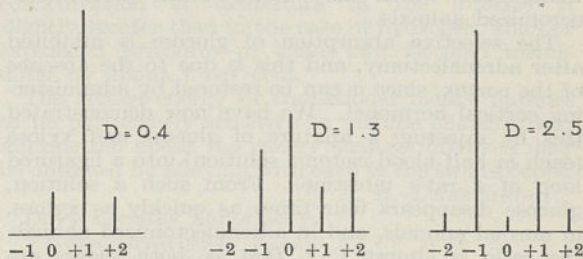


FIG. 1. Intensity of the diffracted light in the various orders for three different values of the thickness  $d$  of the ultra-sonic beam. The light is incident obliquely in the direction of the +1 order, the 0 order being on the normal to the direction of the ultra-sonic wave.  $d$  is connected to the pure number  $D$  which appears in the figures through the relation  $D = \frac{\pi \lambda}{\Lambda^2} d$ ,  $\lambda$  and  $\Lambda$  being the wave-lengths of the light and of the sound waves respectively.

The three diagrams reproduced (Fig. 1) show the calculated intensities in the different orders of diffraction for different thicknesses of the beam of ultra-sonic waves. The angle of incidence and the intensity of the ultra-sonic waves have been kept constant. One sees clearly that the repartition of intensity among the different orders is a function of the thickness of the ultra-sonic beam. The reason for this is that the intensity of a wave diffracted in Laue fashion is a quasi-periodic function of the thickness of the diffracting medium (corresponding to the *Pendellösung* of Ewald for X-rays).

Our diagrams exhibit the asymmetry which is the main feature of Parthasarathy's photographs. It is, of course, impossible to obtain more than qualitative agreement, without precise information about the intensity and breadth of the ultra-sonic beam.

The geometrical representation of Ewald allows an interpretation of the equivalent Brillouin theory, which clarifies greatly the apparent mathematical complexity of the latter. In fact, one can reason out very simply the exact solution of the problem of diffraction, and this seems much easier than trying to solve it approximately, as N. S. Nagendra Nath has done in a recent paper<sup>4</sup>.

The complete report of our investigation will appear shortly in the *Helvetica Physica Acta*.

I wish to thank Prof. Weigle for his valuable advice in this work.

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<sup>1</sup> R. Extermann et G. Wannier, *Helv. Phys. Acta*, 9, 520 (1936).  
<sup>2</sup> S. Parthasarathy, *Proc. Ind. Acad. Sci.*, 3, 594 (1936).  
<sup>3</sup> P. P. Ewald, "Handb. der Phys.", 24, 2, p. 285 (1933).  
<sup>4</sup> N. S. Nagendra Nath, *Proc. Ind. Acad. Sci.*, 4, 222 (1936).



### Sodium and Water Metabolism in Relation to Disturbances of Carbohydrate Metabolism after Adrenalectomy

WE have found that in the absence of the adrenal cortex, flavin is not transformed to flavin phosphoric acid, but that adrenalectomized animals can be kept alive with large quantities of the latter substance (vitamin B<sub>2</sub>)<sup>1</sup>. We have also shown that lack of adrenal cortex causes serious disturbances in intermediate metabolism of carbohydrates and fats, particularly in the absorption of these substances<sup>2-5</sup>. In the following experiments, we have tried to show how these facts are related to the well-known disturbances of water and sodium metabolism which may cause death in adrenalectomized animals.

The selective absorption of glucose is inhibited after adrenalectomy, and this is due to the absence of the cortex, since it can be restored by administering cortical hormone<sup>1</sup>. We have now demonstrated this by injecting a mixture of glucose and xylose (each in half blood-isotonic solution) into a ligatured loop of a rat's intestine. From such a solution, glucose disappears four times as quickly as xylose, in normal animals, and in adrenalectomized animals the ratio is almost 1:1, that is, both sugars are absorbed at the same rate.

TABLE 1. Absorption of a mixture of 3 c.c. of 5.4 per cent glucose and 3 c.c. of 4.5 per cent xylose from a 60 cm. loop of intestine in a rat during one hour.

	Injected (gm.)		Absorbed (gm.)		Ratio of Absorption
	Glucose	Xylose	Glucose	Xylose	
Normal rats	0.162	0.135	0.146	0.034	4.3:1
Adrenalectomized rats	0.162	0.135	0.049	0.028	1.7:1

If the selectively rapid absorption of glucose from an intestinal loop is inhibited by poisoning the animal with iodoacetic acid, then sodium salts diffuse into the interior of the intestine more rapidly than glucose leaves it; hypertony results, and a large quantity of water enters the intestine by osmosis<sup>6</sup>. Exactly the same happens when the selective absorption of glucose is inhibited by adrenalectomy. The intestine is found to be full of fluid one hour after glucose administration. The example given in Table 2 is typical of many such experiments.

TABLE 2. Absorption of 5.4 per cent glucose solution from a 30 cm. intestinal loop of a rat during one hour.

	Glucose (gm.)		Fluid movement (c.c.)	
	Injected	Absorbed	Injected	Found
Normal rat	0.162	0.147	3	0.6
Adrenalectomized rat	0.162	0.042	3	3.5

Thus in adrenalectomized rats, ingestion of glucose causes great losses (into the intestine) of sodium by diffusion and of water by osmosis. Therefore the adrenalectomized animals, in contrast to normal rats, develop intensive diarrhoea after glucose administration. This is also seen in normal animals after the administration of xylose, which is slowly absorbed, or after glucose with iodoacetic acid poisoning, when the glucose is also slowly absorbed.

Thus the inhibition of the selective absorption of glucose in adrenalectomized animals leads *secondarily* to losses of sodium salts and water. Similar disturbances are possible in the intermediate metabolism of carbohydrates and fats<sup>3-5</sup>.

These secondary disturbances of loss of sodium and water may be the cause of death of adrenalectomized animals which can be prevented by giving sodium salts. In several cases, rats adrenalectomized

8-15 days before, died in 3-5 hours when 5 c.c. of 50 per cent glucose solution was fed by stomach tube. A second group of such rats survived when sodium chloride and carbonate were given simultaneously. This supports the above explanation.

A detailed report will be published in *Pflügers Archiv*.

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- <sup>1</sup> F. Verzár and L. Laszt, *Pflügers Arch.*, **237**, 476 (1936).  
<sup>2</sup> W. Willbrandt and L. Lengyel, *Biochem. Z.*, **267**, 204 (1933).  
<sup>3</sup> F. Verzár, *J. Physiol.*, **84**, Proc. (1935).  
<sup>4</sup> F. Verzár and L. Laszt, *Biochem. Z.*, **270**, 351 (1934); **276**, 11 (1935); **278**, 396 (1935); **285**, 356 (1935).  
<sup>5</sup> F. Verzár and L. Jeker, *Pflügers Arch.*, **237**, 13 (1936).  
<sup>6</sup> F. Verzár and E. J. McDougall, *Pflügers Arch.*, **236**, 321 (1935).

### Biosynthesis of Ascorbic Acid

SOME time ago<sup>1</sup>, we observed that incubation of some tissues of the rat with mannose in a mixture of Ringer-Locke solution and phosphate buffer at pH 7.4 resulted in an increase of the ascorbic acid value, as determined by the usual titrimetric technique with 2:6-dichlorophenol indophenol<sup>2</sup>. The experiments *in vitro* were supported by experiments *in vivo*, in which it was shown that the injection of mannose into the rat also caused an increase in the ascorbic acid content of some of its tissues<sup>3</sup>. Cell-free extracts were also obtained from germinating *Phaseolus mungo*, which were likewise capable of converting mannose into ascorbic acid<sup>4</sup>.

Euler, Gartz and Malmberg<sup>5</sup> have, however, not been able to detect the above conversion with the tissues of the rat. Their experiments indicate that they worked in an atmosphere of nitrogen, and that they compared the ascorbic acid values of the fresh tissues with the values obtained after incubation with mannose. We repeated the following experiments in order to clear up the discrepancy. 0.5 gm. of the finely minced tissue was used in each case, suspended in a mixture of 3 c.c. Ringer-Locke solution and 2 c.c. phosphate buffer of pH 7.4, to which 1 c.c. of a freshly prepared aqueous solution, containing 20 mgm. mannose, was added. This was shaken up and incubated for 3 hours at 37° in a 25 c.c. conical flask closed with a rubber cork. The flask was not shaken any more. The control vessel contained 1 c.c. water instead of the mannose solution. Two other vessels contained the same two mixtures in an atmosphere of nitrogen. The results are shown in the accompanying table:

Ascorbic acid (mgm.) per 0.5 gm. liver tissue.

Expt.	In nitrogen		In air		Percentage of increase in air
	With mannose	Without mannose	With mannose	Without mannose	
1	0.29	0.29	0.27	0.20	35
2	—	—	0.21	0.19	10
3	0.32	0.32	0.25	0.21	18
4	0.32	0.32	0.21	0.18	16
5	0.22	0.22	0.13	0.13	23
6	—	—	0.097	0.080	21

These figures show that in an atmosphere of nitrogen the amount of ascorbic acid remains constant, whether mannose is added or not. But in a closed volume of air, if the experiments are carried out



precisely under the conditions mentioned, there is an increase in the amount of ascorbic acid on incubation with mannose. The ascorbic acid value thus obtained after incubation with mannose in air is, however, invariably lower than the value obtained with the fresh tissue, and cannot naturally be compared with it. The figures obtained after incubation with and without mannose are alone comparable. It appears from these results that molecular oxygen is necessary for the conversion with which we are dealing.

Similar results have been obtained with the aqueous extracts of germinated *Phaseolus mungo*, which can also convert mannose into ascorbic acid at pH 5.8 in a closed volume of air but not in nitrogen. Numerous experiments have been carried out in this connexion, and they will be reported later.

