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Co-operation in Medical and Agricultural Research

At a meeting of the New Zealand Branch of the British Medical Association held in March last, a resolution was approved urging the necessity for further research regarding the "factors which govern the incidence of goitre, in particular its relationship to the nature of the soil and the food of the people", and recommending that arrangements should be made to co-ordinate medical research with soil and animal research.

Goitre, which occurs in both human beings and animals, is an endemic disease which appears to be correlated with the nature of the soil and, according to most observers, with the iodine content of the food. A great deal of research has already been done, especially in Switzerland, the United States of America, and in India; but the problem of the etiology of the disease and the best means of its prevention are by no means completely solved. The resolution to co-ordinate work on soils, domestic animals, and human beings is undoubtedly sound.

Investigations on these lines have been carried out in Great Britain in recent years. The greatest obstacle to progress is the difficulty of determining with accuracy the amounts of iodine present in soils and foodstuffs. A committee of the Medical Research Council, with the assistance of Sir Robert Robertson, of the Government Chemical Laboratory, is at present trying to evolve a method which will give trustworthy data and can be used as a standard method throughout the world. If such a method be found, the advance in our knowledge will certainly be along the lines suggested by the New Zealand Medical Conference. It is probable that through the Imperial Agricultural Bureaux, the Medical Research Council, the Public Health Departments, and the Agricultural Research Council, co-operative research not only between medical, veterinary, and agricultural research workers, but also between institutions in different parts of the Empire, may be arranged. It is by such co-operative work that the goitre problem is most likely to be solved.

That such co-operation should not be limited to the question of goitre is emphasised by a message from Lord Bledisloe, the Governor-General, to the New Zealand medical conference. Lord Bledisloe has, for many years, shown a deep interest in veterinary and agricultural research, and in his message he directs attention to the interrelation of human and animal food deficiency diseases. He refers specially to diseases "traceable to lack of

iron, calcium, iodine, phosphates, vitamins, or other essential food factors", and points out that these diseases, which have a common etiology in both human beings and farm animals, require further investigation.

A number of deficiency diseases, for example, Waihi disease in cattle due to phosphorus deficiency, bush sickness to iron deficiency, goitre believed to be associated with iodine deficiency, and several diseases in sheep which may be due to lack of either calcium or phosphorus or both, are already being successfully investigated in New Zealand. There is evidence that similar mineral deficiencies occur under certain conditions in the food of human beings, and there is no doubt that lack of some of the vitamins is of common occurrence in large sections of the world's population.

The wealth of knowledge which research in nutrition has accumulated in the past few years, perhaps on account of its very newness, has not yet been fully applied to the prevention of disease in human beings and domestic animals. The lead given by Lord Bledisloe for the combination of medical, veterinary, and agricultural research resources for an attack on diseases the incidence of which is influenced directly or indirectly by nutrition is therefore timely, and deserves the attention of those responsible for the direction of medical and agricultural research in other countries as well as in New Zealand.

Towards a New World Order

(1) *Letters to John Bull and Others.* By Robert the Peeler. Pp. 140. (London: Williams and Norgate, Ltd., 1931.) Paper, 2*s.* 6*d.*; cloth, 3*s.* 6*d.*

(2) *The League Committees and World Order: a Study of the Permanent Expert Committees of the League of Nations as an Instrument of International Government.* By H. R. G. Greaves. Pp. xi + 266. (London: Oxford University Press, 1932.) 14*s.* net.

(3) *The Economic Consequences of Power Production.* By Fred Henderson. Pp. 220. (London: George Allen and Unwin, Ltd., 1932.) 6*s.* net.

(4) *The Riddle of Rationalisation: a Review of the Potentialities of the Scientific Reorganisation of Industry under a National Plan.* By L. J. Barley. Pp. 128. (London: George Allen and Unwin, Ltd., 1932.) 4*s.* 6*d.* net.

FOR some years before the present trade slump and the economic crisis of last year, acute observers had perceived the bankruptcy of many accepted political and economic theories and the inadequacy of the administration in most western countries to deal with these problems with which the accelerated application of scientific discoveries and methods in all fields of industry and of society was confronting them. The War itself was only a revelation of this bankruptcy and inadequacy in regard to national defence and security, and the halting progress towards disarmament during the last fourteen years underlines that failure. To an unprejudiced observer, the governments of the world as a whole appear to have "learnt nothing, forgotten everything".

The present critical position must be largely attributed to the failure of those in authority to perceive the fundamental changes which have occurred during the last fifty years in the whole character of industry and society, despite repeated warnings. We can recall no more lucid exposition of the fundamental change in human relations for which applied science has been responsible than Prof. J. T. Shotwell gives in an admirable introductory chapter to his book on the Kellogg Pact, but the indifference of the politician and even of industry to such warnings suggests something more deliberate than neglect. The volumes under review have this in common, that from different angles they present an invaluable and constructive analysis of the underlying causes of our difficulties and supply the outline of what to most sane and disinterested persons will appear to be a reasonable solution, and one that in its emphasis on facts and freedom from prejudice or preconceived ideas should command the earnest consideration of all scientific workers.

(1) "Letters to John Bull and Others" is a popular and spirited exposition of the idea of an International Police Force so ably expounded by Major David Davies at greater length in the "Problem of the Twentieth Century". This restatement of the essential points is exceedingly timely and should promote a wider understanding of the problems confronting the Disarmament Conference. "Robert the Peeler", in entertaining but convincing manner, contrives to lay bare the fundamental principles of real progress. The new weapons which science has forged have made disarmament and the renunciation of war the only alternative to annihilation, but he goes further and suggests that by co-operation in an International Police Force the new weapons can be used for the mutual protection of all countries, science having created the conditions which make it possible to supply to the modern world the prin-

ciples and methods successfully practised centuries ago by the Greeks.

The very extent to which the new weapons dominate warfare makes it possible to contemplate handing them over to a small international authority and force which would consequently have a striking power out of all proportion to its numbers and, under modern conditions of transport, could take rapid and effective action in any part of the world. "Robert the Peeler" visualises this International Police Force in conjunction with an International Court of Justice and a tribunal to enforce the findings of which it would be primarily organised.

Naturally, in a short popular work of this type, only the briefest outline can be given of the method of organising such a court or police force, but it is all to the good that as many people as possible should be induced to view the problem as a whole and consider impartially the idea of an International Police Force. Apart from anything else, the existence of such a police force would eliminate decisively one of the gravest present dangers when no adequate defence is available against, for example, air attack, the temptation to get one's blow in first. Nor does "Robert the Peeler" fail to note the folly and danger to society of allowing the continuance of vested interests in the manufacture and exploitation of the new weapons of war.

(2) To destroy the underlying causes of war, by constructing channels of international co-operation and by creating a disinterested point of view wherever national interests conflict is, however, as Mr. Greaves points out, vastly more important than declaring war the evil everyone knows it to be. Disarmament is after all a negative aspect of the League, and one great merit of Mr. Greaves's book is that it gives a connected account and a lucid analysis of the growth of the technical and administrative work of the League in its various expert committees and commissions and assesses their contribution towards the building of a new world order.

The tendency for international organisation to extend is one of the most significant of modern times, and one which received further impetus during the War as indicated in the various inter-Allied systems for shipping control, food, and purchases. The parallel tendency for government to rely increasingly on smaller and more specialised groups of men is equally striking and is changing the very nature of politics. Government has become a thing impossible without the advice of experts and the schemes of technicians, upon whom almost daily are thrust new and weighty functions. The consequent danger of the legislature becoming the tool of its expert advisers is one to which in Great Britain Lord Hewart has directed attention, and the recent Committee of Inquiry, while recognising the tendency, did not regard it as fundamentally wrong but merely recommended the institution of certain safeguards.

The more marked technicality of administration and the necessity for expert opinion are also supported by the need for securing the agreement of the organised and articulate interests affected in State action. The outcome is seen in the practice of creating advisory committees of experts representing outside interests which act as permanent consultative bodies at the disposal of the government. Accordingly, the functional representation of industry, upon the need for which under our new tariff policy Capt. H. Macmillan has rightly insisted, is only a process of devolution which is taking place to an increasing extent and reflects a further development of the basic principle of self-government.

These three tendencies give special significance to the League's expert committees. The growing number of questions which can only be solved by international co-operation, the increasing authority of the expert, and the advance towards functional self-government, stress the importance of these international committees, and this critical study of their development is at pains to elucidate the various factors which have contributed to their relative success or failure. Designed in the main to be consultative, they have already achieved more than a mere advisory function, and although their members are appointed invariably in theory and usually in practice on technical qualifications, the fact that they are constantly in touch with their governments, although not government representatives, has enabled them to transform national into international administration with notable measure of success. The most significant fact about these committees is, however, that each committee deals with its particular problems from a non-national point of view, exactly in the way visualised by General Smuts in his Sidgwick Memorial lecture when pleading for the scientific spirit in human affairs, especially in the international sphere.

It should be unnecessary to stress this point further in view of the events of the past year, but the brief review of the activities of these committees which Mr. Greaves gives us demonstrates plainly that their greatest successes, such as the reconstruction

schemes for Austria, Hungary, and the Greek refugees, are to be attributed to the greater urge which an aroused public opinion and the responsibility for a definite and urgent attack supplied. Equally it is true that in the lesser known but valuable work of the Health Committee, the Economic Committee, the Mandates Commission, or the Communications or Transit Committee, there can be found abundant evidence of the fruitfulness of this new method of handling difficult technical international questions, and that agreement and co-operation are not difficult to secure provided that the duty of securing it is entrusted to specialists more interested in their subject than in national politics or prestige.

While we have already the machinery for handling such questions in this way, which by its very operation co-ordinates technical organisation and develops habits of co-operation and mutual confidence as well as facilitating the growth of a world point of view upon the needs of a world society, the success of the method is largely proportional to the extent to which the personnel of the committee is disinterested. Members must be nominated not as representatives of their countries but as individuals and for their expert qualifications. The necessary influence and contact with the governments of their countries is best secured when their expert qualifications are combined with high personal standing not only professionally but also in the world of government departments. If the expert committee is marked out as a most helpful line of advance towards a new world order in which civilisation will gain control over the destructive forces released in the last fifty years, success can never be achieved until, on one hand, scientific workers are increasingly disposed to accept the social and political responsibilities which are now rightly theirs, and on the other hand, there is, in Great Britain at all events, a much greater readiness to admit the scientific worker to administrative posts on equal terms with experts drawn from other spheres.

The book deserves and demands attention from scientific workers in particular, for the problems which call for treatment in this way are increasing and urgent, and failure to solve them to-day makes solution or control no easier to-morrow. Scientific workers cannot evade their responsibilities for sharing in this task of shaping international government and, by securing a wider publicity for this type of administration, assisting the growth of the public opinion which will promote its success in the more difficult fields of disarmament or treatment of minorities where political factors still prevent progress.

(3) In "The Economic Consequences of Power Production" Mr. Fred Henderson contributes an able analysis of the effect of the immense increase in our productive powers which has resulted from the application of science to methods of production, particularly in relation to the distribution of wealth. The effect of science on production has been discussed largely as if it were a matter of efficiency of production alone, and its effects on distribution have commonly been disregarded or overlooked. This has been partly due to the fact that until recent years the existence of outside markets has tended to mask the full effect of what has really been a fundamental change produced by science in our methods of production. It is only in the last few years, as these outside markets have tended rapidly to disappear and in the Far East and elsewhere countries which were formerly consumers only have entered the ranks of producers and erected barriers against the entry of the goods produced elsewhere, that the resulting dislocation of trade and unemployment culminating in the present depression have forced us to realise the existence of maladjustment and the startling contrast between our success in effective production and our failure in distribution.

To the demonstration of this change and its mechanism Mr. Henderson devotes the first and most lucid part of his book. What science has given us in the mechanical developments of the last half-century is not merely more production but also a new kind of production. A profound and vital change has taken place in the relation of human labour to the processes and products of the world's work. Human physical energy has been superseded by other and greater propellent powers. The human service associated with the machine has ceased to be labour in the old sense. It is now mainly a matter of admitting power to the machine and regulating its degree and direction. It is labour on a higher level of general intelligence than the old unskilled manual labour, and carries a greater strain of responsibility, but in intelligence and responsibility it has nothing in common with skilled craftsmanship. Accordingly, the technique of an industry and intimate knowledge of its processes, raw materials, and products tend to become concentrated in a small central staff of experts. Output in production has thus now only escaped from the limitations of physical energy, but skill has become so unimportant in many industries that the low-paid labour from

rural districts of Japan, China, or India can compete in all essential respects with experienced European operatives.

This shifting of the function of measuring output from labour to non-human energies is the main factor responsible, through our failure to adjust our distributive system, for the present confusion. Every means by which, through rationalisation or fresh scientific discoveries or inventions, our efficiency or resources of power production are increased, decreases the volume of labour required to produce a given output, or, in other words, renders human labour obsolete. Now that previous-customer communities have equipped themselves in the same way for supplying their own industrial products and are protecting their home markets against the incursion of such products from outside, while simultaneously seeking outside markets for themselves, we are rapidly approaching a position in which the home market of every industrial country is unable to absorb the equivalent of its own output and finds the rest of the world closed against the surplus. Widespread and increasing unemployment is the result, and this position, in the midst of incredible abundance which the escape of production from the limits of human labour has made possible, is a grave indictment against our present distributive machinery.

Thus far Mr. Henderson can scarcely fail to carry his readers with him. In the second part of the book he does not reach the same level in analysing the defects of our distributive system, nor does the book include anything more than the broadest constructive suggestions. None the less the main theme is incontestable. The fundamental change which science has made in our methods of production demands certain changes in the economy of distribution. The latter can no longer be allowed to remain on its pre-scientific age basis, and the extension of scientific method and planning into this field is long overdue. We have to face the creation of a new social order for making effective the release of mankind into an age of more abundant living, and the social control of production scientifically planned in relation to use and consumption up to the level of human needs affords the only basis for such a new order.

Mr. Henderson, in directing attention to the profound changes involved by the new conditions of power production and by challenging frankly some of the assumptions in regard to costs of production, and the distribution of leisure and profits which are often too lightly made, renders a notable service. "Man does not exist to serve the needs of an economic system", he rightly observes, and in the creation of the new social order the application of scientific methods and the impartial spirit of science to the solution of our social and economic problems may play a decisive part. We cannot return to the inefficient or wasteful methods of production of the past, but science must do more than merely increase efficiency of production. At least it is clear that no policy of muddling timidity or prejudice will meet the situation.

(4) "The Riddle of Rationalisation" is a much slighter study than Mr. Henderson has given us, but in spite of the omission of any reference to the change in the position of labour in our industrial system produced by machine or power production, Major Barley gives a very competent review of the possibilities of the scientific reorganisation of industry from an industrial point of view. Without challenging, as Mr. Henderson has done, the basic principle of capital or private ownership upon which our present production system rests, he equally recognises that the rationalisation of industry and its scientific management, by increasing the efficiency of production, inevitably reduce the labour required for the same output and thus promote unemployment. Recognising that a return to pre-scientific and inefficient means of production is out of the question, Major Barley sees the solution in the planning of production to increase the standard of living, and the distribution of wealth proportionately with the increase in the efficiency of production resulting from the application of scientific methods or discoveries.

Probably some distribution of leisure may be simultaneously required, but the plea for the extension of scientific methods to the economic field, for constituting an accurate industrial science for the service of the community and for planning production and distribution so far as possible in relation to our known needs, cannot be ignored. A national plan makes scientific adjustment possible and may offer some prospect of solving the unemployment problem and increasing the standard of living of the whole community by fifty per cent, provided the plan is conceived on wide enough lines and appropriate international co-operation secures an adequate and unprejudiced treatment of such matters as reparations and war debts, tariffs, and the international price-level and credit system.

These are large assumptions, but not so large as the pessimistic assumption that science has nothing further to contribute or that its guidance will not

enable man to find a way to the control of those forces which the careless application of scientific discoveries and principles in the mechanical world has released. That simultaneously with increased efficiency of production there has been a perceptible though disproportionate increase in the general standard of living is at least of hopeful significance, and until national planning has been attempted on the lines Major Barley suggests, we remain without an answer to the questions whether it is possible to raise the standard of living and simultaneously to reduce unemployment to the required extent.

The concrete suggestion of a commission for individual industries under an expert National Advisory Economic Planning Department is similar to that since proposed by Capt. Macmillan under the Tariff Commission, and, like that, is essentially an attempt to determine whether, without radical changes in the nature of society, it may not be possible to organise on scientific lines the production, distribution, and exchange of goods so that the needs of the whole community may be adequately served.

Plant Chemistry

The Glycosides. By Dr. E. F. Armstrong and K. F. Armstrong. (Monographs on Biochemistry.) Pp. vii + 123. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1931.) 12*s.* 6*d.* net.

THIS healthy bud from a vigorous parent chronicles important advances in plant chemistry. A chapter in the senior author's earlier monograph, "The Simple Carbohydrates and the Glucosides", published in 1910, was called "The Natural and Synthetic Glucosides" and occupied 14 pages. This has now been expanded into the new volume, which fills 110 pages, exclusive of bibliography and indexes. The change of spelling from "glucosides" to "glycosides" is made in accordance with official practice, and is a recognition of the fact—apparently not realised in 1910—that sugars other than glucose take part in forming these characteristic plant condensation products.

Several hundred of these substances have now been identified. Many are of a very complex nature, and their investigation is correspondingly difficult. The nature of the sugar itself has to be established; it is in most cases one or another of the modifications of glucose, though benzoyl-glucose, primeverose, vicianose, digitoxose, digitalose, and rhamnose have all been isolated from natural glycosides, as have several disaccharides and trisaccharides. The non-sugar part of the molecule may belong to any of an unusually wide range of compounds—phenols, coumarins, anthoxanthins, anthocyanins, isothiocyanates, and many others, including some the structure of which has not yet been worked out. The term "aglucone" for these constituents of glycosides seems a little illogical: surely it should have been "aglycone".

From the last two chapters of the book it is clear that the precise rôle of glycosides in plant physiology still awaits elucidation from the further intensive research that is certain to be undertaken, if only for the reason that a number have definite and recognised pharmacological action; among the better known of these are the glycosides of digitalis and strophanthus.

The volume is as well produced as others in this series, though there are some minor printing errors. Little attention has been paid to uniformity in the lay-out of the tables; Tables 1, 3, and 6 are arranged on one principle, Table 2 on another, Tables 4 and 5 on another, and neither Table 2 nor Table 5 has any column headings at all. Type and paper are adequate, but the luxurious effect of the transverse gold lettering replacing the old vertical black type on the spine is rather marred by its relative illegibility and bad centring. A. L. BACHARACH.

Principles of Modern Physics

Modern Physics: a General Survey of its Principles. By Rev. Theodor Wulf. Translated from the second German edition by C. J. Smith. Pp. xi + 469. (London: Methuen and Co., Ltd., 1930.) 35*s.* net.

THE sixth-form scholar and the first-year university student are in these days well catered for in the matter of textbooks of physics. To be sure, these in general conform to a standard pattern which lends itself to a grasp of detailed facts classified in a traditional and natural manner and to the requirements of examination tests. There has been a tendency, however, of late years to break away somewhat from this pattern, and the book under review constitutes a very notable departure indeed from accepted models. Assuming the "essential and final goal of Physics" to be "the derivation of phenomena on the basis of the internal structure of the smallest constituent particles of matter", the author states that his aim is to give a "co-ordinated account of the fundamental results of Physics". In consequence, he collects in a first part the facts about the material world

which are concerned with movements of observable bodies, transmission of waves, gravitation, and the elastic properties of matter, and then proceeds to Part II., which opens with a chapter on the history of the atomic conception and the discovery of the chemical elements and their classification.

Part II. treats the states of aggregation, heat, and thermodynamics, with a discussion of the facts which help to the comprehension of the atomic hypothesis. From the concept of the simple atom, the author passes on in Part III. to the phenomena of electricity and magnetism, utilising these to develop the idea of an atom with a structure, thus leading to the hypothesis of electrons and nuclei and the part which they play in the emission and absorption of energy by matter. Here will be found an elementary account of the Planck theory of full radiation, Bohr's theory of the emission of spectra, and generalities about the quantum hypothesis. To complete the picture of the physical world, there follows Part IV. on the "Physics of the Ether", embracing a discussion of the phenomena of light and radiation in general, and leading to a short account of Einstein's theory.

It is a commonplace criticism of our system of scientific education to blame it for the production of students crammed with facts the significance and relationships of which they fail to comprehend. We are of the opinion that this is a criticism which overstates the seriousness of the situation, but in so far as it may be true, we can conceive of no better antidote to the so-called deadening effect of the customary textbook than to introduce the young student to this work. It gives a clear picture of the physical world, as consistent with our knowledge as is possible at present, and presents it as a model still incomplete, involving difficulties, and destined no doubt to be profoundly modified in the future. For this inculcation of a truly scientific and philosophic outlook the book is worthy of high praise and can be heartily recommended to sixth-form boy, university student, engineer, medical teacher—indeed, to anyone who may have, for one reason or another, acquired some knowledge of the physical sciences and desires to obtain an insight into their realm, and an understanding of the great changes which have taken place there of late and what effects these changes have produced on the traditional conceptions of space, time, and matter.

The translation appears to have been well done, and shows none of the stiffness of style which accompanies a too literal rendering of a foreign work.

Short Reviews

Les Coaptations chez les insectes. Par Dr. Jean Corset. (Suppléments au Bulletin biologique de France et de Belgique, Supplément 13.) Pp. 337 + 2 pls. (Paris : Laboratoire d'Évolution des Êtres organisés ; Les Presses universitaires de France, 1931.) 85 francs.

IN his introduction to this treatise, the author explains the origin and significance of the term 'coaptation.' He applies it in the sense adopted by M. Cuénot with reference to Arthropoda, and especially insects. A coaptation is defined as a reciprocal adjustment of two independent parts which perform, as the result of their union, a definite function. Examples of such devices are particularly numerous and well developed in connexion with integumentary parts or organs among insects, especially in the order Coleoptera.

M. Corset's memoir is divided into four parts, and in Part I. he describes the anatomical features of coaptations as exhibited among diverse groups of insects. Special mention may be made of the interlocking mechanism of the ovipositor valves in Orthoptera ; the elaborate articulatory devices in relation with the wing covers and thorax of Coleoptera and some Hemiptera ; sutural interlocking of coleopterous elytra ; various types of fore and hind wing union, and so on. Part II. is concerned with the functional aspects of the subject, and, in this connexion, the puzzling problem of the curious mechanical perfection of parts, often in relation to their apparent feeble utility, is raised. In Part III. the biological rôle of these various devices and mechanisms comes in for treatment. Of especial interest are the examples of their close convergence in structural detail among members of very different families and orders that are brought to notice.

Part IV. is more or less philosophical in scope and is devoted to evolutionary questions associated with the parts in question. This subject is rather fully discussed, and it appears to the author to demonstrate the adaptation of a means towards an end through the operation of a directive force or agency. The memoir is well illustrated, mostly by means of sections of the parts involved. It is, on the whole, a very readable work that is suggestive in its outlook. Its production, it may be added, has involved a good deal of original investigation into the structure of the various devices that are discussed. A. D. IMMS.

An Introduction to Plant Physiology. By Dr. W. O. James. Pp. viii + 260. (Oxford : Clarendon Press ; London : Oxford University Press, 1931.) 7*s.* 6*d.* net.

PLANT physiology has few literary champions. There is not one comprehensive textbook on the subject suitable for students reading for a final degree in botany in Great Britain. Except where a junior university course such as that of First M.B. or intermediate science is actually given round a prescribed book (not a commendable practice), there is no botany textbook of that status which gives physiology a fair hearing.

