NATURE

SATURDAY, JULY 16, 1932

CONTENTS

Scientific Leadership in Industry

IN the absence of adequate leadership, science, whether in its broadest aspect or in its narrow technical sense, will never occupy its rightful place in industry. Industry in Great Britain has suffered too much in the past from administrators whose deficiency in regard to a scientific outlook has rendered them incapable of maintaining an adequate scientific staff or of accepting an adequate and sustained research programme as a fixed charge comparable with insurance, depreciation or obsolescence, and incorporating its results in industrial practice.

Not the least important part of the plan which science could evolve would be the provision made for training administrators and leaders for industry and for the State, who would be capable of assessing those scientific factors which are involved to-day in almost every industrial, political or social question of the first importance. Under modern conditions, technical and scientific training is a *sine qua non* of competent leadership whether in industry or in the State, and the absence of adequate planning on scientific lines to-day is largely the result of the dearth of administrators who possess a first-hand experience of scientific technique; this, again, is partly due to a by no means negligible policy of deliberately excluding the scientific worker as such from important administrative positions.

It is difficult to assess the responsibility of the absence of scientific leadership for many of the grave problems confronting society. Under the conditions of modern civilisation, the community in general and not industry alone is dependent upon pure and applied science for its continued progress and prosperity. Under the influence of modern scientific discoveries and their applications in many directions other than industry, the whole basis of society is rapidly becoming scientific, and to an increasing extent the problems which confront the national administrator, whether judiciary or executive, involve factors which require scientific knowledge for their solution.

The Industrial Parliament visualised by Capt. Harold Macmillan, M.P., is an indication of the extent to which the changed conditions of the modern State are bringing us to consider the desirability of re-orientating representation on the basis of functional groups in order to link up knowledge and power more effectively in the service of the State and the general interest. Few aspects of civil life, for example, illustrate more aptly the hiatus between knowledge

and action than the field of transport. Whether we consider road transport, the railways, shipping, or aviation, the facilities which exist to-day are the outcome of scientific discoveries and their application, and the problems they present to society are in the main due to the absence of scientific organisation and control, and consequent development along haphazard lines ruinously expensive to the community as a whole.

In spite of the warning given by the recent Royal Commission on Transport about the absence of vision in such matters and its demonstration of the way in which ignorance and prejudice can bind burdens on the backs of posterity, as with railway development last century, neither in respect of the electrification of suburban services nor in the diversion of heavy goods traffic from the road to rail have any adequate steps been taken to give effect to the recommendations of the Commission, although both these recommendations should encourage employment and the recovery of the railways from their difficult position. In the absence of a more scientific policy, it is still common for a heavy goods lorry to do damage to a road in a few hours amounting to several times the combined value of the lorry and its load.

In other fields we have a number of problems created by industrial wastes. River pollution is becoming increasingly serious as fresh areas of the country are industrialised or the scale of industry increases. The beet sugar industry and the dairying industry provide two recent examples and also illustrate the assistance which scientific research can give in preventing or minimising the nuisance.

Again, the introduction of oil fuel for steamships immediately created a problem of waste-fuel disposal, and the layman could not have been expected to predict the serious consequences to marine and bird life and to many of our coastal resorts of a policy of dumping waste oil at sea. As in problems of atmospheric pollution, the solution lies almost entirely in the application of scientific methods of prevention and control, and in securing support for a scientific policy designed for the general advantage.

These and numerous similar problems have arisen through society using the results of scientific discoveries unguided by scientific and unprejudiced investigation of their reactions on the life of the community. Many such problems need not have become acute had an elementary amount of such foresight and scientific investigation been exercised in the early stages of the development of scientific discoveries, before the creation of vested interests or the growth of those local prejudices which generally hinder so strongly the development of a rational plan.

There are other wide fields in which the contribution of the scientific worker to the welfare of society is equally important and essential. Notably this is true in regard to food supply, where science is responsible not merely for protecting society against adulteration and for securing the purity of all kinds of foodstuffs, but also for the introduction of fertilisers giving higher yields per acre, for breeding new varieties which enable the zone of profitable cultivation to be extended, and for improved agricultural machinery and methods of cultivating and draining the soil. In addition, scientific research is urgently needed not only in the development and application of new insecticides and fungicides for the prevention or control of diseases or pests in the field, but also to an increasing extent to protect the harvested crops from damage by insect life, fungi, or moulds during storage. The colossal losses caused by insects and moulds to such products as cocoa, tobacco, dried fruit, grain, etc., in storage are as yet largely unappreciated by the public in Great Britain, in spite of the importance of storage space to a country which is so largely dependent upon imported foodstuffs.

In another but related direction, scientific workers are conducting investigations into the changes which occur in fresh fruit, meat, and fish in low-temperature storage and transport which have already assisted in improving the market condition of fruit, in minimising wastage during long voyages from overseas, and in improving the handling and transport of white fish so that a larger proportion of the catch can now be landed and marketed fresh than was formerly possible in half the time. The importance of such work in establishing on a firm basis the struggling fishing industry of Great Britain is obvious, apart from its national and social aspect.

Investigations of this type, closely related as they are to the welfare of society, are frequently long-range investigations requiring close co-operation between a number of classes of scientific workers. Only administration capable of taking a long-range and scientific point of view is competent to secure the necessary continuity or co-ordination, and in few fields is definite planning more important. Problems of food production and preservation should be taken out of the arena of political prejudices and debate into an atmosphere of impartial scientific examination.

Bacteriological Laboratories and Methods

Medical Research Council. A System of Bacteriology in relation to Medicine. Vol. 9. By J. A. Arkwright, S. L. Baker, M. M. Barratt, S. P. Bedson, J. C. Broom, H. C. Brown, H. H. Dale, P. Fildes, A. Fleming, A. D. Gardner, A. T. Glenny, J. Gordon, F. C. Happold, E. Hindle, B. C. J. G. Knight, J. C. G. Ledingham, R. J. Ludford, J. McIntosh, J. W. McLeod, P. G. Marshall, E. G. D. Murray, L. W. Proger, Wilson Smith, R. H. Stoughton, R. L. Vollum, L. E. H. Whitby, S. S. Zilva. Pp. 364. (London: H.M. Stationery Office, 1931.) 21*s.* net.

THE final volume of this work will be a boon to laboratory workers, and we welcome this plan of collecting in one volume the important laboratory methods, and congratulate both the writers and the editors on the very judicial selection they have made of the almost innumerable methods and variation of methods which are now employed in different laboratories.

Chap. i., dealing with design of bacteriological laboratories, is full of valuable suggestions, but, to the majority of bacteriologists, the plans are what we might dream of, only to waken and find they are not in the world of reality for us, and perhaps even be glad of that. We think it would have been better to have chosen something simpler, so as to give us an idea of what would be efficient and yet within the region of possibility from the not over-burdened exchequers of most universities and medical schools. The same may be said of the animal houses in Chap. xviii.

Chaps. ii. and iii. are excellent; but on page 40 the heading "Van Gieson's Stain" is surely wrong. Only the latter part is Van Gieson, and this is clear from number 5 under "Method" on the same page.

In Chap. iii., good though it is, there is the tendency to over-elaboration and the recommendation of methods which, under ordinary conditions, are impossible of attainment. Thus on page 63, to get blood serum, we have to go to the slaughter-house, reflect the skin from the neck of the animal, and so on. We may have been unfortunate, but we have never met the slaughterman who will allow us to spend the necessary time on such an operation, and we think such precautions are unnecessary. In this chapter it would have been valuable to have given some indication of simple methods of preparing culture media—methods which might be used by men who are working in the tropics and to whom a laboratory is not available. The elaboration in this chapter makes difficult what can be easily undertaken in any ordinary kitchen.

Chap. iv. deals very clearly with the determination of hydrogen ion concentration, and Chaps. v., vi., and vii. give valuable hints, and all that is necessary, on special cultivation methods and the isolation of single bacterial cells.

Many of the points discussed in Chaps. viii. and ix. are not found in ordinary textbooks of bacteriology, and should prove of great value, especially to the less experienced workers; but even the more senior ones will find valuable hints which may bring about improvements in their own methods. Chap. x., on viruses, collects the work which has appeared in various journals. Chaps. xii. and xiii. contain matters of great interest, and are well written. Their practical application is perhaps somewhat limited at present, but this, in our opinion, does not detract from their value.

Dr. Fildes's experience in serological investigations, and that of Dr. Glenny on toxins and antitoxins, would lead one to expect chapters of very practical value, and this expectation will be realised by those who read their two valuable communications in Chaps. xiv. and xv. The same can be said of Chap. xvi., the joint work of McIntosh and Dale.

Chap. xvii. will be welcomed by all heads of laboratories. It contains an immense amount of information of practical value, and gives details about which we venture to say most of our workers are profoundly ignorant, and which should be known to all. The methods may be too elaborate to be carried out in a laboratory the staff of which is very limited, and the apparatus too expensive; but from the mass of information given it will be possible to obtain a great deal which will be applicable and which must prove very helpful.

In Chap. xviii., Dr. Arkwright has summed up very well the methods by which variants are produced, and this should clear up a good deal of confused work on this subject.

Vitamin deficiency, electric charges, and the effects of ultra-violet rays, are briefly dealt with in Chaps. xix., xx., and xxi.

In Chap. xxii. we have a description of the Rideal-Walker test and the Chick-Martin tests for estimating the power of disinfectants. The authors state that there are so many factors concerned in this testing that the value of the disinfectant can only be judged from experiments in which the precise conditions under which it is to be employed are closely followed. It seems to us rather a serious omission that no reference is made to the fact that an established coefficient for

B. typhosus may be entirely different from the co-efficient for another organism, for example, the streptococcus; or that one disinfectant useful for the destruction of certain bacteria is practically useless in the same dilution for others.

This volume contains the general index for the whole work. We welcome this index very much.

J. M. BEATTIE.

Theory of Algebraic Numbers

Foundations of the Theory of Algebraic Numbers. By Prof. Harris Hancock. Vol. 1: *Introduction to the General Theory.* (Published with the aid of the Charles Phelps Taft Memorial Fund, University of Cincinnati.) Pp. xxvii + 602. (New York: The Macmillan Co., 1931.) 8 dollars.

THIS is the first volume of Prof. Hancock's work and is intended as an introduction to the second volume. Its size shows that he is engaged in no light task. His object is to help in making the theory of algebraic numbers more accessible, more attractive, and less difficult. He obviously has in mind the English-speaking student, or at any rate those for whom German is a source of difficulty. For these, he has undoubtedly made more accessible and more easily readable the difficult theories of Dedekind and Kronecker, as well as the more elementary topics such as algebraic integers, quadratic and cubic fields, an introductory account of ideals, Hilbert's norm residue symbol, the law of quadratic reciprocity, and applications to Fermat's last theorem. The beginner will find much to interest him, as many of the chapters are self-contained and will be useful in supplementing a course of lectures.

The author also states that the theory of algebraic numbers is presented here from a heuristic point of view with the hope that through this method of treatment the innate relation of the general number theory to the function theory, algebra, algebraic (Abelian) integrals, and other branches of mathematics will be further developed, and eventually generalised into a united arithmetised entity, one contributing to the advancement of the other. But I think the author's hope will not be fulfilled, and that, in fact, he has missed an obvious opportunity of increasing considerably the value and usefulness of the present volume. The most important developments in the arithmetical theory of algebraic numbers during the present century have arisen from its association with the theory of groups and the application of this theory to the enunciation and proof of arithmetical theorems. Perhaps Hilbert was the first to emphasise the great arithmetical importance of expressing the properties of an algebraic field by means of its Galois group. It is only about five years ago that Artin showed that the general law of reciprocity (quadratic, cubic, etc.) in any field was most simply and beautifully stated as an isomorphism between the group of the class of ideals in the given field and the Galois group of an appropriate Abelian field.

The ambitious student who means to go deeply into the subject of algebraic numbers—and naturally it is an ambitious student who will contemplate mastering two large volumes—finds no reference whatever to groups. In fact, it seems as if the author made every endeavour to avoid using the language or methods of group theory. Thus in his chapter on algebraic fields of rationality containing some of the Galois theory, where nowadays one would have considered the notion of a group almost indispensable, he speaks of normal realms (that is, fields) and their divisors, but never mentions groups (except with its non-technical meaning) or subgroups or indices. Again, in dealing with classes of ideals, there is no mention that the classes form a group (an Abelian group, of course), a fact of vital importance in advanced work, which would enable him to simplify some proofs. Undoubtedly an introductory chapter on Abelian groups, and its application whenever possible, would have been very desirable and added considerably to the value of this volume.

L. J. MORDELL.

Towards Unity

The New World-Order. Essays arranged and edited by F. S. Marvin. (The Unity Series, 9.) Pp. vi + 188. (London: Oxford University Press, 1932.) 8*s.* 6*d.* net.

EVENTS of the post-War period are forcibly and unmistakably driving home the lesson that the future welfare of the human race is vitally dependent upon world co-operation. The days of self-sufficient nationalism, of splendid isolation, of Monroe doctrines, are clearly numbered, and it is widely felt that the more quickly such venerable creeds are abandoned the brighter will become the prospect for civilisation at large. How soon events will force the political unity that, in some form or other, appears inevitable, it would be rash to prophesy; but if the process of unification is to succeed, it can only be upon a previous basis of intellectual sympathy and understanding. It is in the intense realisation of this cardinal fact that Prof. Marvin and his fellow-thinkers are striving

to establish a wider outlook among the educated classes ; and the signs indicate that they are meeting with an encouraging response—even in the most conservative quarters. Personal contact between scholars of different countries is so sure a method of breaking down the barriers of ignorance and prejudice that the present difficulties of foreign travel are to be deplored ; but such books as this and the previous volumes of the " Unity Series " show what might be done by the printed word if sufficient enthusiasm—and funds—were available.

The present book is based upon lectures delivered at the two Unity History schools held at Danzig (1929) and Stockholm (1931) respectively, the special emphasis at both meetings being laid upon the growth of international co-operation. As Prof. Marvin justly observes, the fundamental law of human unity is best expressed in science, " because it has sprung from experiences common to all men and been elaborated as an articulate and marvellous system to which all civilisations have contributed " ; and since momentous events have happened in science in the last few years, two scientific essays by Prof. Dingle hold pride of place in this collection. They are entitled " The Atom " and " The Universe ", and are written with Prof. Dingle's accustomed skill and lucidity ; their infusion with the author's philosophical views is just sufficient to add zest to the themes without deflecting attention from the facts. The balance of the book is preserved by essays upon English literature, Swedish architecture, international law and finance, economic success and failure, contemporary education, race problems in industry and culture, and the present position in biology. All are provocative of thought, and if the reviewer found Prof. Marvin's essay on contemporary education the most stimulating and attractive, the general level is so uniformly high that, among a dozen readers, there would doubtless be a dozen different orders of preference. We may perhaps mention that anyone who wishes to have details concerning the Unity movement may obtain them from Mrs. Innes, 29 High Oaks Road, Welwyn Garden City, Hertfordshire. E. J. H.

Physics in Physiology

Groundwork of Biophysics. By Dr. G. M. Wishart. Pp. vii + 344. (London : G. Bell and Sons, Ltd., 1931.) 12*s.* 6*d.* net.

EVERYONE who teaches physiology will sympathise with Dr. Wishart in the experience which he has evidently had to induce him to write this book. The great majority of those who come to be taught physiology have had instruction in physics, but having also passed an examination in the subject have laid aside the burden of all that that examination imposed on them. If only this were not so and their training in physics had formed in them the habit of thinking about the world around them as such training should, they would find their study of physiology easier and more fruitful.

This work is written to supply what such students have failed to retain or omitted to acquire. But it is clearly not intended to be an introduction to the study of physiology. The reader is supposed to know what is meant by such things as reflex action and the respiratory quotient, that the excitation wave of the heart begins at the sino-auricular node, that the cells of the pancreas at rest are packed with granules, and that its secretion is inhibited by atropine. He is supposed, in fact, to have been introduced to physiology and to have discovered that he has to go back to what he thought his examination had entitled him to discard. Accordingly he is taken again over the gas laws, the structure of the atom, the law of mass action and the physical principles underlying the methods employed in the investigation of selected problems in physiology.

The question may arise, whether this plan of work is the ideal one, but if it is found in experience to give good results, if students are induced by these means to study physiology as, for example, Bayliss gave them the opportunity of doing in his " Principles ", no one need quarrel over this. There may be those who still regret what they regarded as the dismemberment of physiology, when biochemistry began to be treated as a separate subject. Some of them may be dismayed at the prospect of further dissection leading to the severance of biophysics also as a distinct study. But that is not imminent. There is much in this book that the biochemists are concerned with, and there are, on the other hand, certain things that require physical treatment, the hydrodynamics of the circulation for example, which are left for the teacher of physiology to deal with. It is clearly meant to strengthen his hands, not to restrict his province.

There are chapters in the book in which the students to whom it is presumably addressed, those who failed to apprehend the principles which their instructors in physics and chemistry expounded to them, might be grateful to Dr. Wishart if he had departed, as in other places he has, from

the letter of traditional methods of exposition, methods which must from his premises be sometimes at least unsuccessful. But that the book can and should be helpful there is no doubt; it would be still more helpful if all parts equally were treated with the same freshness and originality of sympathetic exposition.

Short Reviews

Cambridge Excavations in Minorca. Trapucó. Part I. By Dr. Margaret A. Murray. With Chapters by Dr. Edith M. Guest, Dr. C. Ainsworth Mitchell and T. J. Ward. Pp. 50 + 52 plates. (London: Bernard Quaritch, Ltd., 1932.) 12*s.* 6*d.* net.

IN recent years a good deal of attention has been paid by prehistorians to the Balearic Islands, mainly in the hope of finding evidence of maritime trade between Spain, Sicily, and the south of France and the spread of culture between these centres during the copper age, but partly because these islands contain in considerable numbers certain monuments of large unworked stones, which, though unique, bear some resemblance to the megalithic monuments found elsewhere near the coasts of western and northern Europe. The most striking of these monuments are *talyots* and *taulas*, but whereas the former, circular buildings of rough masonry, are found both in Majorca and Minorca, the *taulas* occur only in the latter island.

It was to examine these monuments, and, if possible, to ascertain their age and purpose, that an expedition was sent out to Minorca by the Cambridge Museum of Ethnology. This expedition, which was under the command of Dr. Margaret Murray, carried out most careful excavations, found an abundance of pottery and other objects, which are attributed to the bronze and early iron ages, and took careful measurements of the *taulas* and their surroundings. While the expedition scarcely succeeded in discovering the purpose for which these great T-shaped monuments were erected, though they are concluded to have been objects of worship, it has finally disposed of the theory tentatively advanced by Cartailhac, that they were the central pillars of domestic structures.

The book is well got up, with numerous plates, giving views of the monuments and drawings of the pot-forms, so that, if the expedition has not wholly succeeded in solving all the problems involved, it has provided for archæologists a series of pottery extending over more than a millennium.

H. J. E. P.

Growing Up in New Guinea: a Comparative Study of Primitive Education. By Margaret Mead. Pp. xi + 285 + 16 plates. (London: George Routledge and Sons, Ltd., 1931.) 12*s.* 6*d.* net.

THIS is the second of a series of studies dealing with childhood and adolescence among relatively primitive peoples, undertaken by Dr. Margaret Mead for the purpose of investigating the original nature of the child in the light of the effect of varying types of environment and education. She has already published a volume on the adolescent of Samoa. Here she is concerned with the childhood and youth of the Manus, a sea-dwelling people of the Admiralty Islands. Each of a total of eighty-seven children was studied in detail, inheritance, family background, physical and mental character, and so forth being noted. The method of study also entailed an investigation of the social structure of the village, the system of marriage and relationship, and the economic conditions. The results of these latter investigations are reported in the body of the book only in so far as they bear on the main problem; but further information is given in appendices.

Dr. Mead's record is of the greatest interest, especially as the life of the adult, which is lived in conditions almost puritanical in their harsh rigidity, is in striking contrast to the licence of childhood and among the boys in adolescence. Children are instructed early in respect for property; but beyond that they enjoy absolute freedom, and exhibit a lack of subordination to their parents, especially the indulgent father, which appears to admit of no preparation for the complete subjection to their elders to which they must submit when the girl attains adolescence and the boy marries. It is evident, however, that the early period of apparent licence has in reality been a term of rigorous, if imperceptible, instruction by the force of society. Both sexes have already absorbed innumerable taboos which are obeyed as a second nature. Both in respect of the main problem, and incidentally as a record of a somewhat unusual type of social and economic organisation, Dr. Mead's book is highly instructive.

Tabulæ Biologicæ Periodicæ. Herausgegeben von C. Oppenheimer und L. Pincussen. Band 1 (= *Tabulæ Biologicæ*, Band 7.) Nr. 1. Pp. iii + 144. Nr. 2. Pp. 145-240. (Berlin: W. Junk, 1931.) Band 7 (4 Hefte), 55*s.*

THE first six volumes of "Tabulæ Biologicæ" have already been noticed in our columns. The seventh, of which the first three parts have been received, gives vol. 1 of "Tabulæ Biologicæ Periodicæ". The objects of this journal are to continue the collation of biological data recently published and to substitute corrected figures, based on more accurate estimations, for those already given in previous volumes. The principal data in the new numbers are as follow: series of figures concerning different aspects of photochemical reactions, chemical, physical, and spectrographic data of hæmoglobin and chlorophyll and their derivatives, a very useful table of the vitamin content of foodstuffs, a lengthy list of plant chromosome numbers (occupying more than a hundred pages), tables of the iodine content of vegetable and animal foods, as well as data referring to phonetics, and a number of other miscellaneous constants of biological interest, such as the physico-chemical constants of blood and tissue fluids. The collection of these data is of great value to all biologists. The usefulness of the parts, however, would be greatly enhanced if it were

possible to publish a detailed cumulative index with each. The volume may be recommended to all biochemists, physiologists, and biologists as a useful work of reference.

A Book of General Science. By M. J. Hilton. (Macmillan's Canadian School Series.) Pp. xiv + 399. (Toronto: The Macmillan Co. of Canada, Ltd.; London: Macmillan and Co., Ltd., 1931.) 7*s.* 6*d.* net.

IN this book the subject of general science is dealt with in an interesting way, and is well illustrated. Commencing with a chapter on systems and standards of measurement, the book deals in turn with air, water, life, energy, the earth's crust, and the solar system. Each chapter contains descriptions of experiments; and the necessary apparatus required for the experiments is described, with the method of procedure, what to observe, and an explanation of what has taken place. The atmosphere and the methods employed to measure its pressure lead to the subject of elementary meteorology. A chapter is devoted to the uses to which man puts the properties of air. More space might have been given with advantage to the sections dealing with biology and energy. The book is, however, well worth the attention of teachers and students of general science.

An Introduction to Egyptian Religion: an Account of Religion in Egypt during the Eighteenth Dynasty. By A. W. Shorter. Pp. xv + 139 + 8 plates. (London: Kegan Paul and Co., Ltd., 1931.) 8*s.* 6*d.* net.