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- Guha and Ghosh, *NATURE*, **134**, 739 (1934).  
 2 Ghosh and Guha, *J. Indian Chem. Soc.*, **12**, 30 (1935).  
 3 Guha and Ghosh, *NATURE*, **135**, 234 (1935).  
 4 Guha and Ghosh, *NATURE*, **135**, 871 (1935).  
 5 Euler, Gartz and Malmberg, *Biochem. Z.*, **282**, 402 (1935).

### Expansion Pressures of Metallic Hydrogen and Deuterium

From a recent calculation<sup>1</sup>, it follows that the striking difference in properties between hydrogen and lithium is due to the great stability of the covalent H-H link. Metallic hydrogen (the analogue of metallic lithium) would be formed from hydrogen atoms with an evolution of about 10 kcal. per gm. atom, but is only stable with respect to diatomic hydrogen molecules at pressures not less than  $2.5 \times 10^6$  atmospheres.

Although these pressures have not been experimentally realized, it is possible to investigate the properties of metallic hydrogen (Graham's hydrogenium) in some of its alloys. There is evidence that in the 'hydrides' of transitional elements such as tantalum, palladium and nickel, as well as in solutions of hydrogen in other metals at high temperatures, the hydrogen is in the metallic state, that is, is dissolved as atoms, and is partly dissociated into protons and electrons<sup>2</sup>.

One of the most readily investigated properties is the expansion pressure. Although on purely geometrical grounds the hydrogen atoms and protons could fit into the interstices of the metal lattice with which the hydrogen is alloyed, metallic hydrogen exerts a considerable expansion pressure. For palladium, with a compressibility of approximately  $0.4 \times 10^{-6}$  per atmosphere, an expansion pressure of  $2.5 \times 10^6$  atmospheres would lead to an expansion of 10 per cent in volume, whereas the observed value, when approximately 0.5 gm. atom H is added per gm. atom Pd, is 11 per cent.

In a recent communication<sup>3</sup>, a method is described for investigating special problems in the structures of solids, by making use of the differences in zero point energy when deuterium is substituted for hydrogen. The changes are usually quite large enough for X-ray investigation, and provide an additional parameter which can be varied in studying the equilibrium of the lattice. In the case of the metallic linkage, for example, it is possible to obtain an estimate of the differences in expansion pressures

of metallic hydrogen and deuterium, by measuring the expansion of the palladium lattice when alloyed with each of these isotopes.

As is discussed in a forthcoming publication, the expansion of the palladium lattice leads to an increased heat of solution of hydrogen, with the result that below about 300° C. two phases with atomic ratio H/Pd about 0.02 and 0.5 are formed, with the same lattice structure and the same dissociation pressure of hydrogen. By investigating these two phases in equilibrium, when either hydrogen or deuterium is dissolved in palladium, it is found that the average expansion in the lattice parameter on forming the  $\beta$ -phase is  $0.1430 \pm 0.0004$  A. for hydrogen,  $0.1325 \pm 0.0004$  A. for deuterium. The concentration of deuterium in the  $\beta$ -phase is slightly greater than in the case of hydrogen, and the expansion pressures of these two isotopic metals differ by about 7 per cent.

The lattice energy of transitional metals appears to be particularly sensitive to volume changes, and information about the energy changes involved may be obtained by alloying with each of the two isotopes.

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- <sup>1</sup> Wigner and Huntington, *J. Chem. Phys.*, **3**, 764 (1935).  
<sup>2</sup> cf. Ubbelohde, *Trans. Far. Soc.*, **28**, 275 (1932).  
<sup>3</sup> Ubbelohde, *Trans. Far. Soc.*, **32**, 525 (1936).

### Viscosity of Binary Mixtures

SEVERAL attempts have been made to represent the viscosity,  $\eta$ , of a mixture, as a function of the concentrations,  $c_1$  and  $c_2$ , and the viscosities,  $\eta_1$  and  $\eta_2$ , of the components. So far as we are aware, all investigators (with the exception of Dolezalek) have used the general form:

$$f(\eta) = c_1 f(\eta_1) + c_2 f(\eta_2)$$

with various expressions for  $f$ , such as  $f = \log \eta$  (Arrhenius),  $f = 1/\eta$  (Bingham),  $f = \eta^{1/3}$  (Kendall and Monroe). The latter demonstrated very clearly that, with any of these functions, deviations up to 20 per cent and more appear, when used for mixtures of two liquids with very different physical constants. As a matter of fact, there is no reason to suppose that any expression of this general form can give satisfaction.

Let  $N_1$  and  $N_2$  be the mole fractions of the two components; let us denote by  $z_1$  the interaction of one particular molecule of kind 1 in the layer  $A$  with a molecule of the same kind in layer  $B$ , and by  $z_{12}$  the interaction with a molecule of kind 2. The relative amounts of these interactions of the molecule in the layer  $A$  will be proportional to their probabilities, and thus, in the simplest case, also proportional to the number of the molecules of kind 1, respectively kind 2 in the layer  $B$ , that is, to  $N_1$  and  $N_2$ . The relative amount of the interaction between the two layers  $A$  and  $B$  generated by the total number of molecules of kind 1 is then again proportional to  $N_1$ , and thus amounts to  $(N_1 z_1 + N_2 z_{12}) \cdot N_1$ . Similarly, that of the molecules of kind 2 amounts to  $(N_2 z_2 + N_1 z_{12}) \cdot N_2$ . If  $z$  denotes the total interaction, we may thus write:

$$z = N_1^2 z_1 + 2 N_1 N_2 z_{12} + N_2^2 z_2;$$

and as we may put  $N_1 + N_2 = 1$ ,

$$z = N_1^2 (z_1 + z_2 - 2z_{12}) + 2N_1 (z_{12} - z_2) + z_2 \quad (1)$$



The dissipation of energy occurring when the two layers *A* and *B* are sliding over each other (as in laminar flow) results from their interaction. In other words, the internal friction must be some function of *z*. Dolezalek<sup>1</sup> assumed  $z = \eta$ , but his assumption does not give results in agreement with the experimental data. For reasons which will be stated elsewhere, we have to put  $z = \log \eta$ , and thus, from (1)

$$\log \eta = N_1^2 \cdot \log \frac{\eta_1 \eta_2}{\eta_{12}^2} + 2N_1 \cdot \log \frac{\eta_{12}}{\eta_2} + \log \eta_2 \quad (2)$$

On the other hand, Guzman has pointed out, and Sheppard<sup>2</sup> recently emphasized, that  $\log \eta$  represents a work-function, and thus (2) represents an energy relationship.

This relationship contains only one constant, namely  $\eta_{12}$ : the coefficient of internal friction for molecules of two different kinds. This coefficient should be used in the calculation of diffusion.

Equation 2 fits the data, determined by Kendall and Monroe<sup>3</sup>, with fair accuracy; especially the system benzylbenzoate-toluene, in which case the interpolation formulæ hitherto employed gave very unsatisfactory results (see accompanying table). The same holds for the system hexane-carbontetrachloride.

We obtained by equation 2, again from the data of Kendall and Monroe, for the viscosity of naphtha-

lene dissolved in benzene or in toluene, at 25° C. 2.19 and 2.24 centipoises respectively. The values calculated by Kendall and Monroe differed by more than 20 per cent in the two solvents, as in the case of diphenyl, while we obtain, from the same data, 3,740 centipoises in each case.

$N_1$	$\eta$ observed (K. and M.)	$\eta$ calcul. (K. and M.)	$\eta$ calcul. (equat. 2)	Difference (K. and M.)	Difference (equat. 2)
0.000	0.552	—	0.552	Per cent	Per cent
0.2387	1.183	1.362	1.15	+ 15.1	- 2.6
0.4261	2.015	2.399	2.01	+ 19.1	- 0.4
0.6502	3.614	4.182	3.64	+ 15.7	+ 0.7
0.7890	5.080	5.645	5.15	+ 11.1	+ 1.5
0.9002	6.660	7.024	6.67	+ 5.5	+ 0.6
1.000	8.450	—	8.45	—	0
$\eta_{12} = 2.75$ centipoises					

$N_1$  = mole fraction of benzylbenzoate, in toluene.

The same line of reasoning is being applied to a number of related problems. It seemed, however, worth while to publish these first results.

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<sup>1</sup> Dolezalek, *Z. phys. Chem.*, **83**, 73 (1913).

<sup>2</sup> Sheppard, *NATURE*, **125**, 489 (1930).

<sup>3</sup> Kendall and Monroe, *J. Amer. Chem. Soc.*, **39**, 1785 (1917).

## Points from Foregoing Letters

PROF. H. MUNRO FOX shows that the rates of cleavage of sea urchin eggs are adapted to the temperature of the seas in which they live. For a given rate of cleavage, a higher temperature is necessary in a certain Mediterranean species than in an English species of the same genus; and the same phenomenon occurs within another single species in different latitudes.

Support for Helmholtz's theory that the elements responsible for the initiation of electrical ('action') potentials in the inner ear are 'resonant structures', is adduced by C. S. Hallpike, Prof. H. Hartridge and Dr. A. F. Rawdon-Smith. They find by means of oscillograph records that a 180° phase change in a stimulating tone produces a 'silent period' in the auditory tract potential. No such silent period is observed in the cochlear response, though the phase change is recorded.

Mathematical considerations of the problem of phase transitions between liquids and crystals lead Dr. L. Landau to the view that a Curie point line (with jumps of specific heat, on melting) is not possible, but that there is a possibility of a continuous transition, without a jump in the energy, at a single point in the pressure-temperature plane.

The emission of beta-rays (electrons) from metals during bombardment with fast deuterons is reported by S. Kikuchi, H. Aoki and K. Husimi. There is no residual activity after the bombardment, and the authors consider that the observed effect is due to new types of interaction of the neutron with atoms.