Now we have the reverse. Although the author of this book disclaims the fulfilment of requirements of any formal syllabus, the subject matter dealt with is of the standard 'prescribed' for first-year university students; but whether such students are prepared to invest in a textbook specially for the physiology section is a different matter.

The science of plant physiology is still in the melting pot of hypothesis and conjecture, perhaps more so than any other science. Yet, Dr. James has avoided most of the controversial matter, still keeping his subject alive and to the point. The order of topics is somewhat revolutionary, and thus, we believe, the value of the book is enhanced. Photosynthesis is considered very early in the book, whereas growth and germination are relegated to the end. Nitrogen metabolism receives much deeper consideration than hitherto, and the various forms of plant irritability are dealt with fairly, more after the Continental style than the British, which scarcely considered the subject at all.

The method of treatment is good and the style is excellent. The text throughout is well illustrated. A special feature is the detailed descriptions of experimental work; for, as the author says, "the success or otherwise of an experiment depends so often upon apparent trifles". One of the many details we note with enthusiasm is the discriminating treatment of the important phenomenon of permeability.

Archæology of the Arkansas River Valley. By W. K. Moorehead. With Supplementary Papers on *The Prehistoric Cultures of Oklahoma*, by J. B. Thoburn, and *The Exploration of Jacobs Cavern*, by C. Peabody. (Published for the Department of Archæology, Phillips Academy, Andover, Massachusetts.) Pp. x + 205. (New Haven: Yale University Press; London: Oxford University Press, 1931.) 18*s*. net.

IN this volume Mr. Warren K. Moorehead records the results of a comprehensive survey of the archæology of the Arkansas River valley from its junction with the Mississippi near the Louisiana border to its upper waters. The archæological interest of the valley lies especially in the variety of its cultures. These reflect the geographical conditions, which range from the wooded lowlands at the mouth, where are found mound-builders of characteristic 'pottery-belt' type, to the 'buffalo country' with prehistoric settlements, which point to a more settled habit among Plains Indians before the introduction of the horse, and the desert area in which the river takes its rise. The Ozark Bluff-Dwellers, who have been described by Harrington, are within easy reach of the river, and there is an extension of Pueblo culture in western Kansas, probably a migration from Pecos.

The most interesting problem of the area is afforded by what is here called the Texan Panhandle culture of the upper Canadian, Cimarron, Red, and Arkansas rivers, characterised by 'slab-house' construction. Its origin and affinities are obscure. The suggested relation with either Pueblo or Mexican culture gives rise to difficulty from the absence of features characteristic in these two cultures. Mr. Moorehead discusses the evidence very fully, but in the present state of knowledge there is no possibility of solution. His expectation that the problem will be solved within ten years is probably justified, judging by the progress at present being made in this area. The value of the volume as a contribution to the prehistory of America is much enhanced by the excellent illustrations.

Digressions of a Man of Science. By Sir A. Daniel Hall. Pp. 223. (London: Martin Hopkinson, Ltd., 1932.) 7*s*. 6*d*. net.

IT is sometimes cast in the teeth of the man of science that his interests are narrow and lacking in culture, and that though he has something to say, his literary attainments are not such as to enable him to say it. Both gibes can, no doubt, be supported by examples. The author of these essays is, however, one of many scientific men whose writings make manifest the injustice of the taunts. The range of topics in these "Digressions" is so wide as to cause envy of the versatility of the mind that thinks deeply on philosophical and religious matters, as in "The Faith of a Man of Science" and "Science and Immortality"; that can discuss with expert knowledge the economic and political problems of farming ("What Science has done for Farming"); or with equal facility and happy phrase, and with apt quotation from both prose and verse writers in our own and in other languages, handle such diverse subjects as country churches and their mural tablets, the sheep, shingles, and birds of Romney Marsh and Dungeness, the frequenters of auction-rooms, and ideal tulips, to mention a few examples from the twenty-two chapters. Some of the articles have already seen the light in newspapers or magazines; and thanks are due to Sir Daniel Hall for bringing them within the covers of a book. The insertion of the dates on which he penned each article would have added a personal element of much interest.

Entwicklungsphysiologie der Tiere. Von Dr. Paul Weiss. (Wissenschaftliche Forschungsberichte, Naturwissenschaftliche Reihe, herausgegeben von Dr. Raphael Ed. Liesegang, Band 22.) Pp. xi + 138. (Dresden und Leipzig: Theodor Steinkopff, 1930.) 11 gold marks.

THIS presentation of border-line problems has no counterpart in the English language. Prof. Weiss has succeeded in bringing together under the title of developmental physiology a survey of the present fluidity imposed by experimental embryology on the older and somewhat effete morphology. This is the best presentation of the post-War change in outlook in biology.

The book deals in particular with the balanced growth of the embryo, organ formation, and the rôle of Spemann's 'organisators'. Growth is analysed in terms of cellular proliferation and cellular differentiation, and the characteristic features of growth *in vitro* and *in vivo* are compared. Metamorphoses and regeneration lead up to a final chapter dealing with recent theories in biology.

The *Dana* Expedition of 1928–1930

ON several occasions reference has been made in NATURE to the oceanographical expedition of the *Dana*, 1928–1930. With the support of various Departments of the Danish Government, the East Asiatic Company, and especially of the Carlsberg Foundation, Prof. Johs. Schmidt planned and directed a lengthy cruise in the tropical waters of the Indo-Pacific, to supplement his many years' investigations in the Atlantic and thus to complete the 'magic circle'. The volume now before us * is the first ripe fruit. Richly and beautifully illustrated, in clear print, it is professedly a popular account of the voyage with just sufficient leaven of scientific fact and theory to hold one's interest and make a connected story. The illustrations accompanying this article are from the volume.

The voyage began in June 1928 and ended in June 1930. The total distance logged was more than 65,000 nautical miles. The westward route was chosen in preference to the eastward, to take advantage of the prevailing trade-winds and currents of the Pacific. A brief account of the voyage with a chart of the route followed, and the names of the scientific workers and others engaged in the expedition, have already been given in NATURE (March 21 and 28, 1931).

The first biological discovery of importance in the Pacific was made between the Marquesas and Tahiti—the larva of a true freshwater eel. Before that, the chief aim of the expedition had been to study the horizontal distribution of the oxygen-free layer of intermediate water, which had been discovered on the first *Dana* Expedition in 1921–1922 and later rediscovered by the *Carnegie* in 1929. According to the hydrographer of the expedition (H. Thomsen) this peculiar phenomenon, unknown in the other great oceans, is due to the lack of vertical movements in the eastern waters of the Pacific. The oxygen-free layer extends from Panama as far as Tahiti.

The present volume is an extended narrative of the cruise, or rather a series of narratives. It is evident that the members of the scientific staff as well as the leading officers kept a *Dagbog*, and each has been called upon to give his experiences during the voyage. There are twenty contributions in all, and the material has been so skilfully arranged that they dovetail into one another and present a continuous story of the voyage. The different ports and countries visited, excursions on land, the distinctive fauna and flora of the places, customs, costumes, and dances of the natives, earlier history, influence of traders and missionaries and so on, are all described and discussed with deft hands and discerning eyes. Old memories are here revived of Capt. Cook, the *Beagle*, atolls and palolo, tattooing and cannibalism, early Dutch and other adventurers, and especially of the time when the Danes also were pioneers in the discovery of the East.

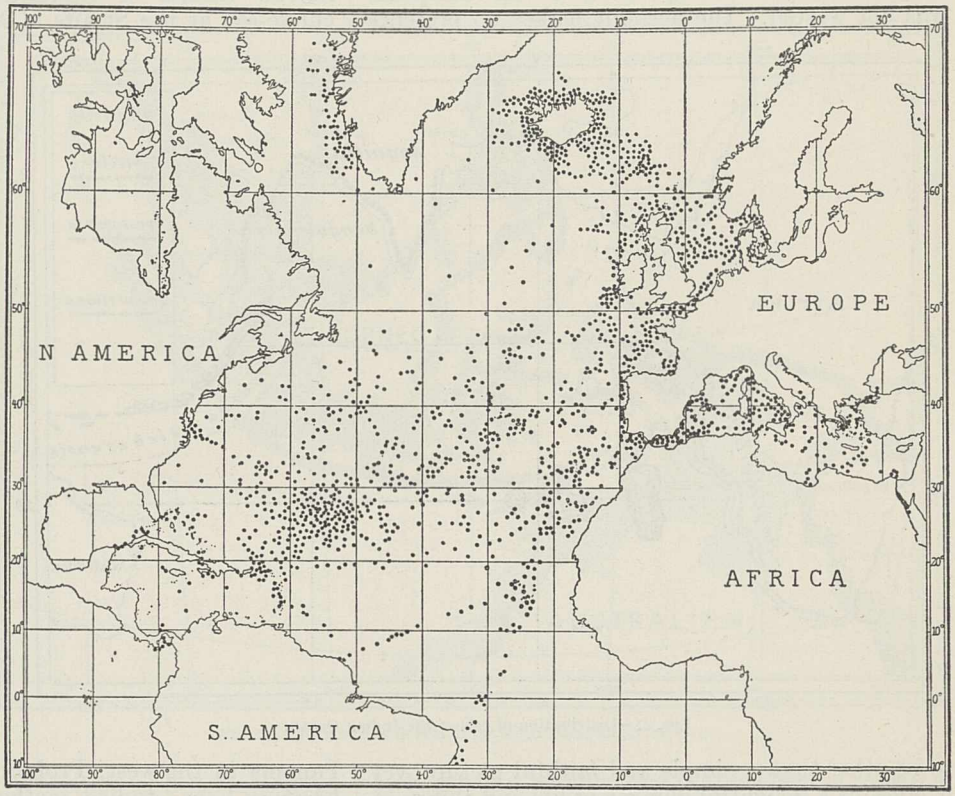

FIG. 1.—Stations in the Atlantic, 1903–1925.

It would be invidious, where the accomplishment of all is on such a high level, to single out any one of these living pictures for special reference, but an exception must be made in the case of "Christmas in New Zealand", by Fru Ingeborg Schmidt, wife of the leader of the expedition. Instead of appearing out of place in what is essentially a scientific if popularly written work, this account

* Dana's Togt Omkring Jorden, 1928–1930. Af Prof. Johannes Schmidt. Pp. 368. (København: Gyldendalske Boghandel, 1392.) 9·75 kr.

is quite typical of the others. Christmas in the height of summer, a *Thuya* with sparkling lights for Christmas tree, *Risengrød med Mandel*, apple cakes and other Danish *Retter* kept in secret for the festival, visits to the many Danish colonists who have found a second Denmark round Palmerston in the North Island, the reception at Wellington, the wonderful grottoes of Waitomo, with the glow-worms (larvæ of *Boletophila luminosa*) spinning threads and lighting lamps to lure the small insects to destruction, the great forests, ferns and trees, birds and their songs—these and many other notes indicate that Fru Schmidt's journey across the world to meet the expedition at the antipodes was not wasted. The account makes no pretence to be other than a simple and faithful picture, yet it gives us a delightful glimpse of life and things in New Zealand.

It need scarcely be added that the expedition was received in all countries and places in the most hospitable manner—by government officials and scientific workers as well as by laymen. At many places indeed the reception was almost embarrassing; as in Samoa, where a native headsman insisted upon displaying his family troubles along with his living spouse—by no means a skeleton. The expedition was able, however, to give as well as to receive entertainment. It carried two films descriptive of life and activities in Denmark and the Faroes, and these were shown, with lecture accompaniment, at a number of places in New Zealand, Australia, the Dutch East Indies, and South Africa. This book expresses the gratitude of the members of the expedition for the universal kindness, especially in the British Dominions and Colonies; but one may well believe that, with their soft speech and gentle manner, these Danes would be welcome guests anywhere and everywhere.

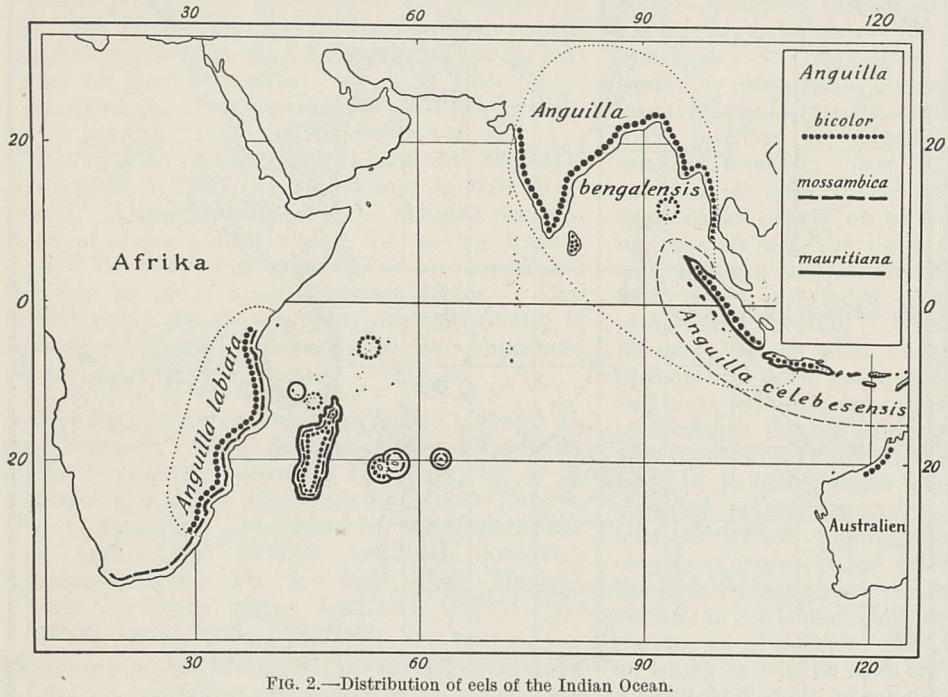

FIG. 2.—Distribution of eels of the Indian Ocean.

The scientific work of the expedition is touched upon in various chapters of this book of the cruise. To understand the references, one must hark back to Prof. Schmidt's earlier activities in Atlantic waters. As is well known, after nearly twenty years of persistent search, Johs. Schmidt discovered the birthplace of the European freshwater eel in the deepest part of the Atlantic at the western end of the Sargasso Sea. In the present volume, Prof. Schmidt shows how his latest exploration of the Mediterranean with improved apparatus has confirmed his earlier conclusions. The Leptocephali of the common eel were found in quantities in the narrow Straits of Gibraltar and again in the cul-de-sac at the Straits of Messina, but occurred only scattered elsewhere and in small numbers, particularly in the eastern basin. This points to an extensive immigration from west to east, similar to that in more northerly waters, and indicates that the eel does not spawn in the Mediterranean.

The eel investigations, however, representing perhaps the cream, count only as a fraction of the immense work accomplished. From North Iceland and the Davis Straits southwards to Brazil, and from the Baltic and Black Sea in the east to the United States and Panama in the west, Prof. Schmidt and his collaborators have studied methodically the physical, chemical, and biological conditions of the waters from surface to bottom—so methodically that every square of 10° shows a number of stations on it, up to forty in the case of the more important, and the total number of stations has amounted in the course of time to more than twelve hundred. The chart reproduced as Fig. 1 epitomises the regional distribution of the investigations. The material collected has been distributed to leading specialists in different countries, and the numerous volumes already published, though the Atlantic series is not yet complete, rival the reports of any other expedition in scientific interest and importance.

By intensive study of the variations, Prof. Schmidt has been able to prove that two species of freshwater eels (*Anguilla*), and only two, occur in the Atlantic region, and both resort to about the same place to spawn. This deep part of the Atlantic is some 4000 miles away from Europe, yet the eels of all European countries, from Finland to Greece,

belong to the same race and go to and come from the same spawning region, the Leptocephali taking about three years to complete their pelagic wanderings. This remarkable fact, which, one may note incidentally, provides support for Wegener's theory of continental shifting, is in striking contrast to the conditions found in the Indo-Pacific Ocean.

Whereas only one species occurs over the wide expanse of Europe, the islands of the Pacific, for example Tahiti, have three separate species occurring together, and the so-called *Anguilla australis* of earlier zoologists has proved to contain no fewer than four species. In all, the Indian region contains six species (Fig. 2) and the Pacific has about twelve (some being common to both regions). These conclusions, based in the first instance on the adult characters, have now been confirmed by the discovery of the various Leptocephali. From the number of species and the conditions found there, Prof. Schmidt has come to the conclusion that the original home of the eels lay in the eastern ocean.

Deep water for the purpose of spawning, and currents to convey the Leptocephali towards land, are apparently necessary for the existence of freshwater eels anywhere. Where one or other is lacking, as in the South Atlantic and on the western side of America, we find no eels in the adjacent countries, and in the Indo-Malayan Archipelago eels are only found in countries and on islands which face directly on to deep water. This is shown in Fig. 3, where the occurrence of eels is indicated by heavy blackening of the coast-lines. The shallow water areas north of Australia and between Borneo, Siam, and Sumatra contain no freshwater eels.

The islands of the Pacific and the coasts of India and East Africa obviously fulfil the requirements, and the Leptocephali have not so far to wander. It follows, almost as corollaries, that the Indo-Pacific Leptocephali are of smaller size than the Atlantic forms and metamorphose in a shorter time. Yet a remarkable thing is that the adults of several of the eastern species at Tahiti, in New Zealand and in the rivers of East Africa, are of gigantic proportions by comparison with the European and American eels.

Other discoveries indicate that the tropical regions of the Atlantic and Pacific possess similar communities of eels (deep-water eels, not *Anguilla*), and that their distribution is closely connected with the hydrographical conditions. Thus, *Nessorhamphus ingolfianus* occurs in the transitional regions north and south of the equator, whereas *N. Dancæ*, with a similar number of vertebræ, occurs only along the equator. Such comparisons of the physical and biological phenomena in the different oceans were among the chief objects of the expedition.

The scientific horizon of Prof. Schmidt is, however, not bounded by the eel. One may recall that he began as a botanist and that his field of research, quite apart from his exploratory work, has ranged from floras and the growth of hops to the variations of fish and fowls. This breadth of vision, so clearly displayed in his leadership, is supplemented by exceptional powers of concentration. We can discern both qualities in his review of the conditions in the Mediterranean; his eel investigations there have already been mentioned; his summary of the physical and biological phenomena is of equal significance.

From west to east in the Mediterranean the quantities of phosphates and nitrates, the substrata of organic life, decrease until in the Ægean the phosphates are entirely lacking and the nitrates less than 5 per cent of the quantity in the Atlantic. Presumably owing to the meagre precipitation of organic debris, the bottom fauna, evaluated by means of Petersen's bottom-sampler, was found to be exceptionally poor in the Gulf of Naples (0·5 gm. per sq. m.), somewhat better in Algiers Bay (20 gm. per sq. m.), and more like the conditions in

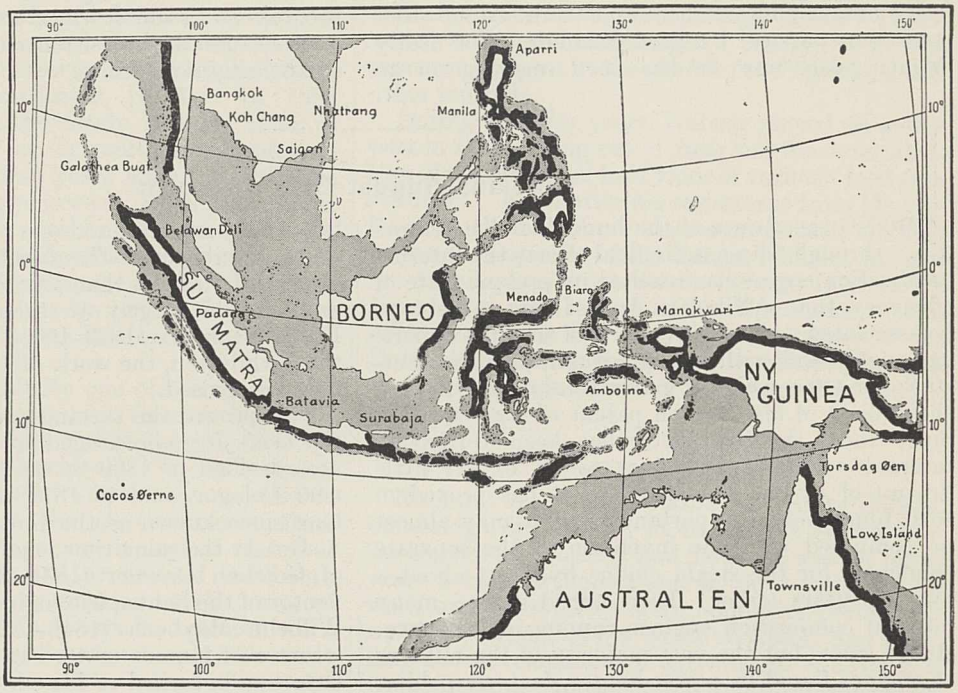

FIG. 3.—Distribution of eels in the Indo-Malayan Archipelago.

northern waters outside the Straits of Gibraltar (50 gm. and more per sq. m.). Hard-bodied animals, Crustacea, corals and star-fishes, which have specialised in the utilisation of inorganic materials, are more or less strongly represented in the Mediterranean, but the soft-bodied animals, Mollusca, are deficient to a remarkable extent. This poverty of the waters and sea bottom of the Mediterranean gives an explanation of the dominant features of the piscine fauna, the scarcity of stationary species, the seasonal abundance of the migratory species, for example, of the herring and mackerel families, and the comparative absence of the gadoid and flatfish families, which form the chief marine food of northern peoples.

We obtain glimpses here and there also of other researches pursued by Prof. Schmidt. For nearly twenty years now he has been carrying on an intensive study of the races of fishes (eels, gadoids, *Zoarces*, etc.) and the causes of variation. In this pursuit, not content with the mere statement of variations in many thousands of specimens from many places, he has turned to direct experiment. The various theories connected with variation, heredity, natural selection, and the influence of environment have been tested by searching inquiry, and when the resources of the Carlsberg Laboratory proved insufficient for his purpose, he has made the waters round the Danish Islands, where the transitional conditions offer exceptional opportunities, his field of experimentation. These experiments, which fit in so well with his more general investigations, are approaching another milestone in their progress and seem destined to throw light not only on the causes and persistence of variations, but also on the origin of species. H. M. K.

Nikolaus August Otto, 1832–1891

AMONG the names of the hundreds of inventors through whose individual efforts the internal combustion engine has reached its present state of efficiency, that of Nikolaus August Otto will always be associated with the invention of the atmospheric gas engine and with the introduction of the four-stroke or Otto cycle for gas engines, which formed the subject of his German patent of Aug. 4, 1877. Since then, the Otto cycle has been applied to internal combustion engines to an extent little dreamt of by the inventor, and it has proved of such fundamental importance that it may almost be compared with the invention of the separate condenser for the steam engine by Watt about a hundred years earlier. There are, it is true, many internal combustion engines running on the two-stroke cycle, but the vast majority of the millions of engines found in power-houses, factories, ships, motor cars, and aeroplanes to-day work on the four-stroke cycle.

Otto was born on June 14, 1832, at Holzhausen in Nassau, and died on Jan. 26, 1891, at the age of fifty-eight years, at Cologne, where he is buried and where his centenary was commemorated on Tuesday last. The celebration was arranged by the Cologne section of the Verein Deutscher Ingenieure, and the address on the work of Otto, which was broadcast, was given by Dr. A. Langen. To mark the occasion the Newcomen Society sent a chaplet with a suitable inscription, to be placed on Otto's tomb, in the Friedhof Melaten.