THIS brief account of the religion of ancient Egypt in the eighteenth and early nineteenth dynasties is intended both for the general reader and for those who are entering on the study of Egyptology. During the last twenty years, our knowledge of Egyptian religion has been much amplified by the labours of the archæologist, and a textbook such as this, which incorporates the new material, was greatly needed. Mr. Shorter has based the whole of his descriptive matter on the monuments, so that the reader unversed in the technique of Egyptian studies may learn how our knowledge is acquired. Akhenaton and Aton worship are not unduly emphasised, as so often happens in the discussion of eighteenth dynasty religious beliefs, though their significance is appreciated to the full. The account of Queen Hatshepsut is, in its way, the best thing in the book.

Colloid Aspects of Food Chemistry and Technology. By Dr. William Clayton. Pp. viii + 571 + 6 plates. (London: J. and A. Churchill, 1932.) 36*s.*

WE start life as a quivering lump of jelly, and most of our foodstuffs are colloids. Food chemistry and food technology have passed beyond the stage of mere analysis into a field of science which engages all the important physico-chemical problems of colloids. Hence the need for a textbook which summarises the voluminous and scattered literature. Such problems as the staling of bread, the foaming of milk, the homogenisation of cheese, the sandiness in ice-cream, the froth on beer, the fining of wine, the clarification of water, to name but a few, all involve colloidal chemistry. Such a work will soon be found invaluable in the food laboratory, and the author's reputation ensures its thoroughness.

In addition to copious references in the text, a classified biography of nearly a hundred pages, containing more than two thousand references, is included, and a valuable feature is a glossary of the new terms which have crept into the subject.

Vorlesungen über vergleichende Anatomie. Von Prof. Otto Bütschli. Lieferung 5: *Leibeshöhle.* Überarbeitet und herausgegeben von C. Hamburger. Pp. iv + 381-490. (Berlin: Julius Springer, 1931.) 16·80 gold marks.

THIS section of Bütschli's textbook of comparative anatomy, commenced by Blochmann and completed by Hamburger of Heidelberg, deals with the body cavities. One half of the text is devoted to the invertebrates and one half to the chordates. The development of the cœlom, mesenteries, pericardio-peritoneal septum, and diaphragm is traced with the aid of simple diagrams. The abdominal pore is traced through cyclostomes, fishes, and birds. The facts of embryology are incorporated in the text with clarity. The absence of theorising and the excellence of the diagrams are to be commended.

Mechanics for Beginners. By F. Barraclough and Dr. E. J. Holmyard. (Dent's Modern Science Series.) Pp. viii + 214 + 8 plates. (London and Toronto: J. M. Dent and Sons, Ltd., 1931.) 2*s.* 6*d.*

THE particularly difficult problem of making the principles of mechanics interesting to the beginner, without at the same time sacrificing scientific accuracy, is very successfully accomplished in the well-known style of which Dr. Holmyard may be said to be the pioneer. The result, with its special emphasis on the historical development of the science, is as much a fascinating reader as a textbook. N. M. B.

Cicatrisation et régénération. Par Prof. Jacques Millot. (Collection Armand Colin: Section de biologie, No. 141.) Pp. 204. (Paris: Armand Colin, 1931.) 10·50 francs.

A BRIEF account of the present views of wound-healing and regeneration of parts in the animal kingdom, with special regard to the more recent experimental methods in the lower animal forms. The physiological factors involved are analysed, and there is an interesting account of the corresponding compensatory mechanism in plants.

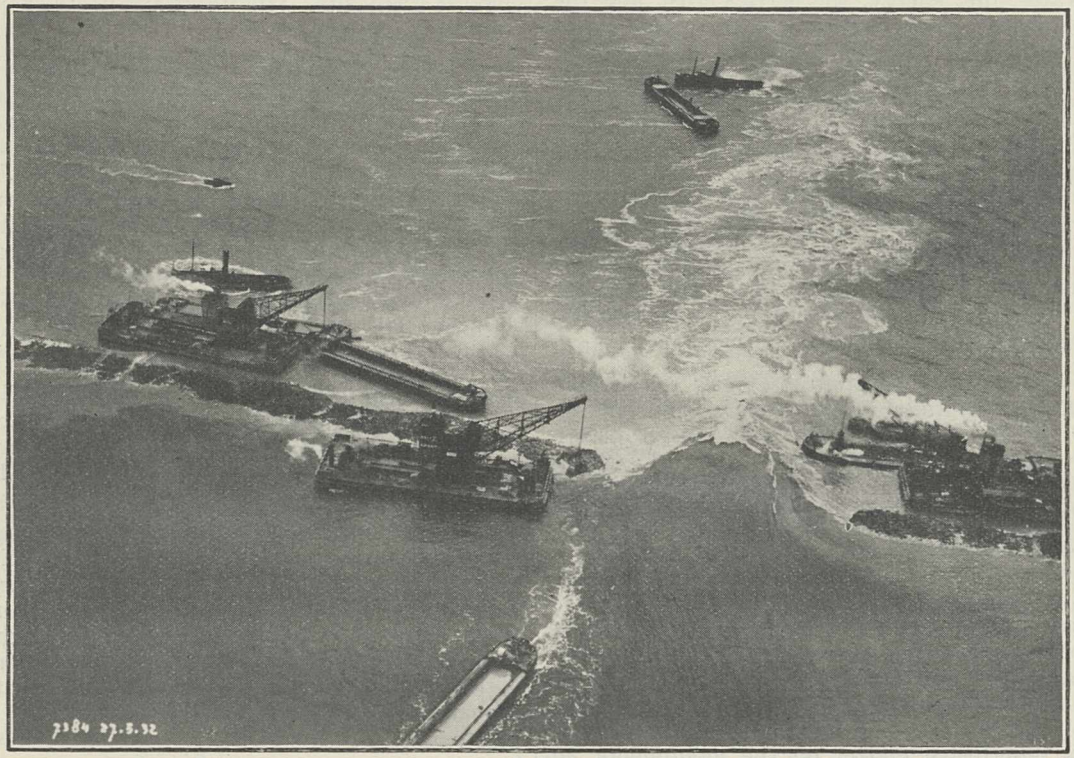
Hunting Insects in the South Seas. By Evelyn Cheesman. Pp. xi + 243 + 8 plates. (London: Philip Allan and Co., Ltd., 1932.) 10*s.* 6*d.* net.

MISS CHEESMAN has travelled widely among the Pacific islands and is a keen observer of insect life. In this, her latest book, she gives a very readable and interesting popular account of insect hunting and other experiences in Tahiti, the Marquesas Islands, and the New Hebrides.

The Enclosure of the Zuider Zee

By Dr. BRYSSON CUNNINGHAM

MAY 28 last will always be a notable date in the annals of the Netherlands. On that day, in the presence of distinguished government officials, the crucial deposit of clay was made which finally and entirely cut off the waters of the Zuider Zee from any intermingling with the outer sea. The means of severance, it is true, is but a narrow earthen embankment, stretching like a taut cord or strip of ribbon, for a length of 18½ miles, from the eastern extremity of the former island of Wieringen to the Friesian coast, but it suffices to create an impassable barrier, intersected only by three locks for purposes of navigation and by two groups of sluices for surplus water discharge, and it marks the commencement of a distinctly new regimen for the impounded area.



Copyright K.L.M. (Royal Dutch Airways).

FIG. 1.—The concluding stage in the enclosure of the Zuider Zee, showing plant in operation.

Hitherto, this vast expanse of nearly a million acres of water has been an arm of the sea; at present, it is an inland lake, the greater part of which is destined to be pumped dry and converted into agricultural holdings, while the residue will constitute a reservoir for fresh water, instead of salt water, to be utilised, apart from navigation, as a source of supply for irrigation and farming. In the ultimate result, the transformation will mean an increase of seven per cent in the area of the whole country and of ten per cent in the area of arable land. Relatively, it is as if Holland were enlarged by the addition of a province roughly equivalent in size to Kent or Essex or Sussex.

In NATURE of Sept. 21, 1929, following a visit to the site of the works, I gave an outline of the scope and probable effects of this tremendous project, which has, for several centuries past, occupied the minds of the Dutch people and exercised the ingenuity of their engineers. Living, as they do, within a territory of restricted extent, much of it lying below sea-level and subject to tidal inundation, they have been compelled, at much trouble and expense, to win from the sea such tracts as were possible in order to find scope for the natural expansion of the population and their industrial activities. According to statistics published in 1924, there had then been an increment of about 250,000 acres, gained since the year 1846. Including the exploitation of land previously considered as waste, the total increase in arable land during the last century has been rather more than a million acres, equivalent to a rate of 10,000 acres a year, but against this must be set off the loss due to building and engineering operations, latterly at the rate of about 6000 acres a year. This leaves a

net annual gain of 4000 acres per annum; but the population is growing fast, and there is at the present time a distinct shortage of arable land.

The acquisition of so large an area as that covered by the Zuider Zee naturally involved a multitude of complex problems, so that it was only after protracted consideration and many financial and legislative delays, inseparable from an undertaking of such magnitude, that the work was actually commenced in 1920. It has therefore been in progress over a period of twelve years. In accordance with the plan prepared by the late Dr. C. Lely, it involved the construction of a main dyke, or embankment, which, starting from the little village of Van Ewijcksluis on the eastern coast of the province of North Holland, extends across a deep strait of 1½ miles to the western side of the island of Wieringen, to be resumed at Den Oever at the eastern extremity of the same island, and thence, apart from a slight curvature at the eastern end, to stretch in a straight line eastwards as far as the village of Zurig on the coast of the province of Friesland. South of the main dyke, or enclosing dam, a series of four separate areas or 'polders' with an aggregate content of about 550,000 acres, is to be reclaimed by pumping out the water into a central lake of about 270,000 acres, provisionally designated the Yssel Lake and designed to receive the discharge of the rivers Yssel, Zwartewater, and Vecht from the mainland. The first of these polders has, in fact, already been reclaimed and the progress made thereon will be referred to later. For the moment, attention is directed to the concluding stages of the work in connexion with the main dyke, which, with the four polders, is shown in the map accompanying my article in NATURE for Sept. 21, 1929.

At the time of writing the above article, the island of Wieringen had already been joined up to the mainland and a substantial roadway formed across the Amstel Diep. The work was proceeding in the main dyke from both extremities, namely, eastwards from Den Oever and westwards from the Friesian coast across the shallows of Makkummerwaard to the site of the navigation locks at Kornwerderzand, a distance of 2½ miles. Approximately half-way between the Kornwerderzand and Den Oever, lies another shoal area, called the Breezand. Advantage was taken of its existence to commence, in 1929, a detached mid-sea section, which has been extended eastwards and westwards to link up with the coastal sections. The intervening spaces were crossed by two deep 'guts' or channels, the Vlieter on the west and the Middelgronden on the east, in which the depth of water increased to as much as 10 metres. These channels were first treated with shallow deposits of material to form 'sill dams', reducing the depth of water over them to more convenient limits. The material consisted of a layer of boulder clay protected by a covering of 'mattresses' of brushwood, weighted down in position by means of heavy stone fragments and secured by stakes driven into the ground. The mattresses were arranged to extend appreciably beyond the limits of the main dyke, in order to ensure protection from scour. These sills were completed in 1930.

When, a year later, preparations were made to proceed with the formation of the dam itself on these sills, it was found that the brushwood, while maintaining its position, had suffered a good deal from the attacks of marine borers, and that considerable corrosion of the galvanised binding wire had taken place. The sill on the Middelgronden had deteriorated to a greater extent than that on the Vlieter, and, accordingly, first attention was given to the execution of the main structure across the former. It was completed in November 1931. The work carried out during the first half of the current year has been the final closing length across the Vlieter.

Copyright K. Maaskant.

FIG. 2.—The last gap in the Vlieter channel.

The method of forming the main dyke consisted in first depositing a substantial body of boulder clay to form a nucleus and a frontal barrier. Behind this was discharged a mass of sand (dredged within the limits of the Zuider Zee and transported to the site), which was covered in turn by a layer of clay, or boulder clay, the latter being a specially tough variety of glacial origin, containing boulders, found in the floor of the Zuider Zee in various places, as well as on the island of Wieringen and on the south coast of the province of Friesland. It has proved eminently suitable for resisting the scouring action of currents, and its qualities in this respect were

fully tested during the period of concentrated flow while the tidal water was passing in and out of the gradually contracting gap, as can be well seen from the photographs in Figs. 1 and 2 taken the day before the final closure was made. I had an opportunity myself of witnessing the concluding stage of the construction of the dam flanking the new north-west polder, and was much impressed by the resistive capacity of the material. As a final covering, the exposed surface of the embankment is protected below the water-line by mattresses of brushwood, weighted with rip-rap, and above the water-line by a stone facing of basalt or limestone, brought from Germany.

A point of interest that requires mention is the effect of the constructional operations on the tidal conditions. It is stated that up to the end of 1929 (with the exception of a period in 1924 due to the closing of the Amstel Diep between the island of Wieringen and the mainland), there had been scarcely any changes in the tidal movement. Afterwards, as a result of the formation of the sills in the channels of Middelgronden and Vlieter, the velocity of flow across the line of the dam increased to a marked degree, reaching 3-3¼ ft. per second, while, at the same time, certain changes were manifesting themselves in the rise of the tide in the outer area, very perceptibly in the Texel Strait and less noticeably in the Vlie Strait. These changes will require further observation before they can be definitely evaluated, but they appear to be of the order of 6-12 inches, generally, in the Wadden Zee.

Copyright K. Maaskant.

FIG. 3.—Harvesting the first crop of rye on the Wieringermeer.

Concurrently with the construction of the main dyke, operations have been in hand for developing the new north-west polder (Wieringermeer) of 50,000 acres, which was reclaimed by the formation of an auxiliary dyke in advance of the main project. It was pumped out in 1930, the quantity of water discharged within a period of six months being more than 132,000 million gallons. The land, of course, had been covered with sea water for centuries and the soil was heavily charged with salt. The mean salinity ranged from ½ to 2 per cent, the variation being due to the proximity, in certain parts, of fresh-water outlets from land drainage systems. A surface soil chart is in course of preparation, for which purpose borings are being taken on every plot of 5 hectares to a depth of 1½ metres. The result of the investigation in regard to the first polder-section shows that the surface layer is of unequal thickness and consists mainly of sand, under which clay is often found, and, further, of a small percentage of clay and sandy clay with a small amount of peat. There appears, however, to be considerable dissimilarity of structure in different areas.

One of the earliest and most important problems to be solved before cultivation could be attempted was that of internal drainage. The first intention of providing a network of shallow trenches was abandoned, as it failed to drain the sub-soil sufficiently, or to remove the salt. Covered-in drains would have been preferred, but the cost was high, and, finally, recourse was had to a system of open trenches on a large scale. They have a depth of 60 cm. and are arranged at distances apart of 11 metres in clay areas and of 15 metres in sandy areas. In the spring of 1931, the sampling of soil showed that about 400 hectares of sandy ground in polder-section No. 1 was suitable for cultivation (Fig. 3), while the ground with a higher clay composition still retained an excess of salt. In the autumn, further tests were made, as a result of which, 1050 hectares were declared suitable for planting with cabbage, or sowing with winter barley and wheat, while 900 hectares were treated with a mixture of grass and clover seed to develop permanent pasturage.

The remarkable experiment of bringing the Zuider Zee into a state of agricultural productivity will be watched with the greatest interest, as its economic value to the inhabitants of the Netherlands is a matter of no little importance. In 1924, the outlay on the main dyke and the reclamation of the polders until the latter attain their full cultivable state was estimated at about thirty million pounds, to which interest over the unproductive period would add some fifteen millions, making a total of forty-five millions. The profits to be derived had, of course, to be evaluated on a more or less speculative basis, but they were put at a figure of fifty-two millions. In 1928, it was reported that actual costs to date had exceeded the estimates by some five millions, due to the rise in prices of public works, particularly dredging, and certain constructional difficulties, which could not have been foreseen. Since then, there have been

some reduction in prices, and if the favourable conditions continue, it is hoped to complete the undertaking without further excess and even with some reduction of the debit.

Everyone will hope that this enterprise of high courage and endeavour will be crowned with the success it deserves. Very great credit is due to its promoters and to the engineering staffs who have faced and overcome all the difficulties which have arisen from time to time. I am indebted to Dr. Ir. J. A. Ringers, director-general of the Rijkswaterstaat, for the photographs reproduced and the greater part of the information on which this article is based. For several years he was in charge of the operations, as director of the association of contracting companies expressly formed for the execution of the project, known as the Maatschappij tot Uitvoering van Zuiderzee-werken. On the Government side, mention should be made of the Zuiderzee Board, with Dr. H. Colijn at its head, and the office of the Zuiderzee works, to which Mr. V. J. P. de Blocq van Kuffeler is director-general.

Basic English *

ABOUT three centuries have now elapsed since three master minds—Descartes, Pascal, and Leibniz—espoused the cause of a *lingua franca*, and ingenious attempts are still being made to devise or construct a synthetic language for international use. The case for the adoption of an international *auxiliary* language (I.A.L.) is stronger now than it has ever been, but results have so far been disappointing. Though several of the projects that have been put forward might, with more or less modification, have proved satisfactory, practically none, with the exceptions of Volapük and Esperanto, has gone far beyond the threshold of the academy or the study. As Prof. Donnan has said, so far as numbers are concerned, Esperanto is the greatest and most successful linguistic experiment that the world has seen. The causes of failure are mainly psychological. Mankind is not ruled by reason, and the idea or ideal of an I.A.L. does not appeal to man's pleasurable emotions or to his primary instincts, except probably to that of pugnacity, for enthusiasts in this field have shown almost as little brotherly love to competitors as did rival religionists in days now happily past. Another obstacle has been the widespread fallacy that anything artificial is *ipso facto* inferior to its natural counterpart. However, the cause endures, and the latest apostle, Mr. C. K. Ogden, comes forward with a simplified form of English, called Basic, to compete, and peradventure to conquer, in the field of international linguistics.

The main features of Basic, which derives its name from the initial letters of the words, British, American, Scientific, International, Commercial, are: a very restricted vocabulary of nouns (600); the use of only sixteen or seventeen verbs, including come, get, give, go, keep, let, make, put, seem, and a few others; the use of 150 adjectives and a number of prepositions, adverbs, pronouns, and conjunctions, but apparently no interjections. The grand total is 850 words, but further nouns can be created by adding the suffixes -er, -ed, and -ing to 300 of the primary nouns. Word-order is essentially the same as in good English, although the adverb is banished to the end of the sentence. Pronunciation is to be standardised by means of gramophone records, but spelling is not to be simplified or made phonetic.

Perusal of the Basic textbooks leads to the conclusion that simple conversations could be carried on with the above 850 words and simple derivatives, although in places the phraseology would appear strange, ambiguous, or prolix. Thus, a witch is "a woman with strange powers"; a widow is "a woman not married again" (every *divorcée* who does not re-marry is thus conveniently made a widow!); and a baby is "a diminutive object". We must not study or use Basic, but "go into" it and "make use of" it. If we are in difficulty, we must not ask but "make a request" for explanation; we must "make dry" our eyes if we cry; and "get off the ship" when we come to land. "Friday", we are told, "is the day all the week's payments are made"; and for dinner we are asked, "What sort of beef will you have, cooked in the oven or over the fire?" (roast, or boiled, fried, or stewed!). Mercifully, we never "die", we merely "take our last breath" or "go to our end".

This simple but circuitous language would be useful to a foreigner wishing to learn something better than 'pidgin' English; it is easy to acquire and to use, and it would serve him as a good introduction to English proper; but it seems certain that the 850 words, *plus* the simple derivatives of the primary nouns, would not suffice for any except very elementary purposes. It is true that provision is made for expanding the primary vocabulary to 1000 words by including in it 150 names of general utility, and further additions, for example, 12 international names, 12 (only) names of sciences, and other proper names are also permitted; but would the foreigner remain content with these? Would he not ask for more, in order to read English newspapers and literature, as well as to converse and correspond with educated Englishmen? English-speaking peoples themselves would not find it easy to talk 'pure' Basic; they would be hard put to it to remember which nouns were in the vocabulary and which were not. For international use, it would be difficult to standardise this language, and the fact that it has a national basis would undoubtedly impede its adoption.

* "Basic English Applied (Science)." By C. K. Ogden. With specimen Translations in Chemistry, Physics, and Biology, by R. Michaelis. Pp. 88. "The Basic Traveller: and other Examples of Basic English." By L. W. Lockhart. Pp. 119. "The Basic Vocabulary: a Statistical Analysis with special reference to Substitution and Translation." By C. K. Ogden. Pp. 96. "The Basic Dictionary: being the 7500 must Useful Words with their Equivalents in Basic English; for the Use of Translators, Teachers, and Students." By C. K. Ogden. Pp. xx+106. "Debabelisation: with a Survey of Contemporary Opinion on the Problem of a Universal Language." By C. K. Ogden. Pp. 171. "Basic English: a General Introduction with Rules and Grammar." By C. K. Ogden. Pp. 95. (London: Kegan Paul and Co., Ltd., 1930–1932.) Each vol. 2*s*. 6*d*. net.

From the literary point of view, it is a relief to read that " although Basic is clear and precise at the level for which it is intended ", it has no literary claims. It seems to discard most of the canons of good style, for example, to prefer the concrete to the abstract, and to use the single word in preference to the circumlocution. The author has little use for " the antic haverings of a pedantic pedestrianism in quest of Pure English " ; so he allows us cheerfully to mix up ' shall ' and ' will ', to use noun-adjectives *ad lib.*, and to end a sentence with a preposition.

The fact that Basic has no literary pretensions and is yet recommended as the I.A.L. for science, suggests that its author has a poor opinion of the literary value of scientific writing. If so, he is not alone ; but if present-day style in scientific writing is generally poor, it is at least preferable to that of Basic. A style that is both concise and precise is indispensable to good scientific writing, and the scientific author who uses two words where one would suffice, is as much a malefactor as the man who makes two blades grow where one grew before is a benefactor to his kind. Although Mr. Ogden realises that a much larger vocabulary is needed for science than for more mundane purposes, it seems certain that many more nouns would be required than he contemplates. As in other national languages, the resources of English are proving more and more inadequate to keep pace with the multiplication of new concepts, so that science would appear to need an I.A.L. possessing a vocabulary of constructed words that would allow of constant and regular expansion, rather than a language like Basic the chief aim of which is to restrict the vocabulary to the smallest possible number of words. What is sauce to the Kafir is not necessarily sauce to the chemist.