A curve showing the scattering of X-rays ( $K\alpha$  rays of molybdenum) by orthophosphoric acid (containing 1 per cent of water) is submitted by J. T. Randall. The author states that this is almost identical with

that for sulphuric acid and, in view of the known rigid tetrahedral nature of the  $\text{SO}_4$  and  $\text{PO}_4$  groups, he intends, by means of a Fourier analysis of the curves, to deduce the distribution of matter in those liquids.

The specific heats of water and of heavy water at various temperatures between 15° and 45° C. have been calculated by Prof. A. Ferguson and A. H. Cockett by determining the electrical power needed to hold the temperature of a calorimeter and its contents stationary at different temperatures above the surrounding medium.

If glucose is administered to rats from which the adrenal glands have been removed, sodium and water diffuse into the intestine producing diarrhoea. The effect may be lethal, but it can be inhibited by giving simultaneously sodium salts. Prof. F. Verzár and L. Laszt, reporting these results, state that they may be related to the previously observed effect of vitamin B<sub>2</sub> on adrenalectomized rats.

Further experiments by Prof. B. C. Guha and B. Ghosh confirm their previous findings, that rat tissue incubated with mannose, in the presence of a limited amount of air, leads to an increase in the amount of ascorbic acid. This increase, however, does not take place when nitrogen is substituted for air, which explains the negative results obtained by Euler, Gartz and Malmberg.

A. R. Ubbelohde reports that X-ray measurements show the expansion pressures of hydrogen and deuterium dissolved in palladium to differ by about 7 per cent. He concludes that in certain hydrides the hydrogen is probably present in the metallic state, and exerts a considerable expansion pressure on the metal with which it is alloyed.



## Research Items

### Marriage among Serbian Gypsies

IN a final study of the Serbian gypsies, Dr. Alexander Petrovič deals with certain conditions affecting the married state (*J. Gypsy Lore Soc.*, iii, 15, 4). Although monogamy is the rule, polygamy is not unknown, depending upon ability to bear the expense of additional marriages. The orthodox gypsies, however, are forbidden plural marriages by law. Among the gypsies of Rogatika, although they are Moslem, polygamy is rare on account of their poverty. The wealthy nomad tin-smiths as a rule have a plurality of wives. One gypsy aged forty years has three wives; and for these it is the custom that one should remain on duty in the tent for a period of eight days, while the other two go out begging. Only rich Christian gypsies solemnize marriage as soon as the bride is brought home. Usually the bride is kept for a while on trial, especially when she is too young for the priest to marry the couple legally. Others do not marry in order to escape payment, or to facilitate getting rid of an undesired wife. Permanence of marriage depends upon economic conditions. In this there is great difference between towns and villages, and different occupations, as for example, between musicians and factory hands. Begging and high earnings in factories have an appreciable effect on the fidelity of the women; and this is the cause of constant quarrels. Of the men in the villages, only one quarter had been married once only, while the remainder had been married repeatedly. In both sexes more than fifty per cent of the marriages had lasted from one to four months only. As a rule, the last marriage lasts the longest—six years and upwards. While the men in the towns tend to marry at a slightly later age than in the villages, the girls marry quite as early.

### Cultural Contacts between India and China

IN *Current Science* (August 1936) an interesting paper appears entitled "The Himalayan Uplift since the Advent of Man: Its Culthistorical Significance" by Prof. B. Sahni. The main idea of Prof. Sahni's paper is to show that cultural contacts between India and China have probably existed since the dawn of human existence; that intercourse between the two countries by direct route across the Himalaya was possible before man conquered the ocean. On the evidence amassed by explorers and observers, it is held that round about Middle Pleistocene time, when the main valley of Kashmir was still occupied by the great 'Karewa Lake', interglacial man of about the same stage of cultural development as Neanderthal or Mousterian man in Europe and as Peking man in the Far East, flourished (a) in the plains of the northern Punjab, (b) on the shores of the Karewa Lake in the heart of Kashmir, and (c) just across the great Himalayan Range. The close cultural contacts between India and China during the historic period are fairly easily explained, as both countries possessed considerable seafaring power in ancient times, whilst the physical endurance of the Buddhist pilgrim mountaineers has become legendary. Palæolithic man had little incentive to travel beyond the

necessary distances to provide him with his daily food. Even if he had wandered between the Punjab and Kashmir, it would be difficult to explain his crossing even the lowest pass in the Himalayas. Thus, the importance of the uplift of the Himalayas during the human epoch is evident.

### Two-Factor Inheritance in Man

IN the Laurence-Moon syndrome, first described in 1866, mental retardation is accompanied by obesity, hypogenitalism, retinal degeneration with pigmentation, and polydactyly, the last condition alone being visible at birth. Dr. E. A. Cockayne has recently shown that although normal parents may produce affected children, their frequency is too great to be due to a single recessive factor. Dr. Madge T. Macklin (*J. Heredity*, 27, No. 3) has collected from the literature 53 families having a total of 283 children, 112 (or 39.6 per cent) of whom were affected. There is also an excess of affected males. An analysis of the various families leads to the conclusion that the condition is due to the presence of two genes, one an autosomal dominant and the other a sex-linked recessive. The large range of characters affected would also support the hypothesis that more than one gene was probably concerned. Cousin marriages are also found to be more frequent in these pedigrees than in the ordinary population.

### Diseases of Birds

THE Biological Institute of São Paulo, Brazil, has published a valuable treatise upon the diseases of birds, compiled by J. Reis, P. Nobrega and A. S. Reis ("Doenças das Aves, Tratado de Ornithopathologia", pp. 469). The thoroughness with which the compilation has been made may be judged by the extent of a few of the sections of the work: virus diseases, 91 pages; various forms of mycetosis, 142 pages; protozoan diseases, 78 pages; diseases of nutrition, 21 pages. The book is well illustrated by photographs and diagrams.

### American Flies of the Genus *Psychoda*

THE family Psychodidæ has been the subject of great attention, particularly with reference to the blood-sucking genus *Phlebotomus*, while the non-hæmophagous forms of the genus *Psychoda* have attracted much less notice. Both in Europe and North America the species *Psychoda alternata* and *P. phalænoides* breed in vast numbers in sprinkling filter beds. At times they issue in such swarms that it is impossible to work in the vicinity without the creatures entering the mouth and nose. No adequate evidence, however, has been presented with regard to their functioning as disseminators of disease germs. In the *Philippine Journal of Science* (59, No. 1, 85; 1936), Mr. F. del Rosario contributes a detailed revisional study of the genus, dealing with the American species. Since Haseman's work, published in 1907, little attempt has been made at a taxonomic study of the group in so far as North America is concerned.



Crustacea from the *Godthaab* Expedition

DR. K. STEPHENSEN has extended our knowledge of the distribution of many species of Crustacea from the waters between Greenland and Arctic America north of the east corner of Labrador in his two papers "Crustacea Decapoda" and "Crustacea Varia" (The *Godthaab* Expedition 1928. Leader: Eigil Riis-Carstensen. Meddelelser om Grønland, Bd. 80. No. 1, 1935 and No. 2, 1936). The decapods are here divided into bottom and pelagic forms, the bottom forms into Arctic, Boreal and Atlantic, the pelagic forms into Arctic and Atlantic. The Arctic forms are again sub-divided, the whole arrangement being based mainly on the summary by Holsten (1916), and maps of the distribution of the species are given. Specially interesting is the distribution of *Bythocaris leucopsis* and *B. payeri*, the former belonging to much deeper water than the latter, *Ephyrina benedicti* new to northern waters, *Hymenodora glacialis* and *H. gracilis*. The finding of the two *Bythocaris* species and *Hymenodora glacialis* proves the identity of the Arctic deep-sea faunas north of the ridge east and west of Greenland. Most useful in the decapod paper are descriptions of larval forms, many of which were hitherto unknown. The larvæ of *Chionoeetes opilio* and of *Hymenodora glacialis* are described for the first time, and a beautiful new *Eryoneicus* (*E. groenlandicus*) which is certainly a larval form. There are also numerous suggestive notes on other larvæ not definitely fitted into their respective places, but the probable adults in most cases being given. In "Crustacea Varia" are included the groups not recorded in the other *Godthaab* Expedition papers.

## Anther Smut of Carnations

DR. H. L. WHITE has directed attention (*Gard. Chron.*, Oct. 3) to the prevalence of the rather unique disease caused by the fungus *Ustilago violacea*. This organism can attack a large number of Caryophyllaceae hosts; but its effects are not usually noticeable until dark-coloured smutty spores are produced upon the anthers. The disease has probably occurred frequently where carnations have been grown in glasshouses; but it has recently attained rather more serious proportions. Numerous side shoots appear on an infected plant, before spores are produced. This feature favours control, for such shoots can be removed before they become a source of further infection, and they should also be rejected in the selection of shoots for purposes of propagation.

## The Plant Chloroplast

PROBABLY no more important physiological unit can be chosen for study than the green chloroplast which is usually regarded as the seat of the photosynthetic process, yet an interesting paper by Kogane Kiyohara (*J. Fac. Sci., Tokyo*, Sec. 3, Botany, 4, Pt. 5) makes it clear how little definite information we have as to its structure and life-history. From a study of 262 species of flowering plants, he finds that the plastid is always a round object, spherical or a more or less flattened disk, with a diameter of about  $5\mu$ . Treatment with silver nitrate or osmic acid reveals a blackened ring in this disk; the starch formation is associated with the non-blackening central region of the plastid. In *Hydrilla verticillata*, in the growing cells of the leaf-base, clear cases are figured of the elongation and subsequent division of such disk-like chloroplasts, an observation

which confirms the views of Schimper and Meyer. But a more controversial point is raised by the author's observation that whilst certain fixatives, particularly Kolatchev's and Carnoy's, show round typical chloroplasts in meristematic cells, the normal chondriosome fixatives distort these structures—which appear to be fluid in these meristematic cells—into typical thread-like chondriosome structures, so that the author concludes that the genetic connexion of chondriosomes with chloroplasts and indeed the presence of chondriosomes in plant cells is not as yet established.

## Direct Oxidation of Soil Humus

DECOMPOSITION of organic matter in the soil leads, amongst other things, to the production of nitrates, which may be used directly by growing crops. Mr. C. B. Greening has suggested (*J. Roy. Hort. Soc.*, 61, Pt. 9; Sept. 1936) that this change might be brought about directly by oxidation of the organic matter with potassium permanganate. Lawns and several garden crops have benefited by the application of a dilute solution of this substance. Experiments quoted in the paper are on a very small scale, but larger trials are in progress at Wisley. The production of large quantities of nitrate in the soil is not to be desired for most crops, and any quick process of oxidation would deplete the soil of its reserves of organic matter, but the new process may well find application in some particular technique of horticulture, and in any case it would provide a new item of intellectual equipment for the scientific gardener.

## Continental Motions

IN the October issue of the *Journal of the Franklin Institute*, Dr. Ross Gunn, of the United States Naval Research Laboratory, calculates by an approximate method the gravitational force on the North American continent due to the probability that the density of the earth's outer shell under the Pacific Ocean is about two per cent greater than under the continents. He finds it is equivalent to a slope downwards towards the Pacific of 1 part in 15,000. He is not prepared to say whether under these conditions the continent is at present at rest, but he considers that the presence of mountain ranges bordering the Pacific shows that in the past these forces have produced crushing and folding of the crust. For the North Atlantic he calculates these forces as being about half those of the Pacific. He considers these unsymmetrical distributions of density throughout the earth's crust support the theory that satellites were produced by fission due to tidal forces in the parent planet when in the liquid state.

## Diamagnetism and Particle Size

INVESTIGATIONS on the susceptibility of substances in the form of small particles, produced by colloidalization or cold working, have revealed, in many cases, an apparent dependence of diamagnetism on particle size. There has been considerable controversy as to whether this is a true surface effect or, as has been maintained by Bhatnagar, simply an impurity effect, due to the larger surface of finely divided material facilitating such processes as oxidation and hydration. A critical survey of the subject has recently been made by Prof. H. Lessheim (*Current Science*, 5; 1936). He shows that the theoretical arguments which have been advanced in favour of a surface effect are certainly inadequate to account for the magnitude



of the changes observed, and gives a detailed discussion of the experimental work on different substances. In many cases, as with bismuth, antimony and lead, the change in diamagnetism is due to the formation of surface layers of oxides; when the oxide is chemically removed, or when sufficient care is taken to exclude the possibility of oxidation during the preparation, the finely divided material has the same susceptibility as the material in bulk. Carbonization and the adsorption of gases may produce similar effects. Changes in diamagnetism are often associated with changes in crystal structure, and in some cases such changes may be brought about by the processes by which the fine particle material is produced. Where such changes can be excluded, Lessheim concludes that there is no definite evidence of an appreciable change in diamagnetism due simply to change in particle size.

#### A New Oxide of Phosphorus

THE discovery of a peroxide of phosphorus, with the formula  $PO_3$  (or possibly  $P_2O_6$ ) is reported by P. W. Schenk and H. Platz (*Naturwiss.*, 24, 651; 1936). When a mixture of phosphorus pentoxide vapour and oxygen is admitted to a discharge tube under a pressure of about 1 mm., and the discharge is passed, a bluish-violet product collects behind the discharge zone. The substance may be kept for about a day at ordinary temperature and in the absence of moisture. In aqueous solution it liberates iodine from potassium iodide. Using this reaction as a method of estimation, it is found that the bluish violet substance contains about two per cent of the new peroxide.

#### Theory of Photographic Development

EXPERIMENTS in favour of their adsorption theory of photographic development have recently been carried out by A. J. Rabinovitch and S. S. Peisachovitch (*Acta Physicochim. U.R.S.S.*, 4, 705; 1936). The conditions obtaining in the exposed photographic plate may be imitated by mixing a colloidal solution of silver bromide to represent the nuclei of silver bromide, and a silver sol, to represent the nuclei of silver present in the exposed plate. Addition of alkaline hydroquinone, metol, adurol, and other photographic developers causes a rapid blackening of the mixture. The colloidal silver may be replaced by platinum, gold, or copper sols, and the same development is obtained. If, however, Bredig's silver sol, or sols of palladium, bismuth, the hydroxides of aluminium, and iron, titanium oxide, or activated charcoal are substituted for silver, development does not occur. It has been shown that the sols which may replace silver and give similar results are those which will adsorb hydroquinone and other developers, whilst those which inhibit development are sols which do not adsorb the developer. By a study of cataphoresis and other experiments it is shown that the particles of the added silver sol are intimately linked with the silver bromide particles. If gelatin is added to the silver bromide sol before the addition of the silver sol, no development of the mixture occurs. Many other phenomena of importance in the theory of photographic development can be examined by means of the above system, including the effect of size of silver particles, hydrogen ion concentration, and addition of various chemicals, such as sodium sulphite and potassium bromide, on the rate of development.

#### Numerical Methods in Late Babylonian Astronomy

PROF. OTTO NEUGEBAUER, of Copenhagen, has published in *Osiris* (2, part 12, 517) what is intended to be the first of a series of studies of Naburimannu's and Kidinnu's systems of the solar and lunar motions, to be continued elsewhere. The texts used are the same as those used by Kugler in his epoch-making work, "Die Babylonische Mondrechnung" (1900) in one of which Prof. Neugebauer has introduced a number of corrections from a British Museum photograph. His interest is in the arithmetical methods used in these texts, especially in the length of the day and the anomalistic motion of the sun. His exposition is remarkably clear, and he finds, as Kugler found before him, that in the system now known as Naburimannu's, the sun is given two uniform velocities each lasting half the year, and the length of the day is made to increase at a uniform rate from one solstice to the other and to diminish at the same uniform rate in the opposite half of the year, while in Kidinnu's system, instead of uniform motions changing suddenly in amount or direction, we have a uniform change between two extremes in the rate of change. In other words, with Naburimannu, first differences are constant between limits, while with Kidinnu second differences are constant between limits. These methods, as Prof. Neugebauer has illustrated elsewhere, are very characteristic of Babylonian mathematics.

#### Multi-Cylinder Steam Turbines

THE English Electric Co. so early as 1923 constructed multi-cylinder turbines, but the development of this engine in recent years is due to the great increase in steam pressures and temperatures, and in the outputs of turbines. In the *English Electric Journal* of September, Mr. J. T. Moore describes the large multi-cylinder turbines now made by the E.E.C. The multi-cylinder turbine has the great advantage that the high pressures and temperatures are confined to a comparatively small section of the turbine. The high pressure cylinder which the steam first enters can be made of symmetrical and very simple design. The casting is therefore free from residual stresses, and high temperatures cause little distortion. It is admirably suited for work in large power stations where sudden changes in the electrical load cause fluctuations in temperature. Recent engines are of the three-cylinder type, the steam after passing through the high-pressure cylinder passing into the much larger intermediate cylinder and finally into the still larger low-pressure cylinder which works at much lower temperatures. Mr. Moore points out that with very high initial steam pressures and temperatures, the casing of the high-pressure cylinder, which is subjected to the highest temperatures, could be made of molybdenum cast steel. The intermediate-pressure cylinder, which is subjected to more average temperatures, could be made of normal cast steel and the low-pressure cylinder of close-grained cast iron. Multi-cylinder turbines have proved their worth in service. For example, a 25,000 kw. set in Sheffield was in operation for 93 per cent of the greatest possible time for a year at an average load of 86 per cent of the total. A 30,000 kw. set at the West Ham power station has generated over five consecutive years 75 per cent of the total output of the station.



## Recent Advances in Horticultural Research

### EAST MALLING RESEARCH STATION

THE annual report of the East Malling Research Station, Kent, for 1935, was published a short time ago (4s., including postage, from the Station). Administrative details are set forth in a supplementary report, leaving the main volume for the presentation of research findings.

The third section is the largest in the volume, and portrays the results of research work in progress. J. Amos, T. N. Hoblyn, R. J. Garner and A. W. Witt describe their studies in incompatibility between stock and scion, and Misses A. B. Breakbane and M. E. Renwick have also contributed to a solution of this problem by issuing a preliminary report upon the internal structure of root wood of stock and scion varieties. H. M. Tydeman reports further investigations in the root systems of apple trees, W. S. Rogers has considered the effects of soil moisture upon plant growth, using an ingenious vacuum moisture meter, and M. C. Vyvyan has a note on the moisture content of the stems of different rootstocks. Spring frosts at East Malling, from 1915 until 1935, are described by T. N. Hoblyn, whilst H. C. Chapelow and H. M. Tydeman deal with more general weather conditions.

Injection as a method of supplying deficiency of particular nutrients has been studied by W. A. Roach, who describes leaf injection, and by J. Hearman, B. F. Goodman Levy and W. A. Roach, who write on stem injection. Dr. H. Wormald has papers upon silver-leaf disease, *Verticillium*-wilt of hops, and a slime fungus on strawberry leaves, in addition to a general report on plant diseases. F. H. Beard, Dr. H. Wormald and W. A. Roach have investigated the bacterial canker of plum trees in relation to nutrition. Entomological investigations are concerned with the mites of hops and fruit trees, and the transmission of strawberry 'yellow-edge' virus, by Dr. A. M. Masee, and "Studies of Impregnation of Tree-banding Materials, by Dr. A. M. Masee and R. M. Greenslade. W. Steer has some "Observations on the Codlin Moth", whilst M. H. Moore, H. B. S. Montgomery and Dr. H. Shaw report upon field trials of several new fungicides and combined washes.

Section 4 of the Report is devoted to bulletins of interest to fruit growers. Here the progressive grower is advised upon "The Rapid Conversion of Unprofitable Fruit Trees by Grafting" (R. J. Garner), "Some Observations on the Roots of Fruit Trees" (W. S. Rogers), and "Some Notes on One Year's Experience with a Gas Store", by A. C. Painter. There are also articles on frost damage by W. A. Bane, the use of derris-root insecticide (W. Steer), upon walnut culture, by Miss J. B. Hamond, and on growing healthy raspberries, by R. V. Harris.

### LONG ASHTON RESEARCH STATION

The staff of the Agricultural and Horticultural Research Station at Long Ashton, Bristol, is to be congratulated upon the extensive results of research work portrayed in the Station's Annual Report for 1935. A rather severe financial loss was sustained when the incipient crop of fruit was ruined by frost in May of last year, but this does not seem to have

curtailed the volume of investigation. G. T. Spinks and Dr. T. Swarbrick have made a virtue of necessity, and have described the frost and its effects in great detail. Dr. Swarbrick has also a progress report of investigations into the varieties of rootstocks for plum propagation.

Reports of work on plant pathology occupy the greater part of the volume. Descriptions of new or specific diseases and pests including a malady of strawberry resembling the American 'crimp' (L. Ogilvie and C. R. Thompson), new virus diseases of the tomato, and *Sclerotinia*-wilt of the hop, by L. Ogilvie, and *Melasma Populi*, a chrysomelid pest of the basket willow, by Dr. H. G. H. Kearns. The incidence of reversion in seedling black currants and in clones derived from them is described by E. Umpleby and T. Swarbrick. New work has been done upon control of the woolly aphid (H. G. H. Kearns and E. Umpleby), of flea beetles (Dr. C. L. Walton), and upon the effects of calcium cyanamide on pea and potato sickness by C. L. Walton, L. Ogilvie and P. W. Brian. Drs. H. G. H. Kearns and H. Martin have investigated the action of lauryl rhodanate as an egg-killing wash, and they have had the co-operation of R. W. Marsh in an investigation of combined washes, designed to eradicate a number of pests or diseases.

A number of papers on cider and fruit products include "Low-temperature Keiving of Cider", by V. L. S. Charley, "Experiments on the Improvement of the Juice from Culinary and Dessert Apples by Maceration with Pressed Bittersweet Pomace", by P. T. P. Pickford, and "Investigations on Fruit Products" by V. L. S. Charley. The last-mentioned paper includes several useful descriptions of modern methods of making fruit syrups, squashes and wines.

The investigations on willow culture are represented by a paper by H. P. Hutchinson, discussing the planting of the cricket bat willow on sewage farms, and a very gratifying report from the Berkeley Square Advisory Centre is also included in the volume. This organization has answered more than 6,500 inquiries, as against 4,813 in 1934, and this in spite of an increased amount of advisory work handled directly by the Long Ashton Research Station.

### CHESHUNT RESEARCH STATION

The twenty-first Annual Report, for 1935, of the Cheshunt Experimental and Research Station, Turner's Hill, Cheshunt, Herts, sets forth the results of a very considerable volume of original investigation. The director, Dr. W. F. Bewley, reviews the whole work of the organization, and also discusses the practical value of experiment and trial work in progress under his aegis. This includes such useful features as the use of straw to provide a more efficient distribution of heat in soil sterilization, the employment of peat as a surface rooting medium for tomatoes, and the provision of soil heat. Mr. P. H. Williams has a very interesting paper on the overwintering of a perennial *Phragmidium* rust of the rose. Dr. H. L. White describes the 'damping-off' disease of lettuce, the crown-rot of rhubarb, the stem-rots and *Verticillium* wilt of the carnation. A disease of cultivated



heaths has been studied by Miss E. Oyler and Dr. Bewley, who find that it is caused by the fungus *Phytophthora Cinnamomi*. New work on virus diseases by Dr. G. C. Ainsworth includes the description of 'bushy-stunt' of tomato, a disease of the 'fern-leaf' type upon the same host, fig mosaic, and a virus disease of water-cress. Mr. E. R. Speyer has turned the entomological investigations to a study of various injuries caused by thrips, particularly on carnations and roses. The uses of the new spray fluids, copper oxychloride, copper salicylanilide, and cuprous cyanide, are discussed by Mr. W. H. Read, whilst Dr. O. Owen has investigated the use of chlorate weed killers, and other problems. In the realm of physiology, Messrs. B. D. Bolas and I. W. Selman

have studied the movement of assimilate in seedling tomato plants, and Mr. D. W. Goodall considers some of the causes of variation in growth-rate of the tomato. Finally, a modest report from the Station's Extension Officer, Mr. O. B. Orchard, shows that the important work of translating research findings into practical technique receives the energetic attention it deserves.

The work of the Station is made possible by the Nursery and Market Garden Industries' Development Society, Ltd., and it is encouraging to note that an endowment fund has now been opened. The Society's late president, H. O. Larsen, has performed his last act of generosity to the Station by a bequest of £2,000.

## British Thunderstorms

IT is a fortunate circumstance for British climatology that there has never been a lack of scientifically-minded laymen ready and willing to co-operate in large-scale observational work. The late G. J. Symons and his successor, Dr. H. R. Mill, found it possible to enrol more than five thousand voluntary observers of rainfall. Quite recently, as we learn from the annual report of the Director of the Meteorological Office, more than eight hundred observers responded to an invitation to co-operate in a special investigation of mist and fog.

Mr. S. Morris Bower began his work on summer thunderstorms in 1931, when he invited co-operation in a project to record storms occurring between the months of April and September. Prior to that date, he had been engaged on a census of winter thunderstorms, following earlier work on similar lines by Capt. C. J. P. Cave. Nearly a thousand observers assisted Mr. Morris Bower in 1931; in 1934 the number of observers had risen to 1,254\*. That is a very large number of persons to take part in a purely private enterprise, and it affords remarkable evidence of the extent to which scientific zeal is disseminated among the general population. We may conclude that the enthusiastic private investigator is assured of public support in a piece of work that seems worth doing, notwithstanding the official meteorological service, to the maintenance of which the observers themselves have to contribute as taxpayers.

That leads us to reflect upon the relationship which should exist between the official service—represented by the Meteorological Office—and a private organization such as that maintained by Mr. Morris Bower. So far as climatology is concerned, the function of the Meteorological Office is to collect and preserve for public use an adequate number of weather records from all parts of the British Isles. In pursuance of that aim, it maintains about fifty official stations; the records from these are supplemented by about three hundred co-operating 'climatological' stations, most of which are maintained by local authorities. The principle of voluntary co-operation has, indeed, been a funda-

mental feature of British climatological work since the earliest days of the Meteorological Office. The 350 official and voluntary stations suffice for the general purposes of climatology; but they do not suffice for an intensive study of the geographical distribution of a particular element such as rainfall, fog or thunderstorms. Thus we have to recognize the need for a closer network of stations when problems of this character arise, and the need is best met by an *ad hoc* organization. The role of the special organization is to amplify and extend the work of the official climatological organization, just as the three hundred co-operating climatological stations amplify and extend the work of the fifty official stations. There is clear evidence that Mr. Morris Bower and his collaborators have fully appreciated this aspect of their work. It is of interest to note that all the observers who participated in the special investigation of fog referred to above, and a large proportion of Mr. Morris Bower's thunderstorm observers, are drawn from the ranks of the five thousand or so rainfall observers of the British Rainfall Organization, which thus forms as it were a 'reservist' body of meteorological workers who may confidently be relied upon to furnish volunteers for any special piece of work.

To return to the report under notice—it is a well-produced account of the summer thunderstorms of 1933 and 1934, illustrated with numerous charts (many in two colours), photographs and diagrams. In addition to the charts and statistics relating purely to the incidence of thunderstorms, there are sections on damage to house property, trees struck by lightning (by Mr. S. T. E. Dark) and on damage to wireless installations (by Mr. Ralph A. Price). The present writer feels that the report is rather lacking in details of individual storms. In "British Rainfall" one finds a good deal of information about the rainfall occurring in noteworthy thunderstorms, and one would like to be able to turn to Mr. Morris Bower's report in order to find the corresponding information about the incidence of thunder and lightning. Such information exists in the form of manuscript records, and it is to be hoped that it will find its way into the report as funds allow. Meanwhile, Mr. Morris Bower and his collaborators are, nevertheless, to be congratulated on the results of their ambitious undertaking. E. G. BILHAM.

\* Survey of Thunderstorms in the British Islands. British Thunderstorms, continuing Summer Thunderstorms. Fourth Annual Report 1934. By S. Morris Bower and Others. Vol. 2, Part 1. Pp. 48+viii+4 plates. (Huddersfield: Thunderstorm Census Organisation, 1936.) 2s. 6d.



## Applications of Mechanical Science

TWO pamphlets recently issued by the Association of Engineering and Shipbuilding Draughtsmen (London: The Draughtsman Publishing Co., Ltd.) may be cited as indicating the continued process of translating the work of investigation and research into the most practical terms. One of these is Part 2 of "The Application of Influence Lines to the Stress Analysis of Beams and Lattice Girders" by R. McCrae (2s.), of which Part 1 dealing with beams was noticed in NATURE of May 23, p. 861. The part now published treats of lattice girders and deals with various types of loading.

While a lattice girder is, as a whole, subjected to bending and shear, these actions produce in its individual members conditions of tension and compression which vary according to the loading. It follows, then, that the treatment differs from that of beams, where the influence line diagrams represent the bending moments and shear forces due to a unit load at any point in the span. Despite this difference, however, the variation in the treatment here expounded is more a matter of detail than of principle, and for those who have much work of this kind to do the method offers useful advantages over the more formal modes of analysis.

The second pamphlet referred to is "Mechanical Tests for Engineering Materials" by A. M. Roberts (4s.), a subject of wider appeal. The development of mechanical testing has been very rapid in recent

years, and an elaborate and comprehensive technique has been devised to deal with different materials and to meet widely varying requirements. For the draughtsman it is advisable that he should be able to indicate or specify suitable acceptance tests for the materials he has incorporated in his designs, and it follows that he must be in a position to decide which methods of testing are most appropriate to each machine or structural detail, so that he can ensure its satisfactory performance in service.

It is to meet this particular requirement that the pamphlet has been prepared, and it explains, in suitably condensed form, the methods and purposes associated with the more usual forms of tests. Tensile, bend, hardness and impact tests are described and elaborated in detail, and the relation of the part under consideration and its service conditions to the appropriate test procedure is discussed; while, in some cases, suggestions are included as to the method of approach in designing for service under static, dynamic or other special conditions. It will thus be apparent that the point of view of the author is different from that of the usual writer on material testing, and his information will supply a real need in the case of many who as designers, buyers or in other capacities are not directly brought into contact with the technical processes of testing, yet require to possess such knowledge as is set out here.

## Sir Charles Parsons Memorial

ACTING in conjunction with various engineering institutions, the Royal Society has made arrangements for honouring the memory of Sir Charles Parsons, whose name is best known in connexion with his invention of the compound steam turbine. These include a memorial in Westminster Abbey, a memorial library in London House, and an annual lecture which, each fourth year, will be delivered on the north-east coast—the scene of Parsons' major activities—and in the intervening years is to be given in London.

This year's lecture, the first of the series, was given before the North-East Coast Institution of Engineers and Shipbuilders at Newcastle-on-Tyne on Friday, November 6, and took the form of a personal appreciation by Sir Frank Smith, who is one of the secretaries of the Royal Society and also secretary of the Department of Scientific and Industrial Research. On the same day, the Institution inaugurated a special exhibition to illustrate the work of Parsons, the wide range of his scientific interests and the fertility of his inventive powers.

In introducing his subject, Sir Frank Smith referred to the influences which heredity and the scientific environment of his youth, as a son of that distinguished man of science, the third Earl of Rosse, exercised upon the course of Parsons' life and work. Those who saw the workshops at Birr Castle have testified to the profound impression made on them by the installations of machinery and

furnaces in the towers of the old building and by the matchless self-possession and unflinching resources of the master mind and guiding hand. The son, who had received his early training there, retained throughout life a keen interest in optics and astronomy, and in his later years was attracted by the same astronomical problem as had earlier engrossed his father, namely, that of producing reflecting mirrors of great size. Their construction in glass did not appeal to him as an engineer and, holding the view that, in the future, larger sizes than 200 inches would be required, he planned that they should be made of steel and had arranged to build a small mirror in sections to test his ideas in practice.

When Parsons went down from Cambridge in 1877, the prevailing feeling about the steam engine was that the limit of useful improvement had been reached. Newcomen's engine required 25 lb. of coal per horse-power hour; Watt had reduced this figure to 5.5; and the amount had in the succeeding years been brought down to about 2 lb. Undaunted by those views, Parsons pressed forward with his invention, and in 1884 took out his first patent, the claims of which show to-day how clearly he realized the future of his engine. The novelty he introduced lay in the method by which he utilized the expansive force of steam. His first turbine, which was of the double-flow type, was made in the same year, and is now to be seen in the Science Museum. It is suggested that, in this invention, Parsons was inspired



by three main influences: the first, his love of attempting what others thought impossible; the second, his exceptional knowledge, at that time, of thermodynamics and the properties of steam; and the third, the advent of the electric dynamo for power generation.

The earliest turbines were designed for driving electric dynamos, and from 1888 the installation of turbo-generators steadily increased, the coal consumption being brought down to 0.7 lb. per horsepower hour. In 1894, Parsons planned the *Turbinia*, an experimental vessel to demonstrate the capabilities of the turbine for ship propulsion, and, in 1897, the Admiralty adopted the method. Trials made a few years later established the efficiency, economy and higher speed possibilities of this new motor for naval purposes. In the merchant service, the Clyde steamer *King Edward* led the way, and by 1904 such important vessels as the *Lusitania* and *Mauretania* were fitted with turbine engines—a remarkably rapid success.

The Parsons Exhibition, which is being held at the Municipal Museum of Science and Industry, Newcastle-on-Tyne, and was opened by the Right Hon. Lord Rayleigh, is well described in the "Catalogue of Parsons Exhibition, November 1936—January 1937" (London: E. and F. N. Spon, Ltd. 6d.). In it are to be seen numerous models of the turbine at the different stages of its development—Hero's, Branca's, Wilson's and several machines made by Parsons. There are many details of blading, bearings, governors and other parts, and some of the instruments and apparatus used by Parsons in his experiments. A series of coloured sectional drawings and photographs illustrates the development of the turbine from 1894 down to 1936. The other inventions of Sir Charles Parsons are also represented, and there are examples of silvered glass reflectors, optical instruments and experimental disks made under his supervision, to round off this notable appreciation of the range of practical inventiveness of one man who, in the province which he made his own, exercised a profound influence upon his time.

## Educational Topics and Events

CAMBRIDGE.—J. F. Brock, Trinity Hall, has been appointed assistant director of research in medicine. J. S. Baxter has been appointed University demonstrator in the Department of Anatomy.

At Gonville and Caius College, Dr. V. J. Chapman, formerly scholar of Pembroke College, has been elected to an unofficial Drosier fellowship.

In accordance with its usual practice, Trinity College announces the offer of a research studentship open to graduates of other universities who propose to go to Cambridge in October 1937 as candidates for the degree of Ph.D. The value of the studentship may be as much as £300 a year. Candidates must not have reached the age of twenty-six years before May 1, 1937. The College also offers Dominion and Colonial exhibitions to students of Dominion and Colonial universities who wish to go to Cambridge next October as candidates for the degree of B.A., M.Litt., M.Sc. or Ph.D. These exhibitions are of the titular value of £40. A candidate for a studentship or exhibition should apply through the principal authority of his university, and his application should reach the Senior Tutor (from whom further particulars may be obtained) by May 1, 1937.

OXFORD.—The Rolleston Memorial Prize for 1936 has been divided between J. A. Moy-Thomas, lecturer of Christ Church, and B. G. Maegraith, fellow of Exeter College.

The Theodore Williams scholarship in physiology for 1936 has been awarded to R. T. Campbell of Magdalen College.

Lord Halifax, chancellor of the University, will preside at a meeting of Congregation on November 24 at which a decree will be promulgated thanking Lord Nuffield for his benefaction to the medical school and describing how it is proposed to make use of it.

ST. ANDREWS.—Under the will of Miss Edith Mary Valentine Scott Lang, the University is offered a bequest of £20,000 provided that it will undertake to supply an astronomical observatory and the necessary instruments. Miss Lang was a daughter of the late Sir Peter Redford Scott Lang, regius professor of mathematics in the University for forty-two years, who was desirous that a lectureship in astronomy should be founded in the University. She directs that the lectureship should be called the Napier lectureship in astronomy, in memory of Baron Napier of Murchiston. From the reading of the will it would appear that in the event of the acceptance of the £20,000, the university is committed to the building of an observatory and the provision of instruments from funds outside the bequest. The will gives no indication of the destination of this £20,000 if the University does not accept it.

THE next election to Beit fellowships for scientific research will take place on or about July 9, 1937. The annual value of a fellowship is £240, and it is tenable for two years. Fellows will be attached to a department of the Imperial College of Science and Technology. Further information can be obtained from the Rector, Imperial College, South Kensington, London, S.W.7.

THE thirty-seventh annual meeting of the Science Masters' Association will be held in the Physics Department of the University of Manchester on January 5-8, 1937, under the presidency of Dr. J. S. B. Stopford, vice-chancellor of the University. On January 5, Dr. Stopford will deliver his presidential address entitled "Aims of Biology in Education". There will be the usual exhibitions of members' apparatus, etc., and a number of visits to works, collieries, etc., has been arranged. Further information can be obtained from the Annual Meeting Secretary, 15 Norham Gardens, Oxford.

WHEN invitations were issued to universities and scientific and learned institutions to take part in the celebrations in June last at the University of Heidelberg, considerable discussion was aroused in the Press in Great Britain, and as a result the invitations to English bodies were withdrawn. It seems there was little controversy on the subject in the United States, and the Viking Press, Inc., New York, has now published a booklet of 61 pages entitled "Heidelberg and the Universities of America", reprinting the "Heidelberg" correspondence and articles from *The Times* and *NATURE*; a brief explanatory introduction, signed by Charles C. Burlingham, James Byrne, Samuel Seabury and Henry L. Stimson, states that the publication has been issued so that "Americans may know the grounds of the English refusal" to take part in the celebrations.



## Science News a Century Ago

### British Surveying in South American Seas

SEVERAL communications were read at a meeting of the Royal Geographical Society on November 14, 1836, some of them relating to expeditions in Kashmir, Australia, South and Central Africa and in British Guiana. The first paper was by Captain R. FitzRoy and was entitled "A Sketch of the Surveying Voyages of H.M.S.S. *Adventure* and *Beagle*, from 1825 to 1836". From the time Captain FitzRoy resumed the surveys in 1831, every mile of the coast from the Rio de la Plata to Cape Horn was closely surveyed and laid down on a large scale, every harbour and anchorage was planned, thirty miles of the Rio Negro and two hundred miles of the Santa Cruz were examined; a chart was made of the Falkland Islands and the whole coasts of Chile and Peru were surveyed. "Traced copies," said Captain FitzRoy, "of the charts of coasts adjacent to Buenos Ayres, of the whole coast of Chili and of the greater part of the shores of Peru were given to the respective governments of those countries before our vessels left their territories, and long before the original documents could reach England." Commenting on this, the *Athenæum* said, "this is, we believe, an instance of liberality without parallel in the whole annals of maritime survey or discovery".

### Geology of the Clyde Estuary

In a paper entitled "On Indications of Change in the relative level of land and water in the Estuary of the Clyde" read to the Geological Society on November 16, 1836, James Smith (1782-1867) said that in the west of Scotland there are two superficial deposits. The lowest, locally called 'till', consists of unstratified clay, mixed with boulders and rarely containing organic remains, while the upper deposit is composed of finely laminated clay overlaid by sand and gravel. In the latter, marine remains of existing species occur in every part of it, but most abundantly in the clay. This stratum he had traced on both sides of the Clyde from Glasgow to Roseneath and Greenock, at points varying from thirty to forty feet above the level of the sea. The lower deposit, the 'till', in his opinion was accumulated by a violent, though transitory, action of a body of water; but the upper was deposited, he thought, at the bottom of the sea, and that there had been a gradual change of level similar to that taking place on the coast of Sweden as described by Mr. Lyell.

### Local Botany in Great Britain

ON November 17, 1836, at a meeting of the Botanical Society, Alexander Irvine (1793-1873) directed the attention of members to the importance of local botany. In the course of his paper, he said that 1,500 species of flowering plants occurred wild in Great Britain, of which about two-thirds were to be found within a circle of twenty-five miles around London. He had himself discovered 670 different species within two miles of Hampstead, while within two miles of Croydon he had found no fewer than 900 different species. The species of vascular plants found in Great Britain comprised nearly all those of Lapland and Sweden, three fourths of those of Germany and about three fifths of those of France. (*Athenæum*.)

### Fox Talbot on the Integral Calculus

At a meeting of the Royal Society held on November 17, 1836, Henry Fox Talbot (1800-77) read part 2 of his paper "Researches in the Integral Calculus". The report on the paper said: "Having explained, in the first part of his paper, a general method of finding the sums of integrals, the author proposes in the second place, to apply this method to discover the properties of different transcendents, beginning with those of the simplest nature. With this view, he first shows its application to the arcs of circles and the conic sections; and demonstrates the possibility of finding three arcs, such that neglecting their signs, the sum of two of them shall be equal to the third, though not superposable in any part: an equality which has been hitherto deemed impossible in the ellipse and hyperbola, without the addition of some algebraic quantity".

### Study of Physiology

In a lecture delivered at the Collège de France and published in the *Lancet* of November 19, 1836, M. Magendie criticized as follows the way in which physiology was being taught in almost all the universities of Europe, Paris included: "What is the student taught, what does he hear during a course of physiology, such as we find it at the present day? A collection of theories, one more visionary, if not more absurd than another; a mass of words, and nothing else, collected from antiquated works and thrown before him without the support of a single fact; to be believed on the words of his professor, without a shadow of that material evidence which constitutes the force of every exact science. It is truly extraordinary to observe how even the most elevated minds are led away by the influence of prejudice, and refuse to acknowledge truths so evident as that contained in the following proposition: 'We can only study phenomenally the experimental method; the laws of physiology are revealed in the manifestation of phenomena; ergo, we should submit the phenomena of physiology to the experimental method'."

### Medico-Botanical Society

THE *Lancet* of November 19, 1836, gives the following account of the first meeting of this society, which was held on November 9, 1836, under the presidency of Earl Stanhope: "The meeting was a good one. Dr. Sigmond read a very interesting and learned paper on the Early English Botanists and the Progress of the Science of Medical Botany in England. The study of the science may be dated from the reign of Henry VIII, when Dr. Turner published his 'Medical Botany'. After this various works at different periods appeared, though but little order was observed in any of them, and none of them gave the results of the author's experience with the various plants described, but merely stated their virtues on the authority of Pliny or Dioscorides. The first Pharmacopœia was published by the London College of Physicians in May 1618, but it contained so many blunders that a new edition was published in December in the same year. Pharmacopœias were first thought of by Valerius Cordus, a student of Nuremberg. In 1745 Sir Hans Sloane improved the Pharmacopœia greatly by giving to it a description of the various plants used in medicine. It was still further improved in 1788, and in 1809 the names adopted by the French chemists were first introduced."



## Societies and Academies

## London

Royal Society, November 5.

O. A. SAUNDERS: The effect of pressure upon natural convection in air. Dimensional considerations suggest that natural convection in air should depend upon the dimensionless number  $ag\theta l^3 \rho^2 / \mu k$ , the effect of which can be found experimentally by varying either the representative linear dimension  $l$ , the representative temperature difference  $\theta$ , or the pressure of the air. Measurements with vertical plane surfaces of four different heights in air at pressures from 0.001 to 65 atmospheres give results which can be expressed satisfactorily in terms of the dimensionless number. Natural convection at higher pressures, up to 1,000 atmospheres, is also discussed. The values of some of the constants are uncertain at the higher pressures, but  $ag\theta l^3 \rho^2 / \mu k$  is not appreciably increased by raising the pressure above about 200 atmospheres, and  $\mu s / k$  is nearly independent of pressure up to 1,000 atmospheres.

R. A. BAGNOLD: The movement of desert sand. The motion of sand grains and their reaction on the air stream when wind blew over a thick layer of dry uniform sand on the floor of a wind tunnel was investigated experimentally. The paths of the individual grains were photographed. The wind velocity distribution and the pressure drop were measured during the sand movement and when movement was prevented. At the same time the total flow of sand past various sections of the tunnel was measured directly. The grain motion was found to consist of a series of bounds: the grains rose steeply into the air stream and fell slowly, gathering forward velocity and striking the sand surface with sufficient impact to splash up more grains into the air stream. Irregularities in the grain paths due to internal air movements were undetected. The drag due to the sand movement is measurable, and is a maximum at the height above the surface at which maximum acceleration of the grains takes place. The length of the characteristic path from impact to impact was found in all experiments to be the same as the measured wave-lengths of the ripples formed on the surface.

J. SMILES and H. WRIGHTON: The micrography of metals in ultra-violet light. Increased resolution of the microstructure of metals has been achieved by the use of ultra-violet radiation. A method of critical illumination used in micrometallurgy and developed for use in high-power visual light systems, so as to reduce glare set up in the optical system to a minimum, has been used. A dispersing system has been incorporated and adjusted to introduce ultra-violet radiation ( $\lambda = 2750 \text{ \AA}$ .) co-axially with the visual light system. Most metals and alloys can be successfully photographed in ultra-violet radiation with increased resolution conforming to the higher equivalent aperture available.

## Paris

Academy of Sciences, October 19 (*C.R.*, 203, 697-752).

PAUL LÉVY: General determination of the limit laws [probability].

BERTRAND GAMBIER: Surfaces of which the asymptotics of one or the other system belong to linear complexes.

DAVID WOLKOWITSCH: Homofocal quadrics.

OLE PEDER ARVESEN: Laguerre's solution of the problem of Apollonius.

JEAN CHAZY: The advance of the node of a planet under the action of a circular ring.

ALEXANDRE PROCA: Photons and particles free from charge.

ANDRÉ FORTIER: The determination of the viscosity of a gas and Sutherland's constant. Discussion of the effects of the experimental error in the viscosity determinations of the Sutherland constant.

EDMOND ROUELLE: Some new experiments on the reduction of frequency in an oscillating circuit the coil in which has an iron core.

PIERRE BARCHEWITZ and AUREL NAHERNIAC: An automatic recording spectrograph for the near infra-red (6000-9500  $\text{\AA}$ .). The amplifying system allows photo-electric currents of the order of  $10^{-15}$  amp. to be detected: the accuracy of determination of the position of well-defined bands is  $\pm 3 \text{ \AA}$ .

ANTOINE GOLDET: The thermal variation of the electric double refraction of a liquid mixture presenting a critical point of miscibility.

JACQUES RABINOVITCH: Magnetic rotatory polarization and magnetic double refraction of  $\alpha$ -nitro-naphthalene in acetone and nitrobenzene solutions.

MME. MARIE FREYMANN: The absorption spectra of secondary amines in the near infra-red.

JEAN CHEDIN and MME. JEANNE CIEUTAT PRADIER: The Raman effect and molecular structure of nitric anhydride. The experiments described lead to the conclusion that  $\text{N}_2\text{O}_5$  exists in two molecular forms. In the gaseous form or in solution in chloroform, carbon tetrachloride or phosphoryl chloride, it is monomolecular. The other form is polymerized, and this is found in the crystals and in the nitric acid and sulphuric acid solutions.

MARCEL BALLAY: The constitution and structural hardening of austenites with beryllium carbides.

A. E. FAVORSKY and P. A. FIKHOMOLOV: The synthesis of an asymmetrical allenic molecule of the fatty series by means of an acetylene-allene transposition.

ANDRÉ BARBOT: A method of extracting aldehydes and ketones from their bisulphite compounds. In certain cases, the usual methods (acid or sodium carbonate) give rise to inconvenience and reduction of yield. The use of formaldehyde is suggested and shown to possess advantages.

HENRY GAULT and ANDRÉ CHABLAY: The action of organic acids on esters. Studies of the reaction velocities of the reversible system acetic acid, methyl palmitate, with and without a catalyst.

MARCEL FRÈREJACQUE: The polymorphism of octacetylsaccharose. This acetate is trimorphous.

GEORGES DUPONT and VICTOR DESREUX: Contribution to the study of  $\beta$ -myrcene. Its catalytic hydrogenation. The hydrogenation of myrcene with platinum black as catalyst gives results entirely different from those obtained when palladium black or Raney nickel is used as the catalyst: the mechanism of hydrogenation is not the same in the two cases.

ALBERT DEMOLON and ETIENNE BASTISSE: The genesis of clay colloids in the spontaneous alteration of a granite in a rain percolation chamber.

JACQUES FROMAGET: The stratigraphy of the recent formations of the northern Annamitic chain and on the existence of man in the lower Quaternary of this part of Indo-China.

ANDRÉ SAVORNIN and ANDRÉ RANARIVELO: Observations on a magnetic storm at Ambatoabo (Madagascar).



**EMILE THELLIER**: The determination of the direction of permanent magnetization of rocks. An improved method for marking the direction of the piece of rock before removing from the soil for examination in the laboratory.

**PIERRE BERTHAULT**: The specific origin of the potato.

**JULIEN COSTANTIN**: Remarks on the preceding communication.

**AD. DAVY DE VIRVILLE**: The flora of some Anglo-Norman reefs.

**EMILE BRUMPT**: The receptivity of various domestic and wild birds to the parasite *Plasmodium gallinaceum* of the domestic fowl. The transmission of this hæmatozoa by the mosquito *Stegomyia fasciata*.

## Forthcoming Events

[Meetings marked with an asterisk are open to the public.]

### Monday, November 16

UNIVERSITY COLLEGE, LONDON, at 5.—Mrs. P. Tookey Kerridge: "The Physiology of Hearing and Speech" (succeeding lectures on November 23, 30 and December 7).\*

UNIVERSITY OF LONDON INSTITUTE OF EDUCATION, at 5.30.—Prof. José Castillejo: "Education and Revolution in Modern Spain" (succeeding lectures on November 18 and 25).\*

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE, at 5.30.—Prof. W. Bullock, F.R.S.: "The Development of Bacteriology with an Account of some of the Pioneers who made it a Science" (Heath Clark Lectures. Succeeding lectures on November 18, 23, 25 and 27).\*

ROYAL SOCIETY OF ARTS, at 8.—Prof. E. V. Appleton, F.R.S.: "Some Problems of Atmospheric Physics" (Cobb Lectures. Succeeding lectures on November 23 and 30).

GEOGRAPHICAL SOCIETY, at 8.30.—Sir Eric Teichman: "The Motor Route from Peking to Kashgar".

### Tuesday, November 17

EUGENICS SOCIETY, at 5.15.—(at the Linnean Society, Burlington House, Piccadilly, W.1).—W. T. J. Gun: "The Heredity of the Royal Caste".\*

### Wednesday, November 18

ROYAL MICROSCOPICAL SOCIETY, at 5.30.—J. E. Barnard, F.R.S., and F. V. Welch: "Microscopy with Ultra-Violet Light".

### Thursday, November 19

UNIVERSITY COLLEGE, LONDON, at 5.30.—E. Ford: "The Nation's Fish Supply" (Buckland Lectures. Succeeding lectures on November 26 and December 3).\*

CHEMICAL SOCIETY, at 8.—Discussion on "Mesomerism in Organic Chemistry" to be opened by Prof. C. K. Ingold, F.R.S.

ASSOCIATION OF SCIENTIFIC WORKERS, at 8.—(in the Mathematics Lecture Theatre, Huxley Building, Royal College of Science, South Kensington, S.W.7).—Public meeting and discussion on: "Defence and the Responsibilities of the Scientist"; speakers to include Prof. S. Chapman, F.R.S., and Air Commodore L. E. O. Charlton.

### Friday, November 20

INSTITUTE OF CHEMISTRY, at 8.—Prof. John Read, F.R.S.: "A Chapter in the Chemistry of Essential Oils" (Stratfield Memorial Lecture).

ROYAL INSTITUTION, at 9.—H. G. Wells: "World Encyclopædia".

## Official Publications Received

### Great Britain and Ireland

The North Staffordshire Field Club. Transactions and Annual Report, 1935-36. Vol. 70. Pp. 98+A183-A212+3 plates. (Stoke-on-Trent: North Staffordshire Field Club.) 7s. 6d. [2210]

The Journal of the Institute of Metals. Vol. 58. Edited by G. Shaw Scott. Pp. 325+30 plates. 31s. 6d. Metallurgical Abstracts (General and Non-Ferrous). Vol. 2 (New Series). Edited by G. Shaw Scott. Pp. vii+889. £4, including 2 "Proceedings" vols. (London: Institute of Metals.) [2211]

University of London: University College. Calendar, Session 1936-1937. Pp. lxxx+582+26. (London: Taylor and Francis.) [2210]

Seventeenth Annual Report of the Ministry of Health, 1935-36. (Cmd. 5287.) Pp. vi+318. (London: H.M. Stationery Office.) 5s. net. [2210]

Philosophical Transactions of the Royal Society of London. Series B, No. 536: Genetical and Taxonomic Investigations in the Genus *Oenothera*. By Prof. R. Ruggles Gates. Pp. 239-355. (London: Harrison and Sons, Ltd.) [2210]

The Journal of the Society for the Bibliography of Natural History. Vol. 1, Part 1: A Catalogue of Papers concerning the Dates of Publication of Natural History Books. By Francis J. Griffin, C. Davies Sherborn and H. S. Marshall. Pp. 30. (London: Society for the Bibliography of Natural History.) 7s. 6d. [2210]

Annals of the Solar Physics Observatory, Cambridge. Vol. 4, Part 2: On some Spectrograms of Nova Persei, 1901, by Prof. F. J. M. Stratton; Vol. 4, Part 3: Nova Aquilæ 1918, a Discussion of the Development of the Band Structure, by Dr. E. S. Pearson; Vol. 4, Part 4: The Absorption Spectrum of Nova Herculis 1934, the First Phase, by Prof. F. J. M. Stratton. Pp. vii+75-161+10 plates. (Cambridge: At the University Press.) 15s. net. [2210]

Speech Institute Pamphlet No. 15: Speech Tunes, Emphasis in Speech, Sounds of Connected Speech. Three Articles by Barbara Storey. Pp. 21. (London: Speech Fellowship and Institute, Ltd.) 7d. [2210]

Department of Scientific and Industrial Research. Report of the Forest Products Research Board for the Year 1935. Pp. vi+78+6 plates. (London: H.M. Stationery Office.) 2s. net. [2210]

### Other Countries

Memoirs of the India Meteorological Department. Vol. 26, Part 6: Typhoons and Indian Weather. By V. Doraiswamy Iyer. Pp. ii+93-130+10 plates. (Delhi: Manager of Publications.) 1.10 rupees; 2s. 9d. [2210]

Canada: Department of Mines: National Museum of Canada. Bulletin No. 80 (Geological Series, No. 53): Revision of the Genus *Calapezia* Billings. By Ian Cox. Pp. ii+49 (4 plates). (Ottawa: King's Printer.) 25 cents. [2210]

Canada: Department of Mines: Bureau of Economic Geology, Geological Survey. Memoir 189: Carmacks District, Yukon. By H. S. Bostock. (No. 2413.) Pp. ii+67+5 plates. 25 cents. Memoir 190: Geology and Mineral Deposits at the Mine of B.C. Nickel Mines, Limited, Yale District, B.C. By H. C. Horwood. (No. 2414.) Pp. ii+15+1 plate. 10 cents. Memoir 192: Gold Occurrences of Ontario East of Lake Superior. By E. D. Kindle. (No. 2416.) Pp. vi+167+1 plate. 50 cents. Memoir 193: Mining Industry of Yukon, 1935. By H. S. Bostock. (No. 2417.) Pp. iii+12. 10 cents. Memoir 195: Mineral Deposits in Renfrew County and Vicinity. By B. C. Freeman. (No. 2419.) Pp. ii+34+1 plate. 25 cents. (Ottawa: King's Printer.) [2210]

Annual Report for the Year 1935 of the South African Institute for Medical Research, Johannesburg. Pp. 91+2 plates. (Johannesburg: South African Institute for Medical Research.) [2210]

The Rockefeller Foundation: International Health Division. Annual Report 1935. Pp. iv+286. (New York: Rockefeller Foundation.) [2210]

Annual Report of the Board of Regents of the Smithsonian Institution showing the Operations, Expenditures and Condition of the Institution for the Year ending June 30, 1935. (Publication 3348.) Pp. xiv+580+95 plates. (Washington, D.C.: Government Printing Office.) 1 dollar. [2210]

Indian Science Abstracts (Being an Annotated Bibliography of Science in India), 1935. Part 1. Pp. 174. (Calcutta: National Institute of Sciences in India.) 7.8 rupees. [2210]

Bibliography of Doctorate Theses in Science and Arts accepted by Indian Universities from January 1930. Issued by the Inter-University Board, India. Pp. 22. (Bangalore: Bangalore Press.) [2210]

Coconut Research Scheme. Annual Report for 1935. Pp. 52. (Lunuwila: Coconut Research Scheme.) [2210]

Advisory Department of the Imperial College of Tropical Agriculture. Report on the Department of Agriculture, St. Lucia, 1935. Pp. v+54. (St. Lucia: Government Printing Office.) 6d. [2210]

Report of the Haffkine Institute for the Years 1932-35. By Lieut.-Col. S. S. Sokhey. Pp. ii+209. (Bombay: Government Printing and Stationery Office; London: High Commissioner for India.) 12 annas; 1s. 3d. [2210]

Statens Meteorologisk-Hydrografiska Anstalt. Meddelanden, Serien Uppsatser. No. 2: Axel Wallén. Av Gustaf Slettenmark. Pp. 208-217. No. 4: Sunshine and Radiation, Mount Nordenskiöld, Spitsbergen. By Hilding Olsson. Pp. 93-118. No. 5: Jordtemperaturer i Bestånd av Ollka Tätet. Av Anders Ångström. (Soil Temperature in Stands of Different Densities.) Pp. 187-218. No. 6: Vindhastighetens dagliga Gång vid Några Svenska Stationer. Av Walter Persson. Pp. 12. No. 7: On the Turbidity of Polar Air. By Olof Tryselius. Pp. 10. No. 8: Effective Radiation during the Second International Polar Year. Pp. 22. (Stockholm: Statens Meteorologisk-Hydrografiska Anstalt.) [2210]

Bulletin of the Madras Government Museum. New Series, General Section, Vol. 3, Part 2: An Outline of Indian Temple Architecture. By Dr. F. H. Gravely. Pp. ii+22+1 plate. (Madras: Government Press.) 12 annas. [2211]