Otto's first occupation was that of a commercial traveller, and it was while engaged in business in Cologne that his attention was attracted to the gas engine. Considering it possible to make a gas engine capable of competing successfully with the steam engine, Otto began inventing, and through this was brought into contact with the engineer, Eugen Langen (1833–1895). On March 31, 1864, the two entered into partnership as N. A. Otto and Co.; on April 21, 1866, they patented the vertical atmospheric gas engine with the free piston, and in the following year exhibited one of their engines at the Paris Exhibition. The fuel consumption of this engine was far less than any of the French engines, and, thanks largely to their countryman, Prof. Franz Reuleaux (1829–1905), one of the jurors of the Exhibition, the work of Otto and Langen was duly recognised.

This proved the turning point in the fortunes of the firm; for, encouraged by Reuleaux, the partners decided in 1869 to erect a factory at Deutz near Cologne, and in 1872 they formed the firm long since known as the Gasmotorenfabrik Deutz A.-G. At the same time, they secured the services of Gottlieb Daimler (1834–1900), the future inventor of the light spirit engine, and with him came Wilhelm Maybach (1846–1929), the future constructor of famous motor-car and aircraft engines. Otto now returned to his earlier experiments with engines working on the four-stroke cycle—a method of operation, it should be remembered, which was described in a pamphlet in 1862 by the Frenchman Alphonse Beau de Rochas. Success was achieved in 1876, the patent secured in 1877, and a four-stroke engine was exhibited at the Paris Exhibition of 1878. With this a new chapter in the history of gas engines began. Their manufacture was taken up by makers in various countries, notably in England by Messrs Crossley Brothers, and Otto gas engines soon became known all over the world.

Like many other persevering pioneers, no sooner had the Deutz firm achieved success than they found themselves drawn into litigation, and in the end the verdict was given against them and their patent declared void. But although it can be clearly shown that many of the ideas incorporated in the Otto engine had been previously thought of by earlier inventors, nothing can detract from the merits of Otto as the first to bring to fruition the valuable plan of operating gas engines on the four-stroke cycle. This alone will always secure for him a place among the greatest pioneers of the internal combustion engine. E. C. S.

Obituary

PROF. MAX RUBNER

BY the death of Geheimer Obermedizinalrat Prof. Max Rubner on April 27, the world has lost one of the most outstanding workers in the field of general nutrition. Rubner, born on June 2, 1854, belonged to the older school of workers who were interested in nutrition, for the most part, from its quantitative aspect, but although his greatest contributions to science were made in this field, even to the end he had also a lively interest in the qualitative side. A student in Munich, he became early in his career interested in the problems of metabolism and naturally gravitated to the laboratory of Carl Voit, becoming, after having spent a year in Ludwig's laboratory, one of his assistants and eventually Privatdozent (1883). In 1885 he was appointed to the newly founded chair of hygiene at Marburg as extraordinary professor, becoming *ordinarius* two years later. In 1891 he was called to Berlin to succeed R. Koch in the chair of hygiene there. This chair he retained until 1909, when he transferred to the chair of physiology in Berlin, vacant by Engelmann's death. This post he held until 1922, when he retired from active professorial work. He was Rector of the University of Berlin in 1910–11.

Rubner was undoubtedly one of the most energetic and stimulating workers in German biological science. In his early days with Voit he confined his attention to metabolic problems. It can be fairly stated that it was he who was mainly responsible for the application of the physical conceptions of Helmholtz and Mayer to biological material. Although he was not the inventor of the bomb calorimeter for the determination of the heats of combustion of foodstuffs, it was his research work in this field which established not only the crude but also the biological calorie values of protein, carbohydrate, and fat, which are accepted as international standards to-day.

Rubner's interest in the energetics of metabolism, begun in Munich, led at Marburg to extraordinarily fruitful research. It was during his Marburg period that he devised his ingenious animal calorimetric work, which enabled him to put forward his law of the specific dynamic action of foodstuffs and to give final and conclusive proof of his fundamental conceptions on the relation of the energy expenditure of an animal to its surface area. This period of his activity is reflected in his most original contribution, "Die Gesetze des Energieverbrauchs" (1902). This is undoubtedly a great but a very difficult book. It used to be said that there was only one man in Europe who could interpret it, and that was not Rubner himself but his friend and former Marburg colleague, Hans Meyer of Vienna. Rubner literally established the energetics of metabolism on a solid and lasting foundation.

Although his view of the work to be carried out by a professor of hygiene would seem at first sight to have been more of the nature of experimental physiology, Rubner did not neglect, particularly after his translation to Berlin, the other aspects of his subject, as his many papers on public health subjects and finally his excellent textbook of hygiene (1907) attest. The range of his interests is simply astonishing, as is also the general high level of the material published.

Undoubtedly the subject nearest Rubner's heart was nutrition in the broadest sense of the term—nutrition as it concerned the people, its relation to growth, to general health. In addition to special sections on food in several large handbooks, he published several volumes of his own; for example, "Kraft und Stoff im Haushalt der Natur" (1909) and "Volksernährungsfragen" (1908), as well as numerous papers in the *Archiv für Physiologie* and other journals.

During the War years, Rubner played an active part in the working out of diets and the determination of the biological food value of various 'food substitutes'. Even after his retirement from his professorial chair, Rubner interested himself actively in the development of the Kaiser-Wilhelm Institut für Arbeitsphysiologie, Berlin (now in Dortmund). He was a member of many Government committees, and was for many years secretary of the Prussian Academy of Sciences, the *Sitzungsberichte* of which contain many of his interesting general papers.

E. P. C.

MR. R. H. ADIE

RICHARD HALIBURTON ADIE, of Trinity College, Cambridge, died on May 18, in his sixty-eighth year. To University, County, and Town he was for many years a familiar figure, and in their activities his work and personality were widely respected. It was the privilege of few to see so closely and for so long the development of agricultural education in Great Britain. In the first agricultural course held in Cambridge, commencing in 1891, Adie was a fellow-student of the late T. B. Wood and Cecil Warburton. His first appointment was as an extension lecturer in agriculture in Devon, which he relinquished to return to Cambridge. A small band, with vision and enthusiasm, had created the Cambridge and County Committee for Agricultural Education, and in 1895 he gave for them the first course of lectures in agricultural economics. Adie's initial studies had been principally in chemistry, and on returning to Cambridge he took charge of the chemical laboratory at St. John's College. College teaching in chemistry continued until the outbreak of the War, and great numbers of men look back to the geniality and patience under which they began the study of chemistry in St. John's.

The year 1899 saw the creation of a Department of Agriculture in the University. It was housed in two basement rooms of the University Chemical Laboratory, the head of which, the late G. D. Liveing, was its most valued friend. Resources were meagre, but the faithful service and remarkable versatility of the pioneer teachers laid foundations for the big developments which were to come.

Adie played an important part here as lecturer in agricultural engineering, surveying, and chemistry, and no less valuably in general development. Happily for the future of agriculture in Cambridge, his interest in civic matters grew rapidly at this time. By 1907 he was a member of the Cambridgeshire County Council, a body on which he served to the end of his life. He was also a member of the Cambridge Borough Council, becoming an alderman in 1914. In these early days, the financial support and the sympathy of the counties for agricultural education was of primary importance, and Adie's constantly growing influence in county administration enabled him to arouse among farmers and landowners a realisation of the part education could play in agricultural progress.

By 1914 the (then) Board of Agriculture scheme for advisory officers had been launched, and Adie became first secretary of the Provincial Council administering it. Throughout the War he was secretary of the Cambridgeshire Agricultural Committee. The School of Agriculture had to bear a full share of the sudden, heavy burden of reorganisation and pressure from students, brought by the cessation of war in 1918–19. It fell to Adie to lecture in engineering and surveying for both agriculture and forestry and in elementary chemistry and physics. In addition, he was secretary of the Special Board for Agriculture and Forestry, which, in its later form, the Faculty Board of Agriculture and Forestry, he served until his resignation in 1929. The lectures in agricultural engineering he continued to within a few weeks of his death.

Adie impressed his pupils by kindness, patience, and a *flair* for demonstration. His colleagues recognised in him a master of administrative procedure, a man of great stability, tenacity, and self-possession. To younger men, including those to whom by degrees he handed over his duties, he gave help, advice, and encouragement unsparingly.

Dr. H. Seidelin

Dr. Harald Seidelin, who died at Antwerp on April 29, was born at Aarhus (Denmark) in 1878, and studied medicine at the University of Copenhagen. In 1904 he went to Mexico, and became professor of pathology and bacteriology in the University of Yucatan, where his work was mainly concerned with investigations into the cause of yellow fever. He returned to Europe in 1910, and the following year joined the staff of the Liverpool School of Tropical Medicine as scientific secretary to the Yellow Fever Bureau. He took part in expeditions of the School to Yucatan and Jamaica to study yellow fever, vomiting sickness, and other obscure tropical diseases, and in 1912 he described certain minute bodies, found in the erythrocytes of yellow fever cases, which he believed to be the causative agent of yellow fever. He gave them the name, *Paraplasma flavigenum*, but his view of the parasitic origin of yellow fever was finally refuted in 1914 by Wenyon and Low. The last seventeen years of Dr. Seidelin's life were devoted to the organisation and development of the medical service of the S.A. des Huileries du Congo Belge (Lever Brothers). Under his able and energetic leadership this service rose to a high state of efficiency, and he was honoured by the Belgian Government in 1929 with the decoration of Chevalier de l'Ordre Royal du Lion. Seidelin was a hard worker, a capable administrator, a careful investigator, and a brilliant linguist, speaking fluently half a dozen languages.

We regret to announce the following deaths:

Prof. J. W. Gregory, F.R.S., emeritus professor of geology in the University of Glasgow, aged sixty-eight years.

Prof. A. A. von Jaczewski, director of the Phytopathological Institute in Leningrad, on Feb. 12.

News and Views

New Associates of the Royal Astronomical Society

The following have been elected associates of the Royal Astronomical Society: Prof. Giorgio Abetti, director of the Royal Astrophysical Observatory at Arcetri, Florence, who is known for his observations on the chromosphere and on solar prominences; Prof. R. Emden, professor of physics, Technical High School, Munich, and author of "Gaskugeln" (1907), which consolidated and extended earlier work on the internal constitution of the stars, and has been the foundation of more recent work on this subject; M. Ernest Esclangon, director of the observatories at Paris and Meudon, who in addition to astronomical work has carried out a gravity survey in south-western France; Prof. H. Ludendorff, director of the Potsdam Observatory, and in 1920–30 secretary of the Astronomische Gesellschaft, distinguished for his work on stellar spectroscopy; Prof. P. J. van Rhijn, director of the Kapteyn Astronomical Laboratory, Groningen, Holland, author of numerous papers on the proper motions and distribution of the stars.

Franklin Institute Awards

The following medals, among others awarded by the Franklin Institute, Philadelphia, were presented on May 18. Franklin Medals to Dr. Ambrose Swasey, of Cleveland, Ohio, for his development of methods and his invention of appliances for making machines, tools, and instruments of the highest precision, of the design and construction of the mountings of many of the world's largest telescopes, and for his scientific vision in the establishment of the Engineering Foundation for the promotion of research and its application in the various fields of engineering; Dr. P. Lenard, of the University of Heidelberg, in recognition of a life's work devoted to fruitful research in physics, which has included the demonstration of cathode rays outside the generating tube and their effects, the discovery of the electronic nature of the emission from surfaces upon which ultra-violet light falls, as well as the basic laws of photoelectricity. Elliott Cresson Medals to Dr. P. W. Bridgman, of the Jefferson Physical Laboratory of Harvard University, Cam-

bridge, Massachusetts, for his fundamental contributions to the technique of high pressure experimentation and to our knowledge of the properties of matter at high pressures; Mr. C. Le G. Fortescue, of the Engineering Department of the Westinghouse Electric and Manufacturing Company of Pittsburgh, Pennsylvania, for the development of the method of symmetrical co-ordinates applied to the solution of polyphase networks; Dr. J. B. Whitehead, Dean of the Engineering School of Johns Hopkins University, Baltimore, Maryland, for his investigations of dielectric behaviour and allied subjects. Howard N. Potts Medal to Prof. G. P. Thomson, of the Imperial College of Science, London, for his experimental demonstration of the wave properties of high speed electrons.

Sir James Hall, Bt., 1761–1832

"AMONG Hutton's friends", wrote Sir Archibald Geikie in his work "The Founders of Geology", "there was one in particular to whom a distinguished place in the list of the founders of geology must be assigned—Sir James Hall of Dunglass. To this original investigator we owe the establishment of experimental research as a branch of geological investigation." The heir to a considerable estate at Dunglass, Haddingtonshire, Hall was born there on Jan. 17, 1761, and died at Edinburgh on June 23, 1832—a century ago. After three years travelling on the Continent, he married a daughter of the Earl of Selkirk and settled at Edinburgh, where he soon became familiar with the interesting group of men who made Edinburgh famous as a centre of scientific thought. He was especially friendly with Playfair and Hutton, being greatly interested in the geological controversies of the time, and after opposing some of the views of Hutton, became one of his keenest supporters. It was this that led him to make a long and laborious series of experiments on the fusion of various substances. "These experiments", said Humboldt in *Cosmos*, "made more than half a century ago, together with the attentive study of the phenomena of granitic veins, have contributed in a very high degree to the recent progress of geological science." For many years Hall was a fellow of the Royal Society of Edinburgh, and at one time served as president. His bust was placed in the Royal School of Mines many years ago.

Sir Prafulla Chandra Rây

WE have received from India some press accounts of the celebration organised by the Lahore branch of the Indian Chemical Society of the seventieth birthday of Sir P. C. Rây, who is well known as a chemist. The great services rendered to India both in a scientific and national capacity by Sir P. C. Rây were emphasised by the speakers. His students have been active in furthering the cause of chemical science and education in India along the lines laid down by their teacher, and the foundation and growth of the Indian Chemical Society may be regarded as indications of the development of the methods which guided his activities in the promotion of chemical science in India. Sir P. C. Rây's experimental work is well known in Europe, and his "History of Hindu Chemistry" is the only work of its kind in a European language. The reports also lay stress on his excellent work in the relief of distress in India, and in encouraging and helping poor students in Bengal especially. A portrait of Sir P. C. Rây was unveiled in the Library of the University Chemical Laboratory at Lahore, and a fund is to be started for the assistance of students. In a communication from Calcutta, it is stated that a memorial volume of about 500 pages in English and native languages and dealing with several subjects is to be published.

Calculating Machines and Scientific Investigation

A DISPLAY of calculating machines was arranged early this month by the Burroughs Adding Machine, Ltd., at 136 Regent Street, London, W.1. The machines shown were of many types, ranging from the simpler hand adding machines (which can also be used by the skilled operator for multiplication and division) to the complex electrically driven Calculating-Book-keeping Machine, which can be set up by adjusting a system of controls to carry out a variety of different automatic functions. It is interesting to note that these machines, designed originally to deal with problems of costing and book-keeping, can be readily employed to simplify a great variety of computing problems. The mathematician, physicist, or statistician is often discouraged from attempting a problem involving the numerical solution of equations, the calculation of quadratures, or the forming of auxiliary tables, because of the apparently prohibitive amount of numerical computation involved. It is possibly not generally realised, however, to what extent such work may be simplified and quickened up by the help of these modern aids to computing. The machines are of course expensive, if needed only for occasional work, but the matter is really one for co-operation.

WE are familiar with the importance of design in scientific experiment; design also is required in fitting a computing problem to a calculating machine, and the skilled designer in this field is already making a useful contribution to scientific investigation. In the past a difficulty has been that the machine expert was unable to understand the problems of the mathematician; it is therefore interesting to learn that the Burroughs Company has realised the advantage of including trained mathematicians on its staff. Another field for the adaptation of these machines is also in view. There are signs both in Great Britain, in Germany, and in the United States of a growing interest in the development of scientific method in industry along the lines of statistical control of the quality of the manufactured product. Should the manufacturer begin to realise the function of statistical analysis in the problem of sampling and of testing and standardising material, he may require his calculating machine to provide him with standard deviations and coefficients of correlation. If so, the machine makers should be ready to give advice on how best to proceed in this field, as well as in the problems of accountancy and costing.

The Joicey Collection of Lepidoptera

RECENT remarks by a learned and very senior judge in the Chancery Division, who was engaged in the hearing of a summons concerning the disposal of the very valuable collection of Lepidoptera formed by the late Mr. J. J. Joicey, serve to direct attention to the extraordinary lack of knowledge of natural history matters prevalent even amongst those whom one is accustomed to regard as amongst the best informed. The judge in this case is reported to have said that " He had never been to the Museum since he was taken there as a boy, much to his discomfort, and he always thought there was too much to see. If the collection went elsewhere it might be seen to better advantage." The museum concerned in the case was the Natural History Museum. Should the judge even now, however, care to make amends, it is safe to say that he will be spared the horror of having to ' see ' the Joicey collection should it eventually, as is hoped, find its way to South Kensington; for, as is common knowledge amongst naturalists, it is not the policy of the British Museum (Natural History) to display to the public collections of such great scientific value as this. Indeed, it would be impossible to do so in this case, for the 250,000 specimens involved would need a whole gallery (which is not available) for their accommodation. Surely it is time judges and others in high position ceased to express gratuitous opinions of the kind mentioned, which, in the long run, may do incalculable harm to the parties involved and, not least, to the respect in which the administrators of the law are normally held. Fortunately, in the case of Mr. Joicey, the decision of the court, although it was not what it was hoped it would be, may still not prejudice the ultimate gift of his collection to the nation by the trustees of the estate of which it at present forms part.

Waste: in Education and Chemistry

PROF. HENRY E. ARMSTRONG is a provocative speaker whose observations in public are generally as pungent as they are pertinent; as a writer he excels in the art of garnishing a deal of common sense with a deal more of trenchant criticism. As a chemical criminologist Prof. Armstrong has no equal; for many decades he seems to have watched his fellow chemists and educationists stray from the obvious path of rectitude and fall one by one into every kind of intellectual disgrace. Such unrivalled experience, together with the habit of fearless insistence on the importance of the most important things, serves to equip him admirably to play the double part of detective inspector and prison chaplain. On two occasions recently Prof. Armstrong has said much that was well worth saying, and has added a good deal that, in our opinion, is more likely to diminish than to enhance the brilliance of his analysis. The first address, delivered before the Imperial College Chemical Society in January last, was entitled " Waste Chemistry ", and the second, delivered before the London and South-Eastern Counties Section of the Institute of Chemistry in February, was entitled " Shifting Sands ". Prof. Armstrong detests waste—including most of the chemistry that is taught in schools and colleges. He deplores waste of effort in the perpetual killing of the slain under the disguise of new jargons. There is considerable point in his stricture (provided it be remembered that it is one thing to kill a dragon but quite another to keep it dead), whether or not this waste of opportunity is " owing to a cultivated and obtuse narrowness of vision "—and he can have full marks for the debating point. But this is not all; in addition to being wasters, we have no sense of proportion and no ability to work problems out to a logical end. Again, all this is probably true in some degree of most of us and in greater degree of some of us.

STILL, the crimes alleged against the prisoner have not all been stated; according to Prof. Armstrong, our educational system is simply dishonest, being calculated to promote selfishness and to give employment to a maximum number of people, all bent, through their inability to think, on using their ignorance in misleading learners. A statement of this kind is purely provocative, and ought not to be made by Prof. Armstrong or anyone else. It ignores a vast amount of unselfish and earnest educational service, and despises the efforts of thousands of men and women of at least average ability and usually possessing some sense of public duty and private responsibility. The educational army, nevertheless, will continue its march, whether or not Prof. Armstrong is the only one in step. To return to the addresses, and to discover in them things worth recording: Prof. Armstrong is undoubtedly right when he warns us that the nations cannot much longer allow the uncontrolled waste of natural resources to continue. Industry of every kind, he rightly says, must be controlled and organised with due reference to both raw materials and requirements, instead of being allowed to proceed, without thought of policy, merely as speculative, individual adventure. Emphasis is laid, too, on the relation of scientific discovery to the use of labour, and the attention of scientific people and employers of scientific people is directed to the need for discovering and directing labour-using rather than labour-saving occupations.

Social Selection of Human Fertility

THE Herbert Spencer Lecture was delivered at Oxford by Dr. R. A. Fisher on June 8 on " The Social Selection of Human Fertility ". After recalling the consistent efforts of Spencer towards the unification of the natural and social sciences, Dr. Fisher spoke of the hypothesis of complete determinism that has been held, as by Laplace, in the sphere of probability. From the course of physical investigation it might be plausibly conjectured that the mathematical formulæ, being often more accurate than the observational results, must more nearly represent reality, and hence that any fortuitous element can be excluded from physical phenomena. Researches, however, into the nature of the ultimate particles of gases do nothing to strengthen the deterministic position. The only principle on which the behaviour of a system can be predicted is that its properties are the average of a large number of independent items of behaviour. Human societies may be large enough

to show natural causation, where their constituents may be regarded as independently active. Limitations are imposed by organisation and by public opinion, but there are features of society which appear to be exempt from such limitations. These are (1) the hereditary endowment received by each generation, and (2) the individual reactions, though not the conditions, of what may be called the process of social promotion.

THERE is a presumption, Dr. Fisher said, that at the present day social promotion depends more on intellectual superiority and less on business aptitude than it did, say, a hundred years ago. Though no occupational class is strictly endogamous, the differences produced by selection for occupational status tend to be perpetuated. An unintentional feature that has arisen in our economic system is that the highest forms of ability are united with relative sterility, and vice versa. Whether a similar process was present in past civilisations it is for historians and archæologists to decide, but in regard to Great Britain " it is difficult to avoid the conclusion that a full half of whatever eugenic value this [fairly well-to-do] class contains may be counted as already lost ". There is, Dr. Fisher concludes, no ground for fatalism ; but in considering the causes of an impending evil, we should as scientific workers distinguish between the inevitable and the avoidable, and as citizens we should in the latter case see to the application of the requisite control.

Science and Philosophy

IN his recent presidential address to the British Institute of Philosophy, under the title " Philosophy and the Ordinary Man ", Sir Herbert Samuel pointed out that although all action and thought is the conscious or unconscious product of a philosophical attitude, the ordinary man takes little interest in philosophy, with which he thinks he has no concern. In this respect philosophy contrasts strikingly with science, which arouses widespread interest. The reason is partly that expositors of science do not disdain to write in the vernacular, whereas many philosophers find it necessary to use a special terminology. It is chiefly, however, that science consists predominantly of a body of knowledge which commands common assent, whereas philosophy is largely an aggregate of individual systems of thought. Nevertheless, it has an important function to perform in constructing an authoritative code of morals for the guidance of those bewildered by the progress of science. It could best do this, said Sir Herbert, and at the same time command greater public interest, if it could be induced " to turn aside from *a priori* methods, to put no great faith in Logic as a guide, . . . and to press forward into the realms of metaphysics and ethics along the roads opened up by mathematics, physics, biology in general and psychology in particular, and by the social sciences ".

The Principle of Causality

THE first principle which philosophy might receive, as established by science, is the principle of causality, which, in spite of recent attacks by some physicists, still reigns supreme. In support of this contention, Sir Herbert Samuel quoted a letter from Einstein and the published opinions of Planck. The principle of causality leads in philosophy straight to a theistic position ; for since the universe is not self-explanatory, there must be " something else ". We cannot, however, at present fathom the nature of the Divine Mind. The principle of causality appears to deny human free-will, but although from a universal point of view this is so, events in the limited sphere of human action proceed as though our wills were free, and practical life must be conducted on that footing. A further application of the principle of causality in philosophy leads to a definition of the 'Good' as that which experience shows to promote well-being, rather than as an ideal standard of values. In the general adoption of the scientific method, philosophy will find its chief opportunity and its main strength.

Harrison's Third Marine Timekeeper

OF special interest among recent additions to the Science Museum collections is the third of the series of four chronometers designed and constructed by John Harrison between the years 1728 and 1759 ; this instrument has been lent by the Lords Commissioners of the Admiralty. The British Government had in 1714 offered an award of £20,000 for an accurate method of determining longitude at sea. It was realised that the problem could be solved by carrying on board ship a trustworthy timekeeper, and Harrison set himself the task of constructing such an instrument ; after devoting practically his whole life to the work, he succeeded in winning the award with his fourth timekeeper. Harrison's No. 3 timekeeper is designed so as to be unaffected by the motion of a ship, while on account of the extensive use of friction wheels it requires no oiling ; it also embodies original and ingenious methods of compensation for variations of temperature and of arc. The chronometers Nos. 2 and 3 are now shown in motion side by side in the Science Museum ; No. 4 is at the Royal Observatory, Greenwich.

Zoological Collections of de Sélys

MANY specialists on the systematics of the Vertebrata are under the mistaken impression that the famous collection made in the course of the nineteenth century by Michel Edmond de Sélys-Longchamps is either destroyed or lost. Happily this is not so. The collection was preserved in the Chateau de Longchamps près Waremme, Belgium, where it occupied the little museum which de Sélys built, but it was not readily accessible to specialists and was in the care of an old servitor. The fate of this collection, which is a veritable treasure-house for mammologists and ornithologists, has just been settled in a way which will give widespread pleasure. Barons Maurice, Raymond, and Edmond de Sélys-Longchamps, grandsons of the great zoologist, have given the whole collection to the nation, and it is being placed in the Royal Museum of Natural History at Brussels. Thus all de Sélys' zoological collections are brought together again, for in 1900 de Sélys bequeathed his important entomological collection to the Museum.

American Expedition to Northern India

SINCE the beginning of March an American scientific expedition sent out by Yale University has, under the leadership of Dr. Hellmut de Terra, been doing geological and biological research in Northern India. Having visited the Salt Range, Dr. de Terra and Prof. G. E. Hutchinson, a biologist at Yale University, have proceeded to Kashmir, where they are making a geological and biological survey of the Kashmir valley. Ultimately they hope that this survey will make possible a clear understanding of the natural history of this southern Himalayan sector, from the pleistocene period to the present day. Another member of the party, Mr. G. E. Lewis, fellow in palæontology at Yale, has been collecting tertiary vertebrate fossils in the Siwalik formations of the Northern Punjab. On May 15 the expedition, accompanied by the surveying officer Khan Sahib Afraz Gul Khan, left Srinagar and started for the Eastern Karakorum, a field in which Dr. de Terra has already done geological work while accompanying Dr. Trinkler's Central Asia Expedition. Five months will be devoted to work in this region, which includes the still little known tract of land lying along the north-west Tibetan plateau. While the rest of the party will be busy with geographical and geological problems, Prof. Hutchinson plans to carry out limnological studies on the great Pangong and adjacent lakes which are among the highest lakes in the world.

IN reference to the work of this expedition in the Salt Range, Dr. L. L. Fermor, officiating director of the Geological Survey of India, writes from Calcutta to point out that a note in these columns (NATURE, Feb. 20, p. 275) on the plans of the expedition—which was based on an announcement issued by Science Service of Washington—"seems unjust to the Geological Survey", in suggesting that the Salt Range had not been examined systematically for palæontological evidence. Dr. Fermor directs attention to a number of contributions to the *Memoirs of the Geological Survey* and *Palaeontologica Indica*—on the geology by A. B. Wynne and Sir Edward Pascoe, and on the palæontology by R. Lyddeker, G. E. Pilgrim, W. Waagen, and others. In addition, Dr. Fermor states that the Range itself is now being surveyed in great detail by E. R. Gee.

Early Man in Palestine

FURTHER information relating to the human skeletal remains found in the Mousterian strata of the Palestinian cave, Mugharet es-Sukhul (see NATURE, May 14, p. 712), as given by Miss D. A. E. Garrod in a communication to the *Times* of June 11, indicates that the discovery is of even greater significance than at first appeared. Now that Mr. MacCown and his assistants have been able in part to remove the breccia in which two of the skeletons were embedded, it is becoming possible to appreciate the bearing of certain incompatibilities with the Neanderthal type, which Sir Arthur Keith had noted in the Galilee skull and other remains found in the Palestine caves in association with a Mousterian culture. These two skeletons are practically complete and lie as they were buried, one on its back, the other on its left side with legs flexed and heels drawn up towards the sacrum. Although the skull has the characteristic powerfully developed supraorbital ridges, the cranial vault is higher and the head somewhat rounder than in Neanderthal man; while viewed from behind, the greater breadth appears nearer the base and the sides are comparatively straighter, converging slightly towards the top of the head. Even more remarkable is the facial skeleton, which appears to exceed in prognathism the most prognathous of Neanderthal skulls, giving it an ape-like appearance. The lower jaw is as heavy and as squarely built as in Neanderthal man, yet it has a decided chin. The limb bones are massive, but longer than those of Neanderthal man; but it is evident that Palestine man walked with the Neanderthal slouch. In view of these facts, Sir Arthur Keith confirms the conclusion of the excavator that here we have a new race, or even a new species, of fossil man, for which Sir Arthur proposes the name *Palœanthropus Palestinus*.

Tornadoes in the United States

IN the *Monthly Weather Review* for last December there is a preliminary report on the frequency of tornadoes in the United States during 1931, on the number of deaths caused by them, and on the material damage. This report shows that in the past year tornadoes were notably scarce compared with other recent years, and did less damage than usual; also that, what is even more satisfactory, they caused less than half the number of deaths recorded in any of the previous fifteen years. Even so, the death roll, resulting from about ninety of these visitations, reached 34, of which no fewer than 14 occurred last December. The unit in which material damage is expressed is the sum of a thousand dollars, and in five months the total damage thus expressed ran into three figures; September was outstanding with 828,000 dollars' worth of damage caused by twelve or thirteen tornadoes. The figures for monthly frequency of occurrence of the storms show a characteristic early summer maximum, with a total of 32 storms in May and June, that is, of more than a third of the year's total. It may be noted that although the tornado and the commonest type of summer thunderstorm are probably both caused by local instability due to the juxtaposition of air masses of different temperature, of which the warmer generally carries a great quantity of water vapour, they must be regarded as in some way essentially different in their modes of origin.

The Five-Year Plan in Russia

A SERIES of economic studies of Russian production under the Five-Year Plan is being published by the Bureau of Research of the Russian Department of the University of Birmingham, under the editorship of Prof. S. Konovalov. No. 5 deals with the economic results for 1931, agricultural collectivisation, and oil production and export. The statistical presentment of the plan is of much interest. As regards agriculture, it is shown that while the 1913 output of

cereals was 81·6 million tons, the average output in 1927, 1928, and 1929 fell to 72·9 million tons, or a decrease of 10·7 per cent. This, however, was increased in 1930, under collective farming, to 87·4 million tons; but the hopes for 1931 of 97·9 million tons fell short by as much as 21·5 million, which, with an annual growth of population of 2·36 per cent, has meant a cessation of export. The shortage would appear to have been largely due to vain attempts to increase too rapidly the area under cereals, which led to badly prepared soil, thin sowing, and delayed harvests. Less favourable weather was another cause. Nevertheless, the sown area of cereal and other crops has been increased during the last year by more than seven per cent. An analysis of the output of large scale industry shows an increase in the last year of 21·7 per cent, against the anticipated 44·3 per cent. At the same time, there are other negative results which are fully analysed in this report, such as the decrease in the productivity of labour, and the increase in cost of production and in prices.

Antirabic Treatment in India

THAT dread disease hydrophobia, caused by the bite of rabid animals, is of considerable importance in India, and 456 deaths were attributed to it in 1930 in the Madras Presidency. The report for 1930 of the Director, Major Iyengar, of the Pasteur Institute of Southern India, Coonoor, records that 541 patients were treated at the Institute, with 5 deaths, a mortality rate of 0·92 per cent. In addition, 4747 cases were treated at other centres in the Madras Presidency, with 5 deaths. Semple's carbolised sheep vaccine was used throughout, the virus being in its 1154th passage at the end of the year. Animals to the number of 229, including one elephant, were also treated, with no death. Bites treated were inflicted by eleven species of animals, including man, panther, leopard, jackal, and fox.

Investigation of the Atmosphere in the U.S.S.R.

A SCIENTIFIC institute has recently been established in Moscow to carry on research on the circumstances of formation of cloud, fog and rainfall. The institute has branches in Leningrad, Odessa, Saratov, Tashkent, and Askhabad. The Leningrad branch of the institute is installing apparatus for investigating the effect on the atmosphere of high-tension currents, X-ray, ultra-violet rays and radioactive radiations. It is hoped to test the apparatus next summer in experiments to be carried out in the drought regions of the U.S.S.R.

Announcements

AT a congregation held at Cambridge on June 11, the honorary degree of Sc.D. was conferred on Sir William Bragg, director of the Royal Institution.

DR. HENRY S. WASHINGTON, the distinguished petrologist of the Geophysical Laboratory of the Carnegie Institution of Washington, has been elected an honorary member of the Mineralogical Society.

PROF. H. E. ARMSTRONG will deliver the next Huxley Memorial Lecture at the Imperial College of Science and Technology on May 4, 1933. Prof. Armstrong will speak on Huxley's educational creed and its outcome.

THE following committee has been appointed to inquire into the sterilisation of mental defectives: Mr. L. G. Brock (chairman), Dr. Wilfred Trotter, Dr. R. A. Fisher, Dr. A. F. Tredgold, Miss Ruth Darwin, Dr. E. W. Adams, Dr. R. H. Crowley, Dr. E. O. Lewis, with Mr. F. Chanter, of the Board of Control, as secretary. The terms of reference are: "To examine and report on the information already available regarding the hereditary transmission and other causes of mental disorder and deficiency; to consider the value of sterilisation as a preventive measure, having regard to its physical, psychological, and social effects, and to the experience of legislation in other countries permitting it; and to suggest what further inquiries might usefully be undertaken in this connexion".

THE reports of the destruction of a gaol at Mymensingh, in Bengal, on May 9 last, by a tornado, were probably incorrect in attributing the damage to a tornado, for the 'nor'westers' are quite capable of doing all the damage described on this occasion and are particularly frequent in May. These squalls, associated with early summer thunderstorms in Northern India, can be very violent.

A NEW catalogue (No. 549) of second-hand books and journals has just reached us from Francis Edwards, Ltd., 83 High Street, Marylebone, W.1. It comprises nearly 1700 works—many rare—dealing with folklore and anthropology.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A lecturer in the Chemistry Department of the Heriot-Watt College, Edinburgh—The Principal, Heriot-Watt College, Edinburgh (June 20). A principal of the Walsall Technical College—The Director of Education, Education Offices, Council House, Walsall (June 25). A principal of the Chelmsford School of Art and Technology—The Director of Education, County Offices, Chelmsford (June 25). A lecturer in zoology (botany subsidiary) at the Chelsea Polytechnic—The Principal, Chelsea Polytechnic, Manresa Road, S.W.3 (June 30). A lecturer in the department of botany in the University of Durham (Durham Division)—The Head of the Department of Science, University of Durham, South Road, Durham (July 1). An F. W. Bennett lecturer in physics at University College, Leicester—The Registrar, University College, Leicester (July 5). A graduate assistant master to teach mathematics, with elementary science as subsidiary subject, in the Halifax Junior Technical School—The Principal, Municipal Technical College, Halifax. An assistant master for the teaching of painter's and decorator's work at the Huddersfield Technical College—The Director of Education, Education Offices, Peel Street, Huddersfield. A chief instructor in agricultural subjects at the Army Vocational Training Centre, Chisledon, Wiltshire—The Commandant, Army Vocational Training Centre, Chisledon, Wiltshire.

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.*]

The Inheritance of Acquired Characters

MR. HALDANE, professor of physiology in the Royal Institution, has adopted the unusual course of delivering an address in which he directly attacks a discourse which, at the request of the managers of the Royal Institution, I delivered a year ago, and an answer from me seems to be called for. Within the limits of a letter I cannot deal with what are in my opinion the fallacies in Prof. Haldane's address, as to do so would involve writing another discourse. I shall have to confine myself to the cardinal points at issue, the more so as no one would have guessed from Prof. Haldane's words either (1) what Lamarck really said or (2) what the argument in my discourse had been.

Briefly, then, my argument was this. Whenever we have evidence which enables us to determine with a probability amounting to practical certainty what the actual course of evolution has been, we find that it presents the same features, namely, an extremely slow and continuous change of structure correlated with a corresponding slow modification of habit. Since changed habits, by exercising different parts of the body, do modify structure, and since we know that animals can and do change their habits in response to the demands of a changed environment, it is a natural inference that the changed habits are the cause of the changed structure, and that the structural response of the individual has finally become engrained in the heredity of the race. So strong is the evidence for this inference, that some of my friends amongst the leading systematists of the British Museum deny altogether the necessity for direct experimental confirmation of it, arguing with probable justice that so many generations would be needed to make the change manifest that the time required would far exceed the span of an experimenter's life.

Lamarck did not, however, as Prof. Haldane mistakenly suggests, suppose that external circumstances (that is, environment) produce a change which is afterwards produced by internal causes (that is, inherited). On the contrary, he stated explicitly that the environment produces *no direct modification of the animal whatever*. (Here he goes too far; there is little doubt that 'mutations' are produced by the direct action of the environment.) What modifies an animal, according to Lamarck, *is its own activity*. This activity, called forth by its needs in a new environment, *if it lasts for a long time*, eventually causes the formation of new habits; these in the long run lead to new structures and are reproduced in the young.

Now, the time at the disposal of an experimenter is only about five years, in very rare cases ten years, and it is too much to hope that in this brief time noticeable modifications of structure will be produced; but there is room for hope that new habits may be formed, and that these new habits may prove to have an influence on posterity. I pointed out that it would be entirely contrary to expectation to find that the new habit persisted when the offspring were replaced in the typical environment; at most we might expect an *intensification* of the habit when the offspring were reared in the new environment, and a *lag* in the reversion to the parental habits when they were replaced in the typical environment.

These expectations, happily, have been fulfilled and I mentioned a number of experiments, three of which, I hold, afford conclusive proof of the influence of habit on posterity. These are: (1) Dürkhen's experiments in exposing the caterpillars of the white butterfly to orange light which suppressed the white colour of the pupal case and made the pupæ look green. When a second generation produced from these pupæ were reared in ordinary daylight, from 35 to 50 per cent were green. (2) Metalnikoff's experiments on the caterpillars of the beeswax moth, in which he inoculated some with a bacillus which proved uniformly fatal, whilst a control were inoculated with a vaccine which protected against the effects of the bacillus. Breeding from these immunised moths for several generations and inoculating each generation with the vaccine, he obtained a strain which were almost immune to the bacillus. (3) Heslop Harrison's experiments on the saw-fly, when he forced a saw-fly to lay its eggs on a plant to which it was not accustomed, and showed that in five years it had learned to prefer its new host plant to the old one.

If, as I think, every fair-minded person must admit on examining the evidence that these experiments are convincing, then the cardinal postulate of the Lamarckian theory is proved and we are free to apply it to explain the progress of evolution, and as a student of evolution all my life I can testify that the light which it throws on the process is amazing.

It is not surprising, therefore, that Prof. Haldane attempts to explain away the results of these experiments, and he does this mainly by attributing them to selection. Now, though he claims to represent a new and insurgent group of younger biologists, his references to selection are evidences of an archaic type of thought. Selection as an effective cause of anything is a superstition which dies hard. That some animals live and some die is known to everyone, but unless the some that die differ from those that live, no change is produced. What a belief in selection really implies is that small inheritable variations in all directions are continually turning up *by chance*. The pure line experiments which Prof. Haldane quotes were placed by me in the forefront of my arguments for Lamarckism, for they prove conclusively that such fluctuating deviations are not inherited, and hence they sweep away the main argument for Darwinism in its classical form. I am not alone in this opinion. In Germany these experiments have led to what is called "Der Krisis im Darwinismus".

Coming, however, to details. It provokes a smile to find Prof. Haldane instructing Dürkhen, who devoted five years to his experiments, what he must do in order to convince him, and asserting that there is not a shadow of evidence for anything more than selection. Dürkhen carefully considered this point, and in later experiments put it to the test. He carefully selected the *darkest* of his pupæ (that is, the not-green), reared a second generation from them, which he exposed to orange light, and he obtained 96 per cent of green pupæ. There is no possibility, he says, of separating a green and a not-green race by selection.

The case for Metalnikoff is even stronger. Here according to Prof. Haldane rigorous selection was used. This is an entire mistake, but I must admit that I did not in my discourse give a sufficiently clear account of these experiments.

Metalnikoff did not breed from the caterpillars which he had immunised and then inoculated with the bacillus. By preliminary experiments (which we

have repeated in my laboratory) he determined that the bacillus was uniformly lethal and that the vaccine afforded a constant immunity against it; then in each generation he immunised half the caterpillars and exposed half to the bacillus—but he always bred from the immunised half, and thus proved the cumulative action of the vaccine. Metalnikoff himself has no doubt as to the bearing of his experiments on Lamarckism; for in France, where he worked, the logical French mind has always clung to Lamarckism and has refused to be obsessed with the value of chance variations. Lastly, with reference to Heslop Harrison's experiments. Here again the argument for selection fails utterly; for the willow plant on which the saw-flies were forced to lay their eggs was a rare hybrid, and the supposition that Harrison was selecting an inborn 'gene' which conferred on the saw-fly larvæ the capacity to live on this plant is an hypothesis too fantastic for anyone except Prof. Haldane. As to the hypothesis of 'larval memory', which is at first sight a plausible one, it is untenable, because it assumes that the instinct of the mother to seek a certain plant and the capacity of the larva to live on this plant are inseparable. But Harrison by crossing two moths whose larvæ fed on different food plants obtained hybrids in which the mother sought the food plant of the paternal race but the unfortunate larvæ could only live on the food plant of the maternal race, and hence perished miserably.

Prof. Haldane makes a reference to my dead friend Kammerer. Let me then put on record that I believe that in time Kammerer will be completely vindicated, and this is the belief also of his teacher, Prof. Przibram. Kammerer was driven to suicide by the discovery that his type-specimens, the fruit of his life's work, had been tampered with and rendered useless. Whatever may happen in the future, one piece of Kammerer's work will endure; he succeeded in disproving for all time the hypothesis, endorsed by Prof. Haldane, that the blindness of cave-animals was due to their having by chance inherited eye defects: for in 1923 he produced in my laboratory large specimens of the blind cave-newt *Proteus anguinus* with fully developed eyes, evolved by exposing the animals at the proper stage of growth to the action of red light. This is the strongest indirect evidence yet adduced for the inheritability of the effects of disuse.

Finally, Prof. Haldane asks, "If we reject Lamarckism, what remains?" He answers, "Neodarwinism". The meaning of this term is doubtful. Certainly it signifies something which would not have been accepted by Darwin, for he remained half a Lamarckian all his life. I shall venture to define it as the theory of 'Chaos and Chance'. Certainly to anyone who accepts chance as an explanation, it is omnipotent and can be used to bridge any gap in the evidence. It is impossible to prove that a thing did not happen by chance, and the attitude which those of us who believe in regularity and law in this as in other departments of Nature must adopt towards the supporters of chance, is that recommended by Virgil to Dante concerning certain nondescript sinners whom they met at the entrance to hell, "*Non ragioniam di loro ma guarda e passa*".

The controversy between supporters of chance and habit as the cause of variation must ultimately be decided by the suffrages of biologists. I must say that I have been greatly cheered by the support which has reached me from all parts of the world, but I cherish particularly the memory of one incident. It is just fifteen years since I delivered my first lecture on this subject to a scientific society. I had the honour of having amongst my audience several distinguished scientific men, of whom one was the eminent physiologist, Prof. J. S. Haldane. After the lecture, I was complaining to him of the prejudice which had to be conquered in order to persuade people of the inheritability of habit. "Well," he said, "one thing is certain: unless it is true, there has been no evolution." With this opinion I cordially agree.

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Origin of the Coronal Lines

IN two recent communications [1] de Bruin has given a group of numerical relations, which relate the strongest visible lines of the corona, 5302·78, 6374·28, 6704, and 6775·90, with certain lines of the O I spectrum. According to de Bruin, there exist in addition to the following well-known deep-lying O I terms: $^3P_{1,2,3}$ = 109,831, 109,672, 109,605, $^1D_2$ = 93,962, $^1S_0$ = 76,037, another group of deep-lying terms: P, Q, R, X, Y, Z: 94,925·1, 94,905·3, 94,898·7, 79,221·7, 78,946·2,

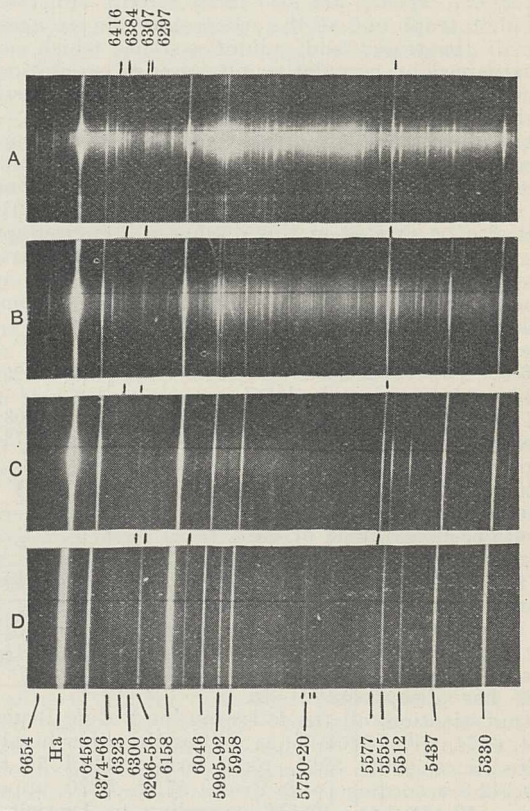


FIG. 1.—Spectra of argon and oxygen. Argon lines marked above, oxygen lines below the spectra.

78,932·3. The intercombinations of these new terms one with another and with the already known existing deep terms, ^3P, $^1D_2$, and $^1S_0$, are supposed to give the hitherto unclassified corona lines: 6775·90: $2p\,^3P_1 - P$, 6704: $2p\,^3P_2 - P$, 6374·28: $Q - X$, 5302·8: $R - 2p\,^1S_0$, as well as some unclassified lines of the O I spectrum: 6654·12: $Y - {}^1D_2$, 6366·28: $P - X$, 6374·29: $Q - X$ (it has been suggested by Hopfield [2] that the last mentioned line is identical with the coronal line 6374·28), and 6266·69 – 6256·61: $(P, Q, R) - (Y, Z)$.

The theoretically expected scheme for the deeper terms of O I has been completely observed and verified previously [3]; unknown higher terms of the configurations s^2p^3 and sp^4 are only to be expected with

negative term values. The question therefore arises as to whether the admittedly exact numerical relationships given by de Bruin have a true physical meaning or whether they are purely accidental, as in previous unsuccessful attempts correlating coronal lines with other spectra. Since, according to de Bruin, these suggested new terms lie very deep, it should be possible to prove their existence by determining experimentally whether they do all actually lie deep. The photographs (Fig. 1) show the part of the O I spectrum under discussion with different degrees of excitation. *A*, *B*, and *C* were taken with a wide discharge tube (3 cm. bore, 60 cm. long, 0·8-1·2 amp. d.c.). *A* shows the spectrum given by argon which contains very small traces of oxygen. In this photograph appear the strongest lines of the quintet and triplet systems and also the green auroral line 5577 : $^1S_0 - {}^1D_2$ and also perhaps (between the argon lines 6296·8 and 6307·7) the line 6300·03 (according to Paschen,[4] $2p\ {}^3P_2 - 2p\ {}^1D_2$). *B* is given by a mixture of a few millimetres of argon and a little more oxygen than previously. The auroral line appears now with great intensity, and in addition the lines 6300 and 6364 (according to Paschen, l.c., $2p\ {}^3P_1 - 2p\ {}^1D_2$) are also fairly strong. Further, this photograph and all the others show the strongest lines of the triplet and quintet systems, which can be explained by cumulative processes of excitation. The weak line 6391·0 ($2p\ {}^3P_0 - 2p\ {}^1D_2$), the third classified by Paschen, is not observable.

It is a remarkable fact that not one of the supposedly classified lines of de Bruin appears with this excitation, although the strong intensity of the auroral line shows that any deep terms greater than 76,037 must also be excited in this discharge. Photograph *C* is taken with pure oxygen of a few millimetres pressure. The energy of excitation is displaced to higher values, the lines 5577, 6300, and 6364 become weaker relative to the other series lines, but the group 6266-56 just begins to be visible on the original plate. The last photograph, *D*, was taken with 0·8 amp. d.c. in a narrow quartz capillary tube of 2 mm. bore.

According to my earlier observations,[5] this mode of excitation is peculiarly suited for the production of highly excited terms. In this case the maximum of excitation is now displaced to larger values; thus 5577 is very weak, and 6300 has disappeared. In contradistinction, all the following lines of de Bruin, 6654, 6374, 6366, 6266-56, as well as the other highly excited lines (5995–5991, upper term = −20,135·2 to −20,142·8 according to de Bruin, 5750–5720, upper term −13,458 to −13,548 according to Frerichs), show considerable intensity. The fact that de Bruin's supposed combinations between deep terms give lines which only appear when the energy is sufficient to excite high-lying terms (negative) proves unambiguously that these lines must involve high-lying terms and not deep ones. It is of interest to note that Paschen and Hopfield, l.c., who used a discharge tube with dimensions between those giving spectra *C* and *D*, actually obtained a spectrum intermediate between that of *C* and *D*.

The present experiments prove definitely that amongst the lines considered only 5577, 6300, and 6364 are lines of deep excitation. Hence the degree of accuracy of wave-length agreement between coronal and oxygen lines does not then come into the question. It therefore appears that the numerical relations of de Bruin are merely accidental, so that the great mystery of the coronal lines remains unresolved.

R. FRERICHS.

Physikalisch-Technische Reichsanstalt,
Charlottenburg, May 15.

[1] NATURE, **129**, 468, March 26, 1932; *Naturwissenschaften*, **20**, 268 1932.
[2] *Phys. Rev.*, **37**, 160; 1931.
[3] R. Frerichs, *Phys. Rev.*, **36**, 398; 1930.
[4] *Z. Phys.*, **65**, 1; 1930.
[5] *Phys. Rev.*, **34**, 1239; 1930.

THE interesting letter of Dr. T. L. de Bruin on this subject [1] throws additional light on the spectrum of neutral oxygen, and is very suggestive in relation to the hitherto unexplained spectrum of the solar corona. It appears, however, to be premature to conclude that the coronal lines—in particular the green line at λ5303—have now been identified. An analysis of the evidence submitted by Dr. de Bruin shows that the suggested interpretation of the green line rests on the existence of the term *R*, the reality of which can be established only by assuming a classification of his groups I. and II. of oxygen lines, which is not the most satisfactory that could be made. The oxygen lines in question are the following:

Group I.		Group II.	
λ (int.).	ν.	λ (int.).	ν.
6654·121 (4)	15024·14	6266·692 (1)	15952·97
6374·292 (5)	15683·68	6264·346 (2)	15958·95
6366·282 (4)	15703·42	6261·314 (5)	15966·68
		6258·965 (1)	15972·67
		6256·616 (3)	15978·67

de Bruin's classification is as follows, the numbers in brackets indicating the differences between the observed values of wave-number and those calculated from his terms:

	P	*Q*	*R*	$2p\ {}^1D_2$
	94925·1	94905·3	94898·7	93970·3
X = 79221·7	15703·4 (0·0)	15683·6 (+0·1)		
Y = 78946·2	15978·9 (−0·2)	15959·1 (−0·1)	15952·5 (+0·5)	15024·1 (0·0)
Z = 78932·3		15973·0 (−0·3)	15966·4 (+0·3)	

It is possible, however, to arrange the lines thus:

	P	*Q*	$2p\ {}^1D_2$
	94924·92	94905·20	93970·3
X = 79221·51	15703·41 (+0·01)	15683·69 (−0·01)	
W = 78952·24	15972·68 (−0·01)	15952·96 (+0·01)	
Y = 78946·24	15978·68 (−0·01)	15958·96 (−0·01)	15024·1 (0·0)

This accounts for one line fewer than de Bruin's classification (a decidedly stronger line than its neighbours, and one which might well be unconnected with them) but demands one less term, so that on grounds of economy of assumptions, it is to be preferred. Furthermore, it agrees throughout with measured values of wave-length to within less than 0·004 A., whereas de Bruin's classification involves errors of more than 0·1 A. in lines measured by Frerichs to the nearest thousandth of an angstrom. If the classification suggested here is the true one, there is no reason to suppose that the term *R* exists, and consequently the green coronal line remains unexplained. Further exact measurements of the oxygen lines in question would settle the point, and are much to be desired.

HERBERT DINGLE.

Imperial College of Science and Technology,
May 25.

[1] NATURE, **129**, 468, March 26, 1932.

The Oldoway Human Skeleton

WE are glad to find from Dr. Leakey's letter in NATURE of May 14 that he is in agreement with us in regarding the Oldoway skeleton as an artificial burial, and regret that, in common with everyone else whom we have consulted in this matter, we interpreted his original letter in NATURE of Oct. 24 to mean that it was naturally deposited without human agency in Bed 2.

With the recognition that it was buried by man, the discussion of its date rests on a series of hypotheses and presumptions which, even at their best, can never give a certainty comparable with that given by a natural deposition.

So far as can be discovered from published sources, the skeleton lay embedded in Bed 2 below a sloping surface dipping down toward a stream course. Bed 2 at the site of the interment was not, when Prof. Reck began his work, covered by Bed 3, which had presumably formerly extended over it but had been removed by erosion. Dr. Leakey now claims that the skeleton was buried in Bed 2 before Bed 3 was deposited over it. This involves the supposition that the deposition of the materials of Bed 2 took place in water so shallow that a bedding plane was at one time exposed to air and sufficiently dried to allow men to walk over and dig a grave in it.

We know of only one line of evidence which could give certainty of the occurrence of such a condition, and should be glad to hear Dr. Leakey's reasons for believing that it has occurred.

Granting this fundamental postulate, we have to consider the evidence that the grave was not dug in comparatively modern times. Dr. Leakey claims that at a time less than fifty years ago the site of the burial was covered by an extension of Bed 3, and that hence, unless the burial took place before Bed 3 was deposited, or less than fifty years ago when Bed 3 was removed, some material of Bed 3, which differs markedly in colour and texture from Bed 2, must have been included in the grave infilling.

Dr. Leakey, however, has shown that some survey pegs inserted by Prof. Reck in 1913 were still *in situ* in 1931, so that the rate of denudation is demonstrably slow. Thus Dr. Leakey's estimate of fifty years implies that the natural surface above the grave of the Oldoway skeleton lay only a few inches below the base of Bed 3. It is clear that an estimate of so small a thickness could only be made if the surface of Bed 2 on which Bed 3 rests is exceptionally plane, and if an elaborate series of levels had been made at the time of the original discovery before the land surface was destroyed. We understand that in fact Bed 2 is merely represented by *remanié* materials in the neighbourhood of the skeleton. It is thus extremely doubtful if it would be possible to make any sufficiently accurate measurements to justify Dr. Leakey's estimate of fifty years. But in any event, the rate of denudation under the conditions existing at Oldoway must vary so greatly from yard to yard, falling probably to nothing where there is any protection afforded by vegetation, that the period required could not be estimated even if the data as to thickness were established.

The photographs published by Prof. Reck show that the whole of the upper and a good deal of the lateral surfaces of the skeleton were exposed during the excavation made for its removal, and it is hence probable that Prof. Reck removed it and a pedestal of the rock on which it rested by the ordinary method of hardening and bandaging. It need scarcely be pointed out that the only material certainly of the grave infilling carried to Munich in this way is that which is contained within the ribs and between the limbs and the trunk, and that this was the first earth to be thrown back again into the grave.

The material of Bed 3 as it exists in a *remanié* form in the neighbourhood of the grave seems to consist of small calcareous nodules of varying hardness stained red with ferric hydrate. It is quite conceivable that their colour might be materially altered by contact with a decaying body. If the thickness of Bed 3 penetrated in the grave was small in proportion to that of Bed 2, the admixture would be small in any case, and the whole of the materials of Bed 3 excavated might be so completely covered during removal by those of Bed 2 that when this soil was shovelled into the grave, it is possible that the whole of the Bed 3 materials might be included in the mound above the surface and none reach the bottom of the pit. Thus although the discovery of a single fragment of Bed 3 in the grave infilling would show that the grave was dug through this bed, the absence of such a fragment does *not* show that the pit did not pass through it.

It is evident that the grave infilling which remained in the block when it was sent to Munich only represents a small proportion of that which filled the whole grave, and as the skeleton was still undisturbed when Dr. Leakey examined it in 1925, it is clear that the proportion of the total volume of the grave infilling which he saw was minute. It is, furthermore, a universal experience that the appearance of a mass of rock is greatly altered by the process of hardening and bandaging; and, as we have pointed out, mere proximity to a large decaying body often alters the character of a matrix. Thus we feel that Dr. Leakey is rash in stating that there is no trace of Bed 3 in the grave infilling.

If Dr. Leakey be held to have established that the grave of the Oldoway man was not dug through Bed 3, he has still to show that it cannot have been dug during the period which has elapsed since the removal of Bed 3 took place. We have already shown that his estimate of fifty years is a guess, owing to the lack of adequate data as to thickness and to the variable rate of denudation from place to place.

Dr. Leakey's evidence that the bones of the skeleton seem to be as much mineralised as the others in Bed 2 is of no great value. The specimens now in the Natural History Museum from this bed vary immensely, from bones easily powdered between the fingers, to others which are hard and brittle. No one can ever say how long it takes any bone to reach any particular physical or chemical state.

The only other evidence which Dr. Leakey advances is that the anatomical characters of the skeleton cannot be matched amongst the local natives. But we understand, though we have not seen their work, that Messrs. Gieseler and Mollison, who have recently described the remains, point out resemblances to the Masai who still inhabit the district.

It is thus apparent that the evidence Dr. Leakey has so far adduced in no way excludes the supposition that the Oldoway skeleton represents a burial of relatively recent date.

The remainder of Dr. Leakey's letter in NATURE of May 14 has no relevance to the particular problem of the age of the Oldoway burial, which is the only one with which we are concerned.

C. FORSTER COOPER.

University Museum of Zoology,
Cambridge.

D. M. S. WATSON.

University College,
London.

The Shedding of Certain Fibres in the Coat of the Lamb

IN his letter[1] in NATURE on *Ovis astore*, Prof. A. F. Barker discusses the shedding of certain fibres by domesticated sheep. As he points out, the shed fibres are usually regarded as representatives of the outer coat of wild sheep. The persistent fibres, of indeterminate growth, are looked upon as derivatives of the ancestral under-coat of wool. It is believed that the fibres of this under-coat, instead of ceasing to grow after a few weeks or months, and later being shed, have taken to maintaining their growth for a very much longer time, often probably throughout the natural lifetime of the animal.

While these generally accepted ideas concerning its ancestral history form the background of our thinking about the biology of the fleece, the present purpose is to point out the need for thinking of shedding and non-shedding in terms of physiology as well as phylogeny. In studies of the fibre types of the New Zealand Romney and their life histories, the attempt to explain the detailed observations made has led to speculations about differences in the activities of the follicles that determine whether a fibre ceases to grow and is succeeded by another, or whether the same fibre grows continuously. The present discussion is based mainly upon work on the region of the middle line of the back near the level of the last rib.

In the New Zealand Romney lamb the structural differences between the collection of birthcoat fibres that cease growing at about two months and those of persistent growth appear to be much less sharply defined than the differences between the fibres of the outer and the inner coats of wild sheep or of the Black-headed Persian.[2] In kempy lambs the biggest fibres present at birth are wellnigh certain to be shed, while many of the smaller types are sure to persist. In between come several types, covering a considerable range of characterisation, and taken together numerically important, that may or may not be shed. Which fibres are shed and which persist is clearly determined by orderly forces.

For many fibres it does appear that the balance may easily be tipped one way or the other towards shedding or persisting. In an earlier communication[3] it was stated that the proportion of sickle-fibres shed varies greatly from lamb to lamb. When many persistent sickle-fibres are present that resemble quite closely, in their apical structural details, some which are shed, it is a common thing to find some of these persistent sickle-fibres with a very marked thinning for half an inch or so below the point corresponding to the base of the shed fibres, while below this thinning the fibre becomes coarse again. Other persistent sickle-fibres, but little dissimilar apically from the last, continue comparatively coarse throughout what is evidently a critical time in the activities of the follicles of many sickle-fibres. It is believed that amongst fibres that will continue their growth for some weeks after birth, the earlier a fibre starts its development the greater its chance of ceasing to grow at about eight weeks, except in so far as the follicle is affected by the kind of birth check, a phenomenon to which reference was made in the earlier communication. It would appear that follicles which are well established before the birth check becomes powerful tend to shed their fibres, and that fibres grown in follicles founded just late enough to miss the force of the check are also more likely to be shed than those that have to face the intensity of the check at a very early stage of growth.

Wide variations from lamb to lamb are found in the proportion of shed and persistent fibres of several types, and it is possible to go a good way in generalising about the structural differences between shed and persistent fibres classified as of the same main type. The facts of the case seem to fall into line if we suppose simply that, in those follicles in which growth ceases for a time, fibre material has at some post-natal stage of development been elaborated at a greater rate than in those follicles where growth continues without interruption. In other words, if the follicle overworks, it is compelled to take a rest, and growth comes to a stop.

It is hoped shortly to publish the detailed evidence upon which this suggestion is based. Attempts are being made to test this explanation in various ways. The present purpose, however, is not to argue for the correctness of a particular working hypothesis, useful though it is proving. It is desired rather to show the kind of outlook upon shedding that results from a study of the details of structure and development of the lamb's coat.

The simple fact that mammalian hair grows only at the basal end invites fuller exploitation. Each fibre is an autographic record of a series of events in the follicle. Often enough portions of the curve traced by a fibre are suggestive of shorthand symbols. A better understanding of the code would enable us to decipher illuminating messages on many a biological question.

F. W. DRY.
Massey Agricultural College,
Palmerston North, New Zealand.

[1] NATURE, **129**, 128, Jan. 23, 1932.
[2] Duerden and Boyd, Union of South Africa Department of Agriculture, *Bull.* No. 82, 1930.
[3] NATURE, **127**, 482, March 28, 1931.

Attack of Oxygen Molecules upon Highly Crystalline Graphite

THE accompanying photographs (Fig. 1) illustrate an observation made while studying the oxidation of graphite. A thin flake of Ceylon graphite (99·9 per cent carbon) was oxidised during many hours at 900° C. in a stream of oxygen at 1 mm. pressure.

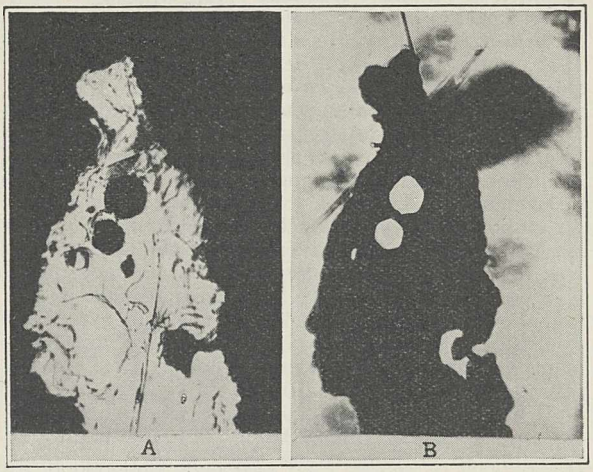


FIG. 1.—Crystalline graphite during oxidation. ×140.

(The product is about 50 per cent carbon dioxide and 50 per cent carbon monoxide.) Photomicrographs were taken at intervals; the two reproduced show the state of the flake when probably more than four-fifths of the original graphite had been oxidised away. In both, the flake is viewed, roughly, perpendicularly to the cleavage plane, *A* by light reflected from this plane, *B* by transmitted light.

There are two interesting features: (*a*) The power of brilliant reflection at the appropriate angle from the

surface of the flake remains unimpaired throughout the oxidation; there is no pitting of this surface. Apparently carbon atoms are removed layer by layer. (*b*) The holes which eventually appear in the flake have a well-defined hexagonal form, which they retain as they grow, although when they reach the size shown, the corners begin to round off a little; when smaller, the hexagon appeared very regular. (Unfortunately, the reproductions appear more distorted than the original photographs, themselves imperfect.) The shadows round the flake in Fig. 1, *B*, are caused by semi-opaque patches in the silica pan carrying the flake. It will be noticed that corresponding sides of the two clearly formed hexagons are parallel.

Possibly the formation of these holes is caused in the first place by the presence of minute inclusions of impurity, such as iron or an alkali metal salt, which would catalyse the oxidation of the carbon with which it is in contact. But the subsequent growth of the hexagons provides a manifestation of the influence of lattice symmetry upon the course of a chemical reaction. It seems to us that the points (*a*) and (*b*) are of interest in connexion with the mechanism of the oxidation of graphite.

E. N. GREER.
B. TOPLEY.

The Sir William Ramsay Laboratories of Inorganic and Physical Chemistry, University College, London, W.C.1, May 12.

Oxidation of Strychnine

I HAVE been studying the action of oxidising agents on strychnine for some time. Leuchs [1] stated that he had obtained an acid with the formula $C_{21}H_{22}O_4N_2$ from strychnidine by means of oxidation with chromic acid. The acid is stated to crystallise from water in brown needles that do not melt up to 320°, and are nearly insoluble in alcohol and acetone, but readily soluble in ammonia, *N*-hydrochloric acid, and acetic acid. The acid in question gives crystalline precipitates in needles and prisms with nitric and hydrobromic acids, and amorphous precipitates with hydriodic and perchloric acids, which then become crystalline scales.

It appears that Leuchs [2] obtained this same compound by oxidising tetra-hydro-strychnine with large quantities of chromic acid in a carrier acidified with sulphuric acid, and Wieland admits that the high melting point of this compound shows [3] that the acid $C_{21}H_{22}O_4N_2$ is a diphenyl derivate, to which he attributes, with more probability, the formula of $C_{42}H_{42}N_4O_8$.[4]

I would like to point out that by oxidising strychnine with chromic acid in a carrier acidified with acetic acid, I have obtained a crystalline compound in very shiny prisms, which melt at 309°-310°, and are soluble in alcohol and chymol when hot, but practically insoluble in water and all organic solvents, especially chloroform.

The reaction of this compound is neutral with litmus paper, and it gives strongly the colour reactions of strychnine. The product in question is obtained with several processes, and analysis gave the following results:

Microscopic analysis gave the following percentages:
Carbon— 68·77, 68·69, 69·07, 68·58.
Hydrogen— 5·68, 5·65, 5·61, 5·53.
Nitrogen— 7·31, 7·38, 7·85, 7·75.
Macroscopic analysis gave the following percentages:
Carbon— 68·99, 68·86.
Hydrogen— 5·75, 5·88.
Nitrogen— 7·40.

These results agree both with a formula of $C_{21}H_{20}N_2O_4$ and that of $C_{42}H_{42}N_4O_8$, and they seem to me to be interesting, since I am of the opinion that this is the first case in which a product has been obtained from the oxidation of strychnine that has the same number of atoms of carbon as that of the alkaloid itself.

Fuller details regarding this question will be sent later to the *Gazzetta Chimica Italiana*.

BERNARDI ALESSANDRO.

Istituto Chem. Farm., R. Università, Bologna, March 29.

[1] *Ber.*, **63**, 2215; 1930.
[2] *Ber.*, **63**, 3184; 1930.
[3] *Lieb. Ann.*, **491**, 111; 1931.
[4] *Ber.*, **65**, 201; 1932.

The NO_3 Frequency in Organic Nitrates

THE characteristic inactive frequency at 9·5 μ, corresponding to a wave-number shift of 1050 cm.$^{-1}$, while it appears as a strong Raman line in the scattered spectrum of all inorganic nitrates examined both as crystals and in solutions, is not represented at all in the Raman effect of the organic nitrates. This is probably due to the influence of the CH group on the oscillations of the NO_3 ion. However, in alcoholic solutions of these organic nitrates this line comes out significantly, the intensity of the line depending upon the solvent used and also upon the concentration of the solution.

In the scattered spectrum of methyl nitrate (pure liquid), in addition to the CH frequencies, the observed Raman lines correspond to $\Delta\nu$583, 662, 866, and 1290, all of which are quite strong. These shifts, which are simple in methyl nitrate, are each split up into two or more components in the spectra of the higher alkyl nitrates, and also there is a considerable change in their intensities. In a twenty per cent solution of methyl nitrate in methyl alcohol none of these lines comes out, but instead we get a strong line at ν23,665 cm.$^{-1}$ which is excited by λ4047 of the mercury arc and corresponds to a shift of 1040. An equimolecular solution of amyl nitrate in amyl alcohol shows this shift only as a very faint line.

In this connexion it may be mentioned that the dielectric constant of methyl alcohol is very high, coming next to water, with a value 35, while for amyl alcohol it is only 16. We have studied the behaviour of this shift with dilution and there is a general tendency for the line to increase in intensity as the dilution increases up to a certain limit. A more detailed acount of the investigation appears elsewhere.

A. S. GANESAN.
V. N. THATTE.

College of Science, Nagpur, India, April 28.

A Displacement in the *N* Lines of Tungsten and Tantalum

WE have recently conducted some experiments on the characteristic radiations of various elements in the extreme soft X-ray region. Spectra have been obtained with the aid of a vacuum spectrograph employing a plane Siegbahn grating in the grazing incidence setting. Using a water-cooled anti-cathode, on to which tungsten was sputtered from the hot filament of the X-ray tube, we have obtained lines at 55·58 and 58·42 A. Thibaud and Soltan [1] have previously obtained wave-lengths of 56·0 and 59·1 A., while Prins,[2] who, in addition to using this procedure, has apparently employed a water-cooled tungsten anti-cathode, has recently published values of 55·7 and 58·4 A., with which our results are in good accord.

Using an anti-cathode of tungsten sheet, allowed to become incandescent, we find that the lines are displaced. The wave-lengths are now 55·29 and 58·09 A. respectively. This represents an increase in the corresponding energies of 1·2 electron volts for each line.

The short wave-length line (55·58 A.) may be safely attributed to a transition ($O_{II,III}$ to N_{IV}) and the long wave-length line (58·42 A.) to (O_{III} to N_{V}). The energy shift obtained when the tungsten is hot being the same for both lines, it is natural to suppose that it is due to a change in the common initial state. This is to be expected, since the final N levels are relatively deep within the atom. We thus arrive at the conclusion that the $O_{II,III}$ level is 1·2 volts deeper for the cold tungsten than for the hot.

The shift of the $O_{II,III}$ level may be explained either by assuming that the crystal structure is different in the two cases, or by supposing that there is a difference in the chemical state. The evidence points to the latter explanation being the correct one, the hot tungsten measurements being due to tungsten and the cold measurements being due to oxidised tungsten.

Experiments with tantalum (73) indicate for the O_{II} level a movement of 3·2 volts in the same direction as that observed for tungsten (74). Curiously enough, there seems to be little shift of the O_{III} level.

F. C. CHALKLIN.
L. P. CHALKLIN.

Physics Laboratory, University College,
London, W.C.1, May 6.

[1] *J. de Phys.*, **8**, Series vi., p. 484; 1927.
[2] *Z. Phys.*, **69**, p. 618; 1921.

Overseas Forestry Officers and Home Appointments

THE issue of NATURE for April 9 included an advertisement of a vacancy for an assistant in the Department of Forestry of one of the universities. The advertisement stated that experience in a Government forest service was very desirable, but the period of only one month allowed for the submission of applications practically precluded the candidature of many officers of the overseas forest services. I think that there must be many able and experienced forest officers in those services who would welcome the opportunity of applying for a vacancy of the nature advertised, and would suggest that universities and institutions having similar vacancies to fill would be able to choose from a much wider field of applicants if longer notice were given.

J. P. MEAD.

Office of the Director of Forestry,
F.M.S. and S.S.,
Kuala Lumpur, May 12.

Chemical Warfare and Disarmament

WE should all be grateful for the eminently sane leader on this subject in NATURE of June 4. The real objection to the use of toxic vapours is that they are too humane. Nearly all the injured soldiers return to the active list after a few months, with the result that the war is prolonged. The use of feeble weapons does not really diminish the number or the seriousness of casualties in war. Supposing that the combatants in 1914–18 had been armed only with swords and daggers, but that the means of transport and therefore the numbers had remained the same, the slaughter would have been much worse, because in every battle the losing side would have been practically annihilated in the hand-to-hand conflict.

I personally am sceptical about the fearful mortality predicted by Prof. Langevin and others as the result of the release of gas bombs over our large cities. Every day hundreds of tons of carbon monoxide are given off by motor cars in our streets, but no one is killed, and it is not certain even that our health is affected. The toxic vapours used in warfare are much more potent than carbon monoxide and are heavier than air, but I am not convinced that they would have a worse effect than an equal quantity of high explosive, which, however, would be sufficiently disastrous if used in really large quantities.

As regards Dr. Delisle Burns's letter, he might with advantage study that of Prof. Cockerell on "Internationalism and Science" also contained in NATURE of June 4. We are all in danger of mistaking "feeling" for "thought". The problem of international peace, commercial as well as military, is mainly one of mass psychology. Will not the psychologists give us a lead?

A. MARSHALL.

3 Hillsleigh Road,
Campden Hill, W.8, June 4.

Light and Sexual Periodicity

I AM much interested by Mr. Ll. J. Llewellyn's letter under this heading,[1] having long wished to obtain information on the effect of absence of sunlight in arctic regions. Eventually everything is traceable to sunlight, but may not the immediate cause, during the dark period, of sexual inefficiency, be the lack of advitants in the winter food? Have they any vegetable food? It has been reported that sterilised milk causes infertility in male rats. We are now learning that our own food, during the low-temperature, low-light period, is greatly deficient in quality —to what extent we have as yet no idea. Animal health and activity are at their lowest at this period. Our reaction to sunlight is probably dependent upon the existence within us of special materials derived from our vegetable food. The sun appears to have no particular recuperative antirachitic value in the east, where the quality of food is at its lowest, owing to soil starvation. A closer study of dietaries is needed in this connexion.

HENRY E. ARMSTRONG.

55 Granville Park,
Lewisham, S.E.13.

[1] NATURE, June 11, p. 868.

Eland-Ox Hybrid

DR. WARREN'S [1] interesting cow-eland hybrid is the sixth mammalian intergeneric cross of which I can find a record. The polecat and ferret, which hybridise. have been placed in different genera, but with very doubtful propriety. Apart from these, the other crosses all involve *Bos*. *Bos taurus* ♀ has given hybrids with *Poëphagus grunniens*, *Bison bison*, and *Bison bonasus*, and *Bos indicus* ♀ with *Bibos frontalis* and *Bibos sondaicus*. In every case the male hybrids were sterile and the females fertile. There was also a significant excess of females where the sex ratio was recorded. I have summarised the literature elsewhere.[2] It is to be hoped that if Dr. Warren's male hybrid calf proves sterile, as seems likely, its testes will be preserved for cytological examination, and the attempt made to breed female hybrids.

J. B. S. HALDANE.

John Innes Horticultural Institution,
Merton Park, London, S.W.19, June 7.

[1] NATURE **129**, 828, June 4, 1932.
[2] *J. Genet.*, **12**, 101; 1922.

Research Items

Nicobarese Burial Customs.—Some observations of hitherto unrecorded ossuary customs practised on the islands of Bompoka and Teressa in the southern area of the Nicobars are recorded in *Man* for May by Mr. C. J. Bonnington. A man of Teressa is buried with his head pointing west as he lies on his back. A soul figure in the form of a post is placed over the grave, which is covered with cloth and the general belongings of the deceased, as well as the head-dress worn by his wife on festive occasions and the skulls of the pigs killed by him, which had hung in his hut as ornaments during his lifetime. In the case of individuals without near relatives, the body is placed as soon as possible in a half-canoe. This is then hung by fibre ropes on a pole supported by two trees in the communal ossuary, which is situated in jungle by the seashore. The body is left to rot, and as the canoe breaks up, the bones fall to the ground to mingle with those of past generations. With burials the remains are disinterred after some months, and if the deceased has been a revered personage, the skull is placed in a life-sized wooden body, which is hollow and has a door in the back through which the remaining bones are introduced. This figure is kept in the hut of the nearest relative. The bones of less important people are kept in little log coffins. These receptacles are kept stacked around the walls of the hut. In one instance observed the figure has a human skull for the head. This was the mother of the present headman, who had been a witch doctor. At meal times food is placed before the wooden figures for the spirits who dwell therein. After a period of sometimes ten years, in which the pig stock of the community is considerably increased, a large feast is held and the bones of the less important people are thrown into the common ossuary. A parallel is cited from Assam.

The Eskimo of Alaska.—The annual report of the Smithsonian Institution of Washington (*Pub.* 3134) on its investigations and field work in 1931 includes an account of investigations which bear on the prehistory of the Eskimo and throw light on a number of points which have hitherto been obscure. During the summer season Dr. Aleš Hrdlička was engaged in the collection of skeletal remains and objects of material culture from prehistoric sites on the Nushagak River and watershed. Anthropometric measurements of the living were also taken. One site on Uyak Bay which was investigated is, it would appear, the oldest yet discovered in the far north. It is concluded that the natives of the Nushagak River and watershed are definitely all Eskimo, belonging to the south-western type, and are identical with the Kuskokwim and the neighbouring Tundra Eskimo from whom they are largely, if not entirely, derived. It is evident that the peninsula was a sieve for movements of the people from the north southwards, and that all comers from the Bering Sea and north-western Asia would naturally come along the western coast, cross by the passes, carrying their skin boats over the few rapids and portages, and find themselves facing Kodiak Island or Cook Inlet, whence the way would be open to the north-west coast and the rest of the continent. The peopling of America, therefore, took place not through Alaska but along its western coast and through the peninsula.

Life History of a Fresh-water Snail.—An investigation of the growth, longevity, and fecundity of the fresh-water snail, *Lymnæa columella*, a species easily reared in aquaria, a free breeder which reaches maturity rapidly, has been carried out by Joshua L. Baily in the Biological Research Institute of Johns Hopkins University (*Biol. General.*, Bd. 7, 1931, p. 407). The maximum duration of life in the specimens which reached maturity ranged from 130 to 139 days, and the youngest mature individual died at 72 days old. In the latter case the number of eggs laid was 64, in the former the numbers varied from 427 to 693, but 725 eggs were laid by an individual which died at 126 days. It is probably true, nevertheless, that total egg-production is directly associated with duration of life and with limiting shell size, and that duration of life is inversely associated with maximum growth rate. Growth itself, as measured by aperture length, is orderly and regular, and can be represented by a logistic curve, another addition to the number of forms in which individual growth can be thus described. The evidence, although suggestive, is less definite regarding the relation between duration of life and limiting shell size, and between the size of a clutch of eggs and limiting shell size, both of which seem to be directly associated.

Diving Powers of the Pelagic Insect, *Halobates*.—*Halobates*, like some related fresh-water Hemiptera, skims upon the surface film, but whether it can break the surface and dive below, for example to avoid storms, has been in dispute. Dr. H. C. Delsman, contrary to the statements in the "Cambridge Natural History", wrote in 1926 (*Treubia*, vol. 8, p. 384), "*Halobates* cannot dive. When frightened it always takes recourse to rapid flight." Now G. M. Henry states that he has seen an Indian Ocean species, *H. flaviventris*, at close quarters while he was bathing, and that there can be no doubt that this species, at any rate, dives freely when disturbed, and reappears on the surface (*Spolia Zeylanica*, vol. 16, p. 353, March 1923). The actual dive was so quick that a *Halobates* scudding along before the observer appeared merely to vanish suddenly. Under water, however, the movements of the insect were impeded and it could be seen for a fraction of a second before it broke the surface-film on returning to the surface. It would be interesting to know by what means, since apparently they do not indulge in high diving, the insects are able to overcome the surface tension.

Californian Fisheries.—Recent researches in fisheries are embodied in three Bulletins (Nos. 28, 29, and 30) of the Division of Fish and Game of California. The first of these (28) is a most useful guide, entitled "Handbook of Common Commercial and Game Fishes of California", by Lionel A. Walford. This work, primarily intended for the use of those with little or no scientific knowledge, aims at establishing official common names of those Californian fishes which are handled commercially or are of special interest to fishermen or dealers. It was enacted in 1919 in a State law that "the Fish and Game Commission shall have the power to decide what is the common usage name of any variety". Thus the names given are official. We find here clear illustrations of anatomical terms, a key to the identification of certain fishes, and descriptions and illustrations of the fishes, each occupying a page, the figures being taken from excellent photographs. The common and scientific name, relationship, distinguishing characters, distribution, fishing season, importance, fishing gear are given in every case. Besides the true fishes some commercial invertebrates are also described. An appendix at the end includes a glossary of names of the fishing gear used in California, and notes on the meaning of

scientific names. The second bulletin (29) is on the "Striped Bass of California (*Roccus lineatus*)" by Eugene C. Scofield. This fish was only brought to California in 1879 from the Atlantic, and ten years after was already a commercial success. The report describes methods of fishing, life history, and details of the commercial catches. The third bulletin (30) is by the staff of the Bureau of Commercial Fisheries on the "Commercial Fish Catch of California for the Year 1929".

The *Discovery* Nebaliacea.—Before the *Discovery* Expedition collected in the South Atlantic seven specimens of *Nebaliopsis*, this genus was known from four specimens, one of which was merely named as "a new *Nebalia*" and was lost. The two original specimens were collected by the *Challenger* Expedition and another by the *Valdivia* Expedition. Of the seven *Discovery* specimens, six were crushed or fragmentary, but one was complete and undistorted. That this species lives at great depths is confirmed by the collection of one example at a depth of about 1½ miles. By studying the undistorted example, Prof. H. Graham Cannon (*Discovery Reports*, **3**, 199-222; 1931) has been able to ascertain the normal arrangement of the limbs and to deduce the mode of feeding. After describing the limbs and their movements, he remarks that the trunk limbs, which have a very thin cuticle, depend to a great extent on the blood-pressure for their turgidity, and differ markedly from the powerful swimming pleopods, which have an abundant musculature and a thick cuticle. The deduced movements of the trunk limbs would result in a forward current in the mid-ventral line, laden with food particles, which are retained by the setæ borne by the inner margins of the trunk limbs, from which they are scraped off and passed forwards by the mandibular palps to the mouth. *Nebaliopsis* is the most specialised of the Nebaliacea, and is regarded as having evolved from a planktonic *Nebalia*. One specimen of *Nebaliella extrema* was found by the *Discovery* in the Palmer Archipelago, and the examination of its trunk limbs shows that they are arranged as in *Nebalia* and have a corresponding setal armature. Epipodites are absent, but each of the proportionally larger exopodites has taken the place of the combined exopodite plus epipodite of *Nebalia*. Interesting observations on the rostrum and the eye-stalks—here thin scythe-like plates—suggest their function in ploughing through the mud and in guarding the anterior opening of the carapace against choking by mud as the animal pushes itself forward by the spinose third and fourth segments of the antennæ. Eight specimens of *Nebalia longicornis* were collected in South Georgia, the Falkland Islands, and near Simon's Town, South Africa.

Plant Immunity.—A very interesting point of view has stimulated the investigations of Dr. A. C. Leeman into plant immunity ("The Problem of Active Plant Immunity", by A. C. Leeman. *Zent. Bakteriologie*, Abt. II., Bd. 85, pp. 360-376; 1932). It is recognised that antibody production and related phenomena, as they are associated with the animal body, play no direct part in the immunity of a plant. But the author has shown that certain extracts and organic substances play a considerable part in stimulating the resistance of a plant to attack by a fungus disease. The substances, when added to the soil, are harmless to the parasite, but become detrimental when taken into a plant and incorporated with its protoplasm. Secretions and extracts of micro-organisms, and various enzymes, have been found to reduce the damage caused by the parasitic fungus *Helminthosporium sativum*. The interaction of micro-organisms has also been studied as a means of disease control.

X-Ray Standards.—The preliminary report on the comparison of the X-ray standards of the United States, Great Britain, Germany, and France made by Dr. L. S. Taylor of the Bureau of Standards to the Third International Congress on Radiology in July has been issued in full (*J. Research*, January). The comparisons were made by means of a portable guarded field ionisation chamber taken to each laboratory. The agreement between the standards is much better than is required for present-day practice. The joint recommendations of the Bureau of Standards, the National Physical Laboratory, the Reichsanstalt, and the Hôpital St. Antoine as to the open-air ionisation chambers to be used in standardisation are given in full, and include the use of a focal spot less than 0·8 cm. in diameter, the shielding of the ionisation chamber from all radiation except that from the face of the target, the use of an aperture of the ionisation chamber not much smaller than 0·8 cm. diameter, with the collector electrode as near as possible to the aperture, and the measurement of the current by a null method if possible.

Photoelectric Cells.—An article by C. J. Smithells, of the General Electric Co. (*Chemistry and Industry*, May 20), gives an account of the applications of photoelectric cells in chemical engineering, and incidentally of the modern types of such cells. There are four main types, namely, the selenium cell (with which may be classed the more modern thalofide cell, in which thallium oxysulphide is the light-sensitive material), the alkali metal cell, the copper oxide rectifier, and the electrolytic cell. The selenium and thalofide cells, which have the greatest sensitivity but are not suited for accurate measurement, depend on the decrease in ohmic resistance of the material on exposure to light. The alkali metal cell has a cathode plate covered with alkali metal, from which electrons are emitted on exposure to light, the current being proportional to the amount of light. The copper oxide rectifier consists of a layer of cuprous oxide on copper, and if a gauze is placed on the oxide layer, a current will flow between the gauze and the copper when light falls on the oxide through the gauze. No external e.m.f. need be applied. A similar effect is obtained with selenium on lead. This is the basis of the German Sperrschicht cell. The electrolytic cells make use of the Becquerel effect, the development of an e.m.f. by substances such as cuprous oxide in a solution of potassium sulphate on illumination, a current flowing between this electrode and another one, for example, platinum, in the solution. The advantages and disadvantages of all these types of cell are discussed, and their uses explained, in the article. The very small currents from the cells are amplified by means of thermionic valves, and with this type of apparatus the alkali metal photoelectric cell is most suitable. An even better arrangement than a thermionic valve and relay is a gas-filled relay, sometimes called a thyratron.

Internal Perturbations in Atoms.—A paper has been published by A. G. Shenstone and H. N. Russell in the first February number of the *Physical Review*, on perturbed series in line spectra, which may lead to a rapid development of the analysis of some spectra which have hitherto proved intractable. It is based upon the idea of resonance in quantum mechanics. If an atom has two states of similar quantum properties, and comparable energy, these may affect each other in such a way that their separate identity partly fails, and they give rise to two states, each of which has an energy different from that which it would normally possess. A quantitative expression for this, not unlike an anomalous dispersion formula, was given two

years ago by R. M. Langer, and it is this which has now been applied to a large number of actual spectra. The perturbations are remarkably common, occurring in such well-known spectra as those of neutral calcium and neutral copper, and can now be detected readily by a graphical method which has been elaborated. In addition, where both of the interacting states have been wrongly included in a single series, this can be recognised; strictly speaking, it is not that one state is associated with one series and the second with another, but that each state belongs to both, but it is often convenient to make the admittedly rather arbitrary distinction. In the present paper, the spectra Ca I, Ba I, Hg I, Cu I, and Al II are discussed in some detail, and a number of corrections and additions are made to the older analyses of these.

Sal Alembroth.—In the *Festschrift für Georg Jacob zum siebzigsten Geburtstag*, Prof. J. Ruska has an article (pp. 234-240) on *Sal Alembroth*. This term is at present applied to a compound $HgCl_2.2NH_4Cl.H_2O$ (probably mixed with NH_4Cl), and has been used in the same sense since the end of the seventeenth century, if not earlier. In medieval times, however, the name appears to have been given to various other substances, for example, one made "ex septem herbarum succis", and there is little doubt that, like many other alchemical terms, it is a transcription of some Arabic name. Prof. Ruska considers the various possibilities that suggest themselves, and rejects the tempting etymology from the Greek ἄμβροτος, since this word is not found in Greek alchemy. The derivation from *al-mabrūk*, "the blessed", which on general grounds appears most likely, is rendered improbable by the fact that no particular compound in Arabic alchemy appears to have been known as *milḥ mabrūk*, sal benedictus. A last possibility is that *alembroth* is a mistranscription of *alṭabarzad*, a Persian word meaning scissile: such Persian terms, frequent in Muslim alchemical books, would often be unintelligible to a western translator, and would consequently be particularly liable to corruption.

Safety Glass.—Mr. J. Wilson, of the Triplex Glass Co., has given an interesting account (*J. Soc. Glass Tech.*, March 1932) of the history, manufacture, and testing of safety glass. The first successful safety glass, Triplex glass, was invented by Edouard Benedictus, although the underlying idea had been patented in 1905 by Wood. Practically all forms of laminated safety glass at present in commercial use consist of two sheets of glass with an interposed sheet of either celluloid or cellulose acetate. In the process used in making safety glass, the clean dry glass is first coated with an extremely thin film of gelatin and re-dried, although some makers omit the gelatin treatment. The glasses and celluloid or cellulose acetate sheet are then assembled, either by vacuum treatment in bags, the lamination being completed by hot water under pressure on the outside of the bag, or else by the use of an inert assembly liquid sprayed over the plates, followed by rolling and pressing, the latter being accomplished in autoclaves in the modern process. The edges are then usually sealed by removing a short strip of the celluloid round the edge and filling with hot bitumen. The glass is subjected to tests: for brittleness and adhesion by dropping a weight on a test piece, for blisters and bubbles by boiling with water, for efficiency of sealing by exposure to moist air, and for discoloration by exposure to ultra-violet light. No commercial safety glass is absolutely fast to light, but the best acetate glasses are better in this respect than the best nitrate glasses. Polymerised resins, such as polyacrylic acid esters, seem to offer advantages over celluloid or cellulose acetate, as they are fast to light and do not require sealing at the edges, although at present there are manufacturing difficulties in their use.

Astronomical Topics

The Lunar Bright Rays.—Messrs. Buell and Stewart have carried out an interesting experiment to test a theory of the nature of the systems of bright rays that surround many lunar craters (*Pop. Ast.*, May). It is well known that the rays are best seen at full moon; this applies to all parts of the disc, both those where the sun is high and where it is low. The suggestion is made that they are conspicuous when the angle between the earth and sun as seen from the moon is small, for the reason that at such a time shadows on the moon are practically absent. The authors think that the rays are due to some whitish powder filling up the interstices between larger, darker lumps of matter. At full moon we receive the full light from the powder, but at other times a large proportion of the powder is in the shadow of the lumps.

An artificial surface was prepared by crushing basalt into large granules, and pouring finely powdered basalt into the interstices; the powder appears much whiter than the granules. The surface was photographed at different angles of light-incidence, and it was found that a close correspondence existed between the results and the phenomena of the lunar rays. The authors' explanation of the rays is that large lumps of basalt (or some similar substance) were expelled from the craters, either by volcanic explosion or meteoric impact, and that the shock of striking the ground caused portions of these lumps to be pulverised, the powder filling the interstices between the lumps. The theory seems well worthy of consideration as a possible explanation of the perplexing phenomena presented by the rays.

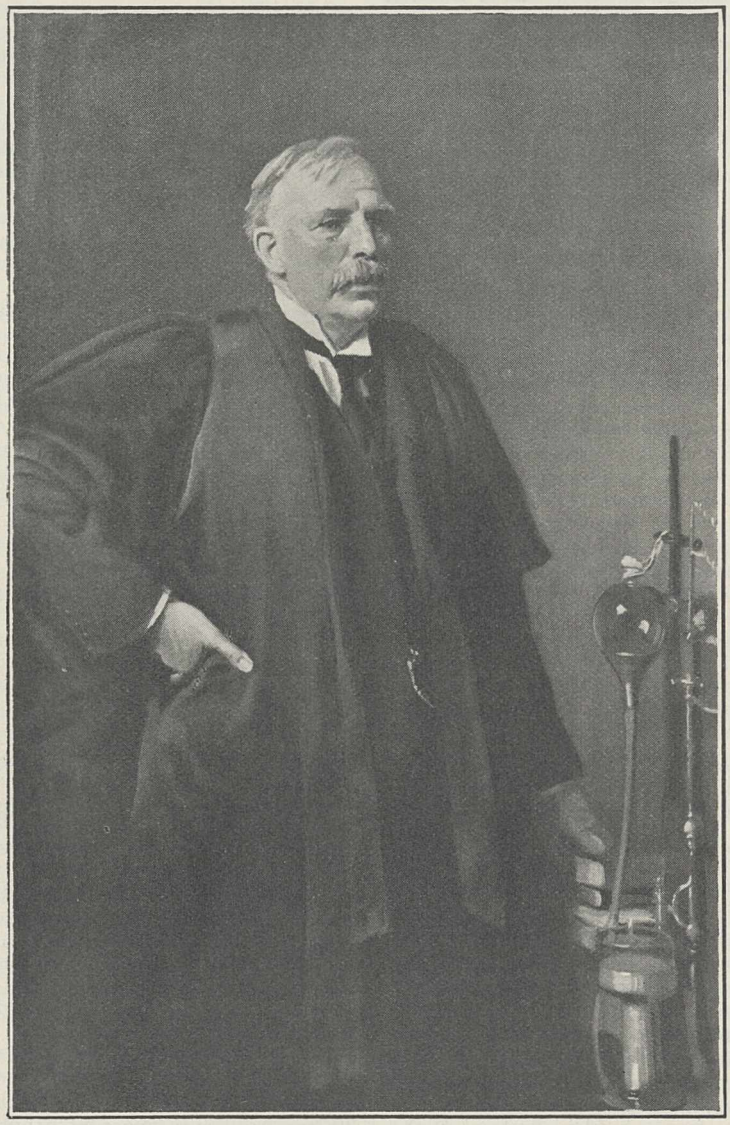
Spectrum of XX Ophiuchi.—The spectrum of this 'iron star' is of very unusual character and shows, in addition, remarkable variations. It is described in detail by P. W. Merrill (*Astrophys. J.*, **75**, 133), who studied it during the years 1921–1931 with the Mount Wilson 100-inch reflector. The star is classed at Harvard as *Bep*, but at the beginning of the above period it was marked by strong, sharp emission lines of H and Fe II, to which were added in 1925 numerous wide displaced absorption lines. The lines of Ti II were prominent amongst the latter, and all showed variations of intensity, width, and displacement. The mean displacement of the bright H lines differed by 30 km./sec. from those of other lines. Another interesting feature is that although the star is a variable (of the *R* Coronæ type), many considerable changes in spectrum occurred during a period of constant brightness, whereas a change of one magnitude in the brightness was accompanied by no appreciable change of spectrum. Some analogies to the spectra of novæ suggest a tentative explanation based on a modification of Halm's hypothesis of an expanding shell surrounding the star. The author suggests that the narrow bright lines and wide absorption lines (exactly the reverse of the conditions found in novæ) may be explained by assuming a thin shell close to the photosphere, in which a large area would give rise to the absorption spectrum and only a fraction at each limb would cause the emission lines.

Presidents of the Royal Society and their Portraits

A PORTRAIT of Lord Rutherford, who was president of the Royal Society for the five-year term 1925–30, was formally handed over on June 9, on behalf of subscribers, to the keeping of the Society for inclusion in its portrait collection of those fellows who have occupied the presidential chair. The present example is by that facile and distinguished artist, Mr. Oswald Birley. As is generally known, Lord Rutherford was born at Nelson, New Zealand; Mr. Birley was born at Auckland, New Zealand, while both are alumni of Trinity College, Cambridge.

There is a number of such portraits of past presidents in the possession and care of the Royal Society. Unfortunately, the list is not a complete one. Regrettable gaps occur both early and late in the Society's history, but during the last half-century there has been a movement in favour of obtaining portraits of all presidents.

In the olden days a spacious canvas depicted the face, attitude, and figure of the subject through the whole-length or three-quarter mode, a representation which, to be venturesome and paraphrase Carlyle, was what a "faithful human creature" saw of a face and figure "with *his* eyes, and which I can never see with *mine*". Modern practice prefers, for various and doubtless satisfactory reasons, a smaller canvas. This involves, however, some monotony of presentation, taken together.



LORD RUTHERFORD OF NELSON. From the portrait by Mr. Oswald Birley.

In those olden days alluded to, many of the portraits had divers places of abode; some were at Gresham College, in the City, thence to Crane Court, thence to Somerset House, migrating westward later on. Moreover, in those times personal gift by the president was generally observed. Lord Brouncker, the first president, who was in office for fifteen years, worthily began in this way. It may be hoped that at some future date a descriptive catalogue of all the portraits will be issued, supplementary to the present lists of portraits, with their painters and donors.

We print below the names of past presidents of the Society, with notes on some of them which are of interest in the present connexion, and with the name of the artist and donor in brackets, where portraits are in the possession of the Royal Society.

Viscount Brouncker (1662–77). There is a portrait of him in the National Gallery. It was Brouncker who signed a licence for the issue of Malpighi's "History of the Silke Worme" (1669). (Sir Peter Lely—president.)

Sir Joseph Williamson (1677–1680). Queen's College, Oxford, has a three-quarters length portrait; Williamson was educated there and was a considerable benefactor of the College. (Sir Godfrey Kneller—president.)

Sir Christopher Wren (1680–82). (Sir Godfrey Kneller — Stephen Wren.)

Sir John Hoskyns (1682–83). No portrait. Long on the council, with Wilkins, Evelyn, and Moray, amongst others. There is a three-quarters portrait of him at Corpus Christi College, Cambridge, in the ownership of a descendant.

Sir Cyril Wyche (1683–84). No portrait.

Samuel Pepys (1684–86). The "Principia" was ordered to be printed on Pepys' *imprimatur*. (Sir Godfrey Kneller—president.)

Earl of Carbery (1686–89). No portrait.

Earl of Pembroke (1689–90). No portrait.

Sir Robert Southwell (1690–95). (Sir Godfrey Kneller—president.)

Charles Montagu (afterwards Earl of Halifax) (1695–1698). No portrait.

Lord Chancellor Somers (1698–1703); painted in judicial robes of office. (Sir Godfrey Kneller—Sir Joseph Jekyll.)

Sir Isaac Newton (1703–27). The Society possesses three portraits. The chief is that by J. Vanderbank, painted in 1726, which hangs in the meeting room over the presidential chair, and was presented by Mr. C. B. Vignoles in 1841. Like the Vanderbank

in the National Gallery, the subject is depicted seated. Newton himself presented a portrait in 1717, by Charles Jervas, sometime a pupil of Kneller. [For the third portrait see below, Martin Folkes.]

Sir Hans Sloane (1727–41). (Sir Godfrey Kneller—Sir Hans Sloane, 1716, after the close of his secretaryship.)

Martin Folkes (1741–52). In addition to his own portrait, Folkes gave the Society a choice portrait of Francis Bacon; also one of Newton, signed by Vanderbank. Folkes was also finely delineated by Thomas Hudson, almost whole-length, seated in the presidential chair, the mace in the picture. This portrait is not at the Royal Society. (William Hogarth—president.)

Earl of Macclesfield (1752–64). (Thomas Hudson—president.)

Earl of Morton (1764 to Oct. 12, 1768). No portrait.

Sir James Burrow (Oct. 27, 1768, to Nov. 30, 1768, and July 2, 1772–Nov. 30, 1772). This fine portrait shows him three-quarters length, in velvet surtout, with neckcloth, seated near a table, on which the left arm is resting. (J. B. Van Loo—president.)

James West (1768–July 2, 1772). No portrait.

Sir John Pringle (1772–78); the "Father of Military Hygiene". (Sir Joshua Reynolds—president.)

Sir Joseph Banks (1778–June 19, 1820). Almost whole-length, seated in the presidential chair, in full panoply of the insignia of the Order of the Bath, with the mace and a silver-gilt inkstand, showing upright quills. Probably the portrait of him in the British Museum, by Sir Thomas Lawrence, would receive preference, where the accessories are not so oppressively obvious in the scheme. (Thomas Phillips—executors of Don José de Mendoza Rios.)

W. H. Wollaston (June 29, 1820–Nov. 30, 1820); one of the seventeen children of a clergyman. (J. Jackson—president's family.)

Sir Humphry Davy (1820–27); almost whole-length, standing, facing spectator. (Sir Thomas Lawrence—Lady Davy, in 1829.)

Davies Gilbert (1827–30). (Thomas Phillips—president.)

H.R.H. the Duke of Sussex (1830–38). During his tenure of office he constantly presided at meetings of the Council and Society. (Thomas Phillips—president.)

Marquess of Northampton (1838–48). (Thomas Phillips—president.)

Earl of Rosse (1848–54). (J. Catterson Smith—president, in 1860.)

Lord Wrottesley (1854–58). No portrait.

Sir Benjamin C. Brodie (1858–61); like Wollaston, Brodie was one of the seventeen children of a clergyman. (After G. F. Watts—Sir B. Brodie, in 1873.)

General Sir E. Sabine (1861–71). (Stephen Pearce—Mrs. Sabine.)

Sir George Airy (1871–73). No portrait.

Sir Joseph Hooker (1873–78). (Hon. John Collier—subscribers, 1881.)

William Spottiswoode (1878–June 27, 1883). (Hon. John Collier—subscribers, 1885.)

Thomas H. Huxley (July 5, 1883–85). No portrait.

Sir Gabriel Stokes (1885–90). (Hubert von Herkomer—subscribers, 1891.)

Lord Kelvin (1890–95); almost whole-figure, and seated in a characteristic attitude, familiar to contemporaries. (Sir W. Q. Orchardson—subscribers, 1899.)

Lord Lister (1895–1900). Almost whole-figure. Mr. Ouless painted the masterly portrait of Darwin, etched by Paul Rajon. (Mr. W. W. Ouless (copy)—purchased.)

Sir William Huggins (1900–5); depicted seated in presidential chair. (Hon. John Collier—subscribers, 1905.)

Lord Rayleigh (1905–8). Almost whole-figure, seated. As in the portrait of Lord Kelvin, the attitude is characteristic, and familiar to his contemporaries. (Sir George Reid—subscribers, 1903.)

Sir Archibald Geikie (1908–13). (Mr. Reginald Eve—subscribers, 1914.)

Sir William Crookes (1913–15). (Mr. E. A. Walton—subscribers.)

Sir J. J. Thomson (1915–20). (Mr. G. Fiddes Watt—subscribers, 1922.)

Sir Charles Sherrington (1920–25). Mr. Reginald Eve—subscribers, 1928.)

Lord Rutherford of Nelson (1925–30). Three-quarters length, in academical robes, standing; right hand on hip, left hand resting on books below, near radium emanation apparatus. (Mr. Oswald Birley—subscribers.)

The Film in National Life

THE report of the inquiry conducted by the Commission on Educational and Cultural Films has just been issued under this title. It makes a substantial book of 204 pages, and is published at the very low price of 1*s.* net (London: George Allen and Unwin, Ltd.). The Commission was set up in 1929 as a result of a conference representing some hundred educational and scientific organisations. Its field of study included methods of improving films and extending their use for educational and cultural purposes; raising the standard of public appreciation of films; and establishing a permanent central organisation for such purposes. The Commission has since received influential support, and four interim reports have been issued. Its final recommendation is "That a National Film Institute be set up in Great Britain, financed in part by public funds and incorporated under Royal Charter". It is pointed out that the chief countries of the world all possess such organisations, which vary in scope, but in no cases are concerned with censorship. An important place is assigned to the film in national life in Austria, Germany, Italy, Japan, Russia, and the United States.

The magnitude of the film industry needs no comment. It is estimated that there are in the world more than 60,000 cinema theatres, about half of which are wired for sound. About 85,000 people are employed by the State in the cinema industry in the U.S.S.R. alone, where the film doubtless serves as an exceedingly powerful instrument for influencing public opinion.

Films have already proved their value in medicine, in nature study and botany, in technical education, and in demonstrating industrial processes. Their application for conveying instruction on agricultural matters is specially noteworthy. Thus in the United States, films of this nature have been shown to more than twenty million farmers, and it is estimated that in Italy five to six million people saw the film entitled "The Wheat Campaign", prepared by the National Film Institute, Luce. The inestimable value of the film for recording history is evident. The official War films illustrated possibilities in this direction. Films have likewise been used in connexion with mountaineering adventures, for the study of racial subjects, and in the photomicrographic form for revealing physiological processes and for studying the growth of plant life.

At present, however, such records are made in a somewhat haphazard manner. There is no deliberate effort to collect representative records of the present age, and as yet no permanent centre where such records could be stored. The 'film library', in fact, is in its infancy. Problems of storage and the whole technique of such a library have received little study. Research has revealed that in the case of negative films taken twenty years ago, the celluloid base is gradually disintegrating. It appears that an acetate base is more stable, and positives on such a base are being made as a stand-by. Evidently this question of the permanence of films of national value is one of great importance, on which further research is needed.

A considerable portion of the report is devoted to the use of films as an educational medium in schools. The film, as a means of instruction, has certain definite advantages over oral methods. It acts as a stimulant, sharpens the critical faculty, and widens the mental horizon, and may be applied to develop dissatisfaction with the inferior and the commonplace. The quality of recollection is more vivid and the impression more lasting than when facts have been presented orally.

It is suggested that films can be applied in three chief ways: (1) in the classroom for teaching, (2) for occasional demonstrations in the school hall on subjects of general interest, and (3) in public cinema theatres, where films making a special appeal to children should be exhibited. Even in such a poor country as Austria, the use of central cinema halls, to which neighbouring schools can send contingents of children, has been developed. Another device, familiar in Italy and Russia, with which experiments have been made in England, is the travelling van.

The great difficulty is that there is at present no machinery for providing contact between university and school staffs and the producer. Many teachers are anxious to obtain educational films, and there are firms willing to make a speciality of producing them; but firms are unwilling to enter upon production without a certainty of a market, and educational authorities are reluctant, even when funds are available, to expend money in this direction without full knowledge that the film will be really suitable for their purpose.

The report contains some data on the cost of production. A feature film, as shown publicly, may cost at least £2000 a week to make and at least £3 a foot in its final form. An educational sound film might cost between 10*s*. and 30*s*. a foot, so that a reel of 1000 ft. would cost £500-£1500. The production of such a film demands means of linking the expert skill of the producer and technician with the professional knowledge of the specialist and the teacher.

As regards size of film, it is believed that the 9 mm. type is only suitable for the private cinema and for research. It is expedient to aim at the use of the 16 mm. standard for classrooms (giving a picture 5 ft. × 6 ft. or 3 ft. × 4 ft.), and the full size (35 mm.) for halls when films of general interest are shown. In an appendix to the report there is a useful list of projectors, accompanied by particulars of price, pressure, wattage and price of lamps, and other data. Of the types recommended for general educational use, the 16 mm. projector costs from £15 to £80 and the 35 mm. from £60 to £150. The latter figure would probably have to be multiplied by four if sound production apparatus were included.

The proposed National Film Institute should serve as a positive agency to encourage valuable and good films rather than discourage bad ones. Government recognition appears essential, but the Institute might be either a Government department or institute or an incorporated institute, or a combination of both. Its functions would include acting as a national clearing-house for information and research; assisting in the preparation of film records and serving as a national repository of films of permanent value; the stimulation of public opinion to demand good films; giving advice to teachers and instructors who need films in connexion with their work; acting as a means of liaison with trade, producers, experts, cultural interests, and educators; and encouraging research. Although the present time, when demands for economy are so imperative, is scarcely opportune for advocating the formation of a National Film Institute, it is felt that ultimately the nation would receive a more than adequate return for the expenditure involved.

Jeremy Bentham, Philosopher and Social Engineer

THE centenary of the death of Jeremy Bentham was commemorated on June 6, at University College, London, when a public lecture was delivered by Mr. C. K. Ogden on Bentham's work.

Mr. Ogden dwelt chiefly on those aspects of Bentham's work which, in his opinion, will claim the attention of future generations. His influence on the past and his message for the present were based upon his profound analysis of the symbolic factor in every branch of human activity. Bentham's exposure of word magic was motivated partly by reflections on the fear of ghosts which dominated his childhood, and partly by a dislike of legal fictions generated by Blackstone's lectures at Oxford. It was not until after his sixtieth year, however, that he embarked on the systematic development of his theory of fictions, which anticipated Vaihinger's "Philosophie des Als Ob", as well as the modern formalistic account of mathematics. It enabled him to provide a 'technological' account of language, such as modern science demands.

Bentham's most original contribution consisted in the elaboration of a technique of 'archetypation' by means of which the fictions of physics and psychology could be translated into the basic pointing symbols, which are the archetypes of all metaphor, all fictions, and all abbreviations. He himself explicitly described his social and legal theories, which had so profound an effect upon the history of the nineteenth century, as applications of the principles of experimental science in the field of economics and government. From this same point of view he championed the cause of the inventor and of technical education. His younger brother, Sir Samuel Bentham, the famous marine engineer, and his nephew, George Bentham, one of the founders of systematic botany, were as much his disciples as Ricardo and Jevons in economics or Southwood Smith and Chadwick in matters of public health.

According to Bentham, all language, all symbolic forms, must be interpreted in an *operational* context. Some words point at things as the hands of a clock point at the hours; others, such as 'right', 'faculty', 'motion', 'redness', or 'of', are like single parts or accessories of a clock. They may help us to do the pointing; but any such part taken in isolation is no more than an intriguing piece of metal about which any number of conflicting theories may be held. Put it back in its place, where it helps to perform some operation, and it can be treated functionally. Above all, we can see what substitutes are possible, either for any particular part or for any portion which operates as a unit.

By neglecting the implications of the technological analysis, philosophy has become, almost entirely, the unjustifiable exploitation of the metaphorical, the fictional, and the elliptical. Bentham's method of archetypation, as shown by Prof. S. M. Buchanan's recent study, " Symbolic Distance ", does all that the logico-analytical theory of 'incomplete symbols' can do, without resort to logical or mathematical jargon at any point.

Bentham's interest in re-formulation found expression in his powerful advocacy of codification, a word which, like 'international', 'maximise', 'minimise', etc., he himself introduced. But the most significant application of Benthamic principles is in connexion with the problem of a universal (auxiliary) language.

Mr. Ogden explained how, by developing certain suggestions put forward by Bentham, he had succeeded in formulating a system whereby 850 English words could be used to take the place of a normal vocabulary of 20,000, for all the purposes of everyday life, general talk, news, trade, and science. To the eye and ear this system, known as 'Basic English', is scarcely distinguishable from standard English; indeed, for some five minutes, Mr. Ogden made use only of 'Basic English', a fact of which the audience was unaware until they were informed of it.

Mr. Ogden concluded with a plea for a more careful study of Bentham's neglected manuscripts and of the symbolic material printed in his posthumous works. It was Talleyrand who said of Bentham, " Though all the world has stolen from him, he is still rich "; and to the inventor and experimenter of the future he may well appear as the founder of a new science, which might be appropriately christened 'Orthology'—the systematic analysis and ordering of symbols at the level of ordinary communication.

Calendar of Geographical Exploration

June 19, 1908.—Northern Arabia

Alois Musil arrived at Damascus, whence he made surveying expeditions and reached Resafe, 12 miles from the Euphrates, the most northerly point which he visited. Resafe is of great interest because of its ruined churches and palaces and its Greek, Aramaic, and Arabic inscriptions. By several journeys Musil made a plane table survey of the whole region. He made other journeys in face of great difficulties; his work resulted in the preparation of a map of northern Arabia, including the district from 37° to 44° E. long. and from 36° to 27° N. lat. Important additions to the map of Arabia Petræa were made, and much new knowledge of the ethnography, linguistics, and natural history of northern Arabia was gained.

June 21, 1764.—The Falkland Islands

Commodore John Byron, who had taken part twenty-five years before in Anson's circumnavigation, sailed from the Downs to look for islands or lands between the Cape of Good Hope and the Strait of Magellan. His voyage was the first of a series which widened the knowledge of the Pacific. Byron reached the Falkland Islands and took possession of them for King George III., though a French colony had been settled there in the previous year by Bougainville. The islands were discovered by John Davis in 1592 and known as John Davis's South Land. In 1690, John Strong discovered the strait between the two main islands and named it Falkland Sound, the name Falkland being transferred to the whole group by Byron. Byron then discovered the Islands of Disappointment to the north of the Low Archipelago, King George's Island, and Nukunau or Byron Island in the Gilbert group, ultimately reaching England in 1766.

June 21, 1882.—Alexandra Land

B. Leigh Smith, who had previously made three journeys to Spitsbergen, set off with his party to try to reach some vessels off Novaya Zemlya. Leigh Smith had set out in the *Eira*, a steam yacht, in 1880, had sailed along the south side of Franz Josef Land to the west, and had discovered 110 miles of coastline of a new island named Alexandra Land. In 1881, Leigh Smith sailed again for Franz Josef Land, but the vessel was caught in the ice and sank. The party built a hut and wintered on the shore, setting off in boats on the date given above. They were met by the *Willem Barents*, a Dutch vessel which made annual polar explorations for many years.

June 22, 1878.—Voyage of the *Vega*

A. E. Nordenskiöld left Karlskrona in the *Vega* for his famous voyage round Asia and Europe. The *Vega* sailed through the polar seas off northern Siberia and passed through Bering Strait, " thus after the lapse of 336 years [since Willoughby's voyage] and when most men experienced in navigation had declared the undertaking impossible, was the north-east passage achieved ". Nordenskiöld had previously reached the mouth of the Yenisei in 1875 in a walrus-hunting sloop, the *Proeven*, and again in a steamer, the *Ymer*, in 1876. His preparations for the voyage of 1878 were very thorough and included a study of the records of previous travellers in various regions of northern Siberia, chiefly from the point of view of the condition of the ice and the direction of the wind at various dates in different years. The *Lena*, which had accompanied the *Vega*, parted from it at the delta of the Lena River about Aug. 27-28 and steamed to Yakutsk, the first vessel from the northern ocean to reach the heart of Siberia. The *Vega* proceeded eastwards to 67° 4′ N. and 173° 23′ W., when she was shut in by ice on Sept. 29, and the party had to spend the winter there. The diet had been carefully thought out and the health of the party remained good, no case of scurvy occurring, nor was there any case of serious frostbite. Meteorological observations were taken every four hours up to Nov. 1, after that date every hour up to April 1, and then again every four hours. Friendly relations were established with the Chukchi, and during the 10 months' winter much useful ethnographical and linguistic information was collected. The *Vega* sailed on July 18 from its winter home and sighted East Cape (now Cape Dezhnev) on July 20. Data about the Eskimo at Port Clarence were collected, a survey of Bering Strait was made, Bering Island was visited and described, and attempts were made to record the date of extinction of Steller's sea cow (*Rhytina Stelleri*, Cuvier), which was abundant on the island when Bering and Steller were wrecked there. The *Vega* then proceeded to Japan, and afterwards returned to Europe via Ceylon, Aden, and the Suez Canal. The voyage was remarkable for the care with which it was organised, and for the masses of scientific data collected by the distinguished group who accompanied Nordenskiöld, as well as for its pioneer geographical character.

June 24, 1339.—An Early Traveller to China and the East

John Marignolli, a Florentine missionary, left Kaffa, whence he went overland to Kulja and Peking. He stayed four years in China, returning by sea. He describes southern China, gives glowing accounts of the beauties of Ceylon, and mentions Ormuz as a great market town. His descriptions of his overland journey

from the Gulf of Persia to the Mediterranean are full of interesting detail. His narrative is a significant commentary on the ideas of the geography of the world current at that time. From his time onwards no traveller from western Europe passed along the land route to China for two hundred and fifty years.

June 24, 1914.—The Vilkitski Islands

The Russian explorer, B. A. Vilkitski, started on a voyage in the arctic to survey some previously discovered islands north-west of Cape Chelyushkin. Between 1912 and 1915, Vilkitski accurately charted much of the Siberian arctic coast, made valuable oceanographical observations, discovered Nicholas Land (Northern Land) and two small islands north-west of Cape Chelyushkin, partial surveys of which were carried out in 1914. Bennett Island was also explored, and Jokhov and Vilkitski Islands to the south of it were discovered. The voyage disposed of some erroneous theories about the coast.

Societies and Academies

LONDON

Royal Society, June 9.—**William A. Bone**: The combustion of hydrocarbons (with experiments) (Bakerian lecture). The principal researches and theories concerning the chemical mechanism of hydrocarbon combustion, from the time of John Dalton until now, are reviewed and discussed in three sections, namely: (1) nineteenth century discoveries, showing how the successive theories of preferential combustion, whether of hydrogen or carbon, failed; (2) development of the 'hydroxylation' theory (1900–15), together with the relevant experimental evidence from both slow and explosive combustion supporting it; and (3) recent developments—'hydroxylation' *v.* 'peroxidation', in which the two theories are discussed in the light of both old and new experimental evidence.

EDINBURGH

Royal Society, May 2.—**L. Hogben, R. L. Worrall, and I. Zieve**: The genetic basis of alcaptonuria. Altogether 151 cases of alcaptonuria recorded in medical literature have been examined. The familiar incidence of the disease satisfies the quantitative requirements of the hypothesis that it is determined by a single autosomal recessive gene substitution. The incidence of consanguineous parentage is in agreement with this conclusion. There is an isolated pedigree in which the disease behaves as a dominant trait. —**J. A. Fraser Roberts**: The significance of familial incidence in relation to human disease. Studies on familial incidence in relation to human disease are rendered difficult because a random sample of the population can rarely be studied. On the other hand, it is relatively simple to investigate the immediate family history of affected persons. The same difficulty arises in the case of recessive Mendelian inheritance. Owing to the small size of the human family, heterozygotes will frequently have exclusively normal children and such families will not be included in the record. Statistical methods have been worked out for eliminating this difficulty. Precisely similar methods can be applied to the study of human disease in general, whether genetic or not. The only assumption involved is that the affected persons studied are a reasonable sample of such persons. The true familial incidence can be calculated for various groupings of the material and the result discussed in relation to the pathology of the condition and other relevant data.—**Hilary B. Moore**: The fæcal pellets of the Anomura. A new type of fæcal pellet is described, in which there is a system of longitudinal canals in the rod-shaped pellet. These cavities are produced by the solidification of semi-liquid food material round a series of bristle-like processes in the stomach, which are then withdrawn as the pellet proceeds down the gut. The canals in the pellet are arranged in a regular pattern peculiar to the species in question. This type of pellet appears to be peculiar to the Anomura, and appears both in the Galatheidea and the Thallassinidea, but not, apparently, in the Paguridea. In all, the pellets of eighteen species, from twelve different genera, are described. The structure of the pellets suggests that the stomach processes have an absorptive function, and serve greatly to increase the surface area of the gut in these mud and detritus-eating forms.—**Alex. R. Horne**: Graphical analysis of internal combustion engine indicator diagrams. The indicator diagram which is obtained from the engine records variations of pressure and volume only. The temperature changes, and consequently the fluctuations of internal energy, must be inferred from the values of pressure and volume, for neither of these quantities can be determined from direct experiment. The graphical methods described, when applied to the indicator diagram, make possible the construction of curves of temperature, internal energy, and work done throughout the complete cycle; while the intercepts of the ordinates between the curves of work and internal energy give the interchanges of heat between the working agent and its container. A graphical method of finding the instantaneous value of n in the law $pv^n = \text{constant}$ is also given. By its use the rate of heat reception or rejection on the part of the working agent with respect to the rate of change of volume can be simply deduced for any point, or series of points, in the cycle.—**W. G. Guthrie**: Pressure effects in the secondary spectrum of hydrogen. An experimental investigation on the secondary spectrum of hydrogen as affected by the pressure of the luminous gas. The spectrum obtained with pressures of 40-50 cm. is compared with that of the 'vacuum' tube, photographed under similar conditions. Tables of intensities are given for several hundred lines in the visible region.—**H. Zwarenstein and I. Schrire**: The adrenal gland of *Xenophus lævis*. This gland is essentially similar in distribution and structure to the adrenal of Urodeles. In addition, adrenal tissue occurs in the walls of the renal veins, inferior vena cava, aorta, and renal arteries, a condition similar to that found in some cyclostomes and fishes.—**L. M. Milne-Thomson**: The zeta function of Jacobi. The elliptic integral of the second kind and the complete elliptic integral of the third kind can be evaluated by means of Jacobi's zeta function. The present paper gives seven-decimal tables of $Z(u/m)$, $m = K^2$, with first and second differences at interval 0·01 for u and 0·1 for m.—**A. Blackwell**: The geodesics in Einstein's unified field theory. Using Einstein's 1930 equations for a unified field theory, the geodesics are worked out. In the special case of gravitation alone, these give the motion of perihelion of a planet as $\frac{1}{2}m^2/h^2$ and the deflexion of a light ray on grazing the sun as $2m/a$, whereas, in 1916, Einstein had $\frac{3m^2}{h^2}$ and $\frac{4m}{a}$ as the amounts required to account for the observed facts. The estimated shift of the spectrum lines is found to be the same as that given by the 1916 theory.

PARIS

Academy of Sciences, May 2.—**A. Lacroix**: Recent falls of meteorites in western Africa.—**L. Cayeux**: The existence of numerous quartz grains, of atmospheric origin, in the Ordovician in the neighbourhood of

Leningrad. The micrographic study of the sands and glauconitic limestones from the neighbourhood of Leningrad shows that, so far back as the Silurian period, the Baltic region was the seat of atmospheric movements strong enough to transport and round off sand grains. This confirms the earlier work of Nathorst, who found similar evidence in West Gothland.—**Charles Nicolle** and **L. Balozet**: Swine fever is transmissible to man in an invisible form. Man is susceptible to this virus but shows no visible symptom. Five days after inoculation the human blood injected into pigs gives swine fever.—**Ch. Porcher** and **Mlle. J. Brigando**: The condition of the lime and phosphoric acid in cow's milk. A discussion of previous work on the same subject by Piettre, with special reference to the effects of the addition of sodium citrate.—**Maurice Fréchet**: The convergence of probabilities *en chaine*.—**G. Cerf**: The integration of partial differential equations.—**Florin Vasilesco**: The normal derivatives of harmonic functions in the problem of Dirichlet.—**Pierre Humbert**: A generalisation of potential.—**Jacques Devisme**: Some partial differential equations.—**G. Valiron**: The directions of Borel of certain integral functions of infinite order.—**Constantin Woronetz**: Rolling without slipping of a solid body on a deformable surface.—**Davin**: The elastic and plastic state of an indefinite two-dimensional body pierced with a circular hole.—**J. Pérès** and **L. Malavard**: Drawing the lines of current in the Oseen flow round a circle.—**A. Buhl**: Multipoint movements corresponding to the Jacobi equation written for the case of a single point.—**Ph. Le Corbeiller**: Maintaining in oscillation the most general passive network.—**Maurice Curie**: Phosphorescent sulphides. The intervention of collisions of the second kind.—**D. Skobelzyn**: The degree of homogeneity of the filtered γ-rays of thorium-C″ and the verification of the formula of Klein-Nishina. A discussion of the possibility of obtaining a monochromatic radiation by filtration through lead.—**Mlle. Ellen Gleditsch** and **Ernst Foyn**: The determination of actinium in uranium minerals. Previous work on this has given somewhat discordant results, the difficulties being of a chemical order. The author gives full details of his method of separating and purifying the actinium and also protactinium, and gives results for brøggerite and Cornish pitchblende.—**L. Andrieux** and **D. Barbetti**: The alkaline borides. The alkaline borides have not been isolated, but from mixtures with the alkaline earth borides it is shown that their probable formulæ are NaB_6, KB_6, and LiB_6.—**Étienne Canals, Marcel Godchot**, and **Mlle. Germaine Cauquil**: The Raman spectra of some cyclic hydrocarbons. The Raman lines for ten hydrocarbons, ranging from cyclopropane to methylcyclooctane are given.—**Lemarchands** and **Sirot**: The determination of barium as chromate. Measurements of the solubility of barium chromate in water and in solutions of potassium chloride.—**P. Brauman** and **S. Takvorian**: A method of preparation of the anhydrous chlorides of the metals of the cerium earths. The dry benzoate of the metal is treated with ether and saturated with dry hydrogen chloride. The benzoic acid is removed by ether and the anhydrous chloride remains.—**G. Austerweil**: Some reactions between zeolites and slightly soluble salts.—**Albert Saint-Maxen**: The action of magnesium hydroxide on the oxidation of hydroquinone.—**André Kling** and **René Schmutz**: The action of dilute acids on phenyliminoquinonediazide.—**R. Cornubert** and **M. De Demo**: Contribution to the study of the dibenzylidene-cyclopentanones.—**Jean Lacoste**: The state of the pre-Riffian and Riffian tectonic problem: the possibilities of co-ordination.—**E. Chaput**: Geological observations in Asia Minor. The Fusulinideæ formations.—**Auguste Chevalier**: The quaternary sea of Timbuctoo.—**Henry Hubert**: The movements of the atmospheric air above Indo-China.—**G. A. Nadson** and **C. A. Stern**: The action at a distance of metals on bacteria and yeasts. Lead, copper, and aluminium, not in contact with the cultures, retard the development of bacteria and yeasts, the effect being greater as the atomic weight of the metal is higher.—**A. de Puymaly**: Observations and remarks on lichens.—**A. Jullien** and **G. Morin**: Cardiac automatism and metabolites in molluscs (*Murex trunculus*).—**C. Hervieux**: Jolles' reaction (indican) applied to milk. Reply to criticisms by Porcher and Tapernoux.—**Louis Fage**: The pelagic phase of coastal benthic Amphipods.—**Ph. Lasseur, P. Vernier, A. Dupaix**, and **J. Marchal**: Observations on the life of *B. caryocyaneus* in media containing lithium salts.—**A. W. Sellards** and **J. Laigret**: The vaccination of man against yellow fever. Experiments on an attenuated mouse virus prove that this virus, injected into man, produces an infection without symptoms, followed by immunity. It is concluded that the vaccination of man against yellow fever can be realised.

VIENNA

Academy of Sciences, Feb. 25.—**Otmar Eckel**: Radiation climate of the Kanzel Peak (Carinthia). On this peak, which is 1474 metres above sea-level, the total intensity of the solar radiation reaches 1 gm.-cal. per sq. cm. per minute for comparatively low elevations (below 20°) of the sun and, in the middle of the year, amounts to 1·41 at midday. The total radiation throughout the year, during which 2165 hours of sunshine are recorded, is among the highest observed in Central Europe. In comparison with the thermal radiation of the sun, the ultra-violet radiation of the sun and sky depends very largely on the height of the sun, the total solar ultra-violet radiation on a horizontal surface during a day in July being fifty times as great as on a January day.—**Karl Mayr**: Definite integrals and hypergeometric functions. New propositions concerning the zero positions of Bessel functions, representations of definite integrals by hypergeometric functions of high order, and relationships between the latter, are deduced.—**Ernst Späth** and **Otto Hromatka**: Dehydration of sapogenin; constitution and synthesis of sapotalin. Dehydration of the sapogenin of *Gypsophila* (alb-sapogenin) yields, besides sapotalin, a series of hydrocarbons of high boiling points. By a method of synthesis, sapotalin is shown to be 1 : 2 : 7-trimethylnaphthalene.—**Leopold Schmid** and **Rudolf Falke**: Action of sodium trityl on inulin in liquid ammonia. This reaction gives rise to parabenzhydryltetraphenylmethane in good yield.—**H. Wieseneder**: Petrographic-geological studies in the Lower Tauern Mountains.—**Emil Abel** and **O. Smetana**: The periodate potential. In relation to the normal hydrogen potential, the normal potential $IO_4' \rightarrow IO_3'$ is $1{\cdot}51 \pm 0{\cdot}01$ volt at 25°. The energy relationships for a number of periodate reactions are deduced.—**Kurt Godel**: The intuitionistic calculus of expression.

March 3.—**Leopold Schmid** and **Erwin Kotter**: Chemical investigation of *Verbascum* flowers. The pigment of these flowers is a glucoside of α-crocetin and is accompanied by a dibasic acid, $C_{14}H_{28}(CO_2H)_2$, which melts at 124° and has been isolated also from *Thapsia* root.—**Walter Knapp**: The action of *o*-phthalyl chloride on the methyl ethers of β-naphthol and of β-thionaphthol. In this action the phthalic acid residue enters at the 1-position of the naphthalene system and no formation of phthalide derivatives is observed. From the phthaloyl-acids further condensation products, containing a seven-membered ring, are formed.—**Gerhard Kirsch** and **Fritz Rieder**: Resonance positions of the beryllium nucleus.

Forthcoming Events

FRIDAY, JUNE 17

PHYSICAL SOCIETY (at Imperial College of Science and Technology), at 5.—Prof. Max Planck: The Concept of Causality in Physics (Guthrie Lecture).

ILLUMINATING ENGINEERING SOCIETY (Annual General Meeting) (at Royal Society of Arts), at 7.15.—Sir Francis Goodenough: Presidential Address.

MONDAY, JUNE 20

ROYAL GEOGRAPHICAL SOCIETY (Annual General Meeting), at 3.—Presidential Address, etc.

TUESDAY, JUNE 21

ROYAL SOCIETY OF MEDICINE, at 5.30.—General Meeting of Fellows.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—A. T. Hopwood: The Oldoway Expedition (Lecture).

BRITISH WATERWORKS ASSOCIATION (Annual General Meeting) (at Bournemouth) (*continued on June* 22 *to* 25).

THURSDAY, JUNE 23

ROYAL SOCIETY OF MEDICINE (Urology Section), at 5.30.—Sir John Thomson-Walker: Some Changes and Problems in Urology (Address).

SATURDAY, JUNE 25

ROYAL SOCIETY OF MEDICINE (Disease in Children Section) (Annual Provincial Meeting) (at Alton).

JOURNÉES MÉDICALES DE BRUXELLES (at Brussels) (*continued on June* 26 *to* 28).

TUESDAY, JUNE 28

NATIONAL PHYSICAL LABORATORY, TEDDINGTON, at 3.—Meeting of the General Board of the Laboratory.

Official Publications Received

BRITISH

The Reaseheath Review: a Journal of Cheshire Agriculture. Vol. 4. Pp. 88. (Nantwich: Cheshire School of Agriculture.) 2*s*.

The Hannah Dairy Research Institute. Bulletin No. 3: The Properties of Milk in relation to the Condensing and Drying of Whole Milk, Separated Milk, and Whey; a Review of Existing Knowledge. By Dr. L. A. Allen. Pp. 159. (Auchincruive.) 4*s*. 6*d*. net.

Seasonal Forecasting: Meteorology as a Branch of Astronomy: Proofs of Solar-Terrestrial Connection as a Factor in Seasonal Weather Forecasting; Presidential Address to the Queensland Astronomical Society, 8th July 1931, by the retiring President, Inigo Jones. Pp. 10. (Brisbane.)

Stonyhurst College Observatory. Results of Geophysical and Solar Observations, 1931; with Report and Notes by the Director, Rev. E. D. O'Connor. Pp. xix+46. (Blackburn.)

The Journal of the Royal Agricultural Society of England. Vol. 92. Pp. 8+448+clxxii+xii+14. (London: John Murray.) 15*s*.

Proceedings of the Royal Society of Edinburgh, Session 1931–1932. Vol. 52, Part 1: Calendar of Hume MSS. in the Possession of the Royal Society of Edinburgh. By J. Y. T. Greig and Harold Beynon. Pp. 138. 11*s*. 6*d*. Vol. 52, Part 3, No. 12: Isohedral and Isogonal Generalizations of the Regular Polyhedra. By Prof. D. M. Y. Somerville. Pp. 251-263. 1*s*. Vol. 52, Part 3, No. 13: The Genetic Basis of Alkaptonuria. By Prof. Lancelot Hogben, R. L. Worrall and I. Zieve. Pp. 264-295+6 plates. 4*s*. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.)

Harper Adams Agricultural College, Newport, Shropshire. Pp. 72. Advisory Report No. 7: Report of the Advisory Departments, 1931–1932. Pp. 30. (Newport.)

Transactions and Proceedings of the Royal Society of South Australia. Vol. 55. Edited by Prof. Walter Howchin, assisted by Arthur M. Lea. Pp. iii+210+8 plates. (Adelaide.)

The Lister Institute of Preventive Medicine. Report of the Governing Body, 1932. Pp. 27. (London: Lister Institute.)

The Royal Society for the Protection of Birds. Forty-first Annual Report (January 1st to December 31st, 1931) with Proceedings of Annual Meeting, 1932. Pp. 54. (London.)

Department of Scientific and Industrial Research. Building Science Abstracts. Vol. 5 (New Series), No. 4, April. Abstracts Nos. 576-746. Pp. 109-140. (London: H.M. Stationery Office.) 1*s*. net.

Empire Cotton Growing Corporation. Report of the Administrative Council of the Corporation submitted to the Eleventh Annual General Meeting on May 26th, 1932. Pp. ii+80. (London.)

Memoirs of the Cotton Research Station, Trinidad. Series A, Genetics, No. 3: (a) Reversal of Dominance in the Interspecific Cross G. Barbadense Linn. × G. Hirsutum Linn. and its bearing on Fisher's Theory of Dominance, by S. G. Harland; (b) The Inheritance of Chlorophyll Deficiency in New World Cottons, by S. G. Harland; (c) "Crumpled," a New Dominant in Asiatic Cottons produced by Complementary Factors, by J. B. Hutchinson. Pp. 31+3 plates. (London: Empire Cotton Growing Corporation.) 2*s*. 6*d*.

Journal and Proceedings of the Asiatic Society of Bengal. New Series, Vol. 25, 1929, No. 3. Pp. ccii. 5.14 rupees. New Series, Vol. 26, 1930, No. 1. Pp. 417. 10.2 rupees. (Calcutta.)

Commonwealth of Australia: Department of Defence. The Laboratories of the Munitions Supply Board. Pp. 20. (Melbourne: H. J. Green.)

The Journal of the Board of Greenkeeping Research. Vol. 2, No. 6, Spring 1932. Pp. 161-222+xxxvii. (Bingley: St. Ives Research Station.) 2*s*. 6*d*.

The Australian Journal of Experimental Biology and Medical Science. Vol. 9: The Robertson Memorial Volume. Edited by Sir Charles Martin and Hedley R. Marston. Pp. v+246. (Adelaide: The University.)

Bulletin of the Madras Government Museum. New Series, Natural History Section, Vol. 3, No. 2: The Hydromedusae of Madras. By M. G. K. Menon. Pp. 36+3 plates. (Madras: Government Press.) 1.2 rupees.

FOREIGN

Science Reports of the Tokyo Bunrika Daigaku, Section A. Nos. 18-19: Über die Reflexion des Diracschen Elektrons an einem Potentialanstieg, von Kwai Umeda; Estimation of Temperature of Exploded Aluminium Vapour by means of an AlH Emission Band, by Hideo Nagashima. Pp. 203-225+plate 13. 30 sen. Nos. 20-21: On the Zero-Points of a Limited Function, II, by Sôichi Kakeya; On the Star-shaped Representation of an Analytic Function, by Sôichi Kakeya. Pp. 227-240. 20 sen. (Tokyo: Maruzen Co., Ltd.)

U.S. Department of the Interior: Geological Survey. Water-Supply Paper 638-C: Outline of Methods for Estimating Ground-Water Supplies. By Oscar Edward Meinzer. (Contributions to the Hydrology of the United States, 1931.) Pp. ii+99-144. 10 cents. Water-Supply Paper 682: Surface Water Supply of the United States, 1929. Part 2: South Atlantic Slope and Eastern Gulf of Mexico Basins. Pp. vi+178. 10 cents. Water-Supply Paper 685: Surface Water Supply of the United States, 1929. Part 5: Hudson Bay and Upper Mississippi River Basins. Pp. v+147. 25 cents. Water-Supply Paper 686: Surface Water Supply of the United States, 1929. Part 6: Missouri River Basin. Pp. ix+290. 50 cents. Water-Supply Paper 699: Surface Water Supply of the United States, 1930. Part 4: St. Lawrence River Basin. Pp. v+125. 25 cents. Water-Supply Paper 703: Surface Water Supply of the United States, 1930. Part 8: Western Gulf of Mexico Basins. Pp. v+131. 25 cents. Water-Supply Paper 707: Surface Water Supply of the United States, 1930. Part 12: North Pacific Slope Drainage Basins. A: Pacific Slope Drainage Basins in Washington and Upper Columbia River Basin. Pp. vii+196. 35 cents. (Washington, D.C.: Government Printing Office.)

Svenska Linné-Sällskapets Årsskrift. Årgång 15, 1932. Pp. v+164. (Uppsala.)

Journal of the Faculty of Agriculture, Hokkaido Imperial University, Sapporo, Japan. Vol. 32, Part 3: Studies on the Effect of Fat-soluble Vitamin upon the Growth of some Parasitic Fungi. By Yoshihiko Tochinai and Mutsuo Terui. Pp. 71-107+2 plates. (Tokyo: Maruzen Co., Ltd.)

Sveriges Geologiska Undersökning. Ser. C, No. 373: De svenska högmossarnas geologi; deras bildningsbetingelser, utvecklingshistoria och utbredning jämte sambandet mellan högmossbildung och försumpning. Av Eric Granlund. Resümee: Die Geologie der schwedischen Hochmoore; ihre Bildungsbedingungen, Entwickelungsgeschichte und Verbreitung, sowie der Zusammenhang von Hochmoorbildung und Versumpfung. Pp. 193. 4.00 kr. Ser. C, No. 374: Über den sogenannten Eisenanthophyllit der Eulysite. Von N. Sundius. Pp. 8. 0.50 kr. (Stockholm: P. A. Norstedt and Söner.)

Bulletin of Yale University. Twenty-eighth Series, Supplement: Report of the Director of the Peabody Museum for the Academic Year 1930–1931. Pp. 30. (New Haven, Conn.)

Transactions of the Connecticut Academy of Arts and Sciences, Vol. 31. The Cephalopods of the Bighorn Formation of the Wind River Mountains of Wyoming. By A. K. Miller. Pp. 193-297+31 plates. (New Haven, Conn.) 2.75 dollars.

Bulletin of the Michigan College of Mining and Technology. New Series, Vol. 5, No. 3: Announcement of Courses, 1932–1933. Pp. 147. (Houghton, Mich.)

U.S. Department of the Interior: Geological Survey. Bulletin 832: The Crystal Cavities of the New Jersey Zeolite Region. By Waldemar T. Schaller. Pp. viii+90+32 plates. 45 cents. Bulletin 836-C: Surface Water Supply of Southeastern Alaska, 1909–1930. By Fred. F. Henshaw. (Mineral Resources of Alaska, 1930.) Pp. iv+137-218. 10 cents. Professional Paper 169: Geology and Ore Deposits of the Bonanza Mining District, Colorado. By W. S. Burbank. With a Section on History and Production, by Charles W. Henderson. Pp. ix+166+35 plates. 2 dollars. (Washington, D.C.: Government Printing Office.)

R. Osservatorio Astrofisico di Catania. L' attività del sole nell' anno 1931. Pp. 13. (Catania.)

Memoirs of the College of Science, Kyoto Imperial University. Series A, Vol. 14, No. 6, November 1931. Pp. 251-335. 1.80 yen. Series A, Vol. 15, No. 1, January. Pp. 42. 1.00 yen. Series A, Vol. 15, No. 2, March. Pp. 43-122. 1.80 yen. (Tokyo and Kyoto: Maruzen Co., Ltd.)

Scientific Papers of the Institute of Physical and Chemical Research. Nos. 359-365: Ultra-Violet Absorption Bands of Sodium Vapour, by Masamichi Kimura and Yôichi Uchida; On the Emission of Yellow-Red Band Spectrum of Sodium, by Masamichi Kimura and Yôichi Uchida; The Nature of Light Absorption by Crystals and an Optical Method of Determining the Heat of Sublimation, by Masamichi Kimura; Energy Levels of CdI_2 Molecule and the Relation between the Absorption Frequencies of the Substance in the States of Vapour and Crystal, by Masamichi Kimura; Absorption Spectra of certain Triatomic Molecules and their Dissociation Products, by Masamichi Kimura; The Absorption Spectra and certain Thermo-Chemical Constants of Lead Halides, by Masamichi Kimura and Yôichi Uchida; A Consideration of the Emission of the Auroral Green Light in the Night Sky, by Masamichi Kimura. Pp. 109-176. (Tôkyô: Iwanami Shoten.) 55 sen.

U.S. Department of Agriculture. Circular No. 221: The White-Pine Weevil. By H. J. MacAloney. Pp. 31. Farmers' Bulletin No. 1670: Hydrocyanic Acid Gas as a Fumigant for Destroying Household Insects. By E. A. Back and R. T. Cotton. Pp. ii+21. 5 cents. (Washington, D.C.: Government Printing Office.)