In " Basic English Applied (Science) ", Basic versions are given of three scientific communications : a paper from the *Journal of the Chemical Society* on the analysis of light oils and motor spirits ; a lecture on the mathematical problem of aerodynamics ; a letter to NATURE (**123**, 601 ; 1929) on spectrographic analysis of animal tissues ; and a few abstracts of patents taken from the *Nickel Bulletin*. Lack of space precludes a detailed appreciation of these efforts, and it must suffice to say that in the writer's opinion the translator has succeeded in making his translations generally intelligible, but that the ' wordiness ', the frequent lack of precision, and the frequently curious phraseology all combine to make one hope that scientific English will never descend " to the level for which Basic is designed ". The following are some examples in which Basic wording (given in italics) is held to be deficient : Desiccator—*drying vessel* ; retort—*heating apparatus* ; alloy—*mixed metal* ; boiling—*at vapour temperature* ; evolution—*development* ; describe—*give details of* ; distil—*give a distillation* ; viscous-fluid flow—*motion in liquid or gaseous mediums*. The method has been developed quantitatively—*By an expansion of the method it is possible to get the amount of the elements present*. A detailed account of the work will be published shortly—*A detailed account of the work will be printed shortly*.

The somewhat unconventional ending to one paper, " *It was very kind of the Director of Fuel Research to let the writer put this paper into print* ", prompts the present writer to sum up his conclusions as follows : *It was very kind of the Editor of* NATURE *to let the writer have these books and give his opinions of them ; they are bright* (clever) *and interesting and in places they give amusement ; but they do not give him strong belief* (convince him). *Though he is of the opinion that the new language* (old wine in a new vessel) *will be of use to men of other countries when they make a start to learn our language, he has the hope and makes the request to a Higher Being* (prays) *that it may at no time come into use for Letters or for Science. It might make better the language of trade ; it is almost not possible to make it worse.*

In making this attempt at ' an attempt ', the reviewer was surprised and perplexed not to find the word " Basic " in the 850-word vocabulary, either among the 400 " necessary names " or the 200 " common things ". Is this an omen ?

Obituary

PROF. ROLAND THAXTER

PROF. ROLAND THAXTER, of Harvard, died on April 22, at the age of seventy-three years. He was born at Newton, Mass., on Aug. 28, 1858, and graduated at Harvard University in 1882, proceeding to post-graduate work there until he was appointed mycologist at the Connecticut Experimental Station in 1888. Three years later he returned to Harvard as assistant professor of cryptogamic botany, becoming professor in 1901. He retired in 1919 with the title of emeritus professor, and acted as honorary curator of the Farlow Herbarium.

Such is the bare outline of the career of one whose work in mycology is classical. His first researches were on the rust *Gymnosporangium*, but he published an account of the entomogenous family Entomopthoreæ in 1888, which still remains one of the most important papers on the group. A few phytopathological reports appeared while he was at Connecticut, some of considerable interest. In 1890 he made his first contribution to our knowledge of the peculiar entomogenous fungi, the Laboulbeniaceæ, and it is with these that his name is chiefly associated, for from being almost unknown, they became, owing to Thaxter's enthusiasm, a group as well understood as any other and containing hundreds of genera and thousands of species.

Thaxter's method was to publish preliminary diagnoses of new genera and species and gather these together in monographs bearing the title " Contributions towards a Monograph of the Laboulbeniaceæ ", which were illustrated with numerous plates of admirable drawings by the author. Part V. of the " Contributions " appeared this year, and he was busy preparing a sixth when he died. Some idea of the work entailed in the

description and figures may be gained from the fact that the five parts in all run to 1185 pages and 166 plates. Probably no mycologist, with the exception of Elias Fries, has ever been identified with a group to the extent that Thaxter was with the Laboulbeniaceæ. However, he did not restrict his observations to this fascinating group, but seemed to possess an almost unhuman *flair* for finding fungi which he himself called "new or peculiar", and described by him occasionally throughout his career. He was, moreover, the first to recognise the anomalous group Myxobacteriaceæ which have lately come into fashion.

Thaxter's association with Prof. W. G. Farlow at Harvard was an ideal one, and together they succeeded in building up a school of cryptogamic botany and herbarium which are without rival in any university. For a number of years Thaxter suffered from ill-health, but his letters were always cheerful, even when increasing trouble with cataract made it seem probable that he would be compelled to cease work. He was somewhat critical of some of the recent tendencies in applied mycology, but his criticisms were given from the fullness of his knowledge of the subject and not from a feeling of having been left behind.

In 1907, Thaxter succeeded Farlow as American editor of the *Annals of Botany*, Farlow having served since its beginning in 1887. His name was thus always prominently before British botanists. He received many distinctions; among others, he was a foreign member of the Linnean Society of London, honorary fellow of the Royal Society of Edinburgh, and honorary member of the British Mycological Society.

Dr. Cuthbert Christy

NEWS has recently been received of the death on May 29, at sixty-eight years of age, of Dr. Cuthbert Christy, the well-known naturalist and explorer, who was engaged in scientific work for the Belgian Government in the Congo. It appears that, while in the Aka River region, he wounded a buffalo which turned and gored him, inflicting fatal injuries. He had for many years been collecting for the British Museum (Natural History), and his collections, notably those from Lakes Nyasa and Tanganyika, have proved to be of quite exceptional importance.

Dr. Christy was the son of Robert Christy of Chelmsford, and was educated at Scarborough and the University of Edinburgh, where he proceeded to take a medical degree and was appointed Mackenzie bursar in anatomy. His first travels abroad started in 1892, when for three years he travelled throughout a large part of South America and the West Indies. Some years later he was appointed Medical Officer of the 2nd Battalion West African Field Force in Northern Nigeria, and afterwards took on the duties of medical officer in India in the Bombay Plague Laboratory. In 1902 he served on the first Sleeping Sickness Commission in Africa, and at a later date was a member of the Liverpool School of Tropical Medicine Sleeping Sickness Expedition to the Congo, and of that organised by the Sudan Government.

Dr. Christy's intimate knowledge of native life in health and disease, and his explorations in many fields, are revealed to some extent in several published works and reports, among them being "Big Game and Pygmies", "Mosquitoes and Malaria", and "The Birds of San Domingo". He was chairman of the International Commission appointed by the League of Nations to inquire into the existence of slavery and forced labour in Liberia; and the recommendations of the Commission were accepted by the Council of the League and the Liberian Government.

Between 1903 and 1910, Dr. Christy visited Ceylon and various parts of East and West Africa, all the time collecting such specimens for the Natural History Museum as came his way. From 1911 until 1914 he was engaged in scientific exploration work in the Congo, and during this period he obtained many specimens for the Museum collections.

Among the mammals collected during this period were an important collection from the neighbourhood of Avakubi, in which Dr. Christy obtained two rats new to science and a dormouse which was named after him, *Graphiurus christyi*. He also obtained specimens of many rare West African forms in the same collection, thus adding considerably to our knowledge of the distribution of these species.

During the War, in spite of official duties, Dr. Christy still continued to collect, and sent home a very fine collection of fish from Mesopotamia. After the War he conducted two very important expeditions, one to Lake Nyasa and one to Lake Tanganyika, where he collected a great quantity and variety of fishes. These collections have proved to be some of the most important that have ever been received by the Natural History Museum, and the number of new species already described is very great; in one genus alone the species have been multiplied by six since Dr. Christy's collection has been worked out. The work in connexion with these collections is still continuing and many new forms doubtless remain to be described.

Medical science has lost a very able man in the death of Dr. Christy, and zoological science has lost one of its keenest collectors and most painstaking observers.

Mr. L. G. Sutton

THE death of Mr. Leonard Goodhart Sutton, in his sixty-ninth year, took place somewhat suddenly at his residence, "Hillside", Reading, on June 13. Mr. Sutton was a grandson of the founder, and at the time of his death senior partner, of the world-famous firm of Sutton and Sons. He was educated at Wellington College, and later went to the Royal Agricultural College, Cirencester, where he became particularly interested in the botany of grasses, of which group of plants he had a wide and accurate knowledge. After leaving Cirencester, Mr. Sutton spent two years in Germany, devoting himself to the study of the methods of seed production. On returning to England he entered the firm as a

partner, and ultimately settled down to development and extension of the floricultural side of the firm's activities, his outlook and experience being afterwards enlarged by visits to California and South Africa.

Mr. Sutton had a keen, refined sense of the æsthetic and cultural merits of flowers in general, and possessed an unerring intuition of the charm of old favourites and the floricultural possibility of new introductions to the garden, such as the South African *Nemesia strumosa* and allied species, which may be arranged to provide a glorious display of colour almost throughout the year. Belonging to the old school of plant breeders, Mr. Sutton paid special attention to the observation of small differences and the repeated selection of these in the evolution of improved forms. He was, however, fully alive to the value of a knowledge of Mendelian laws of inheritance in the practical improvement of garden plants. He wrote very little, but his unpretentious little volume—an extension of a lecture delivered before the Royal Horticultural Society—on garden annuals, is a charming introduction to the beauty, variety, and cultivation of this gay group of plants for which he had such an intense love.

Mr. Sutton took an ardent interest in educational affairs, and at the time of his death was president of the Council of the University of Reading; his inspiring presence and sound judgment will be greatly missed.

WE regret to announce the following deaths:

Dr. Bedford Pierce, past president of the Psychiatry Section of the Royal Society of Medicine, on July 8, aged seventy years.

Sir Richard Threlfall, G.B.E., F.R.S., chairman of the Fuel Research Board, on July 10, aged seventy years.

News and Views

Colloidal Fuel

TOWARDS the end of the War, when the demands for oil for naval purposes exceeded available supplies, efforts were made in America to make the oil go further by admixture of pulverised coal to give a blend called 'colloidal fuel'. Coal is appreciably heavier than oil, and it is obviously essential to prevent segregation of the components when blended. According to the American patent literature, stable solutions were obtained by suitably grinding the coal and by the incorporation of a stabilising 'fixateur', for example, a soap solution or a lime rosin grease. Great publicity was given at the time to this work, and the advantages of such blends were recognised. The coal-oil blend was heavier than water, could be stored under water, and was therefore 'safe' to store, while its calorific value per gallon exceeded that of oil. The lower price of coal reduced the cost of the unit of heat in the oil. In spite of these advantages, when oil again became freely available 'colloidal fuel' passed into the background. The subject was discussed in the House of Commons on July 5, and Mr. Foot, Secretary for Mines, referred to the experimental work which has been carried out by the Cunard Steamship Co., Ltd. This Company has continued investigating the possibility of blending coal with oil, and one of its liners, the *Scythia*, has just made the round trip between Liverpool and New York with one boiler fired solely by 'colloidal fuel' containing 40 per cent of coal.

ACCORDING to a report in the *Times* of July 6, the technical staff of the Cunard Company is entirely satisfied with the performance of the fuel. The burners gave no trouble, the ship's deck was free from grit, and the blend retained its stability. No details have been disclosed as to the mode of preparation, but it is claimed that the blend will retain its stability for three months. 'Colloidal fuel' is of obvious importance to European coal-producing countries, and the importance increases as coal tends to cheapen. Authorities agree that for ocean liners and naval vessels, oil fuel has such advantages over lump coal that even price loses its importance. When coal is pulverised, it acquires some of the advantages of a fluid, but a ship is scarcely the place to manufacture fuel. If a satisfactory blend can be made ashore and taken on board by pumping, the position will be greatly improved. Clearly the problem deserves the closest investigation, and the studies of the Cunard Company may be contrasted with the futility of a deputation of coalowners begging the Government to compel the Admiralty to burn coal instead of oil. Much oil is also being used in land installations, and the fuel should be equally applicable for these.

Professional and Technical Workers in the Civil Service

THE tradition that professional and scientific men should be passed over by authority when the personnel of Royal Commissions and other public inquiries are under consideration is well established and has frequently been the subject of comment in these columns. Recently, however, this attitude towards the expert has expressed itself in a new form. It happens that in the negotiating machinery which deals with economic questions concerning the civil service as a whole the existence of the expert has been recognised, in the constitution of the National Whitley Council, by the formal inclusion of the Institution of Professional Civil Servants as one of the three representative groups of staff associations. Recently, as is generally known, negotiations have been proceeding between the Government and the staff associations through the medium of the National Whitley Council regarding the future of the bonus system in the civil service. At one stage in the negotiations the authorities desired to convey to the staff side of the National Council certain important alternative proposals dealing with the subject under discussion, and for this purpose

the permanent secretary of the Treasury thought it necessary to invite representatives of various sections of civil service opinion to an informal discussion.

WHILE informal discussions may serve a useful purpose, it is worth while asking why no representative was included of the professional and scientific interests in the civil service, of which the Institution is the accredited spokesman, although among those invited was the representative of at least one smaller body representative of non-technical interests. Official representations from the Institution were put aside on the ground that the conversations were 'informal', although the attempt was afterwards made to treat as negotiators the four individuals selected. We could have perhaps understood, even if we had deplored, this failure to acknowledge the existence of the specialist interest in the civil service, were it not for the fact that the Institution's position has already been recognised by its special direct representation on the National Council to which we have referred. It is a curious revelation of official psychology that it should be thought unnecessary to consult with this distinctive and, we claim, this essential element in the modern civil service, upon a major issue affecting specialists in common with other types of civil servants.

Taxes on Books in Australia

MR. LYONS' Government in Australia, "having given very earnest consideration to requests that the taxation burden on educational literature should be lightened", has, we learn from an announcement in the Melbourne *Argus* of June 3, granted certain exemptions which, though satisfactory so far as they go, are very meagre concessions compared with the case against a tax on books of any kind. Primage duty at port of entry will no longer be charged on books and periodicals imported by or for the State public libraries, the National Library at Canberra, and the libraries of the several universities. Hymn books, prayer books, and literature published by or issued under the authority of the League of Nations will also be admitted free; and so will historical records in print, picture, or manuscript imported by or for libraries. Unfortunately, the sales tax still remains.

Alleged Psychic Phenomena

IN a long letter to NATURE, Mr. Harry Price, the honorary director of the National Laboratory of Psychical Research, has commented upon the review of Dr. Osty's book, "Les Pouvoirs inconnus de l'esprit sur la matière", published in these columns on June 25. He states that both Mr. Malcolm and Mr. Lambert changed their views regarding the alleged psychic phenomena produced by Mr. Rudi Schneider, although Mr. Lambert, according to the letter quoted by Mr. Price, merely says that, in his opinion, there was no possibility of the *medium* having produced the phenomena fraudulently. It is clear that these later opinions were not based on personal observation but from reading the record of others. Again, Mr. Price dismisses, without apparently realising its relevance, the incident of the match-box, suggesting, as it does, the invasion of the séance room from without, suspected for so long by competent observers. Moreover, in upholding the genuineness of Mr. Schneider's phenomena, Mr. Price declares that the opinions quoted in the review were from persons who had *a priori* convictions that the mediumship was a fraud—a statement in support of which he offers no evidence and which is almost certainly contrary to fact.

Physics and Psychics

IN conclusion, Mr. Price emphasises his own views on the independent examination of mediums by remarking that it has been his practice to introduce them to men of science of repute in order to encourage independent investigation; and in this he claims some considerable success. It must be remarked, however, that the invitations issued by the late Dr. von Schrenck-Notzing, the late Dr. G. Geley, and by Mr. Price were not for the purpose of granting any true scientific inquiry. The persons invited were merely privileged spectators of phenomena produced under conditions over which they had little control and in circumstances where accuracy of observation was almost impossible. Mr. Price claims that the phenomena described by Dr. Osty have been duplicated by him with similar results, and that when Mr. Schneider is in London in September of this year he will be pleased to invite assistance from physicists. What is wanted, however, is not the mere presence of experts at the experiments of others in an atmosphere which, rightly or wrongly, cannot fail to arouse suspicion. It is an arrangement whereby the alleged influence at a distance, which, it is claimed, can be measured and detected by purely physical means, is so measured and examined by independent observers in their own laboratories, with their own apparatus, and under those conditions most favourable to accurate scrutiny.

Early Man in America

IT is a not infrequent occurrence in America for discoveries to be announced which, it is said, afford indubitable evidence of the existence of man on that continent in very early times. Usually this evidence takes the form of one or more stone implements associated with the bones of extinct mammals, such as an elephant, in deposits held to be Pleistocene and in conditions which are claimed to justify the conclusion that the implements and fossils are contemporary. Usually it appears on further investigation that it is either impossible to verify the exact position, relative or absolute, of the finds, or an application of the strict canon of evidence reveals some flaw which vitiates the conclusion. American palæontologists and archæologists, however, continue to examine with patient determination every claim that is reported, and at the same time to examine diligently areas in which the deposits are such as might well afford the evidence which is sought. One such area is the State of Nebraska, which, in view of its geographical relation to the glacial area of the ice age, is regarded by

American geologists as of great promise in this respect. Three discoveries have been reported in this State recently, according to Science Service of Washington, D.C. In two instances, students of the University of Nebraska have discovered flint implements in association with the bones of fossil bison under some sixteen feet of loess which, it is claimed, is earlier than the last glaciation. These two discoveries lie about sixty miles apart. The third discovery was near the town of Angus, where, it is claimed, a flint implement was found under the scapula of a mammoth. The sites have been visited by Dr. W. D. Strong, of the Bureau of American Ethnology, who regards the discoveries with very considerable reserve.

Antiquities from the Ancient East

ON July 11 two exhibitions of antiquities found in the course of excavations during the past season were opened in London, at University College, Gower Street, and at the British Museum. At University College, Sir Flinders Petrie has on exhibition the finds of the expedition of the British School of Archæology in Egypt at Tell el-Ajjul, the ancient Gaza. The antiquities from the Hyksos levels will give an added attraction to the exhibition in the estimation of the general public ; but the real interest of the collection as a whole lies rather in its extent and completeness in range over Palestinian cultures from the copper age to the time of the eighteenth dynasty and later. A quantity of pottery from the Ægæan and Mycenæan civilisations, from Egypt, Cyprus, and elsewhere, indicates the importance of the site as an early meeting point of international lines of communication. Particularly to be noted among the exhibits are fine daggers of the copper age, alabaster vases of the eighteenth dynasty, and glass of the same period. Two finds to which attention has been directed in preliminary reports on the season's work—the group of battered vessels and gold and silver, associated with burnt bones, which seem to be of the nature of a comminatory offering, and the gold ornament of torc form for which Irish affinities have been suggested —will certainly attract notice. The exhibition will remain open for four weeks.

AT the British Museum the collection of antiquities yielded by the past season's excavations at Ur will remain on exhibition for a period of three months. The character of the work, although it was essential and might have proved of the greatest value scientifically, was not such as would be likely to afford spectacular results for exhibition purposes comparable with those of recent years. There is, however, a number of gold frontlets and beads and a striking terra-cotta figure of a god with a mitre of bull's horns in the best tradition of Ur. There are also a limestone statuette of the goddess Pa-Sag and a copper statuette of the same deity, the latter discovered in the pedestal of a limestone figure. These belong to the third dynasty. A steatite bowl of the same period shows the figures of five oxen as decoration. One of the most interesting items in the collection is the steatite stamp seal assigned to Mohenjo-daro as its place of origin, on which are engraved an Indian buffalo and an inscription in the script of the Indus valley. Mention must also be made of the collection of types of beads from about 4000 B.C. down to the Persian era of the fourth century B.C., and the collection of seal-impressions from various sources which, it is inferred, were once the property of a jewel collector at Ur.

The Freshwater Biological Association

THE annual general meeting of the Freshwater Biological Association of the British Empire was held on June 29, and Mr. Reginald Beddington was elected president. The Report for the year shows that the Association, which was established as the outcome of a discussion at the meeting of the British Association at Glasgow in 1928, has made considerable progress during the past year. Support has been received from the Development Commissioners, scientific societies, waterworks associations, fishery boards and angling associations, and many private individuals. The interests of anglers are very closely concerned with research into the conditions existing in fresh waters, but not as much help as was expected has been received from those directly interested in angling. In September the Association opened a laboratory on the shore of Lake Windermere, certain rooms in Wray Castle, a property owned by the National Trust, having been equipped for this purpose. There are two naturalists employed in research at the laboratory, and there is accommodation for visiting research workers. A number of workers from Great Britain and from abroad have already occupied tables in the laboratory. There is a launch for work on the lake, and this launch is fully equipped for hydro-biological research. In extending its programme of research the Council of the Association has felt the difficulty of a lack of funds. A special appeal is made to all who are interested in fresh waters to support the Association. The address of the honorary secretary is Mr. J. T. Saunders, Christ's College, Cambridge.

Photographic Copying by Contact

IN the early days of photography, the late Mr. J. H. Player invented a method of making full-sized copies of black and white print, drawings, etc., without the use of a camera or lens. The process, known as ' playertype ', is easily worked and may sometimes be used with advantage. The drawing to be copied is taken to the dark room. A sheet of ordinary bromide paper, or a photographic plate, is placed with its sensitive surface in close contact with the drawing. The paper is then exposed for a short time to the light from any convenient ordinary source of white light of low power. The light passes through the paper and its sensitive coating, illuminating the drawing beneath. Less light is reflected back from the black lines of the drawing than from the white ground. Thus the total illumination of the sensitive coating opposite the black lines is less than that opposite the white ground. On developing the sensitive material a somewhat foggy negative is obtained. This negative can be used for

printing any number of photographic copies in the usual way. Recently this process has been revived by Messrs. Luminophor, Ltd., 27 Queen Victoria Street, London, E.C.4, who supply phosphorescent screens to replace the ordinary light source of the original 'playertype'. One of the screens must first be excited by exposure to daylight or to magnesium light. It is then placed upon the bromide paper and drawing and allowed to remain for some minutes. Subsequent operations are similar to those already described for 'playertype'. However, while these phosphorescent screens are sometimes convenient, they are costly and really quite unnecessary.

Beit Memorial Fellowships for Medical Research

The following elections have been made by the Trustees of the Beit Memorial Fellowships for Medical Research, the subject and place of research being indicated after the name:—*Senior Fellowship in Tropical Medicine* (£1000 a year, for one further year): Dr. E. Hindle, spirochætosis, with special reference to the causation of yellow fever. *Fourth Year Fellowships* (value £500 a year): Dr. C. L. Cope, excretion by the mammalian kidney of the glomerular dyestuffs and of the inert sugars believed to be excreted only by the glomeruli (Radcliffe Infirmary and Department of Biochemistry, Oxford); Margaret Honora Roscoe, to continue work on the vitamin B complex (Lister Institute of Preventive Medicine, London); Mr. K. A. C. Elliott, to complete work on peroxidases, and then to study tissue respiration from the point of view of carbon dioxide evolution (Sir William Dunn Institute of Biochemistry, Cambridge). *Junior Fellowships* (£400 a year): Dr. H. P. Himsworth, activation of insulin by a possible kinase and effect of diets of varying composition on diabetic patients (University College Hospital Medical School, London); Mr. N. R. Lawrie, biochemical investigation of the nutritional requirements of Protozoa and the study of patients with abnormal metabolism of sulphur-containing compounds (Sir William Dunn Institute of Biochemistry, Cambridge, and Addenbrooke's Hospital, Cambridge); Dr. D. H. Williams, carbohydrate metabolism, particularly the storage of liver glycogen in experimental animals (Department of Physiology, University College, London); Mr. D. W. W. Henderson, antibacterial mechanisms in prophylaxis and therapy of tetanus; cultivation of the viruses of louping ill and fowlpox (Lister Institute of Preventive Medicine, London); Dr. R. G. R. West, neurological mechanism of tetany and the pharmacology of curare (Physiological Department, St. Bartholomew's Hospital Medical School); Dr. R. Gaddie, intermediate carbohydrate metabolism of isolated frog's heart; mode of action of insulin in the animal body (Departments of Medical Chemistry and Materia Medica, University of Edinburgh); Mr. F. G. Young, storage of carbohydrate by the liver in experimental animals (Departments of Physiology at University College, London, and at the University of Aberdeen); Dr. J. M. Robson, hormonic factors responsible for the maintenance of pregnancy and onset of parturition (Institute of Animal Genetics, Edinburgh).

Beit Fellowships for Scientific Research

BEIT Fellowships for Scientific Research of the annual value of £240 and tenable at the Imperial College of Science, South Kensington, have been awarded to Mr. R. M. Shackleton (University of Liverpool and Imperial College), for research on the geology of the area about Moel Hebog; Mr. E. G. Jones (University College, Nottingham, and the Einstein Institute, Astrophysics Observatory, Potsdam), for research on hyperfine structure of spectral lines; Mr. R. L. Rosenberg (Universities of Cape Town and Berlin), for theoretical investigations in topics connected with quantum mechanics; Dr. O. B. Westcott (University College, Exeter), for research on the electro-deposition of tin with the view of establishing the precise conditions under which crystalline deposits may be obtained and avoiding the unsatisfactory spongy deposits which result from present processes. In addition, the fellowships awarded a year ago to Mr. W. H. Wheeler, for research in chemical technology, and Mr. J. I. Armstrong, for plant physiology research, have been extended for a second year.

Cancer Research

THE ninth annual report of the British Empire Cancer Campaign, presented at the annual meeting on July 11, illustrates the diversity of ways in which the cancer problem is being approached—observational, experimental, and clinical. The best discovery announced is the identification by the Cancer Hospital Research Institute of a pure chemical substance—1 : 2 : 5 : 6 - dibenzanthracene — which causes epithelial and connective tissue tumours in the great majority of treated animals. Some progress has also been made in perfecting an antiserum which will cure mouse tumours, but it remains questionable whether there is much prospect of applying the method successfully to human cases. The account of cancer as a gene mutation lacks something in historical perspective: it does no more than translate Boveri's hypothesis into modern terminology.

Wool Production in the Empire

THE Wool Industries Research Association and the Empire Marketing Board are to be congratulated on their joint effort to make a survey of the conditions of wool production throughout the British Empire, particularly from the point of view of assessing the factors, economic and biological, which play a part in controlling production in different areas. The report, the result of a three years' survey by J. E. Nichols, has just appeared under the title "A Study of Empire Wool Production" (Wool Industries Research Association, Leeds; 5*s*. net). In 148 pages it would be impossible to follow all the vagaries of wool production, but Mr. Nichols has made the most of his space by discussing three main aspects: the conditions under which wool production occurs, and this includes geographical conditions as well as the conditions of the fleece itself; the phases of wool production in the Empire, which means that the breeds of sheep, the qualities of the wools, the factors affecting the industry, are discussed for each country

in turn; and finally, Part 3 "constitutes an attempt to analyse the concept of wool improvement and an examination of methods of development of its production".

Academy of Natural Sciences of Philadelphia

IN an attractive *Year Book* for 1931, it is recorded that the 120th year of the Academy's existence was signalised by notable activities in many directions. In each of the three major fields—laboratory studies, expeditions, and museum exhibits—the year set new records for this oldest institution of its kind in America. During the year, twenty-two expeditions for organised collecting, sponsored wholly or in part by the Academy, obtained material for study or exhibits from North, South, and Central America, as well as from Asia and Africa, and covered more than 175,000 miles during their quests. One result is seen in the addition of more than 8700 new specimens of vertebrates alone to the study collections. That the museum side of the Academy's activities arouses growing interest is indicated by the increased number of visitors, which for the first time exceeded 100,000; but the photographs of the cases of small mammals in the North American hall give an impression of the grouping of incongruous species, which suggests that here there is still room for the development of artistic natural groups. It is announced in *Science* that the following have recently been elected correspondents of the Academy: Prof. L. H. Bailey, Dr. H. B. Bigelow, Prof. R. A. Daly, Dr. Ludwig Diels, Prof. J. Stanley Gardiner, Prof. Hugo Glück, Prof. W. D. Gregory, Prof. A. S. Hitchcock, A. Lutz, Prof. E. de Margerie, Prof. E. D. Merrill, E. W. Nelson, Prof. A. C. Seward, Dr. E. O. Ulrich, and Mr. B. P. Uvarov.

Eradication of Slugs and Snails

SLUGS and snails are some of the most widespread pests on farms and in gardens, but owing to their nocturnal habits and their capacity for excreting slime which enables them to get rid of irritating substances, they are very difficult to control. Their natural enemies, for example, various birds, toads, moles, and predaceous ground beetles, are insufficient to keep their numbers in check, and special means of control are often necessary. Though no means of absolute eradication of these pests is as yet known, the Ministry of Agriculture has published an *Advisory Leaflet* (No. 115), in which various check measures are described. In gardens, large numbers of slugs may be caught by means of traps consisting of cut potatoes, orange skins, cabbage leaves, tiles, boards, or sacking placed on the soil, for the animals will collect under them for shelter during the day. Hand collecting at dusk is also recommended. For larger areas, the use of certain chemicals with a corrosive or toxic action is advised. Quicklime or salt are destructive if they come in contact with the upper part of the slugs' bodies, and applications made at night (or two or three times during the same night, if possible) should prove useful. Barriers of repellent material such as soot, washing soda, 'dry Bordeaux', etc., are often successful, and recent trials have shown that 1 part creosote mixed with 100 parts of precipitated chalk placed around each plant at the rate of $\frac{1}{4}$ oz. per plant is worth further trial.

Forest Fires

LEAFLET No. 9 issued by the Forestry Commission (H.M.S.O., 1931) deals with this subject, which is of growing importance in Great Britain. The type of forests most subject is the coniferous; outside tropical regions, fires in forests of broad-leaved trees are less dangerous. Woodland fires are not new in Great Britain, and in dry seasons they have been only too prevalent on commons. The Forestry Commission attributes twenty-five per cent of the fires occurring nowadays in its new forests to carelessness on the part of picnickers and wayfarers. Since the advent of the Forestry Commission and the large coniferous planting campaign which has been inaugurated under its auspices during the past twelve years, the forest fire problem has entered upon a new phase. The most common form of danger is the surface or ground fire, burning dead leaves, etc., on the forest floor. The stem and crown fire is rarer in Great Britain. Newly planted areas are in greatest danger during March and April, although a dry February produces the same conditions. During a summer drought the danger reappears. The grass, under the influence of dry east winds or a summer drought, becomes as dry as tinder, and a cast-away lighted match or burning cigarette-end will start a fire which will quickly get out of control of the perpetrator of the act. After pointing out the various dangers to plantations situated under differing conditions, the leaflet deals with various methods of control, such as lay-out of plantations, order of felling, removal of debris, patrolling, equipment of tool depots, clearance of growth outside plantations, importance of immediate action, counter-firing, and the measures to be taken after the outbreak.

The Making of Factories

IN *Helios* for March 20, the export journal of the *Zeitschrift für die Elektrotechnik*, there is an interesting account of the Gladitz Company of Berlin, the main business of which is to instal and equip completely in every detail lamp-making factories. Any one willing to start a factory for electric lamps need have no technical knowledge of the subject. For example, a capitalist in Mexico City recently ordered a modern lamp-making factory. The plans for the building were prepared by the company and it was erected under the supervision of a local architect. During this time the necessary equipment, down to the smallest detail, was made in Germany. German engineers then went to Mexico and installed the machinery. They took with them a staff of male and female workers. The Mexican labourers, both men and women, were instructed by this staff. In a year's time the instructors had all left, the only German remaining being the technical manager. Three months after the building was erected, lamps began to be manufactured, and the production is now 16,000 per day. The contract comprises the supply of all machines and accessories, the factory organisa-

tion, the instruction of local labour, continuous control, and consultation. The Gladitz Company has already installed complete factories in many countries of the world, with departments for wire treating, glass treating, exhausting, and finishing the lamps. It is interesting to notice that several of these factories are now being controlled by the large lamp companies. The company considers that this is a compliment to the work turned out by the factories it has started. It is busy at present in developing practical manufacturing methods of making neon signs for manufacturing purposes.

Precautions in Use of Electro-Medical Apparatus

SERIOUS accidents from the use of electro-medical apparatus have so far been few in number, but the risk is likely to increase in the future, owing to more extended use of such appliances and also to the tendency to make use of the standard alternating current of 230 volts. Industrial experience shows that serious shock is more likely to result from alternating than from direct currents of the same voltage. The Ministry of Health has therefore issued a Memorandum (Mem. 161 Med.) with covering Circular (No. 1267) directing attention to precautions that ought to be taken in the use of electro-medical appliances, adoption of which should go far to minimise the risks involved.

Researches from the University of Sydney

The published work of members of the University of Sydney is made more generally available by the issue of collected reprints, which are now classified in twelve series, according to the nature of the research. We have recently received vol. 1, Reprints Nos. 18-24, in Series I. (Agricultural and Veterinary Science), vol. 1, Reprints Nos. 22-32, in Series VIII. (Medical Sciences—Clinical), and vol. 3, Reprints Nos. 1-19, in Series IX. (Medical Sciences—Non-Clinical). Most of the papers have been published within the last two years ; a few are of less recent date. Most, but not all, were originally published in Australian journals. The range of subjects dealt with in each volume is wide, and indicates that an active spirit of research animates Australian scientific workers.

Hawaiian Volcano Observatory

WE regret to learn that, from July 1, the annual fund allotted to volcanology through the U.S. Geological Survey has been reduced from 35,000 to 15,000 dollars. Most of this sum is required for the work of the Hawaiian Volcano Observatory, and one of the first results of the reduction is that the weekly *Volcano Letter*, first issued in 1925, is to be replaced by a monthly leaflet. There will be no suspension of the research work, though the staffs at all the stations, n Hawaii, California, and Alaska, will be reduced.

Announcements

THE fifteenth Faraday Lecture of the Chemical Society will be delivered by Prof. P. Debye, of Leipzig, on March 29, 1933.

DR. H. R. MILL, who during his long association with the Royal Geographical Society has been actively engaged in the promotion and preparation of the polar expeditions of the past forty years or so, has been appointed by the King of Norway a Commander (2nd Class) of the Order of St. Olav, for his services to Norwegian arctic explorers. This order has previously been conferred upon Sir Clements Markham, Sir Ernest Shackleton, and Sir John Scott Keltie.

MRS. BOWEN, Titcomb Manor, Kintbury, Berks, informs us that she has fifteen bound volumes of NATURE, namely, vol. 45 to vol. 60, extending from Nov. 1891 to Oct. 1899, with the exception of vol. 54, which she generously offers to present to a suitable college, institute, or scientific worker, in need of them, upon payment of carriage. Communications should be sent direct to Mrs. Bowen at the above address.

A SPECIAL volume (vol. 9) of the *Australian Journal of Experimental Biology and Medical Science* has been issued as a memento of the late Prof. Brailsford Robertson, who founded the *Journal* and, until his death in January 1930, was its chief editor. The volume contains a biographical account of his scientific work, a bibliography of his writings, and nineteen papers specially contributed by his former colleagues and pupils, who are all acknowledged authorities on the subjects on which they write. The volume forms a unique and interesting collection of papers on those biochemical aspects of biological science to which the late Prof. Robertson during his lifetime made such notable contributions, both directly by his own individual work and indirectly by his inspiring influence on a wide circle of colleagues and pupils.

THE annual Report of the Governing Body of the Lister Institute of Preventive Medicine, recently issued, announces that Prof. William Bulloch has been elected chairman of the governing body, in succession to the late Sir David Bruce. An excellent survey of the numerous researches carried out by workers at the Institute is presented. The National Collection of Type Cultures, housed at the Institute, has had two hundred cultures added, and has distributed more than five thousand cultures, during the year.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—An assistant lecturer in zoology at the University of Birmingham—The Secretary (July 17). A lecturer in electrical engineering and physics at the Borough Polytechnic, Borough Road, London, S.E.1—The Principal (July 18). A principal of the College, and a headmaster of the College Secondary School, Swindon—The Director of Education, Education Office, Clarence Street, Swindon (July 21). A principal of the new Technical School, Hong-Kong—The Secretary (SIR/CA), Board of Education, Whitehall, London, S.W.1, or, for Scottish applicants, The Secretary, Scottish Education Department, Whitehall, London, S.W.1 (July 23). A lecturer in zoology at University College, Nottingham—The Registrar (July 30). A demonstrator in biology at Guy's Hospital Medical School, London Bridge, S.E.1—The Dean (Aug. 5).

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 Oxygen Affinity of Chlorocruorin

CHLOROCRUORIN is the respiratory pigment in the blood of certain polychæte worms. Working in the laboratory of Dr. R. Wurmser in Paris, I have investigated the oxygen affinity of the specific chlorocruorin of *Spirographis spallanzanii*. The blood was diluted to approximately 6 parts in 1000 parts of 0·6 *M* phosphate buffers. In each experiment, 3 c.c. of the diluted blood was placed in a 300 c.c. glass saturator, to one end of which a small trough with parallel glass faces 2 cm. apart was attached. The oxygen pressure in the saturator was varied by measured amounts, and the solution equilibrated at

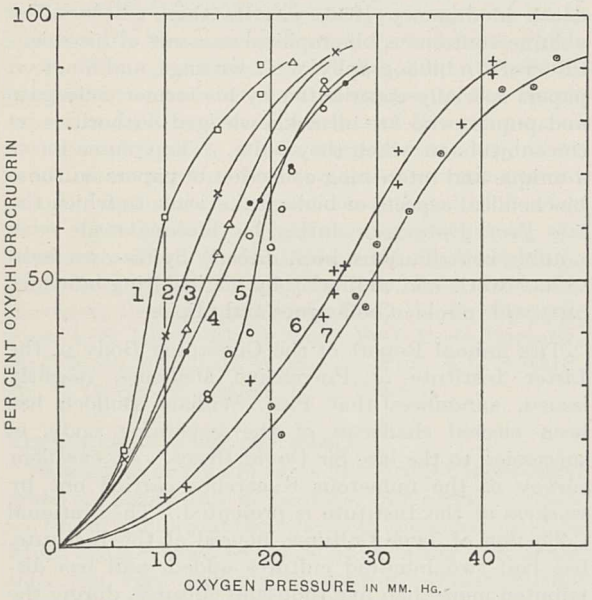


FIG. 1.—Oxidation dissociation curves of chlorocruorin. 1, *p*H 8·0, 10°; 2, *p*H 8·2, 20°; 3, *p*H 8·0, 20°; 4, *p*H 8·0, 26°; 5, *p*H 7·7, 10°; 6, *p*H 7·7, 20°; 7, *p*H 7·35, 26°.

each oxygen pressure by rotating the saturator horizontally in a thermostat. The saturator was then placed vertically with its trough in the course of the light beam of a spectrophotometer. The relative concentrations of oxy- and reduced chlorocruorin were obtained by measuring the light absorption at the wave-lengths in the visible region of the spectrum (604·5 and 580·5 mμ) where there is the greatest difference between the oxidised and reduced pigment.[1]

The results obtained are shown in Fig. 1. The *p*H limits are dictated by the fact that chlorocruorin is unstable above *p*H 8·5 and below *p*H 7·0. Both hydrogen ion concentration and temperature affect the oxygen affinity of chlorocruorin in a similar manner to mammalian hæmoglobin. The temperature coefficients (Q_{10}) of the reaction between chlorocruorin and oxygen (in the buffer solutions used), calculated from the oxygen pressures corresponding to 50 per cent saturation, are 1·6 at *p*H 8·0 and 1·5 at *p*H 7·7. Human whole blood at 38° is 50 per cent saturated with oxygen at an oxygen pressure of 29 mm. Hg, in presence of 40 mm. CO_2.[2] The same is seen to be true for diluted *Spirographis* blood at 26° and *p*H 7·35. The oxygen affinity of chlorocruorin at the temperatures at which the animal lives is, therefore, of the same order of magnitude as that of hæmoglobin in the human body.

The limiting temperatures studied, 10° and 26°, were chosen because the former is that of the winter sea in Brittany, the latter that of the summer sea at Algiers. These are extremes in the habitat of *S. spallanzanii*. It seems probable that the temperature effect on the oxygen dissociation curve is one of the limiting factors in the geographical distribution of poikilothermal animals having respiratory pigments. At too high a temperature the oxygen affinity of the chlorocruorin of *S. spallanzanii* would be so much diminished that there would be an insufficient difference in oxygen pressure between blood and tissues for the latter to receive oxygen at a rate necessary to maintain life.

H. MUNRO FOX.

Zoological Department,
University of Birmingham,
June 3.

[1] Fox, *Proc. Roy. Soc.*, B, **99**, 199; 1926.
[2] Brown and Hill, *Proc. Roy. Soc.*, B, **94**, 297; 1923.

Raman Spectrum of Nitrous Oxide

WE have photographed the Raman spectrum of nitrous oxide with a four-prism glass spectrograph having a camera lens of diameter 5 cm. and focal length 70 cm. The gas was at a pressure of 30 atmospheres and was illuminated with four 32 cm. long mercury lamps, container and lamps being surrounded by a reflector of suitable shape. The exposure time was 14 days, the spectrograph being, of course, enclosed in a thermostat. Average values of the frequency shifts obtained are listed in the first column of the accompanying table. In the third column are stated the transitions to which the Raman lines are ascribed, the quantum numbers V_1, V_2, V_3, and l, introduced by Dennison,[1] being used to designate the vibrational states of the molecule. The fourth column, finally, gives the values of the frequency shifts as computed from the recent infra-red absorption measurements of Plyler and Barker.[2]

Frequency (observed), cm.$^{-1}$.	Intensity.	Transition.	Frequency (computed), cm.$^{-1}$.
1170	weak	$0000 \longrightarrow 0200$	1167·3
1185	weak	$0000 \longrightarrow 020 \pm 2$	1179
1260	weak, broad	Max. *PP*-branch	1256
1282	weak	$010 \pm 1 \longrightarrow 110 \pm 1$	1279
1286·5	very strong	$0000 \longrightarrow 1000$	1285·4
1315	weak, broad	Max. *RR*-branch	1314
2210	weak	$010 \pm 1 \longrightarrow 011 \pm 1$	2210·1
2223·2	strong	$0000 \longrightarrow 0010$	2224·1

The frequency shift of 1286·5 cm.$^{-1}$ was measured three times, being excited by the mercury lines 4047 A., 4078 A., and 4358 A. All the other frequency shifts were measured twice, being excited by 4047 A. and 4358 A. The values obtained for the two strong Raman shifts are probably correct to less than 1 cm.$^{-1}$. They are in fair agreement with the value 1282 cm^{-1}. found by Dickinson, Dillon, and Rasetti,[3] and the values 1283 cm.$^{-1}$ and 2226 cm.$^{-1}$ obtained by Bhagavantam.[4] The ratio between the intensities of the two strong lines may well be 10 to 1, as stated by Bhagavantam. However, with lines so far apart, it is impossible to make a really quantitative estimate of the intensities by mere visual inspection of the plate.

So far as we are aware, none of the weak lines has been observed before. The only lines about the reality of which there may be some doubt are the two

lines corresponding to the frequency shift 1282 cm.$^{-1}$. The difficulty of settling the reality of these lines exists because they lie close to the very strong lines corresponding to the shift 1286·5 cm.$^{-1}$, which lines appear to have an unsymmetrical intensity distribution, with the greatest broadening towards long wave-lengths.

The agreement between the frequency shifts observed in the Raman spectrum and those computed from Plyler and Barker's infra-red measurements is very good, and hence the interpretation given in the third column of the table seems scarcely open to doubt. While all the other Raman frequencies are interpreted as Q-branches, the broad lines having shifts of 1260 cm.$^{-1}$ and 1315 cm.$^{-1}$ undoubtedly represent the maxima of PP- and RR-branches. From their separation from the Q-branch at 1286·5 cm.$^{-1}$, we obtain the value of 61×10^{-40} gm. cm.^{2} for the moment of inertia of the molecule, in good agreement with Plyler and Barker's value $59{\cdot}4 \times 10^{-40}$. It is an interesting fact, also found with liquid carbon disulphide [5] and in perfect accord with the selection rules of Placzek,[6] that the transitions $0000 \longrightarrow 010 \pm 1$ do not occur in the Raman spectrum, while the 'overtones' $0000 \longrightarrow 0200$ and $0000 \longrightarrow 020 \pm 2$ occur, although with low intensity. Our results strongly support the conclusion that the nuclei in the nitrous oxide molecule are linearly and unsymmetrically arranged.

One of us (J. R. N.) is indebted to the John Simon Guggenheim Memorial Foundation for the grant of a fellowship.

A. LANGSETH.
J. RUD NIELSEN.

University Chemical Laboratory and
Institute for Theoretical Physics,
Copenhagen, June 8.

[1] D. M. Dennison, *Rev. Mod. Phys.*, **3**, 280; 1931.
[2] E. K. Plyler and E. F. Barker, *Phys. Rev.*, **38**, 1827; 1931.
[3] R. G. Dickinson, R. T. Dillon, and F. Rasetti, *Phys. Rev.*, **34**, 582; 1929.
[4] S. Bhagavantam, NATURE, **127**, 817; 1931. *Indian J. Phys.*, **6**, 319; 1931.
[5] Cf. D. M. Dennison and N. Wright, *Phys. Rev.*, **38**, 2077; 1931.
[6] G. Placzek, *Leipziger Vorträge*, 1931, p. 71.

Dielectric Constant of Liquid and Solid Nitrobenzene

THE change of the dielectric constant of nitrobenzene with temperature was examined by J. Mazur,[1] who discovered that the value of the dielectric constant in the liquid phase drops abruptly from 38·15 at 9·6° to 11·82 at 7·7°. M. Wolfke and J. Mazur [2] try to explain this behaviour by the change of the structure of the molecule at the temperature of 9·6°, which temperature is said to separate from each other two modifications of nitrobenzene. In order to verify this, I have carried out at different temperatures measurements of the electric polarisation of diluted solutions of nitrobenzene in hexane. The results of these investigations, which will be dealt with in a special publication, show *inter alia* that the nitrobenzene molecule when passing the point 9·6° does not suffer a change of either electric moment or polarising power; [3] moreover, no such change occurs at any temperature between − 4° and + 30°.

I therefore determined to repeat the measurements of J. Mazur. I have investigated the dielectric constant of nitrobenzene in the temperature interval − 3·70 and + 50°. The nitrobenzene was specially purified, for example, by repeated distillation and crystallisation, and dried by bubbling through it for several hours dried and carbon dioxide free air. The condenser was made of thermometric glass and platinum. The temperature was measured outside the condenser (in the oil bath) as well as inside. The results are shown in Fig. 1, and are quite inconsistent with those obtained by J. Mazur. The curve showing the change of dielectric constant with temperature does not show any peculiar point at the temperature of 9·6°. On the other hand, a quite abrupt decrease of the dielectric constant takes place at the freezing of nitrobenzene. This can occur at any temperature below the freezing point (+ 5·66°) provided the nitrobenzene is undercooled (first series of measurements), or at 5·66° without undercooling (second series of measurements). In the latter case, the dielectric constant drops abruptly from 37·25 to 7·36, after which it rapidly decreases to 3·44 at 0°.

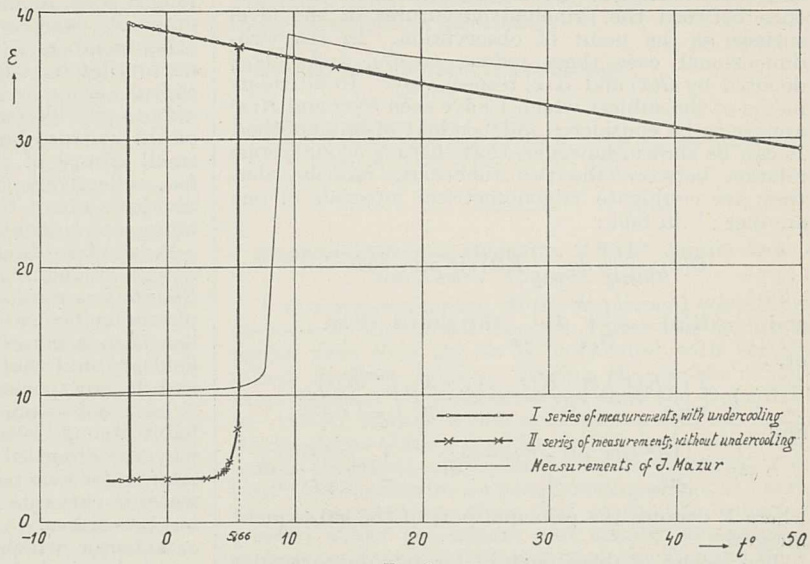


FIG. 1.

Similarly, the density-temperature curve of nitrobenzene shows no inflexion at 9·6°, as found by Mazur,[4] and, therefore, the electric polarisation of liquid nitrobenzene shows no abnormalities down to the freezing point.*

The discrepancy between Dr. Mazur's results and mine are, I think, due, as Prof. Wolfke has suggested to me, first to the method of purifying and the degree of purity of this unusually capricious substance, and, secondly, it may be caused by some hitherto and as yet unknown conditions of obtaining nitrobenzene II, which conditions have been observed by some investigators [5] but not by others.

A. PIEKARA.
Physical Laboratory, Sulkowski Gymnasium,
Rydzyna, Poland,
May 25.

* The same refers to the molecular refraction.
[1] NATURE, **126**, 993; 1930.
[2] NATURE, **128**, 584; 1931.
[3] In agreement with the recent results of M. Wolfke and S. Ziemecki (*Acta Physica Polonica*, **1**, 271; 1932), who found no abnormalities in the refractive index or in the Raman spectrum of nitrobenzene.
[4] NATURE, **127**, 893; 1931.
[5] Cf. the paper of G. W. Stewart (*Phys. Rev.*, **39**, 176; 1932), who obtained positive results when investigating the point of transformation of ethyl ether and nitrobenzene by means of X-rays.

The Connexion between the Eötvös Magnitudes

IN the problem of locating subterranean anomalies of density, the Eötvös balance measures two quantities, the horizontal gravity gradient and the difference between the principal curvatures of the level surface at the point of observation. In the two-dimensional case these reduce to U_{xz} and $-U_{xx}$, denoted by $G(x)$ and $K(x)$ respectively. In all treatments of the subject which I have seen $G(x)$ and $K(x)$ appear to be considered independent of one another. It can be shown, however, that there is a one-to-one relation between the two functions, namely, that they are conjugate trigonometrical integrals of one another ; [1] in fact :

$$G(x) = \frac{1}{\pi}\int_0^{\infty} d\alpha \int_{-\infty}^{+\infty} K(t) \sin \alpha(t-x)dt$$

and $$K(x) = -\frac{1}{\pi}\int_0^{\infty} d\alpha \int_{-\infty}^{+\infty} G(t) \sin \alpha(t-x)dt,$$

or,

$$G(x) = \frac{1}{\pi}\int_0^{\infty} \frac{K(x+t) - K(x-t)}{t}dt = \frac{1}{\pi}P\int_{-\infty}^{+\infty} \frac{K(t)}{t-x}dt$$

and

$$K(x) = -\frac{1}{\pi}\int_0^{\infty} \frac{G(x+t) - G(x-t)}{t}dt = -\frac{1}{\pi}P\int_{-\infty}^{+\infty} \frac{G(t)}{t-x}dt$$

where P denotes the principal part of the subsequent integral.

The second of these pairs of formulæ in particular enables one of the quantities to be obtained from the other, whether given in functional form or as a series of observations.

These results depend solely on the density anomalies lying all on the same side of Ox ; which is, of course, the usual thing, the observations being made along the surface of the ground. They do not depend on the density changes being either continuous or discontinuous.

In the recent experimental survey in Australia [2] it is stated that the gradiometer, which only measures $G(x)$, is more satisfactory from a practical point of view than the torsion balance ; it appears now that the latter instrument provides no further information than the former, so far as two-dimensional structures are concerned, since the measurement of $K(x)$ as well as $G(x)$ is redundant, or is only a check.

O. F. T. ROBERTS.

University of Aberdeen,
June 4.

[1] E. C. Titchmarsh, *Proc. L.M. Soc.*, II., **24**, p. 109.
[2] "Geophysical Prospecting", Imperial Geophysical Experimental Survey, p. 173.

Swarming of Collembola in England

A RECENT letter in NATURE [1] directed attention to instances of swarming of certain species of Collembola. It was stated that "In most . . . cases . . . (if not all) the factor producing this phenomenon would seem to be the relative abundance of the food supply". In another instance it was suggested that "migration *may* account for swarming".

While in agreement with the first suggestion as a possible explanation of this swarming habit, certain observations made from time to time during studies on this order of insects might assist in carrying the subject a stage further. In September 1928 I examined, by means of a binocular microscope, the habits of individuals in a swarm of *Podura aquatica*, L. I was at first surprised at the number of head-capsules of adults which could be seen in the colonies ; each head-capsule was completely devoid of all save the merest traces of the body. Observations revealed the fact that under these conditions the Collembola were carnivorous, and even cannibalistic, in habit. Individuals could be seen vigorously attacking other members of the swarm ; the point of attack was evident, in some cases, by a drop of body fluid which exuded. During an attack the victim struggled and fought with mouth-parts and tarsal claws, but was gradually overpowered. When it succumbed, several other members of the swarm quickly collected around its mutilated body and devoured it, until the head-capsule alone remained. This habit appeared not only to provide food for the support and development of the colonies but also was a factor in keeping the small groups of the Collembola together while they fed, collectively, on the scattered dead bodies. Individuals about to moult proved ready prey for the more active members of the swarm.

A similar observation was recorded to a lesser extent among *Hypogastrura* spp. The swarming of *Sminthurus viridis*, Lubb.—a species which is mainly phytophagous in habit—has not been observed, but it has been a common experience, in heavily infested fields, to find that this species will readily congregate and devour specimens that had recently died.

I am not aware of any reference to this interesting habit among Collembola, and this no doubt explains why the observed species can remain congregated in swarms for long periods in such barren sites as surface water in cart ruts, bare stones, and even on tap water in glass dishes.

A factor which undoubtedly affects this swarming habit is humidity. It has been shown [2] that species of Collembola, particularly atracheate forms, require a saturated atmosphere to survive any length of time. Individuals, therefore, tend to congregate in local environments where these conditions are provided. Species which hibernate in the egg stage (*Sminthurus viridis*, *Bourletiella hortensis*, *B. lutea*, etc.) attain enormous numbers when temperature and humidity favour hatching ; the movement of the young Collembola is then influenced by humidity. Such was the case [3] of *Bourletiella hortensis*, Fitch., which swarmed over the mangold field during the early morning when the soil was moist, but later in the day moved below soil-level, except when near plants which they had damaged. In this latter case the point at which plants' juices exuded provided both food and favourable humidity, hence this species swarmed in such sites.

W. MALDWYN DAVIES.

University College of North Wales
(Memorial Buildings), Bangor,
June 20.

[1] NATURE, **129**, 830, June 4, 1932.
[2] Davies, W. M., *Brit. J. Exp. Biol.*, **6**, i. 79, Sept. 1928.
[3] Davies, W. M., *Bull. Ent. Soc.*, **17**, 159 ; 1926 : *J. Min. Agric.*, **32**, iv., July 1925.

The Rearing of *Hæmatopota pluvialis*, Linné (Cleg, Tabanidæ) under Controlled Experimental Conditions

DESPITE the potential or actual importance of blood-sucking insects in the transmission of pathogenic micro-organisms, investigation of the life-histories of the European species of the Tabanidæ, including that of the cleg, the most common of our palæarctic species, has been comparatively neglected. Hitherto the number of larval stages has not been ascertained in any European tabanid species, and for the rest this has been determined only in one bivoltine North American species [1] and in five trivoltine Indian species.[2]

In our experiments, which commenced in 1930, we have succeeded in inducing females previously fed on human or rabbit hosts to deposit typical tabanid egg-masses in the laboratory. In individual cases females have oviposited twice, the two acts of oviposition being separated by an interval during which a second

blood meal was taken. There is also evidence that a third oviposition may occur. The fact that two or more acts of oviposition can occur separated by intervals when another host is attacked, is of prime significance relative to the biological transmission of micro-organisms from one host to another.

On emerging from the eggs after an incubation period of about ten days, the first larval instars were isolated in a moist sand medium in small glass vials and reared to maturity under conditions identical for all. The number of ecdyses varied from 7 to 9, the last being that preceding pupation, and they were distributed over one or two years. Individuals reared from the same batch of eggs required either one or two years to complete their development, and it may be safely concluded that *H. pluvialis* is heterozygous for univoltine or demivoltine characters. This conclusion is corroborated by the results of a series of experimental rearings now being carried through at a constant temperature of 70° F. Whilst increased temperatures induced a decided increase in the initial rate of metabolism, as expressed in the more rapid growth of the early instars and decrease in the duration of the early stadia, they did not essentially alter the characteristic type of development. That differential development of palæarctic Tabanidæ resulting in life-histories extending over one or two years is not an unusual phenomenon, was abundantly evident in our investigations [3] of Canadian species, and appears to be genetic in its origin.

In order to obviate the risk of overlooking any individual ecdysis—which may readily occur in the case of the earlier ones—a series of measurements of a standard skeletal structure was made in each exuvium recovered. The paired tentorial rods of the head capsule were selected for this purpose and have proved invaluable in checking our observations. Counts of the number of pedunculate bodies in Graber's organ have also proved useful in this respect. Thus in *H. pluvialis* there are twice as many pedunculate bodies for any particular instar as the number which designates that instar. Contrary to what occurs in many other Tabanidæ, there is no elimination of pedunculate bodies to the exterior during larval development.

The detailed results of our investigations will be published later.

A. E. CAMERON.

Department of Zoology,
University of Edinburgh,
June 1.

[1] Schwardt, H. H., *Ann. Entom. Soc. Amer.*, **24**, 409-416; 1931.
[2] Isaac, P. V., *Mem. Dept. Agr. India, Entom. Ser.*, **8**, 53-62; 1924. *Ibid.*, **8**, 93-109; 1925. *Ibid.*, **9**, 21-28; 1925.
[3] Cameron, A. E., *Bull. Ent. Res.*, **17**, 1-42; 1926.

Origin of Insects from Crustacea

WHILE agreeing with the substance of Dr. R. J. Tillyard's remarks on the above subject,[1] it may be pointed out that certain observations upon the development of the coxal styles of the Machilidæ are to be found in a paper by R. Heymons published so long ago as 1906. In this communication, entitled "Ueber die ersten Jügendformen von Machilis",[2] it is mentioned that the styles in association with the thoracic coxæ of *Machilis* are not present in the young stages, and, in fact, are only discernible when the insect is in its third stage of development. This agrees with Dr. Tillyard's observations in which he points out that, in the Australian *Allomachilis*, the coxal styles are wanting in the first and second instars, and that it is only in the later instars that these organs become evident.

Dr. Tillyard also mentions that these problematical structures are devoid of muscles, and this fact, together with his conclusion relative to their being little more than secondarily developed spurs, are in accordance with views previously expressed by F. Silvestri [3] and by R. E. Snodgrass.[4] The main points of Dr. Tillyard's letter, therefore, confirm the conclusions of those investigators mentioned.

A. D. IMMS.

Zoological Laboratory, Cambridge,
June 15.

[1] NATURE, **129**, 828, June 4, 1932.
[2] *Sitzgs. Gesellsch. naturforsch. Freunde*, Berlin, pp. 253-259.
[3] *Zool. Jahrb.*, **3**, Suppl. 6, pp. 773-806; 1905.
[4] *Smiths. Misc. Coll.*, **85**, No. 6, p. 115; 1931.

Implementiferous Deposits of East Anglia and the Lower Thames Valley

A CLOSE examination of the implement-containing deposits of the Lower Thames Valley has led us to realise that they are to be correlated with certain others in East Anglia. During the course of our investigations we have observed that the Boyn Hill or '100-ft.' terrace, which at Hornchurch is cut in the Kimmeridgic Chalky Boulder-clay (2nd glacial phase), and at Dartford attains a surface-level of 137 feet above O.D., contains no pene-contemporaneous hand-axes of greater age than that of the St. Acheul 1 period; whilst the coarse, and usually unstratified, melt-water gravels which rest upon the Coombe Rock include derived Early Mousterian (Levallois) implements and tortoise-cores, in addition to artefacts of earlier epochs.

Our researches prove that the deposits of the Taplow or '50-ft.' terrace, which at Acton reach a surface-level of 100 feet above O.D., were formed after the deposition of the Coombe Rock (3rd glacial phase) which overwhelmed the Early Mousterian (Levallois) factory-site at Baker's Hole, Northfleet. We have noted that (1) the base of the gravel underlying the brickearths of the Taplow terrace is composed (as at Slades Green and elsewhere) of a *remanié* formed from the Coombe Rock and its associated melt-water gravels; (2) the Coombe Rock has been truncated by the deposits of the Taplow terrace at Belmont Castle, and between Slades Green and Stone, and elsewhere; and recently one of us (J. P. T. B.) has discovered between Northfleet and Swanscombe the high and steep-angled cliff which has been cut through the Coombe Rock and Chalk and against which the Taplow deposits have been banked. Here, in the basal gravel underlying the brickearth of the Taplow terrace, we have located a horizon characterised by an abundance of pene-contemporaneous implements of Middle Mousterian age together with derived artefacts and mammalian remains.

During the early part of the succeeding period of elevation which followed the maximum of the Taplow submergence, fluviatile and sub-aerial loams, characterised by the shell *Helicella striata* (Müll.), were formed, which sealed in occupation-floors of the Aurignacian epoch containing flint implements and pottery fragments. The ensuing or 4th glacial phase is represented by stony hill-wash containing 'rafts' of Coombe Rock and/or by the 'trail'; the former may be studied at Grays and Swanscombe, whilst the latter is well developed at Belmont Castle and at Slades Green, where it caps the Taplow deposits. The 'trail' never overlies the Low or '25-ft.' terrace.

The results, both archæological and geological, that we are obtaining will be fully described in November next before the Society of Antiquaries of London: if our views are correct, it follows that no implementiferous deposits earlier than those of the second inter-glacial period of East Anglia are present within

the valley of the Lower Thames, and that these deposits were laid down from Clactonian 2/Acheulian times onwards.

J. P. T. BURCHELL.

30 Southwick Street,
Hyde Park, W.2.

J. REID MOIR.

Hedges, One House Lane,
Ipswich.

Confirmation of the Space-Group of Epsomite

ALTHOUGH orthorhombic magnesium sulphate heptahydrate (epsomite) has been the subject of two previous investigations,[1, 2] in neither case was a complete structure proposed. We commenced work on this substance in the hope of carrying the knowledge of its structure to a more complete stage. Due to unforeseen circumstances, however, the investigation has been interrupted, and it is uncertain when the study can be resumed. We have considered it of interest to report some of our results, since they agree with those already in the literature, and thus serve as a third check on the dimensions of the unit cell and on the space-group.

The crystals employed were small prisms having faces of the form {110} prominently developed. The apparatus consisted of a Shearer X-ray tube fitted with a copper target ($K_\alpha = 1{\cdot}54$ A.) and a Müller spectrograph.

The results obtained for the size of the unit cell and the number of molecules per cell compared with the data of Cardoso and of Westenbrink are as follows :

	Barnes and Hunter.	Cardoso.	Westenbrink.
a_0	11·94	11·91	11·89
b_0	12·03	12·02	12·01
c_0	$6{\cdot}86_5$	6·87	6·86
mol./cell	4	4	4

Oscillation photographs showed conclusively that {h00}, {0k0}, and {00l} are halved. This was based on the fact that reflections from the odd orders from 1 to 12, inclusive, for {h00} and {0k0}, and from 1 to 6, inclusive, for {00l} were missing. Higher orders than these were unattainable with the apparatus employed.

The only orthorhombic space-group with these halvings [3] is Q^4, which is that found by Cardoso and by Westenbrink. Since Q^4 is in the bisphenoidal class, the X-ray data lead to the same conclusion as to crystal class as that reached by the methods of crystallography.

Our results for the dimensions of the unit cell agree more closely with those found by Cardoso, which are those selected by Wyckoff for quotation in the second edition of the " Structure of Crystals ". They were obtained experimentally from rotation photographs about each of the three axes. Westenbrink calculated the primitive translations along the a and c axes by assuming the crystallographic axial ratio ($a : b : c = 0{\cdot}9901 : 1 : 0{\cdot}5709$) [4] to be correct and measuring $\theta/2$ accurately for the second order reflection from {110}.

This work was carried out during the tenure by one of us (R. G. H.) of a bursary from the National Research Council of Canada.

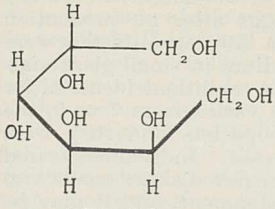
WILLIAM H. BARNES.
R. G. HUNTER.

Departments of Chemistry and of Physics,
McGill University, Montreal,
May 31.

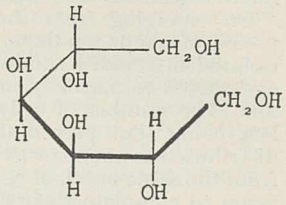
[1] Cardoso, *Z. Krist.*, **63**, 19 ; 1926.
[2] Westenbrink, *Proc. Acad. Sci. Amsterdam*, **29**, 1223 ; 1926.
[3] Astbury and Yardley, *Trans. Roy. Soc.*, A, **224**, 230-236 ; 1924.
[4] Groth, " Chemische Krystallographie ", vol. 2, p. 428 ; 1908.

An X-Ray Study of Mannitol, Dulcitol, and Mannose

IN connexion with a paper under the above title,[1] Prof. W. N. Haworth has pointed out that the actual space formulæ of d-mannitol and i-dulcitol are :

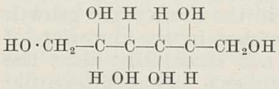


d-Mannitol.

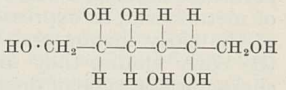


i-Dulcitol.

On uncoiling these to give zigzag or slightly spiral chains of the nature suggested by the dimensions of the unit cells, the projections of the chains on a plane perpendicular to the plane of the zigzag become



d-Mannitol.



i-Dulcitol.

This involves the alteration in position of two hydroxyl groups per molecule in the models illustrated in the paper. These alterations do not affect materially the fundamental features of the respective unit cells, but they introduce interesting possibilities which will be discussed in a separate paper.

I am very much indebted to Prof. Haworth for this correction.

THORA C. MARWICK.

Textile Physics Laboratory,
The University, Leeds,
June 15.

[1] *Proc. Roy. Soc.*, A, **131**, 621 ; 1931.

Removal of Added Nitrogen from Grassland Soils

WORK has been in progress in these laboratories since 1929 on the available nitrogen of grassland soils, with especial reference to the soil ammonia, which in these soils preponderates in quantity and possibly also in importance over the nitrate. The work as a whole will not be completed for some time, but information has already been obtained which may be useful to other workers on the nitrogenous manuring of grassland.

An outstanding result is the speed with which nitrogen added to grassland soils, whether as ammonia or as nitrate, is removed. Observations made here and elsewhere on the rapid falling-off in the response to a single dressing of nitrogen on repeatedly mown plots have suggested that the added nitrogen could not remain for long in the soil, but its rate of removal by vigorously growing herbage has proved unexpectedly high.

A convenient measure of rate of removal is the interval required for three-quarters of the added nitrogen to disappear from the soil. With an early spring application (Feb. 18, 1930) of sulphate of ammonia on pasture, this interval was three weeks, and about the same time was required for a late autumn dressing (Dec. 6, 1929) ; these dressings were applied when the plant was probably almost dormant. For a heavy dressing of sulphate of ammonia applied in mid-spring, when vigorous growth was beginning, the interval required for disappearance of three-fourths of the added nitrogen was only seven days (Park Grass, meadow hay, $3\frac{2}{3}$ cwt. sulphate of ammonia per acre applied March 27, 1931). In late

spring (April 26, 1932), when growth was already vigorous, the corresponding interval for the same rate of application was two days. There was no appreciable accumulation of nitrate in the soil after any of these applications of sulphate of ammonia.

With nitrate of soda, as might have been expected, the disappearance of the added nitrogen was still more rapid: three-quarters of the nitrate added in an equivalent dressing (5 cwt.) on Park Grass had disappeared in about three days in mid-spring, and in late spring less than two days were required.

Without attempting to discuss these results—in particular, the question of what proportion of the nitrogen which disappears is obtained by the plant—they suggest certain practical applications. Evidently the short period during which added nitrogen remains in grassland soils greatly reduces the risk of loss by leaching-out of nitrates, except possibly during the winter months. Where grass is being repeatedly removed, as by mowing or grazing, the direct effect of added nitrogen might be expected to be of brief duration, since even if it is added as ammonia it does not remain long as a 'reserve' in the soil. This very rapid removal of added ammonia by vigorously growing grass—almost as rapid as the removal of nitrate, and a matter of days only—may be taken as a strong indication that in the soil, as well as in culture solutions, grass is able to assimilate ammonia directly without the need for previous nitrification. Further experiments are being made to examine this question.

H. L. RICHARDSON.

Chemistry Department,
Rothamsted Experimental Station,
Harpenden, Herts, May 27.

Chain Reactions in Enzymatic Catalysis

PROF. J. B. S. HALDANE has recently criticised the chain reaction theory [1] in the form in which it has been applied by Haber and Willstätter to biochemical processes.[2] One can scarcely deny the validity of Prof. Haldane's arguments, but his criticism is directed not so much against the chain reaction theory itself as against the particular chain *mechanism* proposed by Haber and Willstätter.

It has been suggested that a more satisfactory explanation of the experimental observations may be given by the *energy chain* mechanism.[3] According to this view, which is due to Christiansen,[4] molecules are capable of existing in an activated condition which they normally assume prior to reacting, and the chains are propagated by the transfer of energy from the products of an exothermal reaction to one of the reactants, which is thereby activated and in turn caused to react, *et seq.*

Prof. Willstätter has raised the objection that the activated molecules would at once lose their energy in collisions with the surrounding water molecules. This objection, which at first appears to be conclusive, loses much of its weight in the light of experimental evidence obtained by Gibson and Hinshelwood,[5] who have shown that the transfer of energy from an activated molecule is a *specific* process, so that the transfer of energy from organic molecules to water molecules may be taken as being comparatively slight.

Further evidence as to the specificity of energy-transfer has come from Perrin's work on fluorescence.[6] The simple observation that fluorescein fluoresces in aqueous solution shows that the activated fluorescein molecules do not easily give up their energy to the surrounding water molecules, but emit it more readily in the form of light.

As Prof. Haldane has pointed out in this connexion, in most intracellular oxidations much of the energy is not liberated directly as heat but is used up in coupled reactions. This is not easily explained on the Haber and Willstätter mechanism, but the idea of the specific transfer of vibrational energy from the products of an exothermal reaction to other molecules in the system makes these coupled reactions readily intelligible.

The Christiansen energy-chain also seems to give a more satisfactory explanation of the specificity of inhibition in enzyme reactions. On this view, inhibition, in so far as it may be attributed to the breaking of reaction chains, is due to the transfer of energy from an activated link-member of the chain to an inhibitor molecule, and this process should also be in some degree specific.

DEREK RICHTER.

Dyson-Perrins Laboratory,
South Parks Road,
Oxford.

[1] NATURE, **129**, 61, July 9, 1932.
[2] Ber., **64**, 2844; 1931.
[3] *Biochem. J.*, in press.
[4] *J. Phys. Chem.*, **28**, 145; 1924.
[5] *Proc. Roy. Soc.*, A, **119**, 605; 1928.
[6] *C.R. Ac. Sci.*, **184**, 1097; 1927.

An Unpublished Letter of Lavoisier

THE Science Library at Clifton College possesses an autograph letter of Lavoisier that I believe to be unpublished. Though it is of no scientific importance, any relic of so great a man deserves to be placed on record, and the following transcription may thus be of interest:

Je suis oblige mon cher Parent par le decret relatif a lemprunt forcé de presenter letat de mes possessions et l'evaluation du revenu doit etre faitte dapres la matrice des Rolles. Je vous serai en consequence tres oblige de faire faire dans chacune des paroisses ou je possede des biens un extrait de la matrice du rolle pour cequi me concerne avec l'evaluation du revenu. La loi ne donne que quinze jours pour faire les declarations aussy il ny a pas de tems a perdre. Vous concevis que le montant des impositions que je paye ne remplisoit pas mon objet, car en general limpost dans presques toutes les communautés est superieur a 'evaluation et puisque la loi a pris pour base cette evaluation il est juste que je proffite du benefice quelle m accorde.

Je ne scais si les haricots ont manque de vos cotes comme aux environs de Paris. Dans letat de denuement ou nous serons cet hiver a Paris pour les comestibles, il nous serait fort important que vous nous envoyassiez les haricots de redevance qui me sont dus.

Il y a bien long tems que je n'ay recu de vos nouvelles mais je concois que vous devez etre tres occupe relativement aux requisitions qui ont ete faittes.

Je vous renouvelle mon cher Parent lassurance de mon inviolable attachement.

Le 18 jt 1793 lan 2e de la republique une et indivisible.

LAVOISIER.

The letter is addressed to Citoyen Parisis fils, at Villers-Cotterets, where Lavoisier's paternal ancestors were established as early as the beginning of the seventeenth century. Charles-Antoine Parisis was a distant relative of Lavoisier by marriage, having married Antoinette-Françoise Lavoisier, second cousin of Lavoisier's father, Jean-Antoine [Grimaux, *Lavoisier*, Paris, 1888, p. 326].

E. J. HOLMYARD.

Clifton College, Bristol,
June 5.

Inheritance of Milking Capacity

Now that Mr. Edwards [1] has made the first point of his original letter clear, his criticism is one which has already been suggested, and discussed, by myself. If this criticism were invariably valid, it should also hold good as regards butter-fat yield. In the case of Mr. Madsen's work the argument may be valid, but as I believe his butter-fat figures were calculated on the averages of percentages, this may explain a similarity in the milk and butter-fat figures. A truer indication may be obtained from the work of Robison and myself, to which Mr. Edwards has already made reference, where, despite what Mr. Edwards calls the phenotypic selection of the sires, the butter-fat correlation of granddaughters to their paternal grandsire is the same as to the maternal grandsire.

With regards to points (2) and (3), Mr. Edwards has shifted the grounds of his argument considerably. In one respect he remains consistent, in that he persists in confusing correlations based on genotype with those based on phenotype. Since he still misunderstands the original statements of Mr. Madsen, I feel that little good can result from a further debate upon these points.

As to point (4), I maintain that I was justified in challenging Mr. Edwards as to the accuracy of his calculation that the results obtained by Mr. Madsen might once in ten times be due to chance. I repeat that one in twenty expresses more accurately the possibility of Mr. Madsen's results being obtained by chance. Tables of the normal curve, which, as Dr. Wishart [2] admits, are for such large samples sufficiently accurate, show that a deviation of $-1{\cdot}64\sigma$ leaves only one-twentieth of the area to the left of that point. The fact that there is also a second twentieth to the *right* of the point $+1{\cdot}64\sigma$ is irrelevant, since positive deviations, however great, could not be cited in support of sex-linkage. The distinction is a simple one, though frequently overlooked. The point has been fully explained by Dr. R. A. Fisher.[3]

It is now four years since the facts first suggested to me the possibility that the hereditary transmission of milking capacity might be in part conditioned by sex-linked genes. Since that time, I and others have been pursuing this subject along various lines, and we have not yet been able to find a valid reason for jettisoning this hypothesis, which appears to be not only warranted by the results obtained by ourselves and others, but also explains many of the practical difficulties of breeders. Neither I nor my colleagues, however, are wedded to this hypothesis, but we still await criticism which might compel us to modify our views.

A. D. BUCHANAN SMITH.

Institute of Animal Genetics,
University of Edinburgh.

[1] NATURE, **129**, 867, June 11, 1932.
[2] NATURE, **129**, 868, June 11, 1932.
[3] Fisher, R. A., "Statistical Methods for Research Workers", 3rd edition, p. 45.

Polypharyngeal Planarians

AMONG a dozen specimens of the planarian, *Polycelis cornuta* Johnson, collected in August 1931 from a small pond at Liss in Hampshire, I observed one specimen with a well-developed double pharynx. I revisited this pond in March of this year and was able to collect several hundred specimens of the same planarian. In this pond *Polycelis cornuta* constituted more than 90 per cent of the planarian population, *Polycelis nigra* and *Dendrocœlum lacteum* being present in small numbers. On examining these specimens of *Polycelis cornuta*, one was again found with a double pharynx.

Polypharyngeal planarians have frequently been recorded from various districts on the Continent, but, so far as I am aware, this is the first time that this type of abnormality has been recorded from the British Isles. Previous records of polypharyngeal planarians have usually been from mountainous districts, but Thienemann [1] has recorded finding one specimen of a tripharyngeal *Polycelis cornuta* from among a hundred specimens collected from springs in Holstein. The dipharyngeal forms are evidently not common, but, from the fact that they have been found fairly easily in two collections made at different times, it may be assumed that this abnormality is established in the race living in this particular pond. *Polycelis cornuta* is a fairly common species in Britain and the existence of the double pharynx is quite obvious on examination, even with a simple lens, so that it is unlikely that these abnormal forms would have escaped notice.

The pond in which the dipharyngeal forms occurred is a small one, about five yards in diameter and less than one foot deep. It is on the slope of a hill and is supplied by a spring draining out of the soil. The temperature of the water of the pond in March 1932 was 6° C., and this temperature corresponded with that of the local streams. The temperature of deep springs from the chalk in the same district at the same time was 9·5° C. It can be assumed, therefore, that the water supply of this pond is not from a deep spring, which would maintain an even temperature of the water throughout the year. The temperature of the water in the pond at the time of my visit in March appears to show that it varies with that of the air, in the same way as other ponds and streams supplied by surface drainage.

JOHN H. LOCHHEAD.

Zoological Laboratory, Cambridge,
June 1.

[1] *Zool. Anz.*, **53**, 118; 1921.

Trochus niloticus, Linn. in Andaman Waters

DR. YONGE in "A Year on the Great Barrier Reef" (Putnam: 1930) states that certain animals like the horse-hoof clam spawn "at the peak of summer"; others like *Trochus niloticus* "during the entire winter".

My observations on the bionomics of *T. niloticus* on the east coast of the Andaman Sea reveal (1) that this species grows during the monsoon and 'winter' months, that is, July to March, and (2) that it starts spawning about the middle of the summer months, that is, April.

The temperature of the Andaman Sea has two definite rises and two falls in a year.[1] The first rise starts in February, to reach a climax in April-May, before the outbreak of the south-west monsoon; there is a fall during the monsoon. The second rise starts in July-August, to reach its highest point in October, before the north-east monsoon; and finally, the second fall begins in November. The first rise of temperature, that is, the April one, reaches a higher degree than the second, the October one. As remarked above, *T. niloticus* starts spawning in April, and it appears, therefore, that in the Andaman waters this mollusc has a minimum temperature above which alone it would spawn. This observation emphasises the idea that the marine invertebrates in tropical waters do not breed haphazardly but with a similar regularity to that observed in temperate waters.

C. AMIRTHALINGAM.

Zoological Survey of India,
Calcutta, May 16.

[1] R. B. S. Sewell, *Mem. Asiatic Soc. Bengal*, vol. 9.

Research Items

Yavapai Shamans.—In the course of a study of the south-eastern Yavapai of Central Arizona, otherwise known as the Mohave-Apache or Yuma-Apache (*Univ. Cal. Pub. Amer. Arch. Eth.*, vol. 29, No. 3), Mr. E. W. Gifford has recorded the methods and system of training of the shaman or medicine man of these people. Shamans' visions come in trances rather than in dreams, and his power is acquired while in a trance. A trance was usually the first intimation that a person was about to become a shaman. In it the god Amchitapuku talked to the novice, taught him songs, told him what to do and say, and how to help the sick. By the same means he revealed to the shaman whether a sick person would live or die. All treatment of the sick was at night. The shaman did not blow on the affected part, nor froth saliva; he sang over the patient and, while singing, saw a flash of lightning in the afflicted part. He then cut a cross there with a flake of glass and sucked the cut, finally producing from his mouth a worm-like object which he displayed to the patient as the cause of his illness. Four eagle feathers, a gourd, and a bull-roarer were employed in healing. Each of these feathers was stuck upright in a cardinal direction near the patient, and while the shaman was singing he touched the seat of the pain with one of them. Sometimes the bull-roarer was swung round as the shaman entered the patient's house. He thus communed with the goddess Widapokwi, and if she so advised him, he whirled it while singing. A sucking shaman was not blamed if a patient died, nor was he blamed for the death of other persons. If, however, a patient died, the shaman returned to the relatives all the property they might have given him.

Decorative Art in Oceania.—In a study of the decorative designs of Oceania based on material in the United States National Museum (*Proc. U.S. Nat. Mus.*, vol. 79, Art. 30), Mr. Herbert W. Krieger distinguishes six distinct geographical design-areas as showing differences in art forms and application of design. They are: Tonga-Samoa, New Zealand, Raratonga-Tubuai-Tahiti, Manihiki, the Marquesas, and the Hawaiian Islands. Tonga-Samoa is characterised by the use of straight lines, zigzags, and a derivative, the dentated line. There are some delineations of animals and men. In the New Zealand area curved lines with a pronounced tendency towards spirals show a clear reaction with Fijian and Papuan types of etched and painted designs. Stylistic art patterns are fixed and standardised. In the Manihiki area sculptures in wood are for the most part unknown; but small plaques with incrustations of shell arranged in symmetrical form are found. The Marquesan designs are more conventional. Two types of human face, strongly stylised, occur. In the Hawaiian area straight lines are decorated with nodes, zigzags, or angles; straight lines, parallel or crossed, form lozenge-shaped designs reinforced with dots or curved lines. In the Raratonga-Tahiti group we find designs derived from anthropomorphic models. All objects appear to have a religious significance. In an area so large as Polynesia and so heterogeneous there are few elements common to the whole area; but as one passes from west to east there is a developmental sequence in the plastic art.

Seasonal Colour-Changes in Mammals.—Apart from that major type of colour-change, from summer coat to winter white, which characterises certain mammals of arctic or subarctic origin, a well-known seasonal change in tint takes place in the common red squirrel, in which the gradual bleaching is attributed to light. Capt. Guy Dollman recalls Andersen's observations on the Indian rufous horseshoe-bat, where a progressive bleaching could not be due to sunlight, and parallels that case by a similar change in the African flying 'squirrel' or scaly-tail, *Anomalurus jacksoni* (*Proc. Linn. Soc. London*, 1931–32, pt. 3, p. 68). Three of four specimens from Uganda are redder than the type, and since light cannot be the cause of the bleaching in these nocturnal animals, it is suggested that the change may be due to oxidation of the dark pigment granules to a paler colour. Since, however, the formation of the dark colouring matter or melanin is said to be due to the action of molecular oxygen or of a specific oxidising agent in the cell, the subsequent reduction of melanin by the same agent seems unlikely, and we suggest hypothetically that the cause may be looked for in another agent to which even the nocturnal mammals are subject, namely, heat. The suggestion is based on the fact that experiment has shown that heat has a restraining effect on the deposition of pigment; although it may be that when the pigment is deposited, heat can no longer affect it. The possibility of the influence of heat on fixed pigment, however, is worth keeping in mind and testing.

Myxosporidia from Indian Fishes.—Dr. H. Ray, of the University of Calcutta, who is engaged in studying the myxosporidia occurring in fishes in Bengal, has sent NATURE a letter upon this subject, but lack of space prevents its publication in full. Of such sporozoa, only two species of *Myxobolus* and one of *Sphærospora* have previously been recorded from Indian fishes. Dr. Ray has found nine species of fish infected. The parasites belong to the genera *Ceratomyxa*, *Chloromyxum*, *Myxidium*, and *Myxobolus*. Several of the species observed are new to science, and accounts of these will be published at an early date. A species of *Ceratomyxa* was found to be fatal to *Gobioides rubicundus* under laboratory conditions; almost every organ of the body in these fishes became infected. Dr. Ray thinks that the possibility of rapid spread and serious effects of myxosporidian infections in the somewhat unnatural conditions of aquaria should not be lost sight of when investigation into occasional heavy mortality of the fish there is undertaken. He is at present studying this question.

Dominance and Modifying Factors in Cotton.—The crinkled dwarf mutation from Sea Island cotton, described by Dr. S. C. Harland, has recently been the subject of further investigation (*J. Genetics*, vol. 25, No. 3). He finds it to be a complete recessive in crosses with the type from which it arose, but that its recessiveness is incomplete in crosses with other members of the Peruvian group. When Upland cotton is crossed with crinkled dwarf, the F_1 is intermediate and the F_2 shows an unclassifiable series from normal to more extreme crinkled. The F_1 back-crossed repeatedly to Upland shows increasing dominance of normal, and in the F_2 from the first back-cross one family showed reversed dominance, 3 crinkled : 1 normal. These and other facts are discussed in the light of Fisher's theory of dominance, and it is concluded that while the genetic behaviour favours Fisher's theory, yet there are difficulties in accounting for the distribution of genes modifying dominance, since all the Peruvian types appear to be homozygous for such genes. The necessary assumption to account for this, namely, that the original normal population has been replaced by normals descended from heterozygotes, appears improbable.

In a further contribution, Dr. Harland gives an account of chlorophyll deficiency occurring in hybrids between Upland and Peruvian cotton and the Polynesian *Gossypium tomentosum*. Three independent pairs of factors are involved. The chlorophyll-deficient class was found to show a range from completely lethal to fully viable, which is interpreted as due to modifying factors. Mr. J. B. Hutchinson also contributes to this series of cotton studies by describing a semi-sterile type called ' crumpled ' which originated in a cross between *G. Nanking* var. *soudanensis* and *G. arboreum* var. *sanguinea*. It is found to be due to two complementary factors the distribution of which differs from strain to strain in Asiatic cottons. One of these factors has been found in two strains of Sudan cotton and the other in 17 varieties belonging to five Asiatic species. A number of modifying factors has also been found here.

Bacterial Canker in Plum Trees.—A canker of plum trees which produces lesions on the stem, associated with rolled and yellowish leaves in spring which later die or wither, has been described by Mr. H. Wormald (*J. Pom. Hort. Sci.*, **9**, No. 4, pp. 239-256, Dec. 1931). Various fungi are found on the lesions during summer, and some of these have occasionally been reported as the actual causes of the malady. The author of the present work studied the appearance of symptoms throughout the year and found that the cankers in spring were full of cells containing bacteria. He isolated an organism which, upon re-inoculation in spring, produced typical cankers which later became the home of the fungi. The bacterium was the real cause ; the fungi were quite secondary in their appearance. *Pseudomonas mors-prunorum* is the name suggested for the new organism. Methods of control are being tried, but no definite recommendations are given.

Solar Radiation at Tokyo.—Regular observations of the intensity of the solar radiation are being made at the Central Meteorological Observatory at Tokyo by means of a self-recording Moll-Gorczynski actinometer. The first seven quarterly actinometric bulletins giving hourly values of the radiation, beginning with the figures for Jan. 21, 1930, have been issued. The introduction, of which there is an English translation, describes the methods of observation. The radiation has to pass through a quartz plate 2 mm. thick before reaching the thermopile of the actinometer. Every day when the weather permits, the actinometer is calibrated with the aid of an Ångström compensating pyrheliometer. After the record has been reduced to the angstrom scale it is converted to the Smithsonian scale. The hourly values of radiation for each day in gram calories per sq. cm. per minute are set out in tables covering single months, and a weather diary for each day is given, the international weather symbols being employed to economise space. Various subsidiary tables have been added, which include figures for the mass of air traversed by the sun's rays and the coefficient of turbidity. This should prove to be a series of publications of importance to those workers studying problems connected with the heat-balance of the earth, for the frequent checks on the accuracy of the observations are likely to ensure a homogeneous and reliable record, of which there are all too few.

High Velocity Positive Ions.—Drs. J. D. Cockcroft and E. T. S. Walton have published a description of the high potential generator which has been used now with such spectacular results (*Proc. Roy. Soc.*, June). The method used consists essentially in the multiplication and rectification of the voltage of a transformer by an arrangement of valves and condensers, the insulation of the high tension system being distributed over a number of units. The rectifier system is of novel design, consisting of four glass cylinders placed end to end in the form of a tower twelve feet high, and containing suitable electrodes and hot filaments and exhausted continuously ; with its four condensers, a potential of more than 700 kv. has been obtained, which is steady to within a few per cent. The method of making vacuum joints which has been used, although crude, seems to be efficient, when used in conjunction with pumps of high speed. It consists simply in putting two surfaces together, working a plastic substance round the joint with the fingers, and finally rubbing over the surface with tap-grease to seal small residual holes. For the earlier work, commercial plasticene was used with satisfactory results, but in the final apparatus this was replaced by a special low vapour pressure putty supplied by the Metropolitan-Vickers Electrical Co. The pumps used also worked with a low vapour pressure oil in place of mercury, thus making the use of liquid air traps unnecessary. The paper is illustrated by a photograph which shows the apparatus set up.

Polarisation of Electrons.—The fact that an electron can be described as having a magnetic moment and an axis of spin carries with it the implication that it should be possible to polarise a beam of electrons. Certain types of experiments are ruled out by the uncertainty principle, but it has been shown by Mott that it should be feasible to carry out the analogue of the old optical experiment of producing and detecting polarisation by successive reflection from two inclined mirrors, under rather stringent conditions. Mott's criteria have been fairly closely observed in experiments described by E. G. Dymond (*Proc. Roy. Soc.*, June). Rather fast electrons were used, and, to avoid multiple scattering, were projected on to two targets of thin gold foil. Many complications were encountered, and the experiment proved to be one of much difficulty, largely on account of the extreme feebleness of the twice scattered beam, but the conclusion is reached that a slight polarisation, of the order of one per cent, was present. Actually a polarisation of ten per cent was predicted by Mott's theory, so that an interesting discrepancy still persists. G. O. Langstroth (l.c.) has reported a negative result in an attempt to polarise electrons by successive reflection from two massive tungsten targets, which provides a problem less difficult than Dymond's experimentally, but considerably more complicated in interpretation.

Theory of Conical Loud Speakers.—Dr. N. W. McLachlan, in a paper read to the Physical Society on March 4, describes the symmetrical modes of vibration of truncated conical shells with special reference to loud speaker diaphragms. There are two salient types of vibration pertaining to these shells. First, radial modes as in a bell, and secondly, symmetrical modes as in a disc. The author discusses the latter type only, as it is this kind of vibration which is of importance in connexion with loud speakers of the hornless type. As the problem stands at present, it appears that to get a solution embodying the two radii, the apical angle, the thickness of the shell and Poisson's ratio for various edge conditions, a team attack by several investigators would be required. The present paper gives an account of a number of experiments carried out by the author. He used paper, glass, and aluminium shells. He found that the modes crowd together as compared with the segregation which occurs in the case of a disc. With thick glass or aluminium of comparatively low loss, the nodal frequencies are very clearly defined peaks. In the case of paper cones driven by coils of small mass, the peaks disappear

and the nodal region is indicated by a broad rounded contour. The influence of thickness, apical angle, and the mass of the driving coil are considered. Vibrations of the air column within the shell and the general requirements for loud speaker diaphragms are discussed. In a letter to NATURE (**129**, 202, Feb. 6, 1932) he reported the occurrence of resonances to the air column in the shell.

Television in Relation to Seeing.—"The Eye, as a Link in the Television Chain", formed the subject of a recent paper by Mr. W. D. Wright before the Television Society. Persistence of vision, an important factor in the cinema, is possibly even more influential in television. The critical frequency increases with intensity. The desired increase in the brightness of television pictures (at present somewhat faint) would therefore increase the numbers of scans per second necessary to avoid objectionable flicker. A light surround to the picture accentuates the sensitiveness of the eye to flicker and should be avoided. At present a speed of 20 pictures per second seems a fair compromise between the desirable and the feasible. 'Irregular scanning' helps in some measure to diminish flicker. The roving and mainly horizontal movements of the eye, and likewise its occasional blinking, tend to produce a rather troublesome stroboscopic effect. On the whole, the advantage in this respect seems to lie with pictures scanned horizontally. The present limitation in size of picture is admittedly a drawback. The author asks, "Is it really possible to obtain lasting enjoyment and entertainment from a picture which is, say, only three or four inches square?" The minuteness of the figures, coupled with the short focusing point for the eye, give rise to a sense of unreality. The brightness of the picture should be as high as possible; 5 candles per sq. ft. would be very satisfactory, 0·5 good, and 0·05 passable. Various factors that may occasion deficiency in contrast or distortion are mentioned. The conditions for a television picture in colour are considered too complex to justify detailed discussion.

Astronomical Topics

Comets.—Some doubt has been thrown on the existence of comet 1932 *h* (Schmitt) from the fact that Prof. Schorr at Bergedorf, Prof. G. Struve at Neubabelsberg, and Dr. W. H. Steavenson at Norwood have failed to find it; some positions that were thought to belong to it really belong to Newman's comet. The evidence for its existence is a photographic position by Schmitt on June 25, 99^{sec} east and 12′ north of Newman's, and a statement that Schmitt confirmed it on June 29. Continuation of the ephemeris of Newman for 0^h:

	R.A.	N. Decl.
July 16	$15^h\ 0{\cdot}7^m$	21° 13′
20	14 57·4	22 36
24	14 54·9	23 51
28	14 53·2	24 58
Aug. 1	14 52·4	25 57

Dr. Bobone has computed the following elements of the comet 1932 *g*, discovered by Mr. Geddes in New Zealand; presumably they are based on observations made at Cordoba (Argentine) (*U.A.I. Circ.*, No. 390):

T	1932 Oct. 26·95 U.T.	
ω	356° 32′	1932·0
Ω	222 56	
i	122 12	
q	1·913	

The axis of this orbit lies very near the ecliptic, suggesting possible periodicity, but there is no close resemblance to any previous comet. The comet will be well placed for southern observers for the next two months; it will then pass nearly behind the sun. It should be visible in Europe as a morning object about the end of the year. *Harvard Card* 224 gives the following position obtained at Cordoba:

June 27·0366 U.T., R.A. (1932·0) $10^h\ 55^m\ 16{\cdot}7^s$, S. Decl. 80° 53′ 25″, Mag. 9.

The Reinmuth Planet, 1932 *H.A.*.—Dr. G. Stracke, of the Berlin Rechen-Institut, who was the first to deduce a good orbit of this remarkable planet, contributes an article on it to *Astr. Nach.* 5878; an accurately drawn diagram shows its orbit and that of the Delporte planet found in March, in relation to the orbits of Venus, the earth, and Mars. The only uncertainty now is the exact period; Stracke finds 1·6395 years, while Miss Covey and Dr. Wyse make it two months longer. Prof. H. E. Wood writes that he observed the planet from Johannesburg, though he has not yet sent positions; when they arrive, they will help in determining the distance from the earth and consequently the period; they will be about 2′ away from simultaneous northern positions in consequence of the proximity to the earth. Dr. Stracke brings out some singularities in the planet's motion; it was in opposition on April 24, and in conjunction with the sun only six weeks later. At discovery it was retrograding more than a degree per day, which instantly attracted attention; but if it had been discovered a week earlier its motion would have been less abnormal, and it might have passed as one of the usual host of minor planets, which did not seem to require close attention. On May 15 it was moving nearly 7° per day, a speed only exceeded by a few comets.

The latest observation now to hand was made by Prof. van Biesbroeck at Yerkes on May 15; it is possible that it may have been followed longer at Johannesburg. Attempts will be made to re-observe it as a morning object in August, but it will be a long way off and therefore faint.

Leyden Observatory.—An interesting feature of the report of the director of Leyden Observatory, Prof. W. de Sitter, is a description of the expedition of Dr. Hins and Mr. van Herk to an equatorial station in Kenya Colony to observe the azimuths of fundamental stars. The chosen station is 9000 feet high, and three-quarters of a mile south of the equator. It is well known that there are differences of declination in the standard catalogues of fundamental stars amounting to considerable fractions of a second; these arise from uncertainties in the correction for refraction. Several years ago Prof. de Sitter proposed the plan of making observations of the azimuths of stars from a station on the equator, thus getting rid of the correction for refraction. He sent Mr. Sanders with a small instrument to make trial observations at a station in the Portuguese Congo. The results were encouraging, and a more accurate instrument has been constructed by Messrs. Cooke, Troughton, and Simms, specially for the present expedition; it is reversible, and observations are made in both positions of the instrument. Stars near the equator appear to move vertically; those farther away have a slow motion in azimuth. An azimuth mark was erected 300 metres from the instrument, to check the zero point. Observations were begun on Nov. 30, and 148 complete observations were made by Dec. 31.

National Physical Laboratory, Teddington

INSPECTION BY THE GENERAL BOARD

ON Tuesday, June 28, the General Board of the National Physical Laboratory made its annual inspection of the Laboratory. A large number of visitors, including members of scientific and technical institutions, government departments, and industrial organisations, were present, and were received by Sir Frederick Gowland Hopkins, president of the Royal Society, chairman of the Board, Sir Richard Glazebrook, chairman of the Executive Committee, and the director, Sir Joseph Petavel.

In the Duplex Wind Tunnel of the Aerodynamics Department, tests were in progress on a model of a large four-engined monoplane, complete with airscrews, to determine the rolling and yawing moments at various angles of yaw and at various angles of the controls. The aim of the tests is to explore the efficiency and general characteristics of the control surfaces with and without the airscrews in operation, and to investigate the efficiency of the overall design. For this type of work a number of small gear-boxes of special design have been constructed, so that as many as six separate airscrews can be operated at once from a single electric motor situated in the fuselage of a model.

Apparatus for tests on the thrust and torque of model high-pitch airscrews was also on view. In consequence of the high speeds now required of aircraft, there has been a demand for airscrews of this type. The tests are expected to provide data both for these designs and for comparison with theory. An interesting feature of the apparatus is the three-phase motor constructed in the Laboratory for driving the screw shaft. Though of dimensions so small that it produces no appreciable interference with the airstream when mounted behind an airscrew of three feet diameter, the motor is capable of delivering 12 brake horse power for extended periods.

For purposes of demonstration, the aerodynamic balance for use in the Compressed Air Tunnel, together with the accessory electrical indicating apparatus, was exhibited. The balance consists essentially of a braced ring frame, in the centre of which the model is rigidly held. The frame can oscillate about three parallel axes, the change from one axis to another being effected electrically from outside the tunnel. From measurements of the moments about the three axes, one of which passes through the centre of gravity of the model, the lift and drag can be computed. A single set of electromagnetic coils, arranged on the principle of the Kelvin current balance and mounted at the top of the frame, suffices to measure the couple about each axis. The stability and sensitivity of the balance can be varied by electromagnets situated at the bottom of the ring frame. The whole of the electrical apparatus can be controlled from outside the tunnel.

An improved means of visualising airflow was demonstrated in the department. The method adopted is a modification of the one shown last year, when airflow was rendered visible by the shadow bands produced when air heated by thin wires was suitably illuminated. In the present method, the wires are replaced by a spark gap in which high frequency sparks are produced. The shadows in this case take the form of a series of semi-opaque 'dots'. By stroboscopic methods it is possible to isolate any given 'dot', the motion of which can then be observed visually or from photographic records. The method is being used in an attempt to determine the nature of turbulent flow in air.

The Engineering Department has given considerable assistance to the British Standards Institution in the design, standardisation, and testing of lifting gear components. Specimen links and hooks, etc., before and after test, were exhibited. On behalf of the Home Office, the department has undertaken investigations into the effect of service on the pitch of calibrated chains, and the effect of heat treatment on threaded parts of cranes and shackles. Special machines designed and constructed in the department for this work were demonstrated. In the chain tests, the chain is driven under conditions closely approximating to those obtaining in block and tackle. The effect of periodic heat treatment is being studied. In the case of threaded shackles and swivels, the machine applies repeated lifts to the specimens under test, the degree of impact being made to resemble closely conditions existing in a 30 cwt. crane.

In connexion with an investigation for the Lubrication Research Committee, experiments were in progress on journal bearings to determine the variation of the coefficient of friction with oil viscosity, load, speed, and clearance, and the effects of speed and clearance on the seizing temperature. These problems have a special application to motor and aircraft engines, and special machines have been constructed for the work. The experiments tend to show that lighter oils than usual may be used with safety. It is found that an increase in the clearance from two or four thousandths of an inch to sixteen thousandths leads to an appreciable decrease in the seizing temperature.

An investigation has been commenced of the way in which stress varies with strain during impact tests of materials. A machine of the swinging hammer type is employed, and the well-known piezo-electric properties of quartz crystals are utilised to record the changes of stress during impact by means of a cathode ray oscillograph. The time scale on the record is obtained by utilising the change in voltage when a condenser is discharged through a resistance. A method of measuring the strain electrically is being developed.

Of interest also were 'cupping' tests on sheet metal. Information is needed regarding the properties of sheet metal used for cold pressing operations. Various cupping tests were shown, and in particular one in which the metal is deformed by oil pressure until fracture occurs. The method can be used to give a fair indication of the tensile strength of the material. The apparatus is fitted with an autographic method of recording load and distension.

In the Metallurgy Department, research is in progress on the constitution of certain magnesium alloys with the view of obtaining better mechanical properties after heat treatment. In connexion with this work, a method has been employed of purifying magnesium by sublimation. Ordinary magnesium is heated *in vacuo* in a crucible to a temperature about 50° C. below its melting point, when it sublimes and is deposited on the cooler parts of the furnace tube, to which it is prevented from adhering by a layer of magnesium oxide. The tubular deposit is afterwards withdrawn. Most of the impurities are left behind in the crucible.

For research on the cracking of boiler plates, an apparatus has been constructed for studying the effects of corroding media, such as caustic soda, on the stability of stressed steel at boiler temperatures and

pressures. Small specimens of boiler plate completely immersed in a corrosive solution can be tested under tension in a seamless high pressure cylinder of steel, which is heated electrically. Steam pressures up to 500 lb. per square inch can be obtained. Apparatus has also been developed for studying the corroding action of superheated steam on materials which are suitable in other respects for use in steam power plant. A special boiler is utilised, consisting essentially of a long coiled tube of rust-resisting steel, which is heated electrically and through which water is circulated. The steam generated is superheated electrically in a stainless steel vessel which contains the material under test. Steam pressure of 1000 lb. per square inch at a temperature of 600° C. can be obtained with the apparatus.

Research work is being carried out in the department, under the auspices of the Dental Investigation Committee of the Department of Scientific and Industrial Research, to determine the factors which affect dimensional changes in dental fillings when these are packed into a tooth. The effects of pressure during the operation of filling, of particle size in the amalgam, and of the proportion of the constituents in the amalgam are being investigated. For this work special lever dilatometers have been designed. These are enclosed in a specially constructed thermostat, so that the experiments can be conducted at ordinary mouth temperatures.

In a number of researches in the department, crucibles and tubes impervious to gases are needed. These are unobtainable commercially in Great Britain and their manufacture has been investigated in the department. Specimens of non-porous sheaths of pure alumina glazed by fusion were exhibited, and their use in optical pyrometry, where the presence of gases and vapours would affect the measurements, was demonstrated.

In the Metrology Department a new balance to weigh loads up to one kilogram has been constructed. This balance will be used for work of the highest precision and in particular for the periodic verification of the national standards of mass. Provision has been made for weighing either in air or *in vacuo*, and for accurate adjustment of the knife edges. To obviate magnetic disturbances, no magnetic material has been employed in the construction of the balance. The apparatus will be operated under steady temperature conditions, and provision has been made for reading the balance and for interchanging weights by means of remote controls.

Experimental apparatus for the measurement of very fine wire such as is used in electric lamps has been developed in the department. The instrument is a combination of a mechanical and optical lever, giving an overall magnification of 15,000. The diameter of the wire can be measured to a few millionths of an inch, and very small variations in thickness can be detected.

In the Heat Division of the Physics Department a number of investigations were in progress on behalf of the Food Investigation Board. Apparatus has been constructed for the measurement of the thermal conductivity of heat insulating materials at low temperatures. The equipment, which is fitted with a novel guard ring system, includes a refrigerating plant and automatic control for maintaining the cold plate at any desired temperature. Considerable work has also been carried out in connexion with the heat transfer between air and banks of metal pipes through which a refrigerant is circulated. The laws of heat transfer for various assemblages of pipes and for a succession of lengths of pipes placed longitudinally in an air stream have been investigated.

For measurements of the thermal conductivity of heat insulating materials at high temperatures, apparatus has been constructed in which samples, the surfaces of which are not flat, can be tested. A Silit heater furnace is so arranged that the face of the specimen can be viewed with an optical pyrometer. Of interest also was a calorimeter for the measurement of the heats of combustion of gases. An adiabatic system is adopted in which the calorimeter is heated electrically at a controlled rate. The apparatus is capable of giving results to a high order of accuracy.

In the Radiology Division considerable work has been done in connexion with the realisation of the X-ray unit of quantity, the Röntgen. In this work precise control of the X-ray output is required, and a constant potential generator has been constructed which enables voltages of 40-230 kilovolts to be applied with a voltage variation not exceeding 1 per cent. A new primary ionisation chamber has also been designed. It is of interest to note that in an intercomparison of the new unit by the three national laboratories of America, Germany, and Great Britain, agreement was obtained within 0·5 per cent.

As an example of the way in which X-rays can be applied to industrial problems, mention may be made of the X-ray examination of chromium plating, which can vary from a bright hard deposit to a grey matt one, depending on the conditions in the plating bath. It is found that the differences in the deposit are due to variations in the shape and size of individual crystals. The brilliant surface is almost invariably associated with the smallest grain size.

In the Optics Division, charts were shown illustrating the new system of colorimetric standardisation adopted by the International Commission on Illumination in 1931. The trichromatic system of colorimetry developed at the Laboratory, in which three spectrum colours are employed as primaries, is utilised. A standardised illuminant is used consisting of a tungsten gas-filled lamp and a special colour filter. The standard colorimetric apparatus used at the laboratory was exhibited.

In the Sound Division the considerable demand for acoustical tests of absorbent materials used in the correction of defective auditoriums is reflected in various improvements in apparatus employed for the work. The measurement of sound intensity in absolute units has received considerable attention, particularly with the view of the absolute calibration of high quality electrical microphones, such as are required for modern developments in gramophone recording and in broadcasting.

In connexion with the rapid visual observation or photographic recording of the variation with frequency of the sound intensity of the note emitted by a loud-speaker, a novel use is made of a cathode ray tube. By means of a special circuit, the intensity of sound from the loud-speaker is plotted visually against a frequency scale instead of the time scale which is usual in oscillographic work.

In the Electric Standards Division of the Electricity Department was shown a piezo-electric quartz oscillator in the form of a ring, to serve as a primary standard of radio frequency. Experiments have shown that the modulus of elasticity of a quartz ring cut with its plane perpendicular to the optic axis is practically constant for all directions in this plane. This form of oscillator is thus eminently suitable for use as a standard of frequency. The oscillator is supported in a vacuum chamber and is thermostatically controlled.

In connexion with measurements of permeability, demonstrations were given of the changes which may occur with time in some materials when a small alternating magnetisation is superimposed on a large d.c. magnetisation. It has been found that in such cases the value of the permeability decreases continuously

for some time after the current is switched on. The amount of change varies with the material and the amplitude of the alternating magnetisation.

In the Electrotechnics Division, apparatus was shown for analysing the motion of rapidly moving automatic switchgear. An oscillographic method is employed, and from the records it is possible to determine the velocity of the moving parts while the switch is being broken, and also the time taken to complete the breaking of the circuit.

In the Wireless Division the fundamental work on very short waves has been continued. For comparison with theory, an apparatus has been developed for the study of the propagation, along the earth's surface, of ultra-short waves of wave-length 1·6 metres. Measurements are made of the decrease of signal strength with distance, at a height up to about 5 metres. A small, single valve, retroaction type oscillator is used as the transmitter, and no aerial is employed. The intensity measurements are made from a distance, with the aid of a telescope, to avoid disturbances in the field due to the proximity of the observer.

Another interesting exhibit showed the production and measurement of oscillations of wave-lengths between 14 and 80 centimetres. These waves are produced by the oscillation of electrons about the grid, which occurs in some valves when the grid has a high positive and the anode a slightly negative potential with respect to the filament.

In connexion with the investigation of the effects of glare undertaken by the Photometry Division, a new form of photometric pupilometer has been devised. In this instrument the observer views an ordinary photometric field, both halves of which are illuminated by the Maxwellian method, in which the light source is focused at the observer's eye. The illuminant for one half of the field is a bright spot, the image of which is considerably less than the smallest diameter of the pupil of the eye. The other half of the field is illuminated by an extended surface, so that the amount of light received varies with the aperture of the pupil. By making a photometric balance it is possible to determine the size of the pupil.

In the High Voltage Division, two high voltage sources of direct current have been constructed, incorporating in one case full-wave and in the other half-wave rectification. The former, which is capable of giving 200 kilovolts, will be used for providing the accelerating voltage for an impulse generator and for general research. The latter, designed for 100 kilovolts, is primarily for use with a high voltage cathode ray oscillograph.

In the William Froude Laboratory, tests were being conducted with a model high speed steamer to determine the effects of rough water on the resistance of ship forms and upon the propeller efficiency, with the view of obtaining improved ship economy at sea. The model was entirely self-propelled through rough water created by the wave machine. Measurements were made of the speed, the power required to drive the model, and the thrust of the propellers. At the same time continuous records were made of the pitching of the hull. Of interest also was a model of an improved design of Thames barge constructed to the designs of the Laboratory. Comparative tests with barges of normal type have shown that with the new design a 33 per cent improvement in speed is obtained, while the power expenditure of the tug is slightly reduced.

International Congress of Prehistoric and Protohistoric Sciences

NOW that the programme is virtually complete, it is safe to predict success for the first International Congress of Prehistoric and Protohistoric Sciences, the first international archæological congress to meet in Great Britain since 1868. When the members assemble in London on Aug. 1, practically every nationality will be represented, and the communications to be submitted will afford a very fair conspectus of the more important departments of prehistoric research as it stands to-day. British archæological studies in various parts of the world, in particular, will be well represented.

Some preliminary information relating to the organisation of the Congress and the excursions of archæological interest which are to follow has already been given in NATURE (see March 26, p. 479) and need not be repeated. In addition to the communications which will be presented to the sections of the Congress at King's College and the presidential address, in which Sir Charles Peers will review the beginnings of archæological studies in Great Britain, discourses will be delivered at general meetings to be held in the evening on Tuesday, Wednesday, and Friday in the Congress week. The speakers will be: Dr. Cyril Fox, director of the National Museum of Wales, on the control of physical geography in the early history of human habitation; and Mr. E. T. Leeds, keeper of the Ashmolean Museum, Oxford, and Mr. T. D. Kendrick, of the British Museum, on the outstanding material expressions of the Celtic and Teutonic civilisations. A fourth general meeting on Saturday morning will be addressed by Mr. O. G. S. Crawford on "Air Photography and Archæology". Here may also be mentioned, as outside the sectional routine, though connected with the proceedings, a visit to the famous palæolithic gravel pit at Swanscombe and an extensive exhibition at Bedford College illustrative of the report which Miss Caton-Thompson will read on her investigation of the prehistory of the Kharga Oasis, Egypt.

Turning to the work of the sections, it is possible to mention here a very small selection only of the large number of papers which have been accepted and allocated to the programmes of the five sections into which the work of the Congress has been classified. In Section I. (Human Palæontology), under the presidency of Sir Arthur Smith Woodward, the most attractive topic undoubtedly will be the recently discovered human remains from Mount Carmel, Palestine. Of neanderthaloid type, but aberrant from that type, they will be described, perhaps exhibited, by Mr. T. McCown, the finder, and discussed by Sir Arthur Keith. The morphology and antiquity of man in America will be the subject of discussion by Dr. Bruno Oetteking, and Dr. L. S. B. Leakey will describe the fossil teeth of Miocene anthropoids recently found by him on the shore of Lake Victoria in East Africa and the circumstances of their discovery.

Mr. Reginald Smith, presiding over Section II., will be concerned with a variety of problems relating to the old stone age, ranging from Africa to the extremes of Europe and Asia. Dr. L. S. B. Leakey will deal with the prehistoric cultural sequences at Oldoway, Tanganyika, and Messrs. Miles Burkitt and E. J. Wayland will discuss the Mgosian culture of Uganda. Prof. R. Vaufrey's paper on the Acheulean of Gafsa, should be valuable. The Abbé Breuil will give the results of his first-hand observation on fire and the bone and stone implements in the cave of Peking man, and he will also review our present knowledge of palæolithic

cave art. A department of the latter topic, the art of the Spanish caves, will be the subject of consideration by M. L. Pericot. Dr. B. S. Petri will describe the palæolithic culture of Siberia.

A number of members will deal with aspects of mesolithic culture: M. Reygasse on the Tardenoisian of North Africa, Prof. Antoniewicz on early man in north-east Poland and Lithuania, Prof. E. Plopson on Rumania, and Prof. R. Serpa da Pinto on Portugal.

Questions relating to the neolithic, bronze, and iron ages in the ancient world fall to the province of Section III., which being by far the largest section, has had to be subdivided. Cis-Alpine European prehistory, under Prof. H. J. Fleure, will devote considerable attention to megalithic monuments, with papers by Prof. Daryll Forde on the varied typology of Breton megaliths, the veteran M. Le Rouzic on the relative chronology of the prehistoric burials of the Morbihan, Prof. R. A. S. Macalister on the horned cairns of Ireland, Mrs. Cunnington on 'Wooden Circles', and Mr. H. St. George Gray on his excavation of Avebury. The interest of this group is rivalled by Prof. Siret on the problem of the æneolithic age and M. Vouga on his investigations in the lake villages of Switzerland. Mr. C. A. R. Radford will describe the hill-villages of the south-west of England, Mr. Hencken will discuss the Cornish tin trade, and Mr. A. Keiller will give an account of the extremely important settlement which he has excavated at Windmill Hill. A question which has long demanded ventilation will be opened by Mr. Brynner Jones on the origin of British domestic cattle and especially the domestic ox.

In the section dealing with the Near East, under the joint presidency of Prof. J. L. Myers and Mr. Sidney Smith, importance will be attached to Sir Arthur Evans's demonstration of the great cleavage between Knossos and Mycenæ in Late Minoan i.b. and the later unifying reaction from Crete. Mesopotamia is represented by, among others, Mr. Leonard Woolley on the early graves of Ur, Mr. Harden on painted pottery from Kish, and Dr. H. Frankfort on Syrian and Anatolian influences in Mesopotamia; while from Anatolia, Dr. H. van den Osten will describe the æneolithic settlement at Alishar in Cappadocia. There may also be mentioned Prof. Gordon Childe on the bearing of a newly discovered metal type from the east on European bronze age chronology, and Dr. O. Menghin on excavations at Beni Salameh in relation to their significance for European prehistory. This must suffice, though it is far from exhausting the list.

The section devoted to areas outside Europe will be much preoccupied with the archæology of beads, especially from Indian iron age burials in the Deccan, described by Mr. E. H. Hunt, and from China, the latter being designated as "of foreign origin". Prof. C. G. Seligman and Mr. Beck jointly will be responsible for the discussion of the latter, and Mr. Beck for the former.

The transition from prehistory to history, the work of Section V. under Mr. E. T. Leeds, deals with the movements of races, Saxons, Vikings, Slavs, etc., in the early centuries of our era. Dr. Schetelig, the foremost of Viking archæologists, will cover broadly the excursions of this people, and Prof. T. Balodis will discuss Lettish origins in this period. Tombs of the Roman iron age in North Jutland will be described by Prof. J. Brønsted, and Dr. A. W. Brøgger will review recent evidence bearing on the iron age in Norway. Mr. E. MacNeil will deal with the Picts, Mr. C. Hawkes with the relations of iron age enclosures in Britain and on the Continent, and last, but by no means least in interest, Mr. E. T. Leeds will review the evidence for the penetration of the Saxons into the upper Thames region.

University and Educational Intelligence

EDINBURGH.—Curricula for the degree of B.Sc. with honours in anthropology have been approved.

Following on the resignation of Dr. C. B. Williams of the lectureship in agricultural and forest entomology, the two lectureships in entomology in the University have been more closely correlated. Dr. A. E. Cameron, at present lecturer in medical entomology, has been placed in general charge of the instruction in entomology in the University, and Mr. J. W. McHardy, formerly entomologist attached to the Medical Department of Tanganyika Territory, has been appointed as the other lecturer in entomology.

Prof. A. J. D. Porteous, McGill University, has been appointed to the lectureship in ancient philosophy about to be vacated by the resignation of Mr. R. P. Hardie.

Intimation has been received of the following resignations: Dr. T. W. M. Cameron, lecturer in helminthology, on appointment as research professor in helminthology at McGill University; Mr. A. D. Hobson, lecturer in zoology, on appointment to the chair of zoology at Armstrong College, Newcastle; Dr. Edward L. Ince, lecturer in mathematics, on appointment to the Imperial College of Science, South Kensington, London.

LONDON.—University post-graduate travelling studentships of the value of £275 for one year have been awarded to Dr. B. W. Bradford (Imperial College of Science and Technology) and Muriel H. E. Long (King's College and King's College Hospital). Dr. Bradford proposes to study the adsorption of gases on metals with particular reference to polar factors, at Frankfort-on-Main, and Miss Long will study surgery and its practice in Vienna, Cologne, Berlin, and Budapest, making Vienna her base, and specialising in stomach surgery.

PROF. A. C. MENZIES, professor of physics at University College, Leicester, has been appointed professor of physics at University College, Southampton.

ECONOMIC depression and unemployment in America have stimulated interest and activity in what is known as the 'educational guidance' movement. An official report on recent developments of the movement is published in *School Life* for May, which also contains an editorial describing how continuation and other schools in various parts of the country are adapting their resources to the task of aiding the unemployed. Among the evidences of increased attention to educational guidance is an increase in the number of schools providing organised guidance services. In Pennsylvania alone 800 now have counsellors or advisers on an extra-curricular, part-time or full-time basis, or have established group guidance through classes in opportunities or occupations. Many State and local communities are organising associations for promoting public-school guidance programmes. Guidance figures more largely in programmes of educational conferences, local, State, and national. The output of literature bearing on the subject is enormous, including textbooks for teachers' training colleges, occupational studies issued by directors of education, reports issued by associations such as the American Vocational Association, vocational surveys and monographs by research workers. Educational broadcasting programmes also give prominence to vocational guidance, while State departments are including guidance work in State courses of study. In Idaho, the State Board of Education has arranged for the formulation of a State guidance programme.

Calendar of Geographical Exploration

July 18, 1801.—Matthew Flinders' Journeys

Matthew Flinders sailed from Spithead in the *Investigator*, commissioned to explore the coasts of Australia, especially the little-known south coast. He discovered Spencer Gulf, St. Vincent Gulf, and Kangaroo Island, and, in a later voyage, circumnavigated Australia. His scientific work was of a high order and added much to our knowledge of magnetism, meteorology, and hydrography. He is said to have been the first to discover, and make corrections for, the effect of iron in the ship on the magnetic compass. In 1798, Flinders and Bass had sailed through the strait between Australia and Tasmania. Flinders achieved success in spite of many difficulties, which included leaking vessels, scurvy, and on one occasion the wreck of his vessel on a coral reef. Undaunted, he set off in a rowing boat to secure help, while the officers and men camped on a sandbank.

July 19, 1619.—Dutch Exploration of the West Coast of Australia

Two ships of the fleet commanded by Frederik Houtman touched the west coast of Australia in 32° 20′ S. Steering northwards to 27°, the commanders came to the conclusion that the coast formed part of the mainland off which Dirk Hartogszoon had, in October 1616, discovered Dirk Hartog Island. The knowledge of the west coast of Australia gained by several Dutch voyages at this period, including that of the *Leeuwin* in 1622, from which the southern cape was named, resulted from an order of the directors of the Dutch East India Company. They instructed captains sailing east from the Cape of Good Hope to take a more southerly course, in the hope of finding a better route to Java; thus within thirteen years, 1616–1629, the west coast of Australia between Cape Leeuwin and 21° S. was charted.

July 19, 1738.—Bouvet Island

Lozier Bouvet sailed from Lorient with two ships fitted out by the French East India Company. Stories of a pleasant land lying south of the Cape of Good Hope, led to the dream of establishing upon it a port of call for French vessels trading to India and China. The stories date back to the early sixteenth century, when a Norman noble, the Sieur de Gonneville, on a voyage to India, was driven ashore on a land still unidentified, but possibly southern Brazil. On Jan. 1, 1739, Bouvet sighted land, now known as Bouvet Island. Bouvet's voyage disposed of the more fantastic theories about Gonneville Land: he sailed for 48° of longitude roughly in 55° S. He described for the first time the huge flat-topped antarctic icebergs.

July 20, 1793.—Alexander Mackenzie in North America

Alexander Mackenzie reached the Pacific at the mouth of the Bellacoola River. He left England in 1792, proceeded to Chipewyan, and later wintered on the Peace River. On June 12 he reached the sources of the Parsnip, and by a short portage arrived at the Fraser system. He then crossed to the Bellacoola and followed it to its mouth, thus showing the practicability of intercourse between the Atlantic and Pacific Oceans. In 1789 he sailed down the Slave River to the Great Slave Lake and followed it to its delta, where, from Whale Island, he saw the Arctic Ocean. This journey was a remarkable feat, 2990 miles of difficult country having been covered in 102 days. These two achievements place Mackenzie in the front ranks of exploration.

Societies and Academies

LONDON

Geological Society, May 25.—**Baron Ferencz von Nopcsa**: The influence of geological and climatological factors on the distribution of non-marine fossil reptiles and Stegocephalia. A study of the terrestrial tetrapods and their distribution indicates three lines of migration in Upper Palæozoic and Lower Mesozoic times: (1) North America to Europe, thence through India and the Malay Archipelago to Australia, and from there to South America; (2) Central Asia to South Africa; and (3) Africa to South America. In Jurassic, Cretaceous, and Tertiary times there appear four lines: (1) Europe to Asia, the Malay Archipelago, and South America; (2) Asia, Fenno-Scandia, Greenland, and North America; (3) Central Asia to South Africa; and (4) North Africa to Brazil. To some extent these migratory lines are the same as those of Upper Palæozoic and Lower Mesozoic times. An attempt is made to correlate them with large-scale tectonic movements of folding and marine transgression, together with continuous changes in the ecliptic, bringing about a cycle of climatic and seasonal changes. —**K. A. Davies**: The geology of the country between Abergwesyn (Breconshire) and Llansawel (Carmarthenshire). The country described lies on the north-western side of the Towy anticlinorium. The rocks belong wholly to the graptolitic facies, and are very similar to those in adjacent areas which have already been described. It is suggested that the differences in grain are indicative of the varying depth of the sea-floor when deposition took place, the coarse deposits being laid down in banks tailing off from the areas made shallow by the cross-folding movements. —**K. A. Davies and J. I. Platt**: The conglomerates and grits of the Bala and Valentian rocks of the district between Rhayader (Radnorshire) and Llansawel (Carmarthenshire). A description is given of the distribution and field characteristics of the arenaceous bands, as well as a petrographical description of the included pebbles of the conglomerates and of the heavy mineral constituents of the grits. Most of the pebbles are quartzite and vein-quartz; sandstones, shales, etc., also occur frequently, but numerous pebbles of igneous rocks were found, as well as a few metamorphic types. The majority of the igneous pebbles are acid volcanic rocks, but interesting intrusive types also occur. All the igneous rocks are rich in soda.

Royal Meteorological Society, June 15.—**G. I. Taylor**: The resonance theory of semidiurnal atmospheric oscillations. The theory that the semidiurnal oscillations in the atmosphere are due chiefly to resonance requires that a free period very close to 12 hours shall exist. Theory shows that the corresponding speed of a tidal free wave is 910 ft. per sec., but direct calculation, and also observations of the Krakatoa air wave, agree in giving the velocity of free gravity waves as about 1050 ft. per sec. It has been suggested that this discrepancy might be explained if rapid pressure changes take place adiabatically while semidiurnal changes are more nearly isothermal. This theory is untenable, because the radiation or conduction necessary to produce any appreciable difference in the speed of the wave from that appropriate to adiabatic changes would give rise to so much damping that amplification by resonance to the desired extent would be impossible, even if the free period of the atmosphere were exactly 12 hours.—**H. L. Wright**: The variation of soil temperature below turf: a discussion of observations at Kew Observatory. Heat passes from 10 cm. to 20 cm. more rapidly

by about one hour and a half than is consistent with the decrease in the ranges of temperature at these depths. The suggestion is advanced that the grass interferes with the normal course of heat conduction. —J. M. Sil: Variations in potential gradient caused by some meteorological phenomena. The author has brought together a number of examples of abnormalities in potential gradient and has endeavoured to trace the connexion between them and some meteorological phenomena such as strong insolation, strong wind, the occurrence of a sea breeze, dust storm, etc. The abnormal effect caused by a dust storm was also produced experimentally on a calm day by blowing a small quantity of local dust particles at a point 3 ft. below the collector, when the earth's positive field was quickly reversed.

PARIS

Academy of Sciences (vol. 194, pp. 1869–1992, May 30).—The president announced the death of Roland Thaxter, *correspondant* for the Section of Botany, and of Albert Durand de Grossouvre, *correspondant* for the Section of Mineralogy.—Ch. Lallemand: Some geographical discoveries made recently in the antarctic region. Results obtained by the whaler *Norvegia*, a vessel specially equipped for survey work.—L. Blaringhem: Intersexual individuals in *Aquilegia*.—P. Viala and P. Marsais: A parasite of vine mildew. *Trichothecium plasmoparæ* has been found to be a parasite of the mildew fungus of the vine. The possibility of utilising it to fight the mildew is discussed.—Charles Achard, Augustin Boutaric, and Maurice Doladilhe: The influence of heating serum on the flocculation caused by dilution with distilled water. After heating to temperatures between 48° and 60° C., dilution with distilled water gives no separation of globulins.—Maurice Gignoux: The possibility of the existence of the Neocomian in the Embrunais zone on the right bank of the Durance.—Georges Bouligand: Level ensembles of a function of the distances of a point with several ensembles.—S. Mandelbrojt: The Dirichlet series the exponents of which are linearly independent. —Vladimir Bernstein: A generalisation of the exponential summation method of Borel.—Mlle. Mary L. Cartwright: The Borel directions of integral functions of finite order.—J. Leray: The movements of unlimited liquids.—Max Serruys: The calculation of an upper limit of the duration of detonation in internal combustion motors and the explanation of the presence of a gap in the diagrams given by certain electric manographs.—Georges Mabboux: The photo-elasticimeter extended to the study of reinforced concrete. An application of optical methods capable of showing changes in structures which have been built some time.—J. Dufay: Emission bands and lines in the spectrum of the night sky.—R. Wavre and P. Dive: An example of a multiform harmonic function furnished by the theory of Newtonian potential.—Jean Jaffray and Pierre Vernotte: The existence of high frequency oscillations in the secondary current of high tension magnetos.—Michel Durepaire: A method of comparison of small capacities.—G. A. Beauvais: A radiometer sensible to Hertzian waves.—Antonio Rostagni: The properties of gases ionised with high frequency currents.—Jean Louis Destouches: The theory of the diffusion of neutrons, absorption coefficient, and ionisation.—M. E. Nahmias: Anomalous absorption by lead of X-rays at about 210 kv. This anomalous absorption, of which no explanation is obvious, agrees with earlier figures given by Jaeger. —I. I. Agarbiceanu: The fluorescence spectrum of I_2.—D. Skobelzyn: The Compton effect of the very hard γ-rays of ThC″.—M. Haïssinsky: The electrolytic deposit of polonium on various metals.—S. Rosenblum and G. Dupouy: Absolute measurements of the velocities of the principal groups of α-rays. Work done using the large electromagnet of the Academy of Sciences. The velocity of the α-rays of RaC′ ($1{\cdot}922 \times 10^9$ cm./sec.), used as a base number, agrees with the figure given by Rutherford and Robinson.—Jean Jacques Trillat: The changes of structure of nitrocellulose films in the course of drying.—Ch. Zinzadzé: The buffer power of some slightly soluble phosphates. A diagram is given showing the buffer action of magnesium and calcium phosphates.—H. Muraour and G. Aunis: The influence of the temperature of the (explosive) powder on the variation of $\int p.dt$ at different densities of charge.—Victor Lombard and Charles Eichner: The diffusion of hydrogen through palladium. Curves are given showing the amounts of hydrogen diffused through palladium at constant pressure with temperatures varying between 196° and 600° C., and at constant temperature (372° C.) with varying pressures.—Mlle. Suzanne Veil: The precipitation of methylene blue by various electrolytes in gelatine.—Maurice Doladilhe: The influence exerted by an electrolyte on the fixation of colloidal colouring matters by the granules of a hydrosol.—M. Auméras and A. Tamisier: The decomposition with increasing temperature of the ammine and hydrated metallic complex compounds.—T. Karantassis and L. Capatos: The use of potassium stannichloride ($K_2SnCl_4.2H_2O$) in analysis. This salt is stable and non-hygroscopic and can be used in volumetric analysis.—A. Sanfourche and Jean Henry: The action of water on dicalcium phosphate.—P. Cristol and J. Cayla: A new conjugated molybdenum blue, boro-molybdic blue. —Albert Kirrmann: The condensation of pyruvic acid with aldehydes.—Lespieau and Wiemann: The synthesis of racemic mannite. Acrolein is oxidised with silver chlorate in the presence of osmic acid: one of the products is shown to be mannite.—Mailhe, Marty, and Gaudry: The decomposition of hydroaromatic hydrocarbons. A study of the decomposition of cyclohexane at temperatures between 500° and 750° C. in presence of silica gel as catalyst.—Ch. Courtot and H. Hartman: The chromatability of the azo colouring matters produced from the hydroxyquinolines.—Georges Lévy: The preparation of a new ethylnaphthol.—V. Cerchez and Mlle. C. Colesiu: The reduction of the acetyloximino esters.—J. Orcel: The existence of coronadite in the manganese minerals of Bou Tazoult, Imini region, Morocco.—Raymond Furon: The phosphate rocks of the Gabon coast.—E. Chaput: Geological observations in Asia Minor: the upper Cretaceous in Central Anatolia.—Elie Gagnebin: The presence of the Gault in the breccia of Chablais (Haute-Savoie).—Louis Dubertret: The structural evolution of the Levant States under the French mandate.—Nicolas Menchikoff: The Devonian containing cephalopods of Oued Saoura and the chains of Ougarta (Sahara).—Maurice Blumenthal: The stratigraphic material of the Bokoya stratum.—Maurice Suess: The presence of gastropods and of vertebrates in the Bou Hanifia grit, Hascara sheet (Oran).—G. Depape: The Tertiary plants of Wei-tchang (China).—Paul Becquerel: The anhydrobiosis of the tubers of *Ranunculus* in liquid nitrogen.—Pierre Chouard and Georges Teissier: Variations in the intensity of growth in melon seedlings in the course of development as a function of the amount of available reserves.—J. Chaine and J. Duvergier: The differentiation of fishes of the genus *Ophidium* by their otoliths.—Mlle. M. Friant: The abrasion of the molars *in utero* of rodents of the Caviideæ.—Raymond-Hamet: The natural classification of the amines similar to adrenaline. The suggested classification is based on the vascular action of maximum doses of the amines.—Fernand Mercier: The influence of the intrarachidian injection of cocaine or its substitutes on the cardio-vascular action of

adrenaline.—**R. Monceaux** and **H. Godard**: The presence of tyrosine and of other free amino-acids in a nævocarcinoma without pigment.—**Maurice Piettre**: Casein complexes. Calcium caseino-phosphate in milk. Reply to a criticism by Porcher and Brigando.—**Jean Caminopetros**: The sensibility of the spermophil *Citillus citillus* to icterohæmorragic spirochetosis.

CAPE TOWN

Royal Society of South Africa, May 18.—H. G. Fourcade: Contributions to the flora of the Knysna and neighbouring divisions. In preparing a list of the flowering plants found in the divisions of George, Knysna, Humansdorp, and Uniondale, based chiefly on his own collections at intervals during many years, the author wished to include the new species collected by himself that were still undescribed, and with this object has supplied their description in the paper. He has added the name changes in his list that have been rendered necessary by the international rules of botanical nomenclature. In testing the numerous new combinations that have already been made by others since the publication of the "Flora Capensis", a number of illegitimate changes were found, and these are rectified whenever they relate to species included in the compiled list.

Forthcoming Events

WEDNESDAY, JULY 20

BRITISH MEDICAL ASSOCIATION (Fourth Victor Horsley Memorial Lecture at University College Hospital Medical School, Gower Street, W.C.1.).—Prof. E. D. Adrian: "The Visceral Sense Organs," at 5 P.M.

Conferences

JULY 23–30

BRITISH MEDICAL ASSOCIATION (London) Centenary Meeting.

Official Publications Received

BRITISH

The Norman Lockyer Observatory. Director's Annual Report, April 1, 1931–March 31, 1932. Pp. 8. Council's Report and Accounts, and List of Council, Staff, Members, etc., June. Pp. 9. (Sidmouth.)

Journal of the Marine Biological Association of the United Kingdom. New Series, Vol. 18, No. 1, May. Pp. 433. (Plymouth.) 17*s.* 6*d.* net.

Proceedings of the Society for Psychical Research. Part 125, Vol. 40, June. Pp. 389-441. (London: Society for Psychical Research.) 4*s.*

The Journal of the Institution of Electrical Engineers. Edited by P. F. Rowell. Vol. 71, No. 426, June. Pp. 144+xviii. (London: E. and F. N. Spon, Ltd.) 10*s.* 6*d.*

The Relation of Food to Disease. By Stanley Dixon. Pp. 38. (London: Institute of Chemistry.)

Proceedings of the Royal Physical Society, Session 1931-32. Vol. 22, Part 2. Pp. 75-106. (Edinburgh: Oliver and Boyd.)

City of Stoke-on-Trent. Report on the Corporation Museums and Art Gallery for the Two Years to 31st March 1932. Pp. 14+2 plates. (Stoke-on-Trent.)

Experimental and Research Station, Nursery and Market Gardens Industries' Development Society, Ltd., Turner's Hill, Cheshunt, Herts. Seventeenth Annual Report, 1931. Pp. 71. (Cheshunt.)

New Zealand: Marine Department. Fisheries Bulletin No. 5: On the Depreciation of Trout-Fishing in the Oreti (or New River), Southland, with Remarks on Conditions in other Parts of New Zealand. By Prof. E. Percival. Pp. 48. (Wellington, N.Z.: Government Printing Office.) 1*s.* 9*d.*

The Indian Forest Records. Silviculture Series, Vol. 17, Part 2: Treatment of Babul (*Acacia arabica*) in Berar. By S. A. Vahid. Pp. v+42+10 plates. (Calcutta: Government of India Central Publication Branch.) 1.14 rupees; 3*s.* 3*d.*

Memoirs of the Asiatic Society of Bengal. Vol. 11, No. 4: String Figures from Gujarat and Kathiawar. By James Hornell. Pp. ii+147-164. (Calcutta.) 1.2 rupees.

Canada: Department of Mines: Geological Survey. Summary Report 1931, Part A. (No. 2305.) Pp. 120. Summary Report 1931, Part D. (No. 2306.) Pp. 58. Economic Geology Series, No. 9: Oil and Gas in Eastern Canada. By G. S. Hume. (No. 2294.) Pp. vii+187. 30 cents. (Ottawa: F. A. Acland.)

Canada: Department of Mines: National Museum of Canada. Bulletin No. 68: Annual Report for 1930. Pp. 91. (Ottawa: F. A. Acland.)

The Welsh Journal of Agriculture: the Journal of the Welsh Agricultural Education Conference. Vol. 8. Pp. 272. (Cardiff: University of Wales Press Board.) 2*s.* 6*d.*

Results of Meteorological Observations made at the Radcliffe Observatory, Oxford, in the Five Years 1926–1930, under the direction of Dr. H. Knox-Shaw. (Published by order of the Radcliffe Trustees.) Vol. 55, with Appendix. Pp. viii + 113. (London: Oxford University Press.)

The Observations of the Reverend Thomas Hornsby, D.D., Savilian Professor of Astronomy and Radcliffe Observer, made with the Transit Instrument and Quadrant at the Radcliffe Observatory, Oxford, in the Years 1774 to 1798. Reduced by Dr. H. Knox-Shaw, Dr. J. Jackson and W. H. Robinson. (Published by order of the Radcliffe Trustees.) Pp. 145. (London: Oxford University Press.)

FOREIGN

Spisy vydávané Přírodovědeckou Fakultou Masarykovy University (Publications de la Faculté des Sciences de l'Université Masaryk). Čis. 146: Sur les hypercirconférences et certaines surfaces paraboliques dans l'espace euclidien à quatre dimensions. Par Otakar Borůvka. Pp. 40. Čis. 147: K teorii Markovových řetězů (Sur la théorie des chaines de Markoff). Napsal Miroslav Konečný. Pp. 18. Čis. 148: Generis Trigonella L. revisio critica, V. Scripsit G. Širjaev. Pp. 43. Čis. 149: Předmiocenní relief a miocenní plošiny v oblasti střední Svratky (Le relief prémiocène et les plates-formes miocènes dans la région de la Svratka moyenne). Napsal Fr. Říkovský. Pp. 21. Čis. 150: Anthropologie Podkarpatské Rusi s některými poznámkami o lidských plemenech vůbec a o metodách anthropologických; Předběžná zpráva (Anthropological Notes on the Peoples of Carpathian Ruthenia, with remarks on Races in General and on some New Methods in Anthropology; Preliminary Report). Napsal Prof. V. Suk. Pp. 29. Čis. 151: Afinita chemických reakcí (Affinity of Chemical Reactions). Napsal Bedřich Macků. Pp. 15. Čis. 152: Fluviatilní terasy střