NATURE

SATURDAY, MAY 14, 1932

CONTENTS

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.
ST. MARTIN'S STREET, LONDON, W.C.2

No. 3263, Vol. 129]

The Training of Archæologists

CONDITIONS at the present moment can scarcely be regarded as propitious for any new undertaking in scientific teaching or research which looks to the financial support of the public for its funds; but the appeal for £30,000 to found an archæological institute in the University of London, which has been launched by Sir Charles Peers, and to which he made reference in his presidential address to the Society of Antiquaries on April 28, is more than justified, even if it were only on the ground of its urgency. It has the backing of the heads of the principal learned societies and other bodies in London which are interested in archæological studies; and it will receive cordial endorsement among those who are acquainted with the difficulties which, in present circumstances, hamper the organisation of these studies, not only in London, but also in other educational centres where archæology is a recognised subject of instruction.

The Board of Archæological Studies in the University of London has had the proposal for an institute of archæology under consideration for some time. It has now become urgently necessary that some decisive action should be taken at once. The plans for the new university buildings in Bloomsbury are in course of preparation, and provision is being made for the accommodation of the Institute of Historical Research and the Institute of Art. It is only fitting, and indeed it is eminently desirable, that, if the University is to have an Institute of Archæology at all, it should be in the same building. The immediate proximity of three departmental institutions dealing with subjects so closely allied will obviously add greatly to their usefulness by facilitating interchange and cross-reference in the consultation of books and other material available for study and research.

In the proposal now put forward, it is not intended that the Institute of Archæology should constitute a separate teaching school of the University. The present teaching arrangements in archæology will be unaffected, except in so far as the Institute will afford an opportunity for practical instruction in archæology along certain lines. It will be a place of training but not of teaching in the academic sense; it will be equally available for students of all descriptions from all parts of the world and in all branches of archæology; and it will be equipped under the three main heads of materials for study, laboratory, and library. Its main function will be the instruction of the student in the practical methods and technique of

archæological investigation in the field and in the archæological workshop—the workshop, that is, in the wider sense in which it covers the classification and serial arrangement, as well as the material preparation for study, of the objects accruing in the course of archæological exploration.

Archæologists have long been convinced of the urgent necessity for the establishment of such a place of training. The demand for the services of trained men, or women, in the field is now far in excess of the supply. The remarkable, not to say at times sensational, discoveries made since the War, in Egypt, in Mesopotamia, and in India, have stimulated public interest in archæological studies, with the result that it has been possible greatly to extend the field of archæological investigation; while the trend in the development of archæological theory has been such as to press on the simultaneous investigation of sites which, at one time, it might have been considered possible to postpone, as less urgent, for examination in orderly rotation.

This increased activity involves a heavy drain on the man-power of archæology: it demands a more intensive training in the direction of both a more highly specialised technical equipment and a wider comparative knowledge, not merely of the general trend of development, but also of details of cultural characteristics and manifestations in the various more or less related provinces of archæological discovery. It would, for example, be hazardous, at the present stage of our knowledge, to attempt to fence off as irrelevant any one province between Western Europe and China at certain periods of prehistory. Such conditions, obviously, make heavy demands on the knowledge of an archæologist outside his special province.

It is, however, in the development of technical methods, both of excavation and salvage, that progress recently has been marked, and in which much is required of the investigator. Not so very long ago, the leader of an archæological expedition often had to improvise methods of salvage and recording his discoveries on the spur of the moment. Now the worker in the field must be equipped with a wide range of technical knowledge, embracing more than a mere nodding acquaintance with the chemical and physical properties and reactions of the material with, in, and on which he works, or which it may be possible or expedient for him to employ in given conditions. So great, in fact, has been the advance in these requirements that a recent report on an archæological investigation refers to the work of a predecessor on the same site only twenty years before, who for that time was highly trained, in terms which might have applied to the Dark Ages.

The work of British archæologists in the field, it is generally conceded, and not without reason, holds a foremost place in the scientific study of archæology throughout the whole world on the score of its vision, its meticulous care in carrying out the work of excavation, and in the accuracy of its observation and record. The credit for this is largely due to great excavators such as Sir Flinders Petrie and Sir Arthur Evans, to name two of the best known only. By their example, by precept, and in many instances by actual instruction, the leaders in archæological research have inculcated scientific methods of investigation in younger men, who have carried on their tradition and helped to develop its principles. British archæology, too, has been fortunate in that bodies such as the Egypt Exploration Society and the Schools of Archæology in Egypt, Athens, Rome, Palestine have been able, by the continuity of their operations from year to year, to afford an unrivalled field of training to the archæological recruit, such as for long was open to the archæologist of almost no other country.

Leaders of archæological expeditions, however, are busy men, and the calls on their time, even the calls of day-to-day routine, are heavy and seem to be on the increase. It is becoming more and more difficult for them to devote themselves in any appreciable degree to the training of younger colleagues in carrying on the work. The conditions of the past, in fact, are no longer possible, nor are they adequate either to the needs of a modern scientific expedition or of the individual. A training institution of some kind must, perforce, be provided in their place. To a limited extent the British Museum has been able to meet the deficiency in one branch of training, the technique of cleaning, preserving, and repairing such material objects as are usually found in the course of excavation, by generously placing its laboratories at the service of a limited number of students. But to act as a school is not the function of a museum; nor can it display for the benefit of students the endless series of objects—potsherds, for example, of which there is a valuable but inaccessible store in London—which are essential to the needs of the beginner in archæology, but of little interest to the general run of those who wish to consult the collections of a museum.

In this connexion, it must be pointed out that the museum worker in archæology is in need of training equally with the man in the field. Ideally, each should know something of the work of the

other; and conditions similar to those which militate against the instruction of juniors in the elementary principles of practical archæology while in the field are becoming increasingly prevalent in our museums.

A brief reference must be made to the needs of comparative study. From the nature of the case, this cannot be carried to any great length in an institute such as is contemplated; nor is it probable that a minutely detailed treatment will be necessary. Provision, it is suggested, will be made for the study of the cultural development of the different centres by the display of original material, supplemented by series of casts sufficiently complete to give a general conspectus of the artistic tradition in each. The use of casts is a very necessary measure in view of the scattered distribution of archæological material in widely separated collections, and the increasing sentiment against the export of antiquities from their country of origin.

Nothing would appear to have been said, at least as yet, as to the possibility of any provision by the Institute of facilities for practical work in the field, that is, in actual excavation—beyond question an element of the first importance in any scheme of training which sets out to be practical. The participation of the students of one of the constituent colleges of the University of London in a succession of small 'digs' on archæological sites proved eminently successful in stimulating keen interest, and in at least one case revealed an unexpected *flair* for archæological investigation. No doubt, even if it should be found impracticable for the Institute itself to work on these lines, arrangements with other bodies carrying out excavations within a reasonable distance of London might well be possible, especially as facilities for observation and participation in the work of excavation have already been granted students on at least one site.

The fact that a concrete proposal for a school of archæological training has been put forward in connexion with the University of London renders nugatory any discussion whether a more suitable situation or greater facilities might have been obtained elsewhere, whether at Oxford or Cambridge with their valuable archæological collections and their powerful if imponderable traditions of the study of antiquity. In any event, the congregation of the great national collections in London would go far to weigh down the scale; while the attraction to overseas visitors of an Institute which throws open its doors to all comers gives the central position of London in relation to the outside world an irresistible claim.

The Butterflies of America

The Butterfly Book: a Popular and Scientific Manual, describing and depicting all the Butterflies of the United States and Canada. By Dr. W. J. Holland. (The Nature Library.) Pp. xii + 424 + 77 plates. (Garden City, N.Y.: Doubleday, Doran and Co., Inc., 1931.) 10 dollars.

THE second edition of Dr. W. J. Holland's "Butterfly Book" brings the subject matter up to date. The text has to a large extent been rewritten and a number of plates have been added, all the species of butterflies occurring in America north of Mexico being depicted, with the exception of a few obscure or doubtful ones. The introduction deals with collecting, breeding, preserving, and classifying specimens, and with manuals, catalogues, and check-lists of North American butterflies. The generic descriptions are illustrated by text-figures of wing-neuration, and occasionally by some additional detail of structure. The descriptions of species are kept as short as possible, the life-history, if known, being added, and the distribution of each species and variety noted. The interpolated chapters of an anecdotal or educative nature are very pleasing interruptions of the necessarily dry and monotonous descriptive text. A complete alphabetical index greatly facilitates the use of the book.

In estimating the merits of a volume of this kind, the reviewer has two lines of approach, giving views at two different angles: the critical examination of the subject matter, and the estimation of the influence of the book on the public. The "Butterfly Book" is primarily a manual for the lover of Nature who devotes his leisure hours to Lepidoptera in one way or another. Its great value consists in supplying a want for a non-expert public which requires a guide in its search for information.

It is essential for the welfare of the human species that this point of view should be understood and acted upon by the advanced man of science. Many biologists of our time are unfortunately only too prone to consider their own corner in science to be the only one worth occupying, forgetting that although the inevitable overcrowding of the earth will necessitate the application of biological principles to human relations, biology will not attain the foremost position it ought to occupy in all councils governing life unless there is a large body of people willing to listen to the biologist and capable of understanding the bearing of his teaching. It is of little avail to try to educate reluctant or even hostile governments steeped in antiquated

notions of the interrelation of human beings with each other and with the environment.

The 'mere' collectors are the important persons, and the more there are of them the easier it will be to introduce an outlook on life conforming to the principles of biology. Dr. W. J. Holland's book is one of the best means of attaining this much-desired end. It is most pleasing and encouraging to read in the introduction that more than 65,000 copies of the first edition have been distributed—an astonishing result. It may safely be predicted that the second edition will also be a 'best seller'. We have here proof that, in North America no less than in Europe, there is a large biologically-minded public; it is for the advanced biologist to encourage it and to be its leader.

The specialist in Lepidoptera will welcome the new edition particularly on account of the many figures of types depicted on the additional plates. As taxonomists, whether amateur or professional, were not (and are not) always careful in the labelling of the specimens on which they based descriptions of new species, and as the method of selecting one specimen as type was formerly not in general use, one or the other reputed type may in reality be an individual added to the collection after the publication of the original description. Dr. Holland states his reasons for accepting as type or typical this or that specimen figured, and if a sceptic should not agree with Dr. Holland in every instance, he will have to defeat Dr. Holland by positive arguments, which is a much more difficult task than the mere expression of doubt.

The nomenclature employed is conservative, Dr. Holland being particularly emphatic, and rightly so, in rejecting the Tentamen of Hübner, a printed questionnaire of 1805 containing names which some authors, mistaking them for generic names, have adopted, causing thereby much unnecessary confusion. The author divides the butterflies into seven families: Nymphalidæ, Libytheidæ, Riodinidæ, Lycænidæ, Pieridæ, Papilionidæ, and Hesperiidæ. The reviewer heartily agrees with him in uniting the Danainæ, Satyrinæ, etc., with the Nymphalinæ in one family, all these butterflies being indeed nothing but diverse developments of one large branch separate from all the other butterflies. The genus *Libythea*, which has a lonely position as occupier of a house of its own, should also have been placed with the Nymphalidæ; but the error, a hundred years old, of considering it nearly related to the Riodinidæ, dies hard, and Dr. Holland here follows the ill-considered opinion of the overwhelming majority of lepidopterists, at whom *Libythea* itself disdainfully turns up its long nose. In the species and varieties, the author adheres to the convenient but scientifically incorrect method of treating the accidentally first-described form of a species as *the* species, and the other forms, which as a rule are really co-ordinated with the first-described one, as varieties of it—a method which leads to phylogenetic inconsistencies.

However, these points do not impair the usefulness of the "Butterfly Book", either for the beginner or for the expert, and will deter nobody from acquiring the handsome volume. Considering the large number of coloured plates, the book could be offered at the moderate price of 10 dollars only in expectation of very large sales. Dr. Holland, who finished the manuscript on his eighty-second birthday, is most heartily to be congratulated on this achievement. It was a laborious task successfully carried through in consequence of the author's great experience, boundless energy, and deep love of Nature.

KARL JORDAN.

The Fascination of Things Inanimate

Inorganic Chemistry. By Prof. T. Martin Lowry. Second edition. Pp. xiv + 1101. (London: Macmillan and Co., Ltd., 1931.) 25*s*. net.

A NEW edition of Lowry's "Inorganic Chemistry" is a welcome event, especially since the author, taking advantage of the necessity to reset the text, has materially altered and improved its structure so as to take full account of many developments in chemistry during the last ten years. He evidently believes that anything which is really true is amenable to simple explanation, if we will but take the trouble, and a commendable feature of his book, a direct outcome of clear thought and plain words, is that it presents satisfactorily many matters which are new or are commonly regarded as difficult.

The historical and introductory chapters remain much as before, and a reperusal of them strongly reinforces the old impression of their sound and attractive character. To begin, as the author does, with substances and their fundamental properties, and pass on at once to practical methods of purification and tests of purity and to means of identification of pure substances, is indeed to put first things first. It is too easy for the pedagogue to forget that the primary duty of the chemist is to know and handle all forms of matter. On this point the author is very sound: with quiet, sustained enthusiasm, which may be inferred from the care and clarity of his descriptions, he develops

and displays the sheer interest and beauty inherent in the curious, unexpected, even perverse behaviour of inanimate material.

From general fundamental ideas, the author passes to consider in turn salts, alkalis, and acids; the calcination of metals; chalk and lime; the burning of carbon and the composition of fixed air; and the burning of hydrogen and other combustible gases. This brings in, naturally, vividly, and accurately, a great part of the earlier history of chemistry, and provides material and reason for the consideration that follows of the laws of chemical combination and the atomic theory.

A review of the properties of gases (which is particularly well done) leads up to Avogadro's hypothesis and the Cannizzaro method for atomic weight, the application of which is illustrated very clearly by a table of data yielding the atomic weights of hydrogen, oxygen, chlorine, and carbon. This leads to a consideration of other methods of determining molecular and atomic weights, and a discussion of solutions and the colligative properties of dissolved substances whereby their molecular weights are ascertained. Having thus touched, naturally and effectively, upon many essential principles usually branded as 'physico-chemical', we pass on to the distillation and crystallisation of mixed liquids, illustrated by some clear and well-chosen phase diagrams and photo-micrographs, and to an outline of the phase rule. Then, by way of electrolysis and typical cells, the author introduces the ionic hypothesis, not shirking the theory of complete ionisation, and discusses the types of valency. As the last item in this review of general theory there is an admirably clear and interesting chapter on the form and structure of crystals.

Reading this part of the book, about a quarter of the whole, one has the sense of a smooth, orderly, and efficient progression of argument. The doubts and pitfalls are not evaded; they are, indeed, clearly and carefully pointed out, but, using what is firmly established, the foundations of chemistry are neatly and strongly laid.

In Part II. of the book, devoted to the non-metals, the matter presented is for the most part that usually found in the larger textbooks. We may remark, however, the inclusion of ortho- and para-hydrogen, a good section on flames (though it seems a pity to omit a diagram of the Smithells flame-separator), a reference to dense ice, and good brief outlines of our knowledge of free radicals and of the theory and practice of the liquefaction of air and hydrogen. As examples of the care that has been taken to bring the matter up to date, the inclusion of fluorine monoxide and hydrogen pentasulphide may be cited. Special praise must also be given to a very full and clear account of the chemistry and constitution of the silicates.

Since authors (and critics) are human, some points may be found, of course, for criticism. For example, the failure to mention any commercial ozoniser, the omission of any reference to the preparation of pure chlorine by thermal decomposition of auric or platinic chloride or to the practical methods of making perchloric acid from sodium or ammonium perchlorate. Also, it might be said that the chlorides of iodine are dismissed too lightly and without any reference to the monotropy of the monochloride; that the most practical method of making chlorine monoxide, by dehydration of hypochlorous acid, is not mentioned; and that the use of the term "silicifluorides" is pedantic. But these, after all, are minor faults—it is, perhaps, merely a matter of opinion whether they are faults at all—and they do not detract appreciably from the outstanding merit of the book.

The latter half, or thereabouts, of the book deals with the metals, which are divided, for convenience, into the "typical" metals (Part III.) and the "non-typical" (Part IV.). In Part III., after a general review of the metallic properties, we pass at once to a discussion of classification and atomic constitution and structure, which is particularly clear and interesting. Thereafter the metals of the alkalis and alkaline earths, beryllium and aluminium, tin and lead, and arsenic, antimony, and bismuth are described. At the end of this part, not at the beginning with the discussion of atomic constitution, there stands in rather curious isolation a table showing the electronic configuration of the elements. One is a little puzzled to know why it should be here, unless it is to be at hand for reference in the discussion, with which Part IV. begins, of the general characteristics of the transition elements. After the remaining metals are disposed of, the book concludes with a short but very good chapter on the radioactive elements.

Because of good, clear type and thin but reasonably opaque paper, the book, despite its thousand pages, is of moderate size and weight and easy to read and handle. It has a good index. As text-books go, it is expensive; but it is well worth its price. The numerous and well-chosen diagrams of apparatus and plant are particularly clear: and the author's delight in crystals is shown by the many excellent photographs of mineral specimens. In fact, his enthusiasm for one very fine crystal

of fluorite (combined, no doubt, with a momentary lapse of memory) has betrayed him into putting it in twice, as Fig. 125 on p. 337 and as Fig. 235 on p. 736.

This, in short, is a chemical work of that rare kind which is both scholarly and humane, and as such it may be commended warmly and without reserve to all serious students of the science and to those who may influence their reading.

Physics and Chemistry of the Soil.

The Soil: an Introduction to the Scientific Study of the Growth of Crops. By Sir A. D. Hall. Fourth edition, revised and enlarged. Pp. xvii + 388. (London: John Murray, 1931.) 9*s*. net.

THE reissue of this well-known textbook will be welcomed by all engaged in agricultural teaching. Appearing first in 1903, it had passed through three editions, with many reprints, by 1920, and has now reached a fourth edition. These facts alone indicate plainly the welcome given to the book in the past, and the reason for this is not far to seek. It demands no wide knowledge of the pure sciences on the part of the reader. It accepts the average student of agriculture as his lecturer generally finds him—a man anxious to know something of the fundamental scientific facts underlying his profession but by force of circumstances quite unable to undertake a thorough scientific training before beginning his more technical studies.

As the author stated in his original introduction, the book is "primarily intended for the students of our agricultural colleges and schools, and for the farmer who wishes to know something about the materials he is handling day by day". This purpose it serves admirably, but its use need not be limited to this type of reader. A teacher might well put it into the hands of the budding agricultural chemist, after his training in pure science, as a general survey of our knowledge of the soil. To such a student its extremely readable character makes it a useful introduction to the more highly specialised publications dealing with particular aspects of the subject.

The new edition follows fairly closely the general lines of previous issues, though a considerable amount of new material has been incorporated. Starting with a description of the soil-forming processes, the author deals successively with the physical and chemical properties of the soil, the soil micro-organisms and the processes dependent on them, the retention of fertilisers, base exchange, the loss of soil constituents by leeching, soil acidity, causes of fertility and sterility in soils, and, finally, the classification of soils into types. Never losing sight of his original object, the author brings each subject within the grasp of the reader he has in view and illustrates the general principles by an abundance of examples from both scientifically controlled field experiments and farming practice.

It is interesting to note the infiltration of recent advances in soil science into a book of this type. Extensive treatment of such subjects as soil colloids, hydrogen ion concentrations, soil profiles, and the classification of soils founded on the work of the Russian school would obviously have been impossible, but each of these subjects receives mention and finds its place amongst the older material.

A short bibliography, useful to the student as a guide to wider reading, has been added, and its value is enhanced by the care which has been taken in the selection of the items. A short index completes the volume.

As might be expected, the book is excellently produced and is singularly free from errors. The volume in its new form certainly maintains the high position it has made for itself in the past.

H. A. D. NEVILLE.

Fundamentals of Ophthalmology

Text-Book of Ophthalmology. By Dr. W. Stewart Duke-Elder. Vol. 1: *The Development, Form and Function of the Visual Apparatus.* Pp. xxix + 1124 + 7 plates. (London: Henry Kimpton, 1932.) 63*s*. net.

THERE have been several good manuals of ophthalmology written by Englishmen. The first of the modern, that is, post-ophthalmoscopic, period was written by the late Mr. Edward Nettleship. It was a very remarkable book, which, like its contemporary, Gowers's "Medical Ophthalmoscopy", well merits perusal even to-day, for it is packed with the observations of a very great scientific clinician. Doubtless a larger and more comprehensive textbook would have been written in due course if it had not been for the appearance of Fuchs's textbook, which was soon translated into English and is still universally read. The English version was edited and published in America, and has undergone transformations in later editions which are not all improvements. As so often occurs, ill-digested new material has been invaginated into the text in such a manner as to obscure its balance and perspective without making it satisfactorily encyclopædic. The

Germans have published more comprehensive works, such as the gigantic "Graefe-Saemisch" in countless volumes, still unfinished, and likely ever to remain so. More recently, they have issued the first three volumes of a so-called "Kurzes Handbuch", which, when the seven volumes are completed, will cost £49!

The time is therefore ripe for a new textbook, and if the final two volumes are as good as the first, the need will be well satisfied by Duke-Elder. This first volume deals with the anatomical, physiological, and psychological foundations of ophthalmology. It is the most complete and most up-to-date résumé of our knowledge of the subject. The separate sections are devoted to phylogeny, anatomy and comparative anatomy, ontogeny, physiology and biochemistry, optics, the physico-chemistry of vision, the physiology of vision (visual sensations), and the psychology of vision (visual perceptions). Though each of these sections demands specialised study and very diverse mental abilities, the author has shown himself well able to surmount each successive obstacle. He possesses an unusual capacity to segregate the salient points from masses of literature, to arrange them in logical order, and to impart some of his own enthusiasm to the reader. For this is no dry-as-dust compilation. He has taken a leaf out of the late Prof. Bayliss's book, and by judicious historical and biographical notes, accompanied by portraits of outstanding workers in the various fields, he has made the book eminently readable and attractive.

The book is also noteworthy in providing a concise account of the author's own valuable contributions to the physiology and biochemistry of the eye. These researches have so important a bearing on general physiology, especially that of lymph formation, that the attention of physiologists should be directed specifically to them. The investigations of Leber, confirmed and extended by Starling and others, proved that it was unnecessary to predicate any true secretory activity to account for most of the facts relating to lymph formation in the eye and the intraocular pressure. These workers propounded a filtration hypothesis, although they were fully conscious of the lacunæ in their knowledge of other biochemical and biophysical factors which undoubtedly play a part. By a masterly application of the methods of modern biochemical technique, Duke-Elder has shown that these factors play indeed the preponderant rôle. By an exhaustive experimental investigation of the hydrostatic conditions and the chemical constitution and physical characters of the intraocular fluid, he has shown that every factor is consistent with the view that the intraocular fluid is a dialysate in equilibrium with the capillary blood.

Without in any way depreciating the value of these researches, it may be pointed out that no more than the filtration hypothesis do they reach finality. Indeed, to some extent, they introduce fresh difficulties. For example, they throw back the peculiarities of lymph constitution and formation in different organs and different species to differing permeability of the capillaries. "The variation is, of course, a biological adaptation to the needs of the tissue concerned" (p. 428), which savours of a teleological *deus ex machina*. There are also many pathological facts which can scarcely be explained on our present knowledge. None the less, the work is of the first order in scientific insight and technical accomplishment.

The book is beautifully produced and illustrated.

Short Reviews

Das periodische System in neuer Anordnung: mit Tabellen über Fünfzehn physikalische Konstanten in Anordnung nach der Ordnungszahl der Elemente und nach der Grösse der Konstanten. Von Dr. Darwin O. Lyon. Zweite Auflage. Pp. vi + 40 + 4 Tafeln + 23 Kurven. (Leipzig und Wien: Franz Deuticke, 1931.) 8 gold marks.

In attempting a detailed study of the magnetic properties of all the elements, particularly in relation to their relative abundance in the earth's crust, in the hope of being able to throw light upon the process of their evolution, the author of this essay has gone to considerable trouble in drawing up an elaborate set of tables, in which a number of physical constants of the various elements are arranged not only in the order of atomic numbers but also in order of magnitude. The Thomsen-Bohr arrangement of the elements is given in Table 1 for reference. Table 2 contains some new features in the familiar scheme of 18 groups and 8 periods. Thus, instead of atomic weights, the following values are inserted: atomic number, electrical resistance, magnetic susceptibility, density and melting point, whilst dia- and para-magnetic properties are indicated by means of shading. The peculiar character of oxygen, which is strongly paramagnetic in itself, though diamagnetic in many of its compounds, is denoted by striped shading.

Much more useful arrangements will, however, be found in Tables 3 and 4, which form the most notable feature of the work. In Table 3 will be found the following physical constants of the elements, arranged in the order of their atomic numbers: atomic number, atomic weight, density and thermal expansion for both solids and liquids, melting and boiling points, latent heats of fusion and of volatilisation, specific heat, electrical resistance, magnetic susceptibility, entropy, and sound

conductivity, the values for the last-named property being restricted to twenty-four elements. Table 4 contains all these constants, but arranged for each property in strict order of magnitude, and, in addition, certain ratios of these constants are tabulated. The different constants have also been plotted graphically after the manner of Lothar Meyer's well-known graph of atomic volumes.

The Botany of Crop Plants: a Text and Reference Book. By Prof. W. W. Robbins. Third edition, revised. Pp. x + 639. (Philadelphia: P. Blakiston's Son and Co., Inc., 1931.) 4 dollars.

THE value of this book, first published in 1917, as a classroom textbook is testified by the fact that a third edition is now called for. The undue inflation that is frequently caused by the inclusion of fresh material in repeated editions is here obviated by the elimination of most of the tables and text matter dealing with the distribution and yield of crop plants. The treatment is essentially botanical, not horticultural, and such matters as methods of cultivation and the soils appropriate for various crops do not come within its scope.

The book is prefaced by a short botanical outline, providing a revision of fundamental points necessary for the better understanding of the main discussion. Crops are dealt with according to their families, and the range of data discussed varies according to the type of information which is most useful in each individual case. The practical and economic aspects are kept in view throughout, and the references at the end of each chapter provide useful guidance to those students who desire more detailed knowledge of particular crops. Where necessary, keys are given for the classification of the different genera, species, or varieties. Many of these keys are original, and no attempt is made at uniformity, each case being dealt with on its own merits.

The illustrations deserve a special meed of praise for their clarity, many of them being simplified annotated line drawings, which convey a distinct impression of the special points they are intended to exemplify.

Polyphase Induction Motors: their Theory, Calculation and Application. By Louis Lagron. Translated by R. C. Simpson and Dr. M. G. Say. Pp. xiv + 218. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1931.) 15*s.* net.

READERS of this book should have a good knowledge of electromagnetic principles and a working knowledge of the ordinary vector methods of discussing alternating current problems. As the book discusses only polyphase induction motors, its scope is scarcely wide enough for the student, whose library is naturally somewhat limited in size. The reasoning is easy to follow, but it is only mildly interesting to the engineer, as few of the difficulties of the theory are pointed out.

For mining purposes and for work in agriculture these motors are widely used, as they are not easily damaged. They were originally called 'asynchronous motors', but this led to confusion with 'a synchronous motor', and so the phrase 'non-synchronous' motor has come into use. The translators use both terms. The great advantage of an induction machine is that it requires no direct current excitation. If we drive it by means of external power above synchronous speed it becomes a generator. Thus it can be used for braking purposes in lifts and trains and, under certain conditions, power can be returned to the lines. Brief descriptions are given of cascade convertors and frequency changers.

But for the Grace of God. By J. W. N. Sullivan. Pp. 223. (London: Jonathan Cape, Ltd., 1932.) 7*s.* 6*d.* net.

IN earlier works Mr. J. W. N. Sullivan has exercised his literary gifts in making science intelligible to readers who are prepared to give thoughtful attention to novel conceptions and complex relationships. He has been very successful in his mission, and has rendered good service to science by his writings. In the present volume Mr. Sullivan tells the story of his life and reactions —physical and psychological. He intended at one time to present the events and experiences in the form of a novel, but decided eventually to adopt the autobiographical style. The emotional episodes are delicately described, but there is nothing particularly unusual about them even to the men of science who are said to be "exceptionally incomplete as human beings". Many thought-provoking aphorisms are, however, to be found in the book; such, for example, as "The attempt to teach mathematics by making it as 'concrete' as possible is killing to the naturally mathematical intelligence", and "It is the scientific man, not the poet, who is the dweller in dreamland". As a personal revelation of the development of a scientific mind, the book is well worth reading.

Seventy Years in Archæology. By Sir Flinders Petrie. Pp. viii + 284 + 26 plates. (London: Sampson Low, Marston and Co., Ltd., n.d.) 18*s.* net.

AT least one reader of Sir Flinders Petrie's autobiography must admit to closing the book with a feeling of disappointment. It falls between two stools. The general reader, who is no Egyptologist, will look to its author in the hope of gaining perspective in a review of archæological discovery in Egypt during the last fifty years, but he will find that the book confines itself strictly within the limitations of its title as a personal record of work in the field year by year since 1880, when Sir Flinders first went to Egypt. The Egyptologist, on the other hand, will regard it as too brief, too summary in its descriptions, to serve as anything more than a reminder of where the author was digging in any given year. From one who is our greatest pioneer and systematiser in archæological exploration, the most prominent and the most striking figure in British archæology in the present century, a broader view of his own work and its relation to archæological studies might legitimately be expected.

The Land Utilisation Survey of Britain

By Dr. L. DUDLEY STAMP, Director of the Survey

AFTER about a year spent in preliminary experiment, the Land Utilisation Survey of Britain, aided by an initial grant from the Rockefeller Research Foundation administered by the London School of Economics, began work with the appointment of its first organising secretary in October 1930. The genesis of the scheme, its aims and objects, have been explained at some length in papers read before the Royal Geographical Society[1] and the Royal Scottish Geographical Society.[2] It may be said very simply that the aim of the Survey is to make a cartographical record, complete for the whole of Great Britain and referring to the years 1931 and 1932, of the uses to which the surface of the country is being placed at the present time.

The record is being made on the maps published by the Ordnance Survey on the scale of six inches to the mile, since on these maps every individual field is already marked (Fig. 1). There are the equivalent of about 22,000 quarter-sheets of these maps, each representing six square miles, to be covered for the whole of Britain, and, broadly speaking, each quarter-sheet requires about two days' work. After a number of preliminary experiments, the following simple classification was adopted. It may be mentioned that it was left to the discretion of the surveyor whether each piece of land is merely marked with the initial letter, as given below, or lightly coloured.

(1) Forest and woodland, marked F; if coloured, a dark green. Forests and woodlands are already marked on the six-inch maps, but it is necessary, especially where the maps are rather out of date, that each area should be checked, and special care is required to include newly planted areas. After consultation with the Forestry Commission, the following classification of forests was adopted: (*a*) High forest—big trees sufficiently close for their crowns to touch, and useful for timber production. (*b*) Coppice, or coppice with standards—woodland that is cut over every few years for fencing, posts, etc. (*c*) Scrub—small bushes or trees unfit for cutting. (*d*) Forest felled and not replanted. Thus each piece of forest or woodland has a lettering, *Fa*, *Fb*, *Fc*, and *Fd*, and it is then also possible to distinguish coniferous, *c*, deciduous, *d*, and mixed, *m* (*Fa*^{d}, etc.).

(2) Meadowland and permanent grass, marked *M* and coloured light green. It is important that rotation grass should be excluded from this category.

(3) Arable or tilled land, including rotation grass and fallow, marked *A* and coloured brown.

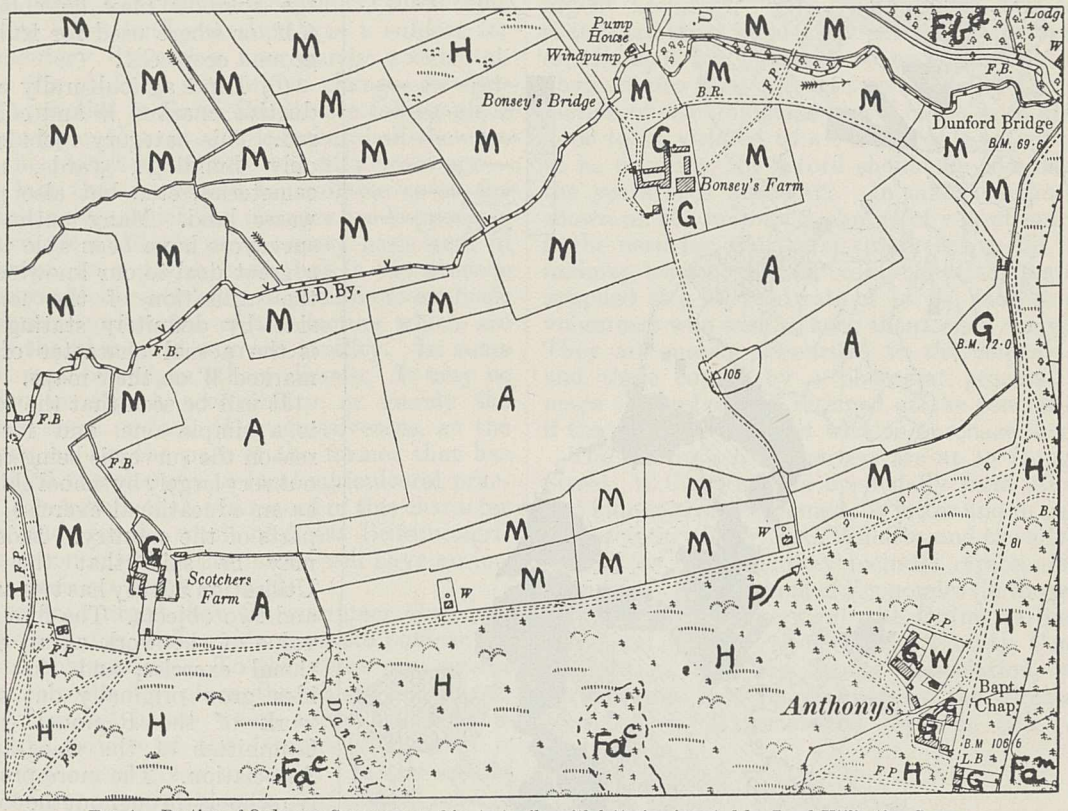

FIG. 1.—Portion of Ordnance Survey map, 6 in. to 1 mile, with lettering inserted by Land Utilisation Survey. (Reproduced by permission.)

Some areas of arable land are quite definitely used as market gardens, which are then further distinguished by the letters *MG*, but it was not felt possible to make a separate category for market gardens, because numbers of tracts of arable land are only used for market gardening purposes occasionally.

(4) Heathland, moorland, commons, and rough hill pasture, including swamp and marsh pasture. These are marked *H* and coloured yellow.

(5) Gardens, allotments, orchards, and nurseries, marked *G* and coloured light purple. Houses with gardens sufficiently large to grow a few vegetables or even flowers come in this category, because the area, though producing comparatively little, is still productive. Allotments are included in this category since they are merely gardens at a distance from the worker's house. Orchards are usually separately distinguished on the six-inch map, and so the symbol combined with the letter *G* readily distinguishes them; but if the ground is used for grazing, the symbols may be combined *GM*, or where used for fruit and ground crops *GA*.

(6) Land agriculturally unproductive, marked *W* and coloured red. This category includes not only buildings, yards, mines, cemeteries, etc., but also purely waste land. Many enthusiastic surveyors have been able to add a great deal to our knowledge of the utilisation of the countryside by definitely stating what is the actual character of land marked *W* on their maps.

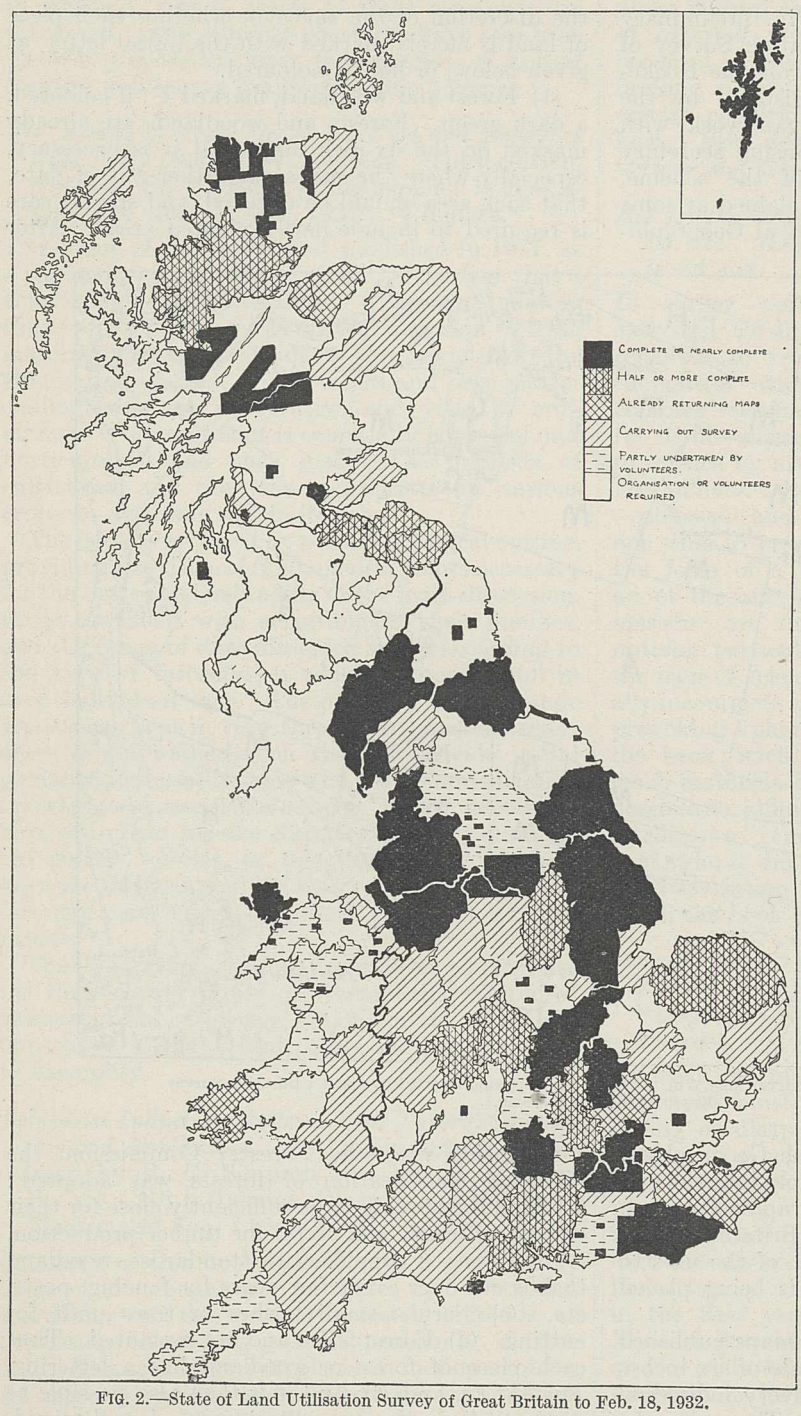

FIG. 2.—State of Land Utilisation Survey of Great Britain to Feb. 18, 1932.

It will be seen that the scheme is a simple one, and for that reason the survey is being carried out very largely by school children, as an educational exercise, in all parts of the country. Indeed, it may be said that the Land Utilisation Survey has two aspects and two objects. The first is the value of the work as an educational exercise, and the whole idea grew originally out of the work of the Regional Survey Committee of the Geographical Association. The more progressive schools throughout the country have for many years been carrying out local regional surveys, and on all hands it was obvious that the training in accurate observation which was entailed and the interest in local environment which was aroused—and invariably led to a remarkable realisation of civic consciousness—afforded an objective in itself. It was only to be regretted that all the rising generation should not be able to share in such an exercise. Hence it was felt that if a nation-wide survey on simple lines could be organised it would heighten the value of existing regional surveys and give a new incentive to those who had not yet undertaken such work, by permitting the participants to realise that they were really doing part of a great nation-wide work.

It may be said at once that the enthusiasm with which the scheme was received by educational authorities almost throughout Great Britain has been remarkable, and about two-thirds of the counties of England and Wales have been organised locally by directors of education. As the accompanying map (Fig. 2) shows, large areas have been completed, and testimony is unanimous as to the educational value of the work.

In the second place, there is the permanent value of such a survey. It must be said at the outset that the Land Utilisation Survey is an entirely independent body and has no connexion with any government department or with any political party, and that the inception of the scheme at a time when land valuation was a subject for Parliamentary discussion was purely accidental. Despite the rapidity with which changes in agricultural practice in Great Britain are taking place —for example, there is now less than half the area under the plough that there was fifty years ago— it is a fact that no record is available as to the exact areas over which the changes are happening. Statistics are available on a county basis and, in manuscript, on a parish basis, but in the absence of cartographical record it is impossible to evaluate the relative importance of the factors which are causing the change in a given locality. In some areas it may be soil, in others climate. It may be elevation or aspect, accessibility, or merely the progressiveness or lack of progressiveness, as the case may be, on the part of the farmer that has determined the changes in local agricultural practice. It is certain that, if a record of this character can be made for the whole of Great Britain, agricultural economists in the future will have an important basis on which to work.

It has been urged that the volunteer observers lack the training with which to make sufficiently accurate observations. To this there are several answers. In the first place, the scheme is a simple one, and on all hands where there are difficult points the advice of the farmers themselves is being sought and given willingly. In the second place, there is a ready check, in that separate sheets of the six-inch map by different surveyors must fit along the edges where they join, and if there is a disparity in observation, this is at once apparent. In the third place, trained observers are checking the results as they are obtained by making traverses across the sheets.

The map reproduced as Fig. 2 shows the present state of the work. Two things deserve emphasis. First, thanks are due to those who have so nobly assisted up to the present date, when more than four thousand sheets have been completed and returned to the central office; but there are still gaps in the scheme, and in a number of cases the organisation of a whole county is a matter of most urgent necessity. Broadly speaking, it is found that there must be at least one really keen person on the spot for the work to be successful. It is obvious also that any serious delay in the completion of remaining tracts will cause work already done to be vitiated to a considerable extent; for, to be of value, the record should be complete for the years 1931 and 1932. In many of the areas shown on the map as in charge of volunteers there is the need for additional volunteers to fill in remaining tracts. It may be said that the maps are supplied at a reduced rate of 1*s.* 6*d.* each to those volunteers who wish to keep them when completed. They are merely forwarded to the central office and there copied by a photostat process. The maps themselves are retained at the central office if the surveyor does not wish to purchase them.

The Survey's headquarters are at 18 Houghton Street, W.C.2, and are open daily from 10 to 5, and inquiries are welcomed, by letter and in person. The secretary is Mr. E. C. Willatts, and the advisory committee of the Survey includes representatives from the London School of Economics (in the person of Sir William Beveridge), the Ordnance Survey, the Land Agents' Society, the County Councils Association, the Boy Scouts' Association, whilst agriculturists are represented by the director of Rothamsted Experimental Station (Sir John Russell).

[1] *Geographical J.*, **78**, July 1931.
[2] *Scottish Geographical Mag.*, **47**, May 1931.

Vortex Motion in Vibrating Columns of Air

ONE of the most familiar and fascinating experiments in acoustics is that initiated by Kundt in 1866, in which the vibrations of an air column enclosed in a glass tube are revealed by means of a fine powder such as cork or lycopodium. Almost everyone is familiar with the manner in which the dust collects in little heaps at the nodes, thereby providing a simple means of estimating the velocity of sound in the gas enclosed in the tube.

An interesting secondary phenomenon also is the formation of a series of ridges or striations of dust lying across the axis of the tube. An attempt to explain this peculiar formation was made in 1891 by W. König. His theory, based on attractions and repulsions between spheres in a vibrating fluid, was universally accepted until the present time. Even Rayleigh found nothing in it to criticise.

In two papers recently published,* Prof. E. N. da C. Andrade has thrown fresh light on the subject in a somewhat startling manner. In the older experiments the observations of the striations were always made under static conditions, that is, after the air vibration had ceased, instead of in the dynamic state whilst the air was in vibration. Not only this, but also the method of excitation was not always maintained for a period sufficiently long for the motion to reach a final stable condition, nor was the amplitude of excitation kept uniform. Prof. Andrade remedies all these defects in

* *Proc. Roy. Soc.*, A, **134**, pp. 445-470; 1931; and *Phil. Trans. Roy. Soc.*, A, **230**, pp. 413-445; 1932.

technique by the simple, but very effective, expedient of using a vibrating diaphragm driven by the alternating current from a thermionic valve oscillator of controllable frequency and current output. By such means he has demonstrated that even very small cork dust particles are unsuitable as true indicators of vibratory air motion. Instead of behaving as tracing points they act as obstacles which initiate local vortex motion in the vibrating gas. Consequently, smoke particles are used as a means of studying the true movement of the air in a dust-free tube, suitable precautions (water jackets, etc.) being taken to prevent circulations due to convection currents. A series of beautiful photographs reveals regular circulations of air in the tube, the general drift being from antinode to node along the wall, returning up the centre of the tube. The resonant air column is divided into half wave-lengths by the regular drift-motion of the gas. The form of the stream lines agrees fairly well with Rayleigh's approximate theory.

An entirely novel and most important application of the air vibrations in the resonant tube is made by Prof. Andrade when he utilises the phenomenon to investigate vortex motion around obstacles in the vibrating air. By means of a specially designed tube, and making use of tobacco smoke (from a "cheap cigarette") to indicate the fluid flow, a series of photographs has been taken to show the formation of vortices around objects of simple geometrical form—spheres and cylinders of various diameters. The conditions of formation of the vortices are studied, in particular the critical velocity necessary to initiate vortex motion. In order to determine this velocity it was necessary to measure the actual amplitude of the air vibration, observing the individual smoke particles by means of a microscope. This measurement is in itself a notable achievement, forming as it does the basis of a standard source of sound. The results obtained for the critical velocity in alternating flow are, considering the difficulty of the experiment, in good agreement with similar measurements by other observers for steady flow.

The second of Prof. Andrade's papers deals more particularly with the general behaviour and grouping of solid particles under the influence of air vibrations in tubes. The phenomena observed, antinodal discs, primary and secondary striations, are shown in a most convincing manner to be due to vortex motion and general circulation set up when the air-particle velocity in the tube exceeds the critical value. König's theory is conclusively proved to be untenable as it entirely ignores such vortex motion. It would require too much space to enter into details of the wonderful arrangements of the irregular particles of cork dust, the spherical particles of carnauba wax and the vortex streams around obstructing particles lying in the tube. Actual photographs of the motion of minute dust particles demonstrate the alternating motion superposed on the general drift.

Acoustics has assuredly taken a new lease of life in recent years. The two papers by Prof. Andrade briefly summarised in the foregoing remarks show in a most striking manner how even an ordinary textbook experiment in sound may be revivified to yield most interesting and valuable information. The old Kundt's tube experiment now provides a means not only of measuring sound velocity, but also of producing vibrations of known amplitude (a standard source of sound), and of studying vortex motion. One cannot help wondering, however, how many "cheap cigarettes" Prof. Andrade must have smoked "in the cause of science".

Neanderthal Man in Palestine

A CABLEGRAM has been received from Mr. Theodore McCown, who, in the temporary absence of Miss Dorothy Garrod, is directing the exploration of caves in Mount Carmel, announcing the discovery of fossil remains of three individuals of the Neanderthal species of mankind. The discovery thus announced is of more than usual importance; it brings to a successful issue a search which has been conducted in Palestine since 1925, first by the British School of Archæology and latterly by a combined expedition fitted out by that School in conjunction with the American School of Prehistoric Research. Miss Garrod is in charge of the combined expedition, and to her must go the chief credit.

To appreciate the importance of the discovery just announced, it is necessary to recall the sequence of events which have led up to it. The first discovery was made by Mr. Turville Petre in 1925 when excavating a cave on the western shores of Lake Galilee; deep in a Mousterian stratum he found the front part of a skull showing Neanderthal characteristics, but also certain other traits which raised a suspicion that the Neanderthalians of Palestine were racially different from their contemporaries of Europe. In 1928, Miss Garrod, while excavating a cave (Shukbah) on the western flanks of the Judean Hill, penetrated a Mousterian stratum and found a tooth and fragment of skull, which, although undoubtedly Neanderthal in their characterisation, left the racial problem of the ancient Palestinians unsolved. In 1929, Miss Garrod began the excavation of a vast cave in the Wady-el-Mughara in the western flank of Mount Carmel, and again reached a Mousterian stratum.

Although fossil traces were again found in that year and in the following (1930), they were insufficient to throw light on racial characterisation. In 1931, however, the search was crowned with a partial success. Mr. McCown, a student of the American School of Prehistoric Research—recommended by its director, Prof. MacCurdy—joined Miss Garrod, and was placed in charge of the excavation of an adjacent rock-shelter. In the terrace of this shelter, six feet below its surface and four feet within a Mousterian stratum, he exposed

part of a child's skeleton embedded in hard travertine.

The block containing the child was hewn out and sent to the Museum of the Royal College of Surgeons, London, where the encrusting rock was successfully chiselled away from the skeleton by Ernest Smith. The extraction involved three months of delicate manipulation. It was then seen that the child had been buried in a sitting posture, heels under the buttocks, back flexed, and head thrust down on the breast. The child had been about four years of age and a little more than three feet in stature, being of slender build. Unfortunately, the face had been smashed after burial and the teeth were found scattered near the skull. The teeth left no doubt as to the racial nature of the child; they had the characteristic Neanderthalian traits. So, too, had the temporal bones. The frontal bone was damaged, but the hinder part of the skull—the part missing in the Galilee skull—was intact and well preserved.

Mr. McCown joined Sir Arthur Keith in January of the present year to complete an investigation of the anatomical details and draw up a report. The hinder part of the child's head differed altogether in its conformation from any Neanderthal skull so far discovered. The cerebellar lobes were set widely apart, so that when the skull is viewed from behind there is a pronounced lateral fullness or bulge—as in the skulls of young anthropoid apes. There were also certain features which recalled modern rather than Neanderthal man. It became important to remove from the interior of the skull—its walls are only 3 mm. in thickness—the hard mass of rock which filled it. This was successfully done by Mr. McCown and a cast was taken of the interior, and thus an exact reproduction of the shape of the brain was obtained. The position of the cerebellar lobes and of the overlying occipital lobes are quite different from the arrangement of parts seen in any known race of mankind.

It therefore became more than ever important that the adult form of the Neanderthal Palestinians should be discovered. The expedition for the present year was timed to set out at the end of March, but owing to Miss Garrod's illness, Mr. McCown had to return alone to resume the excavation of the rock-shelter at Mount Carmel. The cablegram just received announces his success, and justifies the assumption that he is now in a position to determine the racial characteristics of the Neanderthal Palestinians. The stratum at the rock-shelter represents upper or later Mousterian deposits.

Obituary

Sir Patrick Geddes

SIR PATRICK GEDDES died at the Collège des Écossais, Montpellier, on Sunday, April 17, at seventy-seven years of age, but still as full of ideas and enthusiasms as a young man. He was born in Perth in 1854, the son of Capt. Alexander Geddes, of the Black Watch, and he retained throughout life his feeling for the Highlands and their memories and survivals of the days before industrialism. Inspired by Darwin's work, he came to study under Huxley, but his primary interest was in the application of Darwinian ideas to the problems of human society, and he increasingly turned to the ideas of Lamarck, Herbert Spencer, and Auguste Comte, and realised his kinship of thought with Bergson. His thoughts were turned in this direction partly through a threat of blindness which, while he was carrying out research in Mexico, made microscope work impossible and forced him to live in a darkened room. Like Weismann in similar circumstances, he turned to thought and its graphical expression in highly suggestive notation systems.

In biology, Geddes was deeply concerned with ideas of metabolic tides in the organism, and saw plants, animals, and men as incarnations of vital activity fitting the expression of inner needs and urges into the frame of an outer environment that their activity was ever altering. Applications of this point of view to society led him to become the inspiration of the Sociological Society, the apostle of regional and town planning, the friend and counsellor of Herbertson in his geographical efforts at Oxford, the planner of the University of Jerusalem, a suggestive psychologist, and, above all, an interpreter quick to seize important points in the thought of other men and to respond with suggestions of relations that they might not have perceived. For, in a generation bent on analysis, he was ever seeking synthesis and pressing it forward with his overwhelming physical and mental vigour touched by mystical idealism. To try to help fellow-workers to maintain freshness, he first developed the idea of summer schools, which have become such a feature of educational and research efforts; he interested himself in exhibitions, and all but carried through a magnificent scheme in connexion with the Paris Exhibition of 1900, spoiled in the end by a political crisis arising out of the Dreyfus case. He struggled to express and exhibit in his 'Outlook Tower' at Edinburgh his ideas of synthesis, and many a worker has found there, despite its poverty of resources and resulting inadequacies, a stimulus that has never been lost. A large collection of maps and illustrations relating to the evolution of cities was sunk, during the War, on a journey to Madras.

The partnership of Patrick Geddes and J. Arthur Thomson was as picturesque as it was valuable to other thinkers. Their "Evolution of Sex", their little book on "Evolution" in the Home University Library, and their recent instalment of a large work, were all efforts to express a much-needed point of view. In his other partnership, with Victor Branford, Geddes sought in a series of books and articles to give a synthetic view of social evolution. But publication and matters of personal fame in scientific work were always secondary to the desire to help men to understand their environments and

adjust them in such a way as to meet the need, not for immediate gain so much as for an enduring advance from which future generations might gain enhanced opportunities of expression of the best aspects of their personalities. His civic improvements at Edinburgh, his betterment of Indian cities, his efforts for residential halls for British students in French universities with the view of international understanding, and, perhaps most intimately of all, his gardens, were all the expression of the idealism that was the dominant note in a noble character.

DR. L. A. BAUER

DR. LOUIS AGRICOLA BAUER, who was killed on April 12, by falling from a window of his flat in Washington, was probably the best-known authority on terrestrial magnetism in the world. Born in Cincinnati, on Jan. 26, 1865, he was educated at the university there, and in Berlin. From 1887 until 1892 he was astronomer and magnetic computer in the U.S. Coast and Geodetic Survey, and in 1895–96 was an assistant to Michelson at Chicago. There he founded the journal *Terrestrial Magnetism* (the words *and Atmospheric Electricity* being added to the title in 1898); this was then, and still is, the only periodical expressly devoted to the subject. He conducted the journal for many years on his own financial responsibility, occasionally assisted by grants.

In 1896, Dr. Bauer began a magnetic survey of Maryland, under the State geologist—this was the only State magnetic survey that had been undertaken for many years; he continued the survey during two or three summer vacations, and published a very interesting historical account of terrestrial magnetic observation in his first report on the Survey. In 1897 he became assistant professor of mathematics and mathematical physics at Cincinnati. His enthusiasm for terrestrial magnetism, and his energetic pursuit of magnetic work, aroused renewed interest in the subject in the United States, and in 1899 he rejoined the Coast and Geodetic Survey as chief of the newly founded Division of Terrestrial Magnetism. There he initiated an active policy, planning a magnetic survey of the whole of the United States and its territories elsewhere, and, in connexion therewith, instituting four new magnetic observatories, at Cheltenham in Maryland, Baldwin in Kansas, Sitka in Alaska, and Honolulu in Hawaii. He also greatly developed the magnetic work of the ships of the Coast and Geodetic Survey. Though he did not long remain in his new office, his influence on the work of the Coast and Geodetic Survey has been lasting, and the Survey is now one of the most active national organisations undertaking magnetic observatory and survey work.

Bauer's ambitions for his chosen science did not stop short at national frontiers, however; he saw that the science needed a world magnetic survey, and that, on account of the irregular and incalculable course of the secular variation, this survey must be renewed every generation, unless important data are to be for ever lost. He saw also that this could not be achieved by national organisations, so many countries being scientifically backward, while many parts of the oceans had long remained unsurveyed. He therefore drew up a plan for a research department of terrestrial magnetism, which should fill up what was lacking in the efforts made by other magnetic organisations, as regards the world survey, and also do everything possible in other ways to advance the science. His plans led to the formation of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, in 1904; he became the first director, and held the office until he retired through ill-health, in 1930. Under his energetic direction, and with the aid of a devoted staff that he gathered round him, the Department has done a great work for terrestrial magnetism and atmospheric electricity. Perhaps its most important work was done by its two survey ships, first the *Galilee*, and later the non-magnetic ship *Carnegie* (unhappily destroyed, with the loss of its commander, Capt. Ault, in 1929, at Apia, Samoa). Much land magnetic surveying was also done, either directly or by aid given to other bodies. Later the Department instituted two magnetic observatories, at Watheroo in Western Australia and Huancayo in Peru, to mitigate the pressing need for more magnetic observatories in the southern hemisphere. A valuable feature of the ocean survey work was the promptness of publication of the results, which enabled the various national ocean magnetic charts to be greatly improved in many respects. In many other directions also the Department carried out important work, which is still continuing and developing.

In his attempts to elucidate the theoretical aspects of the science Bauer was less successful, but it is well known that the subject is a particularly intractable one. His organising work, and its valuable and permanent results, will assure him a lasting and distinguished place in the roll of benefactors to the science; and his services to it were widely recognised in his lifetime, particularly by his election, in 1927, to the presidency of the international organisation for terrestrial magnetism, under the International Union for Geodesy and Geophysics. S. C.

WE regret to announce the following deaths:

Mr. B. A. Behrend, consulting engineer to the Westinghouse Electric and Manufacturing Co., Boston, Mass., a distinguished American engineer interested particularly in alternating current phenomena, on March 25, aged fifty-six years.

Sir David Drummond, C.B.E., emeritus professor of medicine at the University of Durham College of Medicine, past president of the British Medical Association, a well-known specialist in diseases of the brain, on April 27, aged seventy-nine years.

Dr. Victoria Hazlitt, lecturer in psychology, Bedford College, University of London, for some years secretary of the Committee for Research in Education of the British Psychological Society, on April 19.

News and Views

Oldoway Man

IN the correspondence columns of the present issue (p. 721) Dr. L. S. B. Leakey replies to the criticisms of the conclusions at which he himself and his colleagues have arrived as to the antiquity of the remains of *Homo sapiens* from the Oldoway beds in East Africa. In effect, he agrees with Messrs. Forster Cooper and Watson that it is unlikely that the Oldoway skeleton would have been found in a state of complete articulation and in its contracted position had it been deposited by natural means in the situation in which it was found. It will be remembered that others have felt this a difficulty, notably a writer in *L'Anthropologie*, to whose comment we have already directed attention on a previous occasion (see NATURE, April 23, p. 607). Dr. Leakey, however, now states that he personally is of the belief that the position of the skeleton is due to burial, but a burial contemporary with and not subsequent to the deposition of Bed No. 2, in which it was found, Bed No. 3 being laid down after the burial had taken place. The complete absence of any trace of intermixture of the yellow deposits of Bed No. 2 and of the red deposits of Bed No. 3, of which Dr. Leakey has assured himself by a personal inspection of the actual skeleton, is conclusive. In the event of an ancient burial, such an admixture would be practically inevitable; while of the two alternatives, an ancient and a modern burial, the geological evidence, as interpreted, appears to point beyond question to the former. Strong corroboration is afforded by the fresh evidence now adduced from the fossil beds of the Kavirondo Gulf, where the old Lake beds have yielded Dr. Leakey a fauna and a culture sequence similar to Oldoway, but a fragment of human mandible from Kanam carries back *Homo sapiens* to Pre-Chellean, a stage further removed than Oldoway man.

Physical Research in the University of Melbourne

PROF. T. H. LABY, professor of natural philosophy in the University of Melbourne, is building up an active school of research in the University. He has at the moment eighteen research workers, one-third of whom are full-time workers. Problems in X-rays, heat, and in the propagation of electromagnetic waves are being investigated. Rowland's method of the coincidence in different orders of spectral lines is being applied to the determination of X-ray wave-lengths in terms of wave-lengths in the ultra-violet determined by interferometer methods. A vacuum spectrograph with a Lyle-Merfield grating in which the incident rays make a glancing angle of 5° has been constructed. This work has been delayed by Prof. Laby's recent illness, but tests already made show that the spectrometer is a convenient one, and that a considerable increase in the accuracy of wave-length determinations below 2200 A., including X-ray wave-lengths, will be possible. Experiments on the reflection of X-rays are being continued. Incidental to them it has been found that the K-radiation of carbon ($\lambda = 45$ A.) can be excited in an X-ray tube without any evidence being found of the presence of accompanying continuous radiation.

IN addition to the work on spectral physics, which alone might be considered sufficient to occupy the attention of a research school, Prof. Laby and his collaborators have undertaken investigations on thermal conductivities and the propagation of electromagnetic waves. In view of the uncertainty as to the true value of the thermal conductivities of air and other gases, of their variation with temperature, and similarly of the thermal conductivities of highly purified metals and their temperature variations—our knowledge of the latter seems very indefinite, although there are many theories to account for the supposed facts—experiments to remove some of these uncertainties are being carried out by Hercus, Kannuluik, and others. In the propagation of electromagnetic waves, Martin and Cherry have found evidence that a laterally deviated wave is an important contributory factor to fading. Munro, Huxley, and Higgs, by means of cathode ray direction finders situated at Melbourne and Canberra, have confirmed that atmospherics have their origin in thunderstorms, no other source having been definitely found. The cathode ray direction finder would appear to have considerable value to meterology and aviation in Australia.

Huxley Memorial Lecture

MR. ALDOUS HUXLEY gave the Huxley Memorial Lecture at the Imperial College of Science on May 4 and took as his subject "T. H. Huxley as a Man of Letters". The lecture, which is published as a pamphlet by Messrs. Macmillan and Co., Ltd., price 1*s*. net, was a careful, thoroughly sound, and highly stimulating treatment of the subject. Mr. Huxley based his account mainly on what his grandfather had said himself about his own methods and ideals in writing, and followed this up by analysing in detail several typical specimens of Huxley's writing. It was well worth doing, and sent one back with increased pleasure to the reading of other passages of that incomparable scientific master of good English. He is everywhere vigorous, true, and terse, and it is useful, though not surprising, to learn from what Mr. Aldous Huxley tells us, that the excellent finished product was not only the result of a clear and able mind but also of long, determined, and painful practice. Huxley talked about it in some detail to several correspondents, telling Hooker in 1860 how he found it constantly more and more difficult to finish things satisfactorily (which meant that his standard was always becoming higher), and apologising to Varigny, his French translator, for the condensed and idiomatic English, "which must present many difficulties to a translator". "Sometimes", he says, "I write an essay half a dozen times before I get it into the proper shape. But"—and here was one of the great secrets of his success—"the fact is that I have a great love and

respect for my native tongue and take great pains to use it properly."

Scientific Writings as Literature

WE should, in fact, be inclined to lay the greater stress on Huxley's native taste and effort and on the favourable circumstances of his writings, and less on the detailed features which Mr. Aldous Huxley discovers—the balance of phrases, the cæsura ending, the Biblical allusions, and so forth. These are by the way. The main thing was having clear ideas and trying always to say them in the fewest and most appropriate words. The true man of science has in this respect an initial advantage over other writers, because he starts with a definite statement about something observed which he wishes to convey to his readers in the most direct and effective way. German writers do not conform to the rule owing to the complication of their tongue; but recently some professors of English in an American university compiled an anthology of extracts from the writings of men of science as a textbook for students in English. Plenty of names will occur to one at once of scientific writers who might be named in the same class as Huxley, though none perhaps so racy and pointed. His own contemporary Tyndall was one of the best. It should also be remembered that these men were living and writing at a time when a great new idea was in the air and inspiring both those who promoted it and those who were on the defensive to special mental gymnastics. No one can read Huxley without enjoying the bracing atmosphere of controversy in which he worked. He was always stript and putting the last ounce into his fencing. For this both he and we have largely to thank the doctrine of evolution. We are not so controversial at the present day, or at any rate our controversies have not the same all-pervading and stimulating effect.

Manson Medal for Tropical Medical Research

THE Manson medal for tropical medical research, given triennially by the Royal Society of Tropical Medicine and Hygiene, has this year been awarded to Dr. Theobald Smith. In association with Kilborne in 1893, Theobald Smith showed that red-water fever in cattle is transmitted by ticks, and at the same time demonstrated the passage of infection through the ova of one generation of ticks to the next. This discovery proved that a protozoal parasite of mammals could be disseminated by the bite of a blood-sucking arthropod. Probably because Theobald Smith was dealing with a cattle rather than a human disease, this great event in the history of medicine received scant recognition, though it preceded the better-known work of Bruce on the transmission of sleeping sickness and that of Ross on malaria. Indeed, Theobald Smith was the first to transfer the insect transmission theory of protozoal disease from the realms of hypothesis to those of established fact. In 1904, Theobald Smith reported anaphylactic symptoms in dogs and rabbits, and, in a letter to Ehrlich, wrote the original description of the classical anaphylactic shock in guinea-pigs often known as the Theobald Smith phenomenon. In 1907 he proved that it was possible to immunise guinea-pigs actively by the injections of a balanced mixture of diphtheria toxin and antitoxin, and two years later suggested further investigations of the method with the view of its ultimate application to human beings, thus anticipating Von Behring and Park's work by several years. The previous recipients of the Manson medal have been Sir David Bruce (1933), Senator Ettore Machiafava (1926), and Sir Ronald Ross (1929).

Gravitation and Electrodynamics

IN the last of his Rhodes lectures delivered at Oxford a year ago, Prof. A. Einstein pointed out that a defect in the original form of the general theory of relativity was that the electromagnetic field was not expressed by means of the metric of the space-time continuum as was gravitation. By introducing a modified form of the Riemann geometry admitting of distant parallelism, Prof. Einstein obtained field equations which he hoped would remedy this defect. From his Rouse Ball lecture at Cambridge on May 5, it appears that this method of approach has been unsuccessful. Prof. Einstein has reverted to a mathematical technique introduced by Kaluza, and has succeeded in defining a vector with four or five components in space of one less dimension. Introducing parallel displacement, a five-component vector is projected repeatedly on to a four-dimensional plane, giving rise to a curve, the properties of which provide the relationship required. In this way the extra term required to account for the phenomena of electrodynamics is obtained. The method resembles that used in building up the general theory of relativity.

Twenty-one Years of Radio Communication

WE congratulate the *Wireless World* on the completion of its twenty-first birthday, which is commemorated in the issue of April 27. For its first two years, the journal was known as the *Marconigraph*, but as the number of amateur enthusiasts was rapidly increasing, it changed its title to the more comprehensive one of the *Wireless World*. So far back as 1914, we find from its pages that the late Mr. Campbell Swinton practically predicted the ultimate possibilities of wireless and indicated that at no distant future we would have broadcasting. The War gave a great impetus to the development of radio. After the War, the *Wireless World* took a leading part in the movement for granting amateur licenses and in encouraging the 'Dutch concerts' and the transmissions from Writtle—the forerunners of wireless telephony and broadcasting. It organised communication tests between amateurs in Great Britain and America with the object of finding out whether it would be possible to bridge the Atlantic on short waves. The success of these tests led to intensive research and the discovery that these waves were ideal for distant communication. It also played a foremost part in connexion with Empire broadcasting, and helped to overcome the bitter opposition to the scheme which lasted for several years. The progress made by radio communication during the last twenty-one years is marvellous. There seems no reason to doubt that equally rapid progress will be made for

many years to come. Methods of communication which twenty-one years ago stretched our imagination to the utmost are now commonplace practice. We congratulate Mr. H. S. Pocock, the editor, on the excellent work he has done.

University of the Witwatersrand Library

LAST Christmas Eve, a fire took place in the main block of the University of the Witwatersrand. As a result, very considerable damage was done: the main Library was completely destroyed, as were also the priceless Gubbins collection and the Law Library, which are, naturally, irreplaceable. Through the co-operation of the British Association and of other bodies, many replacements of lost and damaged books have been made, but in order to broaden the basis of the appeal, a meeting was held on May 9, in the council room of the Royal Empire Society, presided over by the Earl of Athlone, himself an honorary graduate of the University, the degree of LL.D. having being conferred upon him when he was the Governor-General of the Union of South Africa, during the visit of the British Association to Johannesburg in 1929. In the course of his introductory remarks, Lord Athlone traced the development of university education in South Africa, and pointed out that the University of the Witwatersrand only received its charter of incorporation ten years ago. In 1925, H.R.H. the Prince of Wales formally opened the new buildings, which occupy a magnificent site on the outskirts of the city. General Smuts was the first honorary graduate. The progress made has been remarkable, and there are now about two thousand students taking the regular courses. It was therefore a tragedy that the 'soul' of the University had been destroyed through the fire.

As a result of the meeting, which was addressed by Dr. W. Cullen, Mr. J. G. Gubbins, Prof. A. P. Newton, Sir Frank Heath, and others, a strong and representative committee, upon which Lord Athlone consented to serve, was formed to co-ordinate British efforts for restoring the library of the University. The loss includes the collection of manuscripts, books, and prints presented by Mr. Gubbins, the Hoernlé anthropological collection, in addition to all scientific journals and the departmental libraries of classics, English, Afrikaans, German, French, history, mathematics, geography, economics, and education. If the appeal for funds is successful, it is proposed to build a fireproof library, as a separate building, at an estimated cost of £60,000, a large part of which will probably be raised from people who live, or have lived, in South Africa. The chief task of the appeal committee will be, therefore, to procure books and other works to restock the library. It is, of course, impossible to replace the original documents destroyed by the fire, but it is hoped that other collections of a like kind will be forthcoming as the needs of the new library become known and the opportunity which it affords of representing every phase of South African life and culture is realised. Gifts of sets of journals and works of reference will also be gratefully accepted. All communications relating to such gifts should be sent to Dr. W. Cullen, 4 Broad Street Place, London, E.C.2.

Plastic Deformation of Metals

DR. F. KÖRBER, director of the Kaiser Wilhelm-Institut für Eisenforschung, Düsseldorf, delivered the twenty-second annual May lecture of the Institute of Metals in London on May 11, on "The Plastic Deformation of Metals". Basing his remarks on the results of a series of investigations conducted at Düsseldorf during recent years, Dr. Körber dealt with the stress relationships and also with the course of the flow of the material during the most important of the mechanical shaping processes. Discussions were entered into on the conditions requisite for the commencement of plastic flow and also on the possibility of drawing conclusions from the resulting flow phenomena as to the distribution of stress in the material at the inception of deformation. The disturbances in the material in consequence of the more marked deformations in drawing, extrusion, and rolling were traced by a suitable method of investigation. The results were compared with the deformation structures obtained by X-ray methods. The knowledge of the deformation processes so obtained enabled conclusions to be drawn as to the energy or power used in the shaping operations. An exact analysis of the course of deformation in the transition zone led to estimates of the internal losses during the alterations in form. Quantitative treatment of the stress relationships which occurred in the zone of deformation is possible in so far as the pressure created at the surface of contact between the tool and the material is known by actual measurements. From the results of determinations along the roll-gap of the pressure between the rolls and the stock being rolled, a complete quantitative presentation of the distribution of stress in the transition zone between the rolls has been formulated.

Electrification of Ulster

IN the *Asea Journal* for February an account is given of the electricity distribution scheme in Northern Ireland. The Irish Free State has built a large water power station on the River Shannon, on the west coast. In Northern Ireland (Ulster), there is also a considerable amount of water power available in the River Bann, which drains a large area round Lough Neagh. A scheme was recently under consideration to build a water power station on this river, but as the question is intimately connected with a land drainage scheme to be carried out by the Government, this scheme has been temporarily suspended. A steam power station has been built in Larne, on the east coast, not far from Belfast. From this station, a 33-kilovolt main transmission line has been taken over the country, through the towns of Ballyclare and Ballymena, with the view of future connexion with the River Bann. The steam power station at Larne has two turbo sets, each of 1750-kilowatt output, and a space has been reserved for one of double the size. In this way the load will be built up gradually, so that when the water power station with its comparatively high initial cost is completed, it will be possible to load it profitably from the start. The electric power will be mainly used by the linen industry, which has long flourished in Ireland. There are also paper mills and cement works in the

district, and numerous small townships. A local company in Larne owns the power station and a Belfast company the overhead distribution system.

Atmospheric Effects and the Andean Eruptions

WHEN a solar halo and sun pillar were observed in London a few days after the recent volcanic outbreaks in the Andes, the question of a connexion between the two phenomena was raised. There was no serious case to be made out for any such connexion, in view of the enormous distance that separates Great Britain from the scene of the eruption, and the incredible wind velocity that would have been necessary to bring volcanic dust in such a short time. Moreover, optical phenomena of this kind are known to be due to ice crystals at great heights and not to dust. The more rational question of ultimate meteorological effects in the northern hemisphere is discussed in a recent bulletin from Science Service, Washington, D.C. We are reminded that after the explosion of the East Indian volcano Krakatoa in 1883, volcanic dust drifted entirely round the earth, and that the remarkable red sunsets that occurred for several years after can reasonably be attributed to the presence of this dust, for the selective absorption effects of dust upon the constituent colours of the light of the sun is proved at almost every fine sunset in industrial regions. Prof. W. J. Humphreys, of the U.S.A. Weather Bureau, has expressed the opinion that it is only on the supposition that the ash has ascended in large quantities above the level of the highest clouds that it may be expected to cross over to the northern hemisphere; if confined to lower layers, it may perform long journeys in the atmospheric circulation of the southern hemisphere but will tend to be entangled by condensing cloud particles and be brought to the earth by rain. Apart from sunset effects, the probable influence of dust at very high levels upon the weather through weakening of the solar radiation is difficult to estimate, owing to the complexity of the reactions likely to be set up.

Funerary Offerings from Ancient Mexico

A TOMB deposit described as second only in intrinsic value to the recently discovered treasure of Monte Alban, we learn from a recent Science Service bulletin, has been discovered at Texmelincan, in the State of Guerrero, one hundred and twenty miles south of Mexico City. The tomb is situated in an area covered with mounds concealing buildings and other remains. The objects in the tomb have now been deposited in the Department of Archæology, Mexico City. Among them the most notable is a disc of gold, eight inches in diameter, with a hole in the centre. On it are engraved two of the characteristic feathered serpents, intertwined, and with the head of an armed warrior protruding from the jaws of each. Two belts, two feet long and three inches wide, are covered with a thin sheeting of beaten gold. There were also found large gold ear-rings, a necklace of thirty-two hollow gold beads and one of seventy-one unusually fine carved jade beads, three necklaces of shell and stone beads, copper bells, and obsidian ear-rings painted red. Some finely polished pottery vessels suggest a Toltec origin. The nearest important city site, it is pointed out, is Xochicalco, which is noted for its 'Toltec Maya' style.

The Rebuilding of Napier and Hastings

The New Zealand correspondent of the *Times*, in the issue for May 5, has given an interesting account of the rebuilding and repair of the towns damaged by the Hawkes Bay earthquake of Feb. 3, 1931. The total loss was estimated at about six million pounds. One-quarter of this amount was provided by the Government, and public subscriptions added nearly £350,000. In Napier, nearly the whole of the business quarter was destroyed. The work of reconstruction includes the widening and replanning of many streets, the laying down of about 20 miles of main sewers, and the provision of new artesian wells or the repair of old ones sufficient to give a supply of four million gallons daily. An unexpected gain from the earthquake is an extensive area of new land. Before the earthquake, plans had been made to reclaim certain shallow parts of the harbour. This work is now unnecessary, as the earthquake raised the level of the land by five or six feet. About 7000 acres of the new land, it is proposed, will be converted into farming land, and the long marine parade will be widened and beautified.

Announcements

SIR ARTHUR KEITH will deliver the Stephen Paget memorial lecture at the annual general meeting of the Research Defence Society, which is to be held on Wednesday, June 15, at 3 P.M., in the lecture hall of the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1.

APPLICATIONS for grants from the Research Fund of the Chemical Society must be made by June 1 on a special form obtainable from the Assistant Secretary, Chemical Society, Burlington House, W.1. Attention is directed to the fact that the income derived from the donation of the Goldsmiths Company is more or less especially devoted to research in inorganic and metallurgical chemistry, and that from the Perkin Memorial Fund to investigations relating to problems connected with the coal-tar and allied industries.

AT the annual general meeting of the Challenger Society held on April 27, a resolution to the following effect was carried unanimously: "That a sum of money, provisionally put at £25, to be modified at the discretion of the Committee, should be devoted to the assistance of a desirable student (or students) to enable him (or them) to work at Plymouth (or other Marine Biological Station). Preference to be given to members of the Society, and the selection to be in the hands of the Committee."

THE following appointments have recently been made by the Secretary of State for the Colonies in the Colonial agricultural and forest services: Mr. E. Ballard, to be Government entomologist, Palestine; Mr. E. D. Hill and Mr. W. R. Hudson, inspectors of plants and produce, Gold Coast, to be senior inspectors; Mr. R. R. Staples, agricultural economist, Tanganyika Territory, to be pasture research officer,

Tanganyika Territory; Mr. C. G. Trapnell, to be ecologist, Northern Rhodesia; Mr. H. E. Desch, formerly assistant conservator of forests, Nigeria, to be forest research officer (wood technologist), Federated Malay States.

THE Council of the Institution of Civil Engineers has made the following awards in respect of papers read and discussed at the ordinary meetings during session 1931–32: Telford Gold Medals to Dr. C. F. Jenkin, emeritus professor of engineering science in the University of Oxford, and to Sir Bernard D'O. Darley, of Bahawalpur, India; Stephenson Gold Medal to Mr. B. G. White (London); a Telford premium jointly to Mr. H. C. Whitehead (Birmingham) and Mr. F. R. O'Shaughnessy (Birmingham); Telford premiums to Mr. Raymond Carpmael (London), Mr. H. J. Deane (London), Mr. John Goodman (Skipton); a Manby premium jointly to Mr. W. F. Stanton (Bishops Castle) and Mr. A. G. Le Clercq (Walton-on-Thames); a Trevithick premium to Mr. W. C. Ash (Vizagapatam, India).

THE Council of the Institution of Electrical Engineers has made the following awards of premiums for papers read during the session 1931–32, or accepted for publication: Institution premium to Mr. J. Bruce; Ayrton premium to Mr. F. Lydall; Fahie premium to Messrs. H. Kingsbury and R. A. Goodman; John Hopkinson premium to Mr. H. W. Clothier; Kelvin premium to Prof. W. M. Thornton and Dr. W. G. Thompson; Paris premium to Messrs. E. W. Dickinson and H. W. Grimmitt; extra premiums to Messrs. H. Blades and A. C. MacQueen, Messrs. R. O. Kapp and C. G. Carrothers, Dr. F. Luschen, Messrs. H. Pearce and T. T. Evans, Mr. E. A. Watson, Major E. H. E. Woodward, and Mr. W. A. Carne. Wireless Section premiums: Duddell premium to Mr. T. L. Eckersley; extra premiums to Mr. B. S. Gossling, Messrs. J. A. Ratcliffe, L. G. Vedy and A. F. Wilkins. Meter and Instrument Section premiums: Silvanus Thompson premium to Prof. J. T. MacGregor-Morris and Mr. H. Wright; an extra premium to Mr. S. H. C. Morton.

Two awards of the Gold Medal of the Institution of Mining and Metallurgy, the highest distinction in its power to confer, have been made by the Council: (*a*) Sir Harold Carpenter, in recognition of his eminent services in the advancement of metallurgical science and technology; (*b*) Dr. Thomas A. Rickard, in recognition of his services in the general advancement of mining engineering, with special reference to his contributions to technical and historical literature. The following awards have also been made: The Consolidated Gold Fields of South Africa, Ltd., Gold Medal to Mr. P. J. Crowle for his investigations on ground movement and methods of support in deep mines (Kolar Gold Fields); The Consolidated Gold Fields of South Africa, Ltd., premium of forty guineas to Prof. Bernard W. Holman for his work on flotation reagents; the William Frecheville Student's Prize of ten guineas to Mr. Gilbert F. Hatch for his paper on "Check Sampling of Diamond Drill Holes at the Trepca Mines, Jugoslavia".

THE office of the High Commissioner for India, India House, Aldwych, is about to publish, in two volumes, "A Manual on the Commercial Timbers of British India", by R. S. Pearson and Prof. H. P. Brown. Descriptions will be given of each family and genus, while under species each timber will be dealt with in detail, commencing with nomenclature and references and followed in order by information on distribution, supplies, a full description of the structure of the timber, mechanical and seasoning properties, durability, working qualities, and present and prospective uses.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A headmaster of the Junior Technical School, Stoke-on-Trent—The Director of Education, Education Offices, Town Hall, Hanley, Stoke-on-Trent (May 16). A lecturer in the Department of Commerce of the Leicester College of Technology—The Registrar, College of Technology, Leicester (May 18). A head of the Junior Day Technical (Engineering) School of Handsworth Technical College—The Chief Education Officer, Higher Education Department, Education Office, Margaret Street, Birmingham (May 23). A demonstrator of physiology at the London (Royal Free Hospital) School of Medicine for Women—The Warden and Secretary, 8 Hunter Street, W.C.1 (May 25). A head of the Chemistry Department and a lecturer in physics and subsidiary chemistry at the Kingston-upon-Hull Municipal Technical College—The Director of Education, Education Offices, Guildhall, Hull (May 28). A lecturer in mechanical engineering at Armstrong College—The Registrar, Armstrong College, Newcastle-upon-Tyne (May 28). A lecturer in mechanical engineering at the Camborne Technical School—The Principal, Technical School, Camborne (May 31). A Morna Macleod research student in biochemistry at the Lister Institute of Preventive Medicine—The Secretary, Lister Institute, Chelsea Bridge Road, S.W.1 (June 1). A resident assistant pathologist at the Royal Free Hospital and London (R.F.H.) School of Medicine for Women—The Secretary, Royal Free Hospital, London, W.C.1, or The Warden and Secretary, London (R.F.H.) School of Medicine for Women, W.C.1 (June 3). A Charles Murchison Scholar in clinical medicine at the Royal College of Physicians of London—The Registrar, College of Physicians, Pall Mall East, S.W.1 (June 4). A Geoffrey Duveen Travelling Student for research in oto-rhino-larnygology in the University of London—The Academic Registrar, University of London, South Kensington, S.W.7 (June 11). A cotton research botanist in the Bombay Presidency, for the co-ordination of cotton research work in progress in the presidency, and a cotton research botanist in the Punjab, for research with the view to making improvements in local and American cotton—The High Commissioner for India, General Department, India House, Aldwych, W.C.2 (July 16). An assistant lecturer at the University College of the South West of England for work mainly in the teaching of biology in the Education Department—The Registrar, University College, Exeter.

Letters to the Editor

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

Photochemistry of Vitamins A, B, C, D

THE photochemistry of the vitamins has been studied with the help of a large quartz monochromator. The solutions to be irradiated were enclosed between quartz windows in a rectangular slot cut in a small brass block. The section of the cell corresponded with the dimensions of the rectangular image formed by the curved slit of the monochromator, so that the whole of the solution was irradiated. The cell was filled and emptied with a hypodermic syringe, and was arranged so that the solutions could be handled in the absence of oxygen. Stirring was effected by two steel shot operated by a magnet.

The procedure was to study the absorption spectrum of the substance, and then to irradiate it with an intense beam of light of similar wave-length to that of an absorption band selected after consideration of the spectroscopic data. This procedure usually destroyed the electronic system producing the band, and often led to the development of new bands. When applied to a suitable pre-vitamin, monochromatic irradiation with light of the correct wave-length produces maximum yields of the vitamin; on the other hand, when the destruction by irradiation of the biological activity of a vitamin is effected by the elimination of an absorption band, the activity can be linked up conclusively with the presence of the band. The principal results obtained up to the present are set out below.

Vitamin A.—The absorption spectrum of β-carotene (supplied by Dr. Thomas Moore of the Nutrition Laboratory) was found to contain a weak band at 2700 A., in addition to the well-known bands in the visible. Since this band was thought to be of peculiar importance, a solution of carotene in cyclohexane was irradiated in an atmosphere of nitrogen by the mercury line 2650. After a few hours, a strong band appeared at a wave-length corresponding closely with that of the band at 3280, which is already widely recognised as characteristic of vitamin A. Further, the solution gave a blue coloration with antimony trichloride in chloroform. Biological experiments, which will occupy perhaps a month, have already been begun in order to determine the activity of the irradiated solution. If the results of these experiments are in harmony with the spectroscopic evidence, it will appear that a photochemical transformation of carotene into vitamin A has been effected.

The destruction of vitamin A has been effected by irradiation with light of wave-length 3130, whereby the characteristic band at 3280 was eliminated in the course of a few hours.

Vitamin B_1.—A specimen of vitamin B_1, prepared by Jansen and Donath and supplied to us by Mr. Birch of the Nutrition Laboratory, showed three absorption bands at 2600, 2400, and 2100. Irradiation by the mercury line 2537 greatly reduced the intensity of the band at 2600, and destroyed the B_1 activity of the sample, as tested by Mr. Birch's observations of the heart-beats of rats. A specimen of the vitamin which had been deactivated by heating with alkali showed a similar absorption spectrum, in which the band of longest wave-length was again missing. The correlation of the 2600 band with the activity of vitamin B_1 has thus been fully established.

Vitamin C.—We have not yet been able to examine the absorption spectrum of vitamin C, but have found a strong band (which is affected but little by irradiation) at 2650 A. in hexuronic acid, which Szent-Györgyi[1] has identified with this vitamin. We have also examined the absorption spectrum of narcotine, which, according to Rygh, is converted into vitamin C by irradiation. In our experiments, no change in the spectrum was produced by irradiation with light corresponding with the wave-length of the bands at 3000 and 2850 A.; but irradiation with light covering the band at 2400 produced a complete change in the spectrum, which after irradiation consisted of a single band at 2900 A. A comparison of the spectrum of a concentrate of vitamin C with those of hexuronic acid and of narcotine, before and after irradiation, should go far towards settling the problem of identifying the vitamin with these substances.

Vitamin D.—The conversion of ergosterol into calciferol by irradiation is rendered difficult by the overlapping of their absorption bands, since the five narrow bands of ergosterol are almost covered by a wide calciferol band of shorter wave-length. The wave-length of the mercury line at 3130 was found to

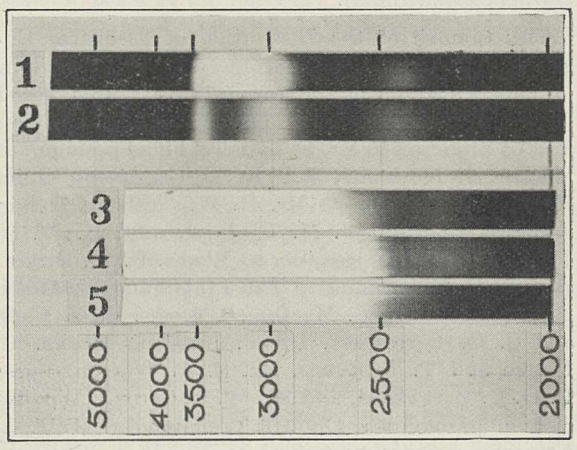

FIG. 1.—Spectra of vitamins (positive, showing *dark* absorption bands). 1. Carotene. 2. Carotene after irradiation with λ2537. 3. Vitamin B_1. 4. Vitamin B_1 after irradiation with λ2537. 5. Vitamin B_1 after heating with alkali.

be too long to convert ergosterol into calciferol even after irradiating for several hours in the absence of oxygen; but the 2967 line, which corresponds approximately with the longest wave-length of the ergosterol bands, produced a strong absorption in the calciferol region after only two hours' irradiation. On the other hand, calciferol was destroyed completely by irradiation for one hour with the mercury lines at 2650 or 2537, with a very slow destruction (which may be attributed to the great width of the calciferol band) when irradiated by the line at 3130. A maximum yield of calciferol is therefore to be expected when light of wave-lengths less than about 2800 is cut out, in agreement with the methods of Reerink and van Wijk and of Askew *et al.* In order to obtain further information, it is proposed to work out the kinetics of these transformations and to determine the quantum efficiencies of the two photochemical processes for light of various wave-lengths; the spectroscopic evidence is, however, already sufficient to indicate that the conversion of ergosterol into calciferol depends on the migration of a double bond to a position in which its influence on the other double bonds is greatly enhanced.

A fuller account of these experiments will be published later, but it is already clear that irradiation

with monochromatic light has very great advantages (as compared with the use of filters) for photochemical experiments in the ultra-violet, especially in the ease and certainty with which an absorbing group can be eliminated from a complex organic molecule by irradiation with light of related frequency. The value of the spectroscopic diagnosis of the structure of the absorbing centres in complex organic compounds will also be rendered much more complete and certain when it is possible to carry out the examination at the temperature of liquid hydrogen, preparations for which are already in progress.

The experiments described above were only possible as a result of the generous co-operation of our biological colleagues in Cambridge and of the Medical Research Council. In particular, we wish to acknowledge our indebtedness to Sir Frederick Gowland Hopkins, Prof. J. B. S. Haldane, Mr. N. W. Pirie, and Dr. B. Woolf of the Sir John Dunn Laboratory of Biochemistry, to Dr. L. J. Harris, Dr. T. Moore, and Mr. T. W. Birch of the Nutrition Laboratory, and to Dr. Bourdillon and his collaborators at Mount Vernon.

F. P. BOWDEN.
C. P. SNOW.

Laboratory of Physical Chemistry,
Cambridge.

NATURE, April 16, p. 576.

Properties and Structures of Crystalline Vitamins

THE absorption spectra of crystals of ergosterol and calciferol are the same as those of their solutions but for a slight alteration of wave-lengths. The changes produced in solution by irradiation in monochromatic ultra-violet light can also be produced in crystals. They can be observed by the progressive alteration from anisotropic to isotropic material in a polarising microscope. Ergosterol is transformed presumably to calciferol in light of 2967 A., but scarcely at all in 3650, 3130, and 2537 A. Calciferol, on the other hand, is stable at 3650 and 2537 A., but destroyed in 3130 A. This differs from the behaviour of solutions partly on account of the greater absorption and the formation of protecting layers on the surface of the crystals.

X-ray analysis of crystalline vitamins reveals only the general size and shape of the molecule and is not sensitive to activation. Further work on pyrocalciferol, suprasterol, and also on cholesterol, cholic acid, and pregnandiol, has shown the essential correctness of my previous suggestions on sterol structure.[1] It is clear that the usually accepted sterol structure must be considerably modified. The crystals of vitamin B_1 show a large, flat cell, and that and their strong negative birefringence point to ring molecules. The same is true of hexuronic acid. The crystals of β-carotene and the related α-crocetin do not show the long spacings expected from the constitution of these bodies, but further work is necessary to elucidate their structure.

J. D. BERNAL.

Mineralogical Laboratory, Cambridge.

[1] NATURE, Feb. 20, 1932.

The Oldoway Human Skeleton

IN NATURE of Feb. 27, p. 312, Messrs. Forster Cooper and Watson set out the reasons by which they are "forced to the conclusion that the Oldoway man reached the position in which he was found by an artificial and probably a relatively recent burial". Among the reasons which they adduce for this conclusion is the fact that the "skeleton, which is of modern type, with filed teeth, was found completely articulated down even to the phalanges, and in a position of extraordinary contraction". As field palæontologists, they regard the possibility of a skeleton getting into the deposits in such a state by *natural means* as so unlikely, that they find it hard to believe that the skeleton was contemporary with the deposits in which it lay.

In our letter in NATURE of Oct. 24, 1931, p. 724, we stated our conclusion: "There is no possible doubt that the human skeleton . . . came from Bed No. 2 and not from . . . Bed No. 4", and we also stated that "Beds Nos. 3 and 4 . . . overlie Bed No. 2 conformably", but we made no statement that the skeleton was deposited in Bed No. 2 without artificial aid.

Personally, I am quite in agreement with Messrs. Forster Cooper and Watson that a *complete articulated human skeleton in the contracted position* is not likely to become buried in a lake deposit by natural agencies, but I have never claimed that that happened with the Oldoway skeleton, although I am aware that Prof. Reck did formerly make such a claim.

I am, however, quite satisfied, after examining all the evidence, that Bed No. 3 at Oldoway, with its 50 per cent extinct fauna, was laid down after the skeleton became embedded in Bed No. 2, and that the skeleton was certainly not a *subsequent* burial into the deposits. My own personal belief is that contemporary man, living on the edge of the then existing Oldoway lake, buried the skeleton into the muddy, clayey edge of the lake whilst Bed No. 2 was in process of being deposited, for Bed No. 2 is essentially a shallow water deposit at the place where the skeleton was found. Bed No. 3, which is of a brilliant red colour and of quite a different texture, was then deposited above it.

It would take too much space to set out here all the geological and other evidence which shows that the skeleton was already in Bed No. 2 before Bed No. 3 was laid down, but I may perhaps summarise some of the chief reasons, as follows:

Bed No. 2, which contained the skeleton, is of a yellow colour, and the skeleton lay in its topmost levels. Immediately over it lies Bed No. 3, which is red in colour and of a quite different texture.

The position of the skeleton was such that unless it had been buried into the deposits within the last few years (at most fifty) any supposed grave-digging into Bed No. 2 must also have affected Bed No. 3, and it thus follows that, unless the skeleton was a burial of the past very few years, the refilling of the grave must have resulted in an admixture of red and yellow material around the body.

I was lucky enough personally to examine the skeleton at Munich while it was still intact in its original matrix, and could detect no trace whatever of such admixture, or of disturbance.

The bones of the skeleton, while not so heavily mineralised as those from Bed No. 3 or even Bed No. 1, are, so far as I know, every bit as mineralised as most of the bones from Bed No. 2 itself. This less complete mineralisation is presumably due to the varying nature of the deposits.

I have personally examined the so-called 'filing' of the teeth of the Oldoway man on the original specimen at Munich, and this 'filing' has no resemblance to any filing done by native tribes to-day, and it is, to my mind, exceedingly doubtful if it can be called filing at all.

I hope that Messrs. Watson and Forster Cooper will have been satisfied by this statement of mine, incomplete though it is, but I should like to give them still further evidence in support of the genuineness of the antiquity of *Homo sapiens* in East Africa.

During the past six weeks, I have been carrying out investigations on the north-east shore of Victoria Nyanza, at the well-known fossil beds in the region of Kendu and Homo on the south side of the Kavirondo Gulf.

My results there have far and away exceeded my expectations, and amply corroborate the conclusions we came to at Oldoway. A series of old lake beds was examined which yielded a fauna and a culture sequence similar to that of the Oldoway Beds Nos. 1 to 4. The beds were found to contain teeth of a giant *Deinotherium* of the same type as that from Bed No. 1 at Oldoway, in association with tools of Pre-Chellean type exactly as at Oldoway. This same bed also yielded teeth of an extinct elephant apparently (I have only Zittel available) closely allied to, if not actually a species of, *Tetrabeladon*. The later beds contain *Elephas antiquus* sp., *Hylochœrus* sp., *Hipparion* sp., *Pelorovis* (?), and other animals typical of the higher Oldoway beds, together with tools of the Chellean type.

Actually *in situ* at a place called Kanam, in the same horizon as the Pre-Chellean tools and the *Deinotherium*, we found a fragment of a mandible of *Homo sapiens* type, thus putting *Homo sapiens* in East Africa back one stage further than Oldoway man—in fact, in deposits of the same age as Bed No. 1 at Oldoway. The horizons which have yielded the Chellean tools have not yielded, unfortunately, human remains actually *in situ*. We have, however, found fragments of the skulls of three different individuals of *Homo sapiens* type completely mineralised and just washed out of the exposures by the rains. They are in the same state of complete mineralisation as the remains of *Elephas antiquus*, *Hipparion*, etc., from the same beds, and I have personally no doubt whatever that they were *in situ* a month or two ago, before the beginning of the present rainy season. These later remains are probably, then, the contemporary of the Oldoway skeleton, and since we have fragments which make up the greater part of the skull cap of one of the individuals, an interesting comparison will be possible later on.

In conclusion, I may record the discovery of teeth, with fragments of upper and lower jaws, of several individuals of a very interesting anthropoid ape in deposits of apparently Miocene age on Rusinga Island. The associated fauna includes creodonts, a small primitive rhinoceros, very numerous remains of a small *Deinotherium* about half the size of the Oldoway *Deinotherium*, and numerous other unidentified teeth and bones. I hope to be able to make a further communication about this anthropoid shortly.

L. S. B. LEAKEY.

East African Archæological Expedition,
P.O. Box 40, Limuru, Kenya, April 19.

Modification of Light Quanta by Elastic Heat Oscillations in Scattering Media

IN my previous communications [1] I pointed out the existence of a new type of modified radiation produced by scattering of light in liquids and crystals, which may be ascribed to the interaction of light waves and the acoustic oscillations in the medium.

Recent experiments with carbon disulphide and chlorbenzene have fully confirmed the results obtained previously with other liquids. The unmodified and modified components in the case of these liquids are very diffuse. The observed and calculated values of the displacements of components are given in the accompanying table.

	$\Delta\lambda$ obs. in A.	$\Delta\lambda$ calcul. in A.
Carbon disulphide .	0·049	0·040
Chlorbenzene . .	0·047	0·042

In Fig. 1 microphotometer curves of spectrograms from benzene at scattering angles $\theta = 90°$ and $\theta = 135°$ are shown and the unmodified and modified components can be seen quite clearly. The results of the measurements of these spectrograms are given in Table 2 in my previous note.[2]

The appearance of the central unmodified line, which should not be present according to the Brillouin-Mandelstam theory,[3] may possibly be explained by superposition of unresolved modified lines due to

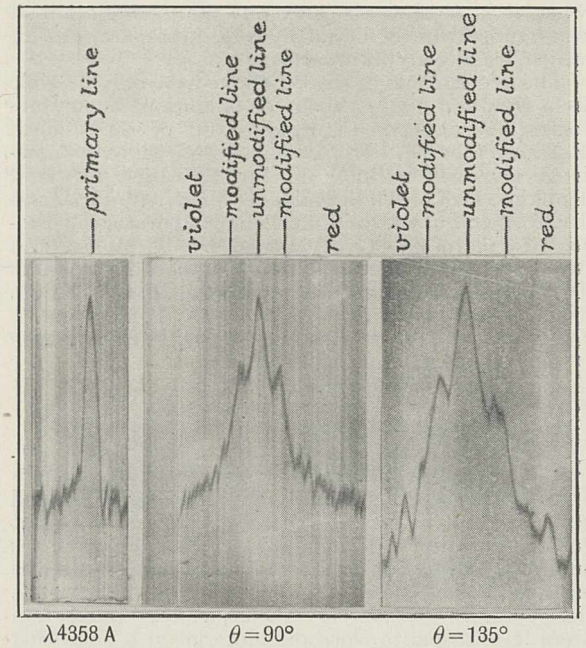

FIG. 1.

reflections of higher orders. These reflections arise from heat waves of wave-lengths 2, 3, 4, ... times greater than that which produces the first order reflection with the change of the frequency determined by the equation :

$$\Delta\nu = \pm 2\nu_0 \frac{v}{c} \sin\frac{\theta}{2}.$$

The modification of frequency produced by reflections of higher orders should be 2, 3, 4, ... times less than that given by this formula. The superposition of these unresolved modified lines may give rise to the appearance of the broadened central ' unmodified ' line. The identity of polarisation of ' unmodified ' and two adjacent modified lines [4] is in accordance with this view.

In all liquids as yet investigated, I have been unable to detect any displacement of the scattered line towards the red (*c.* 0·05 A.) as was described by Cabannes and Salvaire.[5] I was also unable to find such displacement in the same two liquids (benzene and ethyl alcohol), which were investigated by Cabannes and Salvaire. With my apparatus I could easily detect much smaller displacements than those (0·035 A. and 0·05 A.) observed by these authors.

To make this point clear, Mr. Khvostikov and I undertook a careful comparative examination with an echelon grating of light scattered by benzene and by optical glass. It has been shown [6] that optical glass does not produce any noticeable modification in the scattered light. During the whole time of exposure, the spectra produced by benzene and glass were photographed simultaneously side by side on the same photographic plate. It was found that the central component of benzene coincides with the single line (unchanged original line) given by optical glass, and

two modified components of benzene are situated symmetrically on both sides of it.

Further investigations were undertaken with styrolene (C_8H_8). In this amorphous solid, Cabannes has found [7] a displacement towards the red of the scattered line similar to that in liquids. With this substance also we were unable to confirm the observations of Cabannes. In accordance with what would be expected from theoretical considerations,[6] neither broadening nor displacement of the line scattered by styrolene could be detected.

Recently the experiments on the structure of the scattered lines were repeated by Vacher [8] and Rafałowski.[9] Using a Fabry and Perot interferometer, Vacher was unable to detect the modified lines found by me. He could not find any splitting (structure) of the scattered line, but only the broadening and the displacement towards the red of the original line. Thus his results agree with those of Cabannes and Salvaire.

Rafałowski, using a Lummer-Gehrcke plate, also was unable to confirm my observations. The modified lines observed by me should appear in the spectrum half-way between the neighbouring orders of the primary line. He found, however, that the spectrum of light scattered by benzene differs from that scattered by white paper (that is, arc spectrum) only by continuous background and by a slight broadening of lines.

I repeated, therefore, with a large glass Lummer-Gehrcke plate (1 cm. × 4 cm. × 30 cm.), the comparative examination of light scattered by benzene and by optical glass described above, although I believe that a Lummer-Gehrcke plate is less suitable for the examination of the phenomenon than an echelon grating. Owing to overlapping of different orders, the structure of the scattered line could not be resolved (the distance between neighbouring orders of my Lummer-Gehrcke plate is only 0·07 A. at λ4358 A.). The photograph showed a continuous blackening in the case of benzene, whereas optical glass gave well-defined interference fringes.

These results are in agreement with my previous experiments with an echelon grating and confirm the existence of modified lines of nearly the same intensity as the unmodified one, and disagree with Rafalowski's observations.

A detailed account of the experiments will be published in the *Zeitschrift für Physik*.

E. GROSS.

Optical Institute,
Leningrad, Feb. 20.

[1] NATURE, **126**, 201, 400, and 603 ; 1930.
[2] NATURE, **126**, 201 ; 1930.
[3] L. Brillouin, *Ann. Phys.*, **17**, 88 ; 1922 ; and L. Mandelstam, *J. Russ. Phys.-Chem. Soc.*, **58**, 831 ; 1926.
[4] NATURE, **126**, 400 ; 1930.
[5] J. Cabannes and P. Salvaire, *C.R.*, **188**, 907 ; 1929.
[6] *Z. Physik*, **63**, 685 ; 1930.
[7] J. Cabannes, *Trans. Faraday Soc.*, **25**, 813 ; 1929.
[8] M. Vacher, *Phys. Ber.*, **12**, 1044 ; 1931 ; and *C.R.*, **191**, 1121 ; 1930.
[9] St. Rafałowski, NATURE, **128**, 495 ; 1931.

Isotopic Displacement and Hyperfine Structure

THE analysis of the hyperfine structure of thallium and mercury [1] has led to the discovery of a structure which is not due to the spin of the nucleus but to a displacement of the atomic levels in different isotopes.

Recently, Bartlett [2] has carried out some calculations on the order of magnitude of these displacements, assuming deviations from the Coulomb law near the nucleus ; he assumed the potential energy to have a constant value V_0 for distances smaller than a certain critical radius r_m, where r_m may be called the radius of the nucleus. His calculations led to an agreement as to the order of magnitude of the displacement of atomic levels with those found experimentally, if r_m was chosen to be equal to 10^{-12} cm. and δr_m (for different isotopes) of the order of 10^{-13} cm. These values are of the same order of magnitude as those to which Gamow's theory of the α-decay led.[3]

However, Bartlett's method of calculation is very rough, as he works out the energy of perturbation with the help of eigenfunctions of hydrogen-like atoms, not taking account of the screening of the nucleus by the core electrons. This, of course, would result in a considerable over-estimation of the displacement, if it were not compensated by the omission of a factor $\sqrt{Z^3/n^3}$ in the coefficient of normalisation. Furthermore, Bartlett is neglecting relativity corrections, which, according to our calculations, are not inappreciable, owing to the fact that the eigenfunctions become infinite at the origin.

We have worked out the displacements using eigenfunctions of the relativistic equation, normalising them so as to be asymptotically equal to the Schrödinger eigenfunctions for large values of r. We find [4] that for s-electrons the electronic density near the nucleus becomes

$$\frac{2(1+\rho)\psi^2(0)}{[\Gamma(2\rho+1)]^2}\left(\frac{2Zr}{a_1}\right)^{2\rho-2}$$

where

$$\rho=\sqrt{1-\gamma^2}, \quad \gamma=Z\alpha=\frac{2\pi Ze^2}{hc}\sim\frac{Z}{137},$$

$a_1=\dfrac{h^2}{4\pi^2me^2}$ = radius of the Bohr orbit of hydrogen, and $\psi(0)$ the value of the unrelativistic eigenfunction in the origin, which has to be worked out numerically with the help of the Thomas-Fermi potential.

From this we derive for the displacement w of an s-term, assuming for the potential inside the nucleus $V_0=-\dfrac{Ze^2}{r_m}$:

$$w=\frac{8\pi(1+\rho)\psi^2(0)}{[\Gamma(2\rho+1)]^2hc}\left(\frac{2Z}{a_1}\right)^{2\rho-2}\int_0^{r_m}\left(\frac{Ze^2}{r}-\frac{Ze^2}{r_m}\right)r^{2\rho}dr$$

$$=\frac{8\pi(1+\rho)\psi^2(0)}{[\Gamma(2\rho+1)]^2(2\rho+1)hc}\left(\frac{2Z}{a_1}\right)^{2\rho-2}Ze^2\frac{r_m^{2\rho}}{2\rho}.$$

The relative displacement δw of two isotopes with a difference δr_m between the radii of their nuclei becomes therefore :

$$\delta w=\frac{8\pi(1+\rho)\psi^2(0)}{[\Gamma(2\rho+1)]^2(2\rho+1)hc}\left(\frac{2Z}{a_1}\right)^{2\rho-2}Ze^2r_m^{2\rho-1}\delta r_m.$$

For mercury we find $\rho=0{\cdot}81$, $\psi^2(0)\sim3\times10^{26}$ cm.$^{-3}$, and

$$\delta w\sim2{\cdot}5\times10^{22}r_m^{0{\cdot}62}\delta r_m \text{ cm.}^{-1}.$$

Assuming, as Bartlett, $r_m=10^{-12}$ cm., $\delta r_m=10^{-13}$ cm., we get

$$\delta w\sim100 \text{ cm.}^{-1},$$

which is several hundred times larger than the experimental value.

It appears now unlikely that r_m should be considerably smaller than 10^{-12} cm. : in order to get the experimental values of the displacement, we would therefore have to assume δr_m to be of the order of 10^{-16} cm., that is, $\dfrac{\delta r_m}{r_m}=\dfrac{1}{10{,}000}$. This seems scarcely compatible with the fact that the difference in mass of successive isotopes is about one hundredth of their total mass.

One could question the validity of Schrödinger's method of perturbations, as in our case the perturbation, though extending only over a very limited area, is very large. But we may satisfy ourselves with respect to this objection in the following way. For the type of potential curve near the nucleus assumed

here and a Coulomb field farther outside, the solutions of the Dirac equations can be found accurately, without using approximations; in this case we found good agreement with the approximative method.

My thanks are due to Prof. Pauli and Dr. Delbrück for helpful discussion.

GIULIO RACAH.
Physical Institute,
Eidg. Techn. Hochschule,
Zürich, Jan. 27.

[1] Schüler and Keyston, *Z. Phys.*, **70**, 1; 1931: **72**, 423; 1931.
[2] NATURE, **128**, 408; 1931.
[3] Gamow, "Constitution of Atomic Nuclei and Radioactivity", Chap. ii., Tab. III.
[4] See Racah, *Cim.*, **8**, 178; 1931.

Electric Arc between Carbon and Substances which are Insulators at Ordinary Temperatures

IT is well known that glass, chalk, porcelain, etc., become conductors if they are brought to high temperatures. Using this fact, an electric arc can be started between a carbon electrode and a second electrode of these materials.

With a glass electrode the arc is particularly noiseless, even with alternating current (4-5 amperes: 100 volts). The emitted light is a whitish-golden light of warm tonality. Observation with the spectroscope showed a continuous spectrum, which is originated by the pure arc (without the electrodes), and some bright lines. Some dark lines were also observed, and, among them, the *D* lines, which are remarkably strong. If the arc is projected longitudinally on the slit, some of the dark lines (particularly the *D* lines) show a beaded ('venternodalis') feature. This peculiar feature was also observed by me some years ago under different conditions;[1] but in the glass arc is much more marked.

With a chalk electrode the starting of the arc is more difficult.

In order to start the arc with a porcelain electrode, this must be previously brought to a very high temperature. The arc with a porcelain electrode is very white and bright; it has sometimes explosive properties.

MARIANO PIERUCCI.
Physical Institute of the Royal University,
Modena, Italy.

[1] *Nuovo Cimento*, S. VII., vol. 26, pp. 75-76; 1923.

Vanishing Life of Australia

MY attention has been directed to an article in NATURE of Sept. 12 last, entitled "Vanishing Life of Australia". As the officer in charge of the Department the function of which it is to protect the native game of this State, a few lines on the subject may not be out of place.

With much of what is said in the article I agree, but some of the statements made are, I fear, rather misleading to the general public. For example, within one hour's motor run of the City of Melbourne—a city of more than one million inhabitants—can be seen kangaroos, lyre birds, and koalas or native bears in their native state, thriving and unmolested by the public. As a matter of fact, there are more kangaroos and wallabies now in this State of Victoria than there were twenty years ago, this being due to adequate protection and the abolition of the market shooter. A similar condition of affairs can be truthfully said to apply to the platypus, that unique paradox which is now common in most of our waters. I have no reason to fear the wiping out of our unique fauna in the immediate future.

The two principal factors in these days accounting for the reduction in numbers of the Australian fauna are the spread of settlement resulting in the opening up of the country and the difficulty of securing adequate suitable areas for sanctuaries and national parks. However, some of the more beautiful of our cockatoos and parrots, which were nearing extinction a few years ago, have been brought back in greatly increased numbers in recent years, due to strict protection and the proclamation as sanctuaries of their breeding places.

The adequate protection of our rare birds and animals has been made possible by a gradual tightening up of the law. It is now illegal to have in possession, no matter when or where obtained, any of the following birds or animals, or their skins or feathers: Platypus, Koala, Lyre Bird, Rock Pebbler Parrot, Major Mitchell Cockatoo.

This law, which is easy of administration, together with the force of public opinion, has meant not only the preservation of these species, which were tending to become rare, but also their gradual increase, so that they are now more abundant than they were years ago. Furthermore, as an aid in their protection, no permits whatsoever are given to take any of these particular species. Any other native bird or animal may be given the benefit of this special protection at any time, should it be thought there is any need for it, simply by an Order in Council.

These remarks will indicate to your readers that this State of Victoria realises its responsibilities by conserving for future generations the unique birds and animals committed to its care by giving them adequate protection under the law.

F. LEWIS,
Chief Inspector of Fisheries and Game.
143 King Street,
Melbourne, C.1, Australia,
Feb. 24.

THE efforts made, officially and unofficially, to protect the rare creatures of Australia, deserve commendation, but their effectiveness as regards certain species is in some doubt, if we may judge from the opinion of the Council of the Royal Zoological Society of New South Wales (see NATURE, Dec. 5, 1931, p. 935). Moreover, Mr. Lewis should have reminded us that the Melbourne *Argus* of Sept. 18, 1931, published six days after our leading article appeared, announced that an individual had been fined £955 5*s*. for unlawfully consigning 3821 skins of 'opossums', a fact which suggests that the protection afforded by the law is yet far from perfect (see NATURE, Jan. 23, 1932, p. 126).

THE WRITER OF THE ARTICLE.

Electrical Potential Differences across Onion Epidermis

R. J. PUMPHREY, in a careful investigation,[1] has found constant electrical potential differences across epidermis stripped from the bulb scales of onions when this membrane separated unlike solutions of electrolytes. We, on the other hand, had previously observed under similar conditions potential differences which changed with time.[2] Pumphrey offers the suggestion that the fall in potential difference in our experiments was due to diffusion of salt from the KCl bridges used to connect the calomel half-cells with the solutions bathing the membrane.

This was an entirely plausible explanation, but we do not believe it to be the correct one, for the following reasons: In our experiments the KCl bridges were removed from the experimental set-up immediately after each observation. In preparation for the succeeding observation their tips were rinsed with the

particular solution with which each was to make contact, and they were then placed in position. In practically all cases the observed potential difference increased with some rapidity during an initial period of considerable duration, during which several observations were made. If this were due to salts diffusing from the bridges, it would be necessary to make the exceedingly improbable assumption that more than ten times as much salt diffused into the more concentrated solution (0·1 *N*) bathing the membrane as into the less concentrated solution (0·01 *N*). Somewhat similar considerations apply to the succeeding period of constant potential difference.

After a time the potential difference ordinarily fell off. Pumphrey's explanation applies better here. However, we noted that in general the shorter the period between the readings, the closer was the correspondence between successive readings ; the potential varied with the time rather than with the number of insertions of the bridges. When the interval between observations was long and, therefore, the KCl bridges were not being inserted, the potential fell, nevertheless. For example, in one experiment, using 0·1 *M* NaCl on one side of the membrane and 0·01 *M* NaCl on the other, the potential fell from 28 mv. to 3 mv. during an interval of twenty hours during which no observations were made.

It must be recognised that an appropriate combination of convective streaming and diffusion might be imagined, such as would account for the inconstancy of the potential difference in our experiments. Certain other differences between our experimental procedure and that of Pumphrey might be used as a basis for speculation, did it seem worth while. We regard it as preferable to seek an opportunity to repeat our experiments in such a way as to shed further light on the probable causes of the differences between Pumphrey's results and our own.

A. C. GIESE.
R. I. GIESE.
S. C. BROOKS.

Department of Zoology,
University of California,
Berkeley, California,
March 14.

[1] Pumphrey, R. J., *Proc. Roy. Soc.*, B, **109**, 434 ; 1932.
[2] Brooks, S. C., A. C. Giese, and R. I. Giese, *J. Exp. Biol.*, **8**, 124 ; 1931.

Photomicrographic Method for Magnification and Recording in High Speed Pressure Indicators

PRESSURE gauges for recording rapidly changing pressures, such as occur in discharge of firearms or explosions in closed vessels, usually consist of a pressure member which rotates a mirror suitably linked to it. The rotation of the mirror is used to give an optically enlarged indication of the deflexion of the pressure member. These methods have attendant disadvantages. In such gauges we have found it possible to use a photomicrographic method of magnification and recording pressure time curves.

The movement of the pressure member is communicated to an operating rod rigidly connected to the pressure member where the maximum movement takes place. The free end of the operating rod carries a needle at right angles to its longitudinal axis and direction of motion. By means of suitable illumination by light, an enlarged image or shadow picture of the edge of the needle is formed on the film of a drum camera used in photographing the records. The enlarged image is concentrated in a direction normal to the long axis of the needle by means of a cylindrical lens so that a linear image in the form of a black and white line is formed on the film of the camera. The optical system employed for enlarging and recording the very small motions of the needle attached to the operating rod of the gauge is essentially similar to that used for photographic registration with the Einthoven string galvanometer.[1]

In this manner, by dispensing with mirror systems, we have been able to cut down the mass of the working parts of a rifle pressure time recorder of the piston type to about 10 gm. An example of a pressure time curve

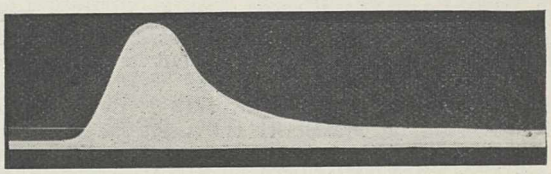

FIG. 1.

obtained in discharge of a British service rifle is shown in the accompanying photograph (Fig. 1).

We have also employed the system for closed vessel gauges, and found it useful for recording small motions of various descriptions.

JAMES TAYLOR.
ROBERT WARK.

Research Department (Nobel Section),
Imperial Chemical Industries,
Stevenston, Ayrshire.

[1] See "Oscillographs", Irwin, 1925, p. 24.

Temperatures of the Wolf-Rayet Stars

IN a recent paper [1] C. S. Beals has published the contour of the emission line of ionised helium 4686 in the spectrum of the Wolf-Rayet star H.D. 192163. We may suppose that the mechanism of excitation of emission lines in the spectrum of Wolf-Rayet stars is identical with that of planetary nebulæ. According to Zanstra's theory, we can obtain the temperature of star from the ratio :

$$\frac{\text{whole intensity of line}}{\text{intensity of 1 A. of continuous spectrum}}$$

According to the contour of line 4686, this ratio for the star under consideration is nearly equal to 200. Neglecting the presence of other lines of ionised helium, we find from Zanstra's Table 7 [2] the temperature $T = 65{,}000°$ as a lower limit. For many Wolf-Rayet stars the intensity of line 4686 is much greater, and therefore we may expect even higher values of surface temperature.

V. AMBARZUMIAN.

Poulkovo, Observatory,
Tchuckrjaevka, April 7.

[1] *Mon. Not. Roy. Ast. Soc.*, **92**, 196 ; 1932.
[2] *Pub. Dom. Astrophys. Obs., Victoria*, **4**, 240 ; 1931.

Planetary Positions on Medieval Maps

A RECENT issue (Feb. 27) of the *Illustrated London News* contained a reproduction of an old map believed to have been used, and possibly drawn, by Columbus. At the side of the world map is a map showing the celestial 'spheres' according to the Ptolemaic system. It is of special interest because it shows the positions * of the heavenly bodies approximately as follows : Sun, Aries 0 ; Moon, Libra 0 ; Mercury, Aries 22 ; Venus, Aquarius 17 ; Mars, Cancer 2 ; Jupiter, Virgo 7 ; Saturn, Scorpio 22.

* Degrees are not given in the figure. I have merely estimated the degree according to the distance of each planet from the commencement of the sign in which it is placed.

The placing of the planets is not symmetrical, nor are they placed symbolically, for example, in the signs described as the 'exaltations' of the planets by Ptolemy. Probably, therefore, they are either placed in the figure at random or are intended to show the positions of the planets at a specific epoch.

Calculation shows that on no day within the last three thousand years were all the planets in or near the positions stated. But if we suppose that the man who first drew the figure was an observer, not a calculator, that his deductions as to position were made from observations extending over a few weeks, and that he could not see Mercury, but merely guessed its position, the celestial 'theme' may have been originally drawn in March A.D. 131. By the time of full moon on March 31 the positions were approximately: Sun, Aries 7; Moon, Libra 7; Mercury, Pisces 10½; Venus, Pisces 9½; Mars, Cancer 2; Jupiter, Virgo 20½; Saturn, Scorpio 21. Venus had been near Aquarius 17 about March 12.

The period of Roman rule in Egypt was a period of astronomical activity. Not only have we the works of the famous astronomer Ptolemy from that period, but quite a number of horoscopes. In these the planetary positions are sometimes given fairly accurately, but in others, for example, the horoscope of Tryphon (A.D. 16), and the horoscope of Anubion (A.D. 137), the position of Mercury is quite wrongly given.

The same period is known also to have been a period when there was an interest in map-making, and it is quite conceivable that the map-maker of the fifteenth century copied the figure of the heavens from some older map without knowing what it represented.

I should be glad if anyone who knows about any maps of the Middle Ages, with planetary positions marked on them, would give me information in regard to them.

DUNCAN MACNAUGHTON.

22 Young Street,
Edinburgh,
March 31.

Halibut Liver Oil as a Source of Vitamin A

REFERENCES in the literature that the liver oil of the halibut (*Hippoglossus vulgaris*) is a very rich source of vitamin A (of the order of 50-100 times as rich as cod-liver oil) have been confirmed by me. However, it was soon found that not all samples of halibut liver oil gave such high values, and all potencies from 30 blue units (0·2 c.c. of 20 per cent solution) up to 1600 blue units have been observed. It is to be noted that this irregularity is the rule, and not the exception, in my experience. If halibut liver oil is to become of commercial value as a ready-made vitamin A concentrate (and this possibility is at present being investigated by several manufacturing firms), it is clearly necessary to know something of these fluctuations, whether they are seasonal, etc. This is all the more necessary as, for some reason at present unknown, halibut liver oil cannot be obtained by steaming the livers (as with cod liver oil, for example), and the more expensive process of solvent extraction must be resorted to.

A prolonged series of experiments on this problem of the excessive fluctuations in vitamin A potency of halibut liver oil is being carried out, and attempts will be made to find not only the seasonal effects (if any), but also the influence of the diet of the fish concerned. The work is not sufficiently advanced as yet to draw any definite conclusions.

J. A. LOVERN.

Department of Scientific and Industrial Research,
Torry Research Station, Aberdeen.

Implements of Late Magdalenian Age underlying the Raised-Beach at Larne, Co. Antrim

IN July 1930 I made the discovery that the Lower Estuarine Clay of north-east Ireland contains a pene-contemporaneous and well-developed flint industry of Late Magdalenian age. Subsequent investigations in the company of my friend Mr. C. Blake Whelan resulted in the recovery of several hundreds of these artefacts from the two small exposures of Lower Estuarine Clay on the western shore of Island Magee.[1] The type specimens, exhibiting a distinctive blue patination, have been fully described and illustrated in my last paper.[2]

Lately I have established the fact that the Lower Estuarine Clay which underlies the gravels of the 25-foot raised-beach on the Curran at Larne contains a similar industry to that previously located on Island Magee.

Elsewhere I have, upon archæological grounds, suggested that a considerable period elapsed between the deposition of the Lower Estuarine Clay and the gravels of the 25-foot raised-beach.[3]

Sections on the Curran appear to offer geological support to the above conclusion. Not only is there evidence that the Lower Estuarine Clay had suffered substantial surface erosion prior to the deposition of the gravels of the 25-foot raised-beach of Early Neolithic times,[4] but also that the period of erosion was followed by the formation of marine sands characterised by a molluscan fauna of wider range in types than that of the overlying raised-beach gravels.[5]

J. P. T. BURCHELL.

30 Southwick Street,
Hyde Park, W.2, April 9.

[1] NATURE, **126**, 133, July 26, 1930.
[2] *Proc. Preh. Soc. E. Anglia*, vol. 6, pt. 4, pp. 270–81; 1931.
[3] Loc. cit., pp. 285 and 287.
[4] Praeger, *Proc. Roy. Irish Acad.*, vol. 4, ser. 3, Pl. 1 (Fig. 3); 1896: vol. 25, sec. C, Fig. 3; 1904.
[5] Praeger, *Proc. Roy. Irish Acad.*, vol. 4, ser. 3, pp. 39-40; 1896.

Proper Name of the Amœba

THE common little amœba of stagnant waters appears to have no well-established scientific name. I have, to-day, received an elaborate paper, by S. O. Mast and P. L. Johnson, published in *Archiv für Protistenkunde*, 1931, intended to settle the matter. These authors give many apparently good reasons for thinking that the "Kleine Proteus" of Rösel (1755) was in fact a myxomycete. Hence the names applied by Linnæus and Pallas to this organism are not applicable to the amœba.

The final conclusion reached is that the valid name must be *Amœba proteus* Leidy, 1878. But Leidy expressly states that he is using the specific name coined by Pallas, 1766 (*Volvox proteus*). There are no grounds whatever for attributing the specific name to him, and no matter what he described, the type of *A. proteus* is the organism referred to by Pallas.

The generic name *Amœba* is an emendation from *Amiba*, as Leidy states. The earliest specific name under *Amiba*, and the type of the genus, is *A. divergens* Bory, 1822. With this stands or falls the generic name. Apparently the oldest specific name for an amœba in the modern sense is *Proteus diffluens*, which Sherborn ascribes to G. Adams, 1787 (not Müller, 1786, as commonly cited). Mast and Johnson do not think this is identical with the *Amœba proteus* of modern authors, but Schaeffer, who paid much attention to the subject, so considered it. What, then, is the proper name of the common amœba?

T. D. A. COCKERELL.

University of Colorado,
Boulder, Colorado, March 22.

Research Items

Marriage in Africa.—In *Man* for April, Mr. J. H. Driberg discusses the character of State marriages—the marriages of chiefs and rainmakers—in Africa, and argues that they are not, as is usually held, outside the ordinary rules of African marriage. The ruler's official wife is not his first wife, but the wife he marries after his accession to office. The marriage wealth is not paid by the husband, but is contributed by the whole tribe, and however many marriages the chief may have contracted before, and however many children he may have had, it is the State wife, the cattle for whose marriage has been publicly subscribed, who provides the heir. But if the tribe is the logical and organic development of the family through the clan, this marriage also would have had the clan recognition. Every eldest son of an eldest son, as the representative of his local community, has a State wife, provision for whose marriage has been made by the community at large. This is his first wife. The purpose of the marriage is to ensure continuity and to make possible the reincarnation of an ancestor. The clan is intimately concerned in the provision of a first wife of a member whose status will involve certain religious and economic duties. Therefore, the clan must contribute at least a proportion of the marriage wealth. Occasionally a young man may acquire sufficient wealth to make him economically independent. Even when this happens, the clan will insist on providing a portion of the marriage wealth in order to assert its rights. If, however, the first marriage is contracted without the assistance of the clan, it is not recognised as a clan transaction. The children have no clan affiliation, but form a new clan, of which the husband is the eponymous founder.

Yurok-Karok Basket Weavers.—A study of the basketry craft of the Indians of the Klamath and Trinity Rivers, California, by Miss Lila M. O'Neale (*University of California Publications in American Archæology and Ethnology*, vol. 32, No. 1), may be noted as dealing more specifically with the relation of the women to their work than with the technological side of the subject. The basket-work of these Indians has long been marked for its attainment of a high degree of excellence. It is limited, with the exception of minor matters of finish, to the twining technique. In material, form, proportions, and stylised design motives it is moulded by a set of traditions which have been transmitted from generation to generation. As a woman's baskets are destroyed at her death, no baskets of great age are in existence among the Indians themselves. Although the Indians have been in contact with the whites since 1850 and modern ideas have not entirely failed to penetrate, the women who at present make baskets are conscious of the deviations and judge to-day's products by yesterday's criteria. The teacher of the basket maker is generally the mother, if she is living, otherwise the grandmother or an aunt. The child is generally five or six years of age when her first basket is started for her, but it may be another five years before she is able to start a basket for herself. Grown women refer to their training with pride. The actual weaving of a basket presupposes days of preparation in gathering, preparing, sorting, and storing of materials. Small children, extreme old age, or physical disability are the only excuses for not engaging in this preparatory work, and such failure is regretted, as each woman knows that her choice of material for her own work is superior to that of anyone who may do it for her.

Zebu-Yak Hybrids.—For several years, crosses have been made between zebu Indian cattle and yaks in the Zoological Park at Moscow. Mr. M. M. Zavadovsky has published an account of the results (*J. Heredity*, vol. 22, No. 10). A zebu bull was originally crossed with a yak cow, producing a female, which was repeatedly crossed with its father. Crosses of the offspring were also made with a hornless yak bull, a total of 14 hybrid animals being produced from this bigeneric cross. The F_1 and F_2 females are fully fertile with both parent species, while the male hybrids are sterile and are shown histologically to produce no sperms. A study of the chromosomes might throw further light on this male hybrid sterility. Heterosis or hybrid vigour occurs in this, as in certain other crosses among the Bovidæ. The characters the inheritance of which was studied included coat colour, length of hair, the 'fringe' of the yak, length of tail hair, and shape of hump, horns, and muzzle. The dominance is frequently incomplete, but there is clear evidence of Mendelian segregation when the F_1 is crossed back to either parent. The zebu is grey with short hair, the yak black-brown with long hair and a fringe. The F_1 animals have the yak colour but with hair scarcely longer than the zebu. In back-crosses the black-brown animals were grey-brown until the first coat was shed. The fringe of the yak is almost completely recessive, while the yak type of tail is incompletely dominant, giving intermediate lengths of hair in back-crosses. The yak shape of hump is partially dominant to that of the zebu, the hybrids having no hump at first but developing one in after years. The horns of the F_1 generation are different from either parent, and probably at least two pairs of genes are concerned. The muzzle of the hybrid is intermediate but nearer the zebu, and there is evident segregation in the next generation. Absence of horns is dominant in yak hybrids, as in cattle.

Origin of the American Fauna.—The discovery of a wide range of mammalian fossils in America has made possible a well-documented history of this group. Briefly, three main elements are concerned: a northern, circumpolar, modern element; a more southerly, older element; and a still more southerly, still older element, the original fauna of South America. It can scarcely be expected, as Emmett Reid Dunn has pointed out (*Copeia*, Oct. 1930, p. 106), that reptiles and amphibians should show elements so clear-cut as to origin, for they make poor fossils, they cannot stand cold climates and therefore the northern element will be weak, and they are more subject to accidents of environment. Notwithstanding these difficulties, the author's analysis of the distribution of American turtles and other groups of reptiles and amphibians shows that in the basal elements of the herpetological fauna there is surprising agreement with the scheme formulated for the mammals.

Nematode Disease of Potatoes.—Extensive work on the nematode disease of potatoes has been carried out by Dr. D. G. O'Brien and Mr. E. G. Prentice (*West of Scotland Agric. Coll. Res. Bull.* No. 2, 63 pp.). The history of the study of the parasite is reviewed, and detailed descriptions of the symptoms which it causes on potatoes are given. Variations in morphology, due to adaptation, occur and are described minutely. The relation of the organism to soil environment and its distribution have also received attention. One important fact is that the nematode disease is often

followed by secondary parasites, the chief of which is *Rhizoctonia solani*. The presence of the fungus appears to aggravate the disease, causing 'nematode nests', that is, areas in the potato crop where the plants are unhealthy and rot prematurely. It is interesting to recall, in this connexion, the results of other work (see NATURE, March 5, 1932, p. 367) showing that *Heterodera Schachtii* is mainly responsible for the disease of potatoes known as 'sickness', with which *R. solani* may also be associated as a secondary parasite. Potato sickness and nematode disease are, presumably, but two names for the same malady.

Climatic Synopsis of Manila.—The annual summary of monthly meteorological data for Manila for each year is in the form of a single sheet two feet wide and more than a foot from top to bottom—a rather awkward-sized document to study. The sheet for 1931 was available in London early in March, a notable feat of the Manila Central Observatory. This Observatory is probably best known to meteorologists as contributing so much to our knowledge of the structure of the typhoons of the Philippines. Manila lies approximately in lat. 15° N. and is near the western extremity of the world's largest stretch of tropical ocean; it fails to be ideally placed for providing information about cyclones only in so far as land influences are present owing to the large size of the island of Luzon. The irregular visits of these violent disturbances are to a region which is normally one of extraordinary tranquillity, where barometric pressure may show only the same systematic slight changes according to the time of day for weeks in succession. At Manila, moreover, temperature has varied over a total range of only 43° F. since the beginning of 1885—a range occasionally surpassed in less than twelve hours even in the temperate climate of England. Alongside the figures for the different climatic elements for 1931 long period averages are given. These will enable anyone interested in the weather of this part of the Far East to find points of interest in what appears at first sight to be only a dreary collection of statistics; it is a pity, nevertheless, that some short note on outstanding peculiarities of each year cannot be added to supplement the tables.

Penetrating Radiation from Beryllium.—Dr. J. Chadwick's suggestion (NATURE, **129**, 312, 1932) that the penetrating radiation produced when beryllium is bombarded with α-particles consists of neutrons has been discussed by F. Rasetti in *Die Naturwissenschaften* (April 1, p. 252). Rasetti has obtained results in agreement with the neutron hypothesis, in that he has been able to repeat the earlier work with the Wilson expansion chamber, and to photograph trails attributed to hydrogen, helium, and carbon nuclei which have received energy from the neutrons. His work is not obviously in accord with this, in that it appears quite easy to prevent individual units of the beryllium radiation from passing consecutively through both of two Geiger-Müller counters; coincident discharges of the two can be completely stopped by the interposition of 5 mm. of aluminium between them, which should not affect neutrons appreciably. This corresponds, however, to the absorption of electrons set free by the recoil from a 10 million volt γ-ray quantum, and to overcome this difficulty it is suggested that the beryllium radiation is a mixture of both neutrons and γ-rays.

Examination of Turbulent Flow with an Ultramicroscope.—A. Fage and H. C. H. Townend have described an ultramicroscope method for studying turbulent flow which has been developed at the National Physical Laboratory (*Proc. Roy. Soc.*, April). Ordinary tap water contains many particles which can be used for this purpose, being small enough to show Brownian movement when the water is at rest, and appearing in the objective as bright streaks when strongly illuminated with the fluid moving. The local movement of the fluid can be found from the appearance of the streaks. Although it was found that only ocular observations could be made, photographic recording proving impracticable, the method is specially valuable, both because no instruments have to be put in the fluid and because the use of a microscope restricts the volume under observation at any instant. The results are not readily compared with von Kármán's theory of turbulence, but the prediction that the velocity fluctuations on the axis of the pipe are zero is wrong, fluctuations amounting to 20 per cent of the mean rate of flow being observed. At the wall, the flow tended to a laminar type, but the motion of the particles in the laminæ remained sinuous even to within 1/40,000 in. of the boundary, no particle being seen to move in a rectilinear path. A further observation made was that as the rate of flow was increased through the critical range of the Reynolds's number, the changes of flow occurred with great suddenness; there was no sign of a growth in the *degree* of turbulence, but only a change in the relative frequency and duration of rectilinear and turbulent flow.

Magnetostriction in Strong Fields.—In three recent papers (*Roy. Soc. Proc.*, April) Prof. P. Kapitza has extended considerably the theory of the change in dimensions of a body in a magnetic field and the technique for measuring this. The first paper contains an account of the generalised thermodynamics of the effect for crystals, based largely on Voigt's work. The second describes the modifications necessary in the magnetic balance to convert it into an extensometer; the extraordinarily high sensitivity to length changes of 2×10^{-7} cm. has been attained. In the third, the new methods are applied to a detailed study of bismuth and a less complete study of antimony and some other feebly magnetic bodies (graphite, gallium, tungsten, tin, beryllium, magnesium, and rock-salt), not all of which gave a measurable effect. For bismuth, the change in length in weak fields is proportional to the square of the field in all circumstances, but in strong fields at low temperatures there is marked deviation from this law. The sign of the effect is different for the trigonal and perpendicular axes, and the total effect quite small on this account in multicrystalline specimens. For certain axes in bismuth an irreversible change occurs, which has been called 'magneto-slipping'. This is the first occasion on which magnetostriction has been observed for other than ferromagnetic substances, and the experiments are to be extended to transverse and volume effects, whilst the results of some experiments on ferromagnetics in strong fields have still to be published.

The Quinhydrone Electrode.—Lammert and Morgan (*J. Amer. Chem. Soc.*, March) report further experiments with the quinhydrone electrode which will be of interest to users of this apparatus. They find that, in acetate and phosphate buffer solutions of pH 4·6 – 5·0 and 6·1 – 6·5 respectively, it gives results of fair precision, the average potential differences between two like electrodes being about ten times as large as the corresponding averages in 0·1M hydrochloric acid. In unbuffered salt solutions in the neutral range, however, the behaviour may be very erratic, particularly if gold or graphite electrodes are used, and the error, due to lack of reproducibility, may be far greater than any constant error calculated by Sörensen and described as 'salt error'. The rôle of the electrode substance in the quinhydrone half

cell cannot be neglected, and must be tested for each particular system in which the electrode is to be used. The authors conclude that the quinhydrone half-cell, whilst providing an excellent secondary standard, must be used with great discretion as a working electrode, its use being preceded by a study of its reproducibility in the system under investigation.

Micro-Methods and Enzyme Studies.—Almost the whole of our knowledge of enzyme action is based on the behaviour, *in vitro*, of enzymes isolated from the tissues. While this may give valuable information of the mode of action of enzymes secreted from the tissues, it is clear that for the majority of intracellular enzymes there can be no comparison between the conditions in the reaction medium, *in vitro*, and those which obtain in the cell. Furthermore, the methods of extraction themselves are in many, if not most, cases such as to leave it certain that radical alterations in the properties of the enzymes will ensue during extraction. The recognition of problems such as these has led K. Linderstrøm-Lang and H. Holter (*C.R. Lab. Carlsberg*, **19**, No. 4, 1931) to consider what degree of refinement in existing methods is required. In their judgment, an increase of delicacy of about one hundred thousand times would suffice to study the enzymatic activity of a single cell; but methods capable of measuring changes one thousand times as small as those detected by current macro-methods would remove most of the difficulties experienced. They have therefore devised a method of this degree of refinement for following the hydrolysis of a peptide by malt peptidase. The amino nitrogen is estimated in acetone by titration with $N/20$ alcoholic hydrochloric acid and naphthyl red, thus eliminating the effects of carbon dioxide on the end point. The apparatus is simple, and the mean error on a titration of 20 c. mm. is of the order of 0·03 c. mm. Now a section of a root 40μ thick weighs approximately 0·003 mgm. and it contains only about 300 cells. This, in suitable circumstances, will break down sufficient peptide to give a result thirty times greater than the probably experimental error. Evidently, on this basis, the presence or absence of activity in 10-20 cells could be demonstrated.

Creep Tests on Steel for Steam Plant.—In a paper entitled "Testing of Materials for Service in High-Temperature Steam-Plant", by R. W. Bailey and A. M. Roberts, read to the Institution of Mechanical Engineers on Feb. 19, particular reference was made to the creep tests required for steels used for turbine discs and cylinders, steam pipes, boiler tubes, superheater tubes, and bolts for steam joints, which during their working life are subject to stress at high temperatures. The subject of creep, which has become of increasing importance in power station practice, was first brought before the Institution in 1924 by Prof. F. C. Lea, whose experiments were begun in 1915. Since 1924 the subject has been studied by Dickenson, Tapsell, Baumann, Batson, and others, and investigations on creep at high temperatures are being made at the National Physical Laboratory and at the works of the Metropolitan-Vickers Electrical and Manufacturing Co., Ltd. It was with the researches by this company the authors were mainly concerned, and in this paper they gave the results of many tests, some of them lasting over thousands of hours, discussed the various phenomena observed in materials subject to stress at high temperature, described the plant and instruments used, and made suggestions as to the tests which should be required by the manufacturers. The paper is fully illustrated with curves, diagrams, and photographs.

Astronomical Topics

The Reinmuth Object.—Drs. Whipple and Cunningham found a parabolic orbit for this object. Dr. Stracke gives the following elliptical orbit from observations on April 24, 27, and May 1 (*Rech. Inst. Circ.* 604):

T	1932 July 8·9999 U.T.	
ω	284° 36′ 0·5″	1932·0
Ω	35 54 38·5	
i	5 53 35·4	
ϕ	31 52 33·2	
log q	9·8216414	
Period	1·6659463 years	

This orbit satisfies the following observation by Dr. W. H. Steavenson within about 3′; the discordance of the parabolic orbit is considerably greater:

May $6^d\ 0^h\ 27{\cdot}3^m$ U.T., R.A. (1932·0) $12^h\ 31^m\ 29{\cdot}19^s$, S. Decl. 11° 2′ 6·8″.

There is also the fact that the parallactic shift in R.A. between two Heidelberg positions on April 24 is 23″ by observation, 20″ as calculated from the ellipse, and 10″ from the parabola. There are therefore good grounds for supposing that the ellipse is nearer to the truth. If so, the object is still more remarkable than the Delporte planet. Its perihelion point is inside the orbit of Venus, and it passes within about 3 million miles of the earth's orbit at two different points. Its period is only half that of Encke's comet, so that even as a comet it would be remarkable; but its aspect appears to be quite stellar. Observations are urgently needed, as the object will be lost in the twilight before long. Dr. Stracke gives the following ephemeris for 0^h:

	R.A.	S. Dec.	r.	Δ.
May 14	$9^h\ 48{\cdot}1^m$	9° 2′		
15	9 21·1	7 25	1·015	0·070
16	8 54·0	6 26		
17	8 27·7	5 22	0·997	0·072
18	8 2·8	4 18		
19	7 39·7	3 15	0·978	0·077

The nearest approach to the earth, 6½ million miles, is on May 15.

A New Kind of Eclipse Map.—*Monthly Notices* of the Royal Astronomical Society for March has a map of a novel kind to illustrate the eclipse of Aug. 31 next. Prof. S. Chapman contributes a paper on the influence of a solar eclipse on the ionisation of the upper atmosphere. It is important to use the coming eclipse to test the theory that the lower ionised layer in the atmosphere, the height of which is stated to be about 100 km., is ionised by neutral corpuscles emitted by the sun. Since these corpuscles travel much more slowly than light, the region of the earth that is affected by them differs considerably from the region of optical eclipse. Also, the screening is shown to be efficient over a region of the earth much larger than the zone of totality; in fact, it is nearly as large as the region of partial eclipse. It is shown that the axis of the shadow cylinder of the corpuscles will strike the earth two hours earlier than the optical shadow-cone, and that the British Isles and western Europe enjoy corpuscular eclipse, though they are outside the optical shadow. The map was drawn by Mr. J. C. P. Miller, at Prof. Chapman's request. It brings out the curious fact that a small portion of the track of optical totality is outside the region of corpuscular eclipse.

Conditions of Air in Tunnels*

ADEQUATE ventilation of tunnels assumes a fresh importance when a continuous stream of vehicles driven by internal combustion engines and coal-fired steam waggons is passing through them. From the progress of such vehicles in the tunnel products objectionable to health may arise, such as carbon monoxide and suspended sooty matter from incomplete combustion, moisture from the combustion of hydrocarbons, sulphur, for the most part, from coal, and lead from petrol treated with lead ethyl. A report on the actual condition of the air in two of London's tunnels is consequently of interest.

The condition of the air in the tunnels at Blackwall and Rotherhithe has been the subject of study by the chemical staff of the London County Council, determinations of carbon monoxide, suspended matter, and the relative humidity having been made during a period of nearly two years. In addition, determinations of the sulphur impurities were made from time to time by members of the staff of the Government Chemist, using the methods recently devised for the Committee on Atmospheric Pollution.

Under normal conditions of traffic, the highest concentration of carbon monoxide found in these tunnels was 3·1 parts in 10,000 of air, but on the occasion of a severe traffic block caused by an accident at Blackwall a value as high as 11·5 parts in 10,000 was obtained. It is noteworthy that the highest concentration of carbon monoxide found by workers in the United States in the New Jersey tunnel was 8 parts in 10,000, and that the average values were between 3 and 4 parts in 10,000. Further, the maximum concentration of carbon monoxide found by the Ethyl Petrol Committee in traffic blocks in the streets of London was 1·7 part in 10,000.

During the period covered by the tests, extraction fans were installed at one position at Blackwall, whereupon an improvement in the condition of the air at that place was observed. From the work of Haldane, Douglas, and Hartridge in Great Britain and of Henderson and his co-workers in the United States, it may be concluded that no appreciable physiological effect is produced by carbon monoxide in concentrations not exceeding 3 parts in 10,000 of air when breathed for 1 hour. Mr. Regan recommends, therefore, that the proportion of carbon monoxide in the air of the tunnels should not be allowed to exceed 2 parts in 10,000.

Suspended matter determined by the Owens portable air filter was indicated by 12 fog-shade units as a highest value under normal conditions of traffic at both Blackwall and Rotherhithe, each fog-shade unit representing 0·32 milligrams of black suspended matter in a cubic metre of air, while a reading above 10 indicates a dense fog. It is recommended that the maximum permissible reading for black suspended matter should be 6 fog-shade units.

Since at no time did the relative humidity of the air in the tunnels approach 100 per cent, the fogs observed from time to time were smoke fogs, not water-vapour fogs. It was found, too, that when the average daily temperature outside the tunnels was above 58° F. the average humidity in the tunnels was above that of the outside air. Usually, however, the reverse was the case.

The average quantities of sulphur dioxide found at Blackwall and Rotherhithe were 0·26 and 0·51 parts per million, respectively: these values, while not being excessive, are somewhat higher than the average figures, namely, about 0·13 parts per million, for the air of London given on page 48 of the seventeenth report (for the year ended March 31, 1931) of the Committee on Atmospheric Pollution.

The possibility that the air in the tunnels might contain lead was not overlooked, but no experimental work has been carried out up to the present time. It is fortunate that there is available in the results obtained by the Ethyl Petrol Committee a datum line for the quantity of lead occurring in the dust of the streets of London. On the average the settled dust of the streets contains 0·35 per cent of lead. If, therefore, the air of the tunnels were to become polluted with lead owing to an increase in the use by motor vehicles of leaded petrol, it is to be expected that the proportion of lead then found in the air would be greatly in excess of this value.

As a result of the investigation it is concluded that the atmospheric conditions in the tunnels are worst about 10 A.M., that they are worse in summer than in winter, and particularly when the temperature of the outside air rises above that of the tunnels. Additions to the ventilating plant at both tunnels are being made, and those at Blackwall are well advanced towards completion. A. G. F.

* London County Council. Annual Report of the Council, 1930. Vol. 4 (Part 3). Public Health. Medical Supplement to the Report on the Hospital Services. Page 271. The Ventilation of Vehicular Tunnels with Particular Reference to those at Blackwall and Rotherhithe. By C. J. Regan.

Nutrient Salts in the Mediterranean

THE well-known sterility of the Mediterranean Sea compared with the neighbouring waters of the Atlantic Ocean finds a ready explanation in the chemical investigations carried out on board the Danish research vessel *Dana* by Helge Thomsen in the summer of 1930.* Determinations were made at all depths at stations in the southern Mediterranean of the nutrient salts, phosphate and nitrate, known to be essential for the growth and reproduction of the phytoplankton, which in turn form the foodstuff, directly or indirectly, of almost all other life in the sea. The results are striking.

In the Mediterranean the concentrations of both salts are much less than in the great oceans of the world at similar depths. In depths greater than 200 metres the maximum nitrate content is everywhere 3–4 times greater in the Indian and Pacific Oceans and 2–4 times greater in the Atlantic than in the Mediterranean. For the minimum values the corresponding ratios are very high (of the order 8–23) in depths between 200 metres and 600 metres in accordance with the very low minimum values in the Mediterranean. Further, below 400 metres depth the maximum values for both phosphate and nitrate in the Mediterranean are less than the minimum values in the oceans.

In the surface waters, interpretation of the very low results found is more difficult, since so much of the work both in the Mediterranean and in the oceans in higher latitudes has had to be done in summer, when the salts could conceivably have been depleted by a preceding spring outburst of diatom growth. The region of complete depletion (less than 5 mgm. phos-

* "Nitrate and Phosphate Contents of Mediterranean Water." Report on the Danish Oceanographical Expeditions, 1908–10, to the Mediterranean and Adjacent Seas: vol. 3, *Miscellaneous Papers*, No. 6, pp. 14. Copenhagen, 1931.

phate (P_2O_5) or 10 mgm. nitrate nitrogen per cubic metre) usually extended down to 150-200 metres, and in this connexion red algæ have been found growing in this sea down to 130 metres, far below the limit to which sufficient light could penetrate in the more turbid northern waters.† Thus it would seem that the very scarcity of nourishment and resulting sparseness of sub-surface life enables light to penetrate far into the water for plants there to utilise the minute quantities of phosphate and nitrate which diffuse up from the meagre bottom store. Perhaps, indeed, in the Mediterranean the region most favourable for planktonic organisms may be far removed from the surface, at, say, 100 metres, where a sufficiency both of light and of nutrient salts are found together. This is far lower than is found anywhere in waters around Great Britain. Experimental data on the amount and quality of the light penetrating to such depths and of its suitability for photosynthesis should prove illuminating.

† Harvey, H. W., "Biological Chemistry and Physics of Sea Water". Cambridge, 1928.

The concentrations of both phosphate and nitrate decrease going eastward from the Straits of Gibraltar. In the Ægean Sea phosphates were not detected at any depth, and nitrates were very poor. It is manifest that life cannot flourish on any considerable scale in such impoverished waters. In the Straits of Messina nitrate appeared to be comparatively high, apparently due to vertical mixing, but it was unaccompanied by phosphate and was presumably therefore of little value.

The scarcity of nutrient salts in the Mediterranean is attributed by Thomsen to the exchange of water through the Straits of Gibraltar, since Atlantic *surface* water, already poor in nitrate and phosphate, runs in over the outgoing bottom current of Mediterranean water. This exchange of water has been well established by several vessels, including the *Dana*, and Thomsen's own analyses in the Straits and the Alboran Sea testify to the impoverishment of the inflowing Atlantic surface water, at any rate in April and June.

L. H. N. C.

Acoustic and Telephone Measurements

IN a paper read by H. R. Harbottle to the Institution of Electrical Engineers on April 8, a brief description is given of some of the work carried out in the research section of the British Post Office. He begins by discussing electro-acoustic and acousto-electric measurements of instruments. He next describes voice-ear measurements on microphones and receivers, and finally deals with mechanical tests by means of which rapid acceptance tests can be made and estimates given of the commercial life of instruments.

Mr. Harbottle attributes the progress made during recent years to the methods invented of expressing the results of measurements in telephony by reference to absolute units. These methods followed on the invention and development of the thermionic valve. This has enabled acoustic pressures and velocities to be measured accurately, and has led to the rapid advances made in radio-telephony. This in turn has promoted world-wide telephonic communication.

To enable this to be done, an international committee had to be formed, called the C.C.I.—Comité Consultatif International des Communications Téléphoniques à grande distance—the objects of which were the formulation of correct methods of measurement. Standard instruments were required which had to give a constant response over the range at which they were used. At the present time this can only be achieved by the use of insensitive instruments in which the mechanical resonances have been removed outside the working range by increasing or diminishing the stiffness. The output is then raised by a thermionic valve amplifier suitably applied. A wide field has been found for these instruments in broadcasting, sound pictures, and gramophone reproduction.

The instrument used at the present time as a working standard in most acousto-electric and electro-acoustic measurements is a condenser microphone. It consists of a thin aluminium diaphragm, gold-plated to prevent oxidisation, forming one plate of the condenser, the other being a circular insulated brass electrode. This is grooved, and is fixed at a small distance away from the other plate. The space between them is practically sealed, and so adds 'stiffness' to the diaphragm. Due to this, the frequency of natural resonance is effectively suppressed.

The microphone is polarised by applying 200 volts across it. Its vibrations cause variations in the capacitance, and consequently it acts like a generator producing electric currents. It is calibrated by one of three methods—the thermophone method, recommended by the C.C.I., the Rayleigh disc method, or the compensator method. The results obtained by these methods have been found by the Post Office to agree satisfactorily.

By means of an automatic device the life test of a carbon microphone can be reduced to about one-fiftieth of the normal time taken. A current is first switched on—this represents the lifting of the receiver from the switch hook. A klaxon is next operated momentarily—this simulates the removal of the receiver by the subscriber; 7·5 seconds later the microphone is subjected to a rhythmic 'howl-warble' tone for 7·5 seconds, and this tone is repeated seven times at intervals of 7·5 seconds. At the end of $1\frac{1}{2}$ minutes the klaxon is momentarily operated and the current switched off. There is then an interval of 1·5 minutes and the cycle begins again. In a week's time the wear on the telephone is the same as that made by a subscriber who in a year makes a thousand calls.

South Sandwich Islands*

THE first of the two *Discovery* Reports before us is the list of stations 137 to 433 made by R.R.S. *William Scoresby* in the seas between South Georgia, the Falkland Islands, and the South Shetlands from January 1928 to May 1929, and other stations made by members of the *Discovery* investigations staff from whale factory ships about the South Sandwich Islands and in the Ross Sea. This follows the first station list published in an earlier volume of the *Discovery* Reports.

The second report under notice deals with the South Sandwich Islands. These islands were discovered by Cook in 1775 and Bellingshausen in 1819, but they lie in stormy and frequently ice-invested seas off the track of most antarctic expeditions, and have been rarely visited except by sealers and whalers until the *Discovery* spent twenty days among the group in

* *Discovery* Reports. Issued by the *Discovery* Committee, Colonial Office, London, on behalf of the Government of the Dependencies of the Falkland Islands. Vol. 3. Station List, 1927–1929. Pp. 132+10 plates. 14*s*. 6*d*. net. The South Sandwich Islands. By Dr. Stanley Kemp and A. L. Nelson; with a Report on Rock Specimens, by Dr. G. W. Tyrrell. Pp. 133-198+plates 11-31. 18*s*. net. (Cambridge: At the University Press, 1931.)

February and March 1930. The eleven islands, extending in a chain of 193 miles, are all small and volcanic. The largest has a circumference of only twenty-four miles. Landing is always difficult and on some islands perhaps impossible. Sulphurous fumes in places are a menace. The *Discovery* found no active volcanic eruptions, though five islands were emitting vapours and fumes. There were indications that volcanic activity is abating, and three islands show no recent signs of it. The rocks collected were all typical Andean lavas, as described by Dr. Tyrrell, and confirm Suess's theory of a South Antillean arc. The conspicuous 'deep' to the east, sinking to 4421 fathoms, is another noteworthy feature. The only possibility of sedimentary rocks in the whole group appears to be in Freezeland Peak on Bristol Island, but no landing was achieved there. Some of the islands have ice-caps: others have foreland glaciers. Vegetation seems to be confined to a few lichens and algæ. No flowering plants were seen. Fur seals were not found, though they probably occurred in the past. The volume contains maps and photographs of all the islands, and also an Admiralty chart of the group. It is a fairly complete monograph on the islands. R. N. R. B.

University and Educational Intelligence

CAMBRIDGE.—An election to an Isaac Newton Studentship will be held early in the Michaelmas Term, 1932. These studentships are for the furtherance of advanced study and research in astronomy and physical optics. Members of the University are eligible who have obtained a degree in the University and were under the age of twenty-five years on Jan. 1, 1932: failing such a candidate, a research student, subject to the same condition as to age, may be elected. The studentship will be of the value of £250 a year, and will be tenable for three years. Applications should be sent to the Vice-Chancellor between Oct. 7 and 13, 1932.

Candidates for the Michael Foster Studentship in physiology are requested to send their applications, with a statement of the course of research they propose to undertake, to Prof. J. Barcroft, Physiology School, before the end of June. The student receives the annual value of the fund (about £100).

At Jesus College, Dr. W. H. Thorpe has been elected a fellow. He has been a research fellow of the Rockefeller Foundation at the University of California and a member of the research staff of the Imperial Institute of Entomology. At St. John's College, Dr. L. Rosenhead has been elected a fellow. He entered the college with an Open Strathcona Research Studentship for mathematics, and in 1930 was elected a Senior Research Student of the Royal Exhibition of 1851.

LONDON.—Applications are invited for the Laura de Saliceto studentship for the advancement of cancer research, value £150 annually and tenable for not less than two years. Applications should reach the Academic Registrar, University of London, South Kensington, S.W.7, by July 1 at latest.

OXFORD.—The proposed regulations for the new Final Honour School of Geography are now published, and will be dealt with by Congregation in due course. The stated subjects include physical and regional geography, cartography, the geography of man, and the history of geographical discovery. In addition to these, a special subject may be offered. The examination will be partly practical, and will include laboratory and field work. Candidates will be required to show sufficient knowledge of French or German and of the elements of physics and biology.

READING.—Dr. William B. Brierley, since 1918 head of the Department of Mycology in the Institute of Plant Pathology at the Rothamsted Experimental Station, has been appointed professor of agricultural botany in succession to Prof. J. Percival, who is retiring next September.

THE usual summer vacation course for teachers will be held at Bingley Training College, Yorks, on July 27–Aug. 10. Among the courses available are one on biology by Prof. R. Douglas Laurie, professor of zoology, University College, Aberystwyth, and another on the senior school, by Sir Percy Nunn, director of the University of London Institute of Education. Application should be submitted not later than June, while grants-in-aid applications must reach the Education Officer, County Hall, Wakefield, not later than May 31.

THE University of Cambridge publishes annually abstracts of dissertations approved for its Ph.D., M.Sc., and M.Litt. degrees (Cambridge: At the University Press, 1932). These summaries, each of which has been approved by the examiners or supervisor of studies, afford a convenient index to the scope of recent advanced study and research in the University. The sixty-one dissertations for the year 1930–31 are distributed among the faculties as follows: Physics and chemistry 24, biology 11, mathematics 8, agriculture 4, engineering 3, archæology and anthropology 2, history 2, geography, medicine, music, moral science, economics, English, and classics one each. Thirty-eight of the candidates had previously studied in other universities, namely: Liverpool 5, Wales 4, Scottish universities 4, other universities in the British Isles 4, universities in Canada, South Africa, Australia, and New Zealand 11, in India 7, in the United States of America 2, Switzerland 1.

COMMERCIAL education in the United States is reviewed in *Bulletin* No. 20, 1931, of the Office of Education, Washington, being advance pages of the official Biennial Survey (1928–30) of Education in the United States. Few people have any idea of the enormous amount of time and energy devoted in the United States to commercial education and to the investigation and discussion of the principles and methods employed in this field in secondary schools and universities. More than a million young men and women are enrolled in business courses, exceeding the number in any field of vocational training, and during the past ten years there was an increase of more than three hundred per cent in such enrolments in colleges and universities. At this rate the schools of commerce will soon be throughout the States, as they are already in many institutions, the largest of the professional and vocational university schools. At the Congress of Universities of the British Empire, held at Edinburgh last July, the subject of commercial education figured prominently, and reference was made to the resistance of British universities to the dangers of being stampeded into endeavouring to make university education more 'practical', with the deplorable results experienced in American universities. This bulletin recounts facts which tend to discount the force of this criticism and show that we have something to learn not only from their mistakes but also from their thoroughgoing investigation of principles and methods. The bulletin contains summaries of the results of these and other investigations, and will, doubtless, be in request at the International Conference on Commercial Education to be held in London this year. It is obtainable, price 10 cents, from the Superintendent of Documents, Government Printing Office, Washington, D.C.

Calendar of Geographical Exploration

May 18 (or 20), 1499.—Amerigo Vespucci

Alonzo de Ojeda sailed from Cadiz, with Amerigo Vespucci on board one of his vessels. Vespucci was a contractor for ship's provisions, and did not, apparently, go to sea until he was more than forty years of age. He claimed to have made four voyages to the New World, in 1497, 1499, 1501, and 1503. The first and third voyages are rejected by many, but not all, students. However this may be, there is no doubt that Vespucci went with Ojeda on his voyage, though the two men were not on the same boat, Ojeda reaching the coast of America near Surinam and proceeding to Maracaibo, while Vespucci reached it in 5° S., roughly. In his third voyage, Vespucci claims to have sailed along the east coast of South America from 5° to 50° S., a voyage which, if genuine, gives him a high place in exploration. According to Vespucci's own statement, he had on his first voyage reached the mainland on June 16, 1497, namely, 8 days before John Cabot. The name America appears to have resulted from a copy of Vespucci's letter about this voyage reaching the professor of cosmography at St. Dié University (Lorraine), who suggested in his "Cosmographiæ Introductio" (1507) that the newly discovered land should be called "America, because Americus discovered it".

May 19, 1845.—Sir John Franklin

Sir John Franklin left England for Cape Walker, whence he hoped to reach Bering Strait. He wintered on Beechey Island, and next summer proceeded southward down Peel Sound, spending the second winter in 70° 5′ N., 98° 23′ W., on the pack ice, where the ships were held fast all through the summer of 1847. Franklin died on June 11, 1847: the party deserted the ships in April 1848, and tried to penetrate south by land, but all perished. The numerous parties organised to try to obtain information about Franklin's fate resulted in great additions to geographical knowledge of the American arctic. News of Franklin's fate was first obtained from Eskimo in 1851; and in 1859, Hobson, a member of M'Clintock's expedition, found a sheet of paper on King William Island recording briefly what had happened up to the attempt to escape overland. Franklin's first arctic voyage was undertaken in 1818, when he was in charge of one of the vessels in Buchan's expedition. In 1819 he was leader of an expedition which resulted in the charting of much of the unknown coast-line of North America and occupied three years. This and a further journey in 1826 added 1200 miles of coast-line to the map of arctic America. From 1836 until 1843 he was lieutenant-governor of Tasmania (van Diemen's Land). Renewed interest in the polar regions at the time of his return to England led to his last and tragic journey.

Societies and Academies

LONDON

Royal Society, May 5.—**A. V. Hill**: A closer analysis of the heat production of nerve. The heat production of nerve is believed to occur in two phases, 'initial' and 'recovery': the former is presumably an accompaniment of the physical and chemical changes which take place during the propagation of the impulse; the latter, of the processes by which those changes are reversed and the nerve restored to its initial state. It is not easy to separate the one from the other. The possibility that the initial heat is due to phosphagen breakdown or lactic acid formation is discussed: the quantities available are sufficient.—**H. E. Roaf**: The influence of coloured surrounds and coloured backgrounds on visual thresholds. Exposure of the retina to light raises the differential threshold. For the fovea, the chief influence in raising the threshold is the simultaneous exposure to light, and for the parts of the retina outside the fovea there is considerable spread of effect from one part of the retina to another. The influence of wave-length on the results is very striking with foveal vision, as 'red' light raises the threshold for all parts of the spectrum, but 'green' and 'blue' lights have a negligible effect on the long wave-length end of the spectrum.—**N. Gavrilescu, A. P. Meiklejohn, R. Passmore, and R. A. Peters**: Carbohydrate metabolism in birds. The site of the biochemical lesion in avian polyneuritis. Oxygen uptakes of normal and avitaminous brains have been measured. The results suggest that vitamin B_1 deficiency is connected essentially with the intermediary metabolism of carbohydrate.

Geological Society, March 23.—**William S. Boulton**: The rocks between the Carboniferous and Trias in the Birmingham district. The succession at Windsor Street Gas Works in east Birmingham is continuous to a depth of more than 1000 feet, and includes the Bunter (with a basal breccia), the Nechells breccia, and part of the calcareous conglomerate group. The content of the breccias and conglomerates was described, and a graph was given showing the percentage distribution of rock types at different depths. The heavy mineral residues of the associated sandstones have also been determined. The Barr Beacon beds underlying the Bunter Pebble beds, mapped by the Geological Survey as Hopwas breccia, are of Bunter age, and with them were correlated the breccias at Tower Hill, near Hamstead, and also the more extensive beds of sand-rock at the base of the Bunter of Cannock Chase. The breccias of Hopwas, Sutton Park, Warley, Northfield, and the Lickey, though discontinuous deposits, are of the same general age, and have all been derived from highlands to the immediate east and south, the outcrops of which mainly consisted of Uriconian felsite- and andesite-tuffs and lavas, and basalts. Extensive and prolonged erosion accompanied and followed the Hercynian earth-movements in the area.

LEEDS

Philosophical and Literary Society, March 1.—**E. C. Stoner**: The correlation of the gyromagnetic ratio and the magnetic moment of paramagnetic salts. The observed magnetic moments and gyromagnetic ratios are compatible with each other, and may be accounted for by considering the interaction between the spin and orbital moments of one ion and the interaction of the ion with its surroundings.—**G. W. Brindley**: On the refraction of X-rays by perfect crystals. If the *atomformfaktor f* is incorporated in Ewald's treatment of the reflection of X-rays by perfect crystals in the way suggested by Darwin's earlier treatment of the subject, then the refractive indices of calcite for X-rays calculated from the observed widths of reflections are in good agreement with values obtained in other ways. The agreement is not good if the *atomformfaktor* is omitted.—**E. C. Pollard**: Nature of the potential barrier of the nitrogen nucleus. Experiments have been carried out on the variation of the yield of protons produced by fast α-particles from nitrogen as the energy of the impinging particle is reduced; the aim being to determine whether the α-particle enters the nucleus by resonance or by scaling the potential barrier. The results appear to show that resonance does not occur; entry is over the

top, and an approximate estimate of the height of the nuclear barrier is given.—H. M. Dawson and W. Lowson: The catalytic effect of acids on the rate of ester hydrolysis in relation to the ester concentration and the nature of the acid. The nature of the process which is involved in the acid catalysed hydrolysis of ethyl acetate is discussed and consideration given to the conditions under which the velocity of the reaction may be used as a measure of hydrogen ion concentration. A comparison of the catalytic effects produced by hydrochloric, chloro-acetic, glycollic, and acetic acids at ester concentrations ranging from 10 c.c. to 60 c.c. ester per litre shows that the ionisation constants of the weak acids decrease continuously as the ester concentration increases. Extrapolation to zero ester concentration is necessary if strictly comparable values are to be obtained.—C. H. Douglas Clark: Spectroscopy and valency. (1) The periodic groups of atoms and ions. The classification previously proposed for atoms in ground states has been extended to the rare earth elements, to inert gas-like ions, and to ions of transition elements. The electron groups s^2, p^6, d^{10}, and f^{14} tend to show central symmetry in respect of electron spins in ground states, with maximum valencies and maximum possibility of variable valencies near the centres of the groups, whilst departures from central symmetry are accompanied by the appearance of irregularities in valency. Such departures afford interpretation of the anomalous valencies of transition elements. The evidence of ionisation serves to confirm the views put forward.—N. Gill: The phloem of ash, *Fraxinus excelsior* Linn., its differentiation and seasonal variation. Production of large sieve tubes, each usually having a single companion cell in transverse section, begins in spring and continues throughout the summer, being most vigorous when the leaves are fully expanded. Just before leaf fall a modified type of sieve tube is produced, and is characterised by a smaller transverse area and a larger proportion of cambiform companion cells. No further phloem is produced after leaf fall until the following spring.

PARIS

Academy of Sciences, March 29.—A. Buhl: New integral invariances connected with differential equations containing several parameters.—Émile Sevin: Concerning the energy of matter.—Nicolas Kryloff and Nicolas Bogoliuboff: The phenomena of demultiplication of frequency in radiotechnics.—G. Reboul: A particular mode of activation of matter.—René Audubert and Mlle. Cécile Stora: The photovoltaic properties of cadmium sulphide. The sensibility of cadmium sulphide with regard to various radiations of the visible spectrum has been determined, and the results given graphically. If photo-electronic phenomena intervene, they play only a secondary part.—Maurice Billy and Mlle. Irène San-Galli: A new method of investigation for the study of the hydrated peroxides.—C. T. Popesco: The effects of a new system of grafting in *Lycium vulgare* placed on the tomato.—Mlle. Odette Tuzet: The centrioles of the egg of the sea urchin, *Paracentrotus lividus*.—Victor-Pauchet and A. Bécart: The gastro-photographic method and its automatic means of control.

GENEVA

Society of Physics and Natural History, Feb. 4.—Arnold Pictet: Inheritance of polydactyly in the guinea-pig. Polydactyly arises from the union of two parents of a polydactyl strain. One of the parents contributes a factor of intensity, the other a factor of intensity in the heterozygote state: together they contribute an additional common factor, the combinations of these three factors being indispensable for the creation of polydactyly. The polydactyls thus created may produce normal types indefinitely and the normal types produce polydactyls indefinitely.—Charles Jung: The calculation of the ureo-secretory coefficient considering the two kidneys separately. The author shows that when the two kidneys work at different concentrations the ureo-secretory coefficient calculated from the total urine is incorrect. He gives an example where the error amounts to 13·8 per cent of the whole, calculated by adding the partial yields.—A. Schidlof and H. Saini: An attempt at a theory of emission of the β-rays by radioactive nuclei. The new interpretation of the authors gives an explanation of the analogy which exists between the α-rays and the β-rays, and makes clear the cause of the difference between the two classes of radiations.—P. Dive and R. Wavre: The Newtonian potential and multiform functions. The authors show in a very curious example the precautions which should be taken when prolonging analytically an ordinary potential, according to the nature of the topological data.—Léon Collet and Ed. Paréjas: Results of the geological expedition of Harvard University in the Canadian Rockies (Jasper National Park), 1929. (4) The geological section along Mural Glacier and the thrust plane of the Mumm Peak nappe. The authors give the detailed succession of the terranes along Mural Glacier and determine the thrust plane of the Mumm Peak nappe on both sides of the glacier. Owing to this overthrust, Lower Cambrian with Olenellus overrides Upper Cambrian.—(5) The geological section between Mount Robson and Moose Pass. The authors present the first complete geological section between Mount Robson and Moose Pass. On this section the thrust plane of the Mumm Peak nappe passes between the Chetang Ridge and the Tatei Ridge. Few corrections have to be made to Walcott's section of Mount Robson.

WASHINGTON, D.C.

National Academy of Sciences (*Proc.*, **18**, No. 1, Jan. 15).—Charles P. Winsor: The Gompertz curve as a growth curve. Benjamin Gompertz's curve (*Phil. Trans.*, 1825) is compared with the logistic curve; the former seems to give a good fit with material showing an inflection when about 37 per cent of total growth is completed, whereas the latter has its point of inflection about midway between the asymptotes.—Wilder D. Bancroft, Robert S. Gutsell, and John E. Rutzler, jr.: Reversible coagulation in living tissue (10). Morphine was withdrawn gradually from a drug addict of long-standing, giving large doses of sodium rhodanate. There were no major withdrawal symptoms. The sodium salt rapidly peptises protein colloids agglomerated by morphine, and also seems to assist in eliminating morphine from the tissue.—Harlow Shapley, Ernst J. Öpik, and Samuel L. Boothroyd: The Arizona expedition for the study of meteors. The equipment consists of two huts, on the opposite slopes of the roofs of which are iron reticules to provide co-ordinates of reference for visual observations. The huts are 23 miles apart on an east-west line. Telescopic observations are being made at two stations 2 miles apart. Angular velocities are being observed by a 'double-pendulum apparatus' consisting of an oscillating plate-glass mirror.—Howard Sprague Reed: The growth of *Scenedesmus acutus*. Growth of this alga followed the sigmoid curve of autocatalysis except for an initial lag.—H. E. Dolk and K. V. Thimann: Studies on the growth hormone of plants (1). The technique of preparing this hormone in quantity from mold cultures is described. Its activity was tested on the

coleoptiles of oats and a unit is suggested. The hormone appears to be an acid which is readily oxidised. A method of purification is described.—**Warren W. Wilcox**: The basis of the dependence of visual acuity on illumination. Acuity was measured by observing the separation of two parallel bars. For bright bars on a dark ground, acuity first falls with increased illumination, passes through a minimum and then rises. For dark bars on a bright background, acuity decreases with increasing illumination, the rate of decrease becoming progressively less. It is concluded that irradiation, or apparent shift of contours, is the only cause of the variations of visual acuity with intensity; Hecht's theory of a variation in the number of functional retinal elements is unnecessary.—**Henry Margenau**: Quantum dynamical correction for the equation of state of real gases. London has suggested that the deviations of light gases such as hydrogen and helium from the perfect gas law may be due to the existence of zero point energy associated with the vibratory motion of molecules in quantised collision states rendering the attractive Van der Waals' forces partially ineffective. This problem is investigated quantitatively.—**William Duane**: New lines in the *K*-series of X-rays.—**Hassler Whitney**: Note on Perron's solution of the Dirichlet problem.—**J. v. Neumann**: Proof of the quasi-egodic hypothesis.—**Jesse Douglas**: Seven theorems in the problem of Plateau.—**A. W. Tucker**: On combinatorial topology.—**W. Seidel and S. B. Littauer**: Lines of Julia of integral functions.—**Eberhard Hopf**: On the time average theorem in dynamics.—**G. A. Miller**: Sets of distinct group operators involving all the products but not all the squares.—**Tracy Yerkes Thomas**: Conformal tensors (1).—**D. V. Widder**: On the changes of sign of the derivatives of a function defined by a Laplace integral.—**Arthur L. Fox**: The relationship between chemical constitution and taste. Phenyl thio carbamide and related substances are bitter in taste to some people and not to others. The taste of these compounds is associated with a C=S linkage (see also NATURE, **128**, 124, July 18, 1931).—**Albert F. Blakeslee**: Genetics of sensory thresholds: taste for phenyl thio carbamide. Inability to taste this compound is inherited as a Mendelian recessive. From experiments using different strengths of solutions, it was found that innate differences exist as regards threshold value, the strength of the sensory reactions, and the ability to detect differences of concentration and to discriminate between different substances.—**Harold H. Plough**: Elimination of self-sterility in the *Styela* egg—a reinterpretation with further experiments. The author stated in an earlier paper that self-sterility was eliminated due to the addition of ammonia or caustic soda to sea-water containing the eggs. This is incorrect; the effective factor is time. On standing in sea-water, eggs and sperm undergo a spontaneous change which removes the block to self-fertilisation.—**T. Cunliffe Barnes**: The physiological effect of trihydrol in water. Water containing large quantities of the trihydrol form of water causes much increased rate of growth of *Spirogyra*; it is suggested that the colloidal trihydrol aggregates are the first steps in the formation of carbohydrates (see also NATURE, **129**, 691, May 7, 1932).

VIENNA

Academy of Sciences, Jan. 28.—**Otto Porsch**: The bat-flower problem. A number of species are added to the list of flowers fertilised by bats.—**Adolf Franke, Alfred Kroupa, and Theodora Panzer**: Ring contraction in the formation of internal ethers (oxides) from glycols. In continuation of the investigation of the action of sulphuric acid on higher glycols, it is found that tetradecan-1 : 14-diol also yields an internal ether, 1 : 5-oxidotetradecane.—**Robert Sandri**: Diffusion and transport of gases in liquids. (2) Diffusion of hydrogen through colloidal and liquid membranes. When a narrow gas-filled tube is closed at one end with a long drop of water and at the other with a thin membrane (rubber), diffusion of the gas and air through the membrane forces the water in one direction or the other. Quantitative investigation of this phenomenon yields results in approximate agreement with Fick's theory of diffusion and with Henry's law.—**Wilhelm Petraschek**: Comparative studies of deposits—the magnesites and siderites of the Alps.—**Alexander Tornquist**: An ore-deposit of the Raibl-Bleiberg type in the Dolomites.—**Leopold Kölbl**: The north-east end of the Grossvenedig mountain group.—**K. Graff**: Night measurements of the transmissivity coefficients of the atmosphere in Mallorca in winter. Determinations of the transparency coefficient of the atmosphere at night by measuring the brightness of stars at different distances from the zenith yielded surprisingly high values, 23 out of 38 exceeding 0·85, or, allowing for the barometric height, 0·881. These values are distinctly greater than those obtained in Säntis and Etna, which are both between 2500 metres and 3000 metres above sea-level.—**K. Graff**: Distribution of brightness in the sky at full moon. Except in the immediate neighbourhood of the full moon, the relative brightness of the night sky was found to vary only from 1 at the zenith to 0·4 in the polar region.—**Michael Radaković**: Raman effect. (17) The possible distributions of forces in the mechanical model of a triatomic molecule.—**Rudolf Scharfetter**: Vegetational relationships of the Gerlitzen in Carinthia.—**Viktor Lebzelter**: Individual growth in the Koisan race group.—**Josef Hoffmann**: Behaviour of alkali glasses containing chlorine, fluorine, and sulphate ions, and of manganese glasses, with and without iron, towards β- and γ-radiation. Experimental results confirm the previous conclusion that, with silicate glasses, blue and violet radiation colours are not produced by alkali metal atoms. In manganese glasses, red radiation colours are attributable to $Mn^{\cdots}$ ions and violet colours to the simultaneous presence of $Mn^{\cdots}$ and $Mn^{\cdot\cdot}$ ions. The latter alone give no colour, but in combination with iron a grey colour.—**Karl Przibram**: An empirical rule concerning the behaviour of certain plastic bodies towards pressure.—**Stefan Meyer**: Proton numbers, atomic numbers, and range of α-radiators. The range of α-radiators is given approximately by the expression, $\log R_0 = \log D + 0{\cdot}60 - 0{\cdot}043(P - 223)$, where P is the proton number and D is a function of the atomic number which varies periodically with the cube-root of the reciprocal atomic volume. A property of the nucleus, apparently connected with the periodic behaviour of the shell electrons, is also deduced.

Feb. 4.—**Anton Schedler and Max Toperczer**: Distribution of the geomagnetic declination in Austria at the epoch 1930·0.—**Max Toperczer**: The measurement of the magnetic declination with magnets suspended by threads. The corrections rendered necessary in applying this method of measuring magnetic declination, owing to the influence of torsion in combination with the imperfect character of the suspension, are considered. Measurements with two magnets being only just sufficient to eliminate the disturbing influences, the use of a greater number (at least three) of magnets is proposed.—**A. Dadieu, K. W. F. Kohlrausch, and A. Pongratz**: Studies on the Raman effect. (18) Raman spectrum of organic substances (polysubstituted benzenes) (1). Experiments with the six isomeric xylidines and xylenols show that the spectral type is determined by the position of the substituents and not by their nature. The spectra

may be classified in three groups according to the positions of the radicles introduced: (1) symmetrical, 1 : 3 : 5; (2) vicinal, 1 : 2 : 6 or 1 : 2 : 3, and (3) unsymmetrical. Only in case (1) does the principal benzene line ($\Delta\nu = 990$) appear with marked intensity, and as the symmetry of the nucleus vibration with the 1 : 3 : 5-compound can be only trigonal, it is concluded that the symmetry of the ring itself is also trigonal.—**Alfred Brukl** and **Bruno Hahn**: The heteropoly-acids of germanium.

Forthcoming Events

FRIDAY, MAY 13

ROYAL ANTHROPOLOGICAL INSTITUTE (Sociological Research Committee), at 5.30.—J. H. Driberg: Economic Stages of Development in Africa.

ROYAL SOCIETY OF MEDICINE (Clinical Section), at 5.30.—Annual General Meeting.

BRITISH ASSOCIATION OF CHEMISTS (London Section) (at Broad Street Station Restaurant, E.C.), at 7.—Annual General Meeting.

INSTITUTION OF ELECTRICAL ENGINEERS (Scottish Centre) (at Cowdray Hall, Aberdeen), at 7.30.—Prof. J. K. Catterson-Smith: Everyday Uses of Electricity (Faraday Lecture).

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Sir John C. W. Reith: Broadcasting.

INTERNATIONAL COMMITTEE ON THE HISTORY OF SCIENCE (at Paris) (*continued on May* 14 *to* 16).

SATURDAY, MAY 14

ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS (Annual Conference) (at Technical College, Cardiff) (*continued on May* 15 *to* 17).

TUESDAY, MAY 17

ROYAL SOCIETY OF MEDICINE, at 5.—Special Meeting of Fellows.

KING'S COLLEGE, LONDON, at 5.30.—Prof. M. Schlick: Form and Content. (Succeeding Lectures on May 18 and 20.)

IRON AND STEEL INSTITUTE (Additional Meeting) (at Royal Metal Exchange, Swansea), at 6.—Presentation of Papers.

WEDNESDAY, MAY 18

NATIONAL INSTITUTE OF INDUSTRIAL PSYCHOLOGY (at London School of Economics), at 5.30.—Dr. C. S. Myers: Psychological and Social Factors in Business Rationalisation (3): The Advantages of Rationalisation.

INSTITUTION OF WATER ENGINEERS (at Sheffield).—Summer General Meeting (*continued at Buxton, May* 19 *to* 21).

THURSDAY, MAY 19

UNIVERSITY COLLEGE, at 2.30.—Sir Flinders Petrie: Canaanite Civilisation (*to be repeated on May* 21, *at* 3, *and on May* 24, *at* 5.30).

LONDON MATHEMATICAL SOCIETY (at Royal Astronomical Society), at 5.—Prof. H. Levy: A Numerical Study of Differential Equations (Lecture).

ROYAL SOCIETY OF MEDICINE (Dermatology Section), at 5.—Annual General Meeting.

LIVERPOOL BIOLOGICAL SOCIETY (in Zoology Department, Liverpool University), at 5.30.—Mrs. C. S. Hodson: Biological Advances and Eugenics (Lecture).

UNIVERSITY COLLEGE, at 5.30.—Dr. C. S. Myers: The Absurdity of any Mind-Body Relation (Hobhouse Memorial Lecture).

CHEMICAL SOCIETY, at 8.—Discussion on Some Aspects of Asymmetric Synthesis.

ROYAL SOCIETY OF MEDICINE (Neurology Section), at 8.—Annual General Meeting.

BRITISH INSTITUTE OF RADIOLOGY (Annual General Meeting), at 8.—Dr. J. C. Mottram: On the Relationship of Beta and Gamma Radiation in the Treatment of Tumours; The Action of Radium on Blood Supply—The White Reaction.

GERMAN OPHTHALMOLOGICAL SOCIETY (at Leipzig) (*continued on May* 20 *and* 21).

CONGRESS OF INTERNATIONAL ASSOCIATION FOR BRIDGE AND STRUCTURAL ENGINEERING (at Paris) (*continued on May* 20 *to* 25).

FRIDAY, MAY 20

ROYAL SOCIETY OF MEDICINE (Physical Medicine Section), at 5.30.—Annual General Meeting.

ROYAL SOCIETY OF MEDICINE (Radiology Section), at 8.30.—Annual General Meeting.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. H. E. Armstrong: Faraday at the Sign of the Hexagon: Coal Colour and Constitution.

INSTITUTION OF ELECTRICAL ENGINEERS (Western Centre) (at Sedbury, Monmouthshire).—Summer Meeting (*continued on May* 21 *to* 23).

SATURDAY, MAY 21

INSTITUTION OF ELECTRICAL ENGINEERS (Irish Centre—Dublin) (at Trinity College, Dublin), at 7.45.—Annual General Meeting.

GERMAN CONGRESS FOR PSYCHICAL HYGIENE (at Bonn).

Official Publications Received

BRITISH

The Scientific Proceedings of the Royal Dublin Society. Vol. 20 (N.S.), No. 17: Report on the Recent Bog-Flow at Glencullin, Co. Mayo. By A. D. Delap, A. Farrington, R. Lloyd Praeger and Louis B. Smyth. Pp. 181-192. 1s. Vol. 20 (N.S.), No. 19: Electrical Properties of Oil-Water Emulsions, with special reference to the Structure of the Plasmatic Membrane, II. By Prof. Henry H. Dixon and Dr. T. A. Bennet-Clark. Pp. 211-226. 1s. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.)

Agricultural Progress: the Journal of the Agricultural Education Association. Vol. 9, 1932. Pp. 184. (Cambridge: W. Heffer and Sons, Ltd.) 5s. net.

Seale-Hayne Agricultural College: Department of Plant Pathology. Eighth Annual Report for the Year ending September 30th, 1931. (Pamphlet No. 37.) Pp. 25. (Newton Abbot.)

Journal of the Indian Institute of Science. Vol. 15A, Part 1: Salt Stains on South Indian Hides and Skins. By V. N. Patwardhan and M. Subramania Sastry. Pp. 8+1 plate. (Bangalore.) 12 annas.

India: Meteorological Department. Winds, Weather and Currents on the Coasts of India and the Laws of Storms. Pp. iii+51+18 plates. (Calcutta: Government of India Central Publication Branch.) 2.6 rupees; 4s. 6d.

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 57: Infectious Exterotoxaemia (The So-called Braxy-like Disease) of Sheep in Western Australia. By H. W. Bennetts. Pp. 72. (Melbourne: H. J. Green.)

FOREIGN

University of California Publications in American Archæology and Ethnology. Vol. 33, No. 1: The Western Kuksu Cult. By E. M. Loeb. Pp. vi+137. (Berkeley, Calif.; University of California Press; London: Cambridge University Press.) 1.50 dollars.

Japanese Journal of Botany: Transactions and Abstracts. Vol. 6, No. 1. Pp. v+137+26. (Tokyo: National Research Council of Japan.)

Rubber Research Institute of Malaya. Planting Manual No. 3: Plantation Sheet Rubber Manufacture. By R. O. Bishop. Pp. iv+61. (Kuala Lumpur.) 2 dollars.

Smithsonian Miscellaneous Collections. Vol. 87, No. 5: The Narrative of a Southern Cheyenne Woman. By Truman Michelson. (Publication 3140.) Pp. 13. Vol. 87, No. 3: Seth Eastman, the Master Painter of the North American Indian. By David I. Bushnell, Jr. (Publication 3136.) Pp. 19+15 plates. (Washington, D.C.: Smithsonian Institution.)

Japanese Journal of Astronomy and Geophysics. Transactions and Abstracts, Vol. 9, No. 2. Pp. ii+77-125+7-11. (Tokyo: National Research Council of Japan.)

Iowa Geological Survey. Vol. 34: Annual Report, 1928; with Accompanying Papers. Pp. viii+464. (Des Moines.)

Proceedings of the United States National Museum. Vol. 80, Art. 14: Upper Cretaceous Foraminifera from Trinidad. By Joseph A. Cushman and P. W. Jarvis. (No. 2914.) Pp. 60+16 plates. Vol. 80, Art. 18: The Parasitic Habit in the Ducks, a Theoretical Consideration. By Herbert Friedman. (No. 2918.) Pp. 7. (Washington, D.C.: Government Printing Office.)

U.S. Department of Agriculture. Technical Bulletin No. 299: Repellency to the Japanese Beetle of Extracts made from Plants immune to Attack. By F. W. Metzger and D. H. Grant. Pp. 22. (Washington, D.C.: Government Printing Office.) 5 cents.

CATALOGUES

Classified List of Second-hand Scientific Instruments. (No. 101.) Pp. vi+58. (London: C. Baker.)

B.D.H. Reagents for Delicate Analysis and "Spot" Tests. Pp. iv+40. (London: The British Drug Houses, Ltd.)

Women Writers (Seventh Century to Present Day): Biographies and Autographs of Celebrated Women, Children's Books, Costume, Nursing, etc. (Catalogue 548.) Pp. 28. (London: Francis Edwards, Ltd.)

Industrial Thermometers, Hydrometers, Pressure Gauges. (List No. 579.) Pp. 52. (London: C. F. Casella and Co., Ltd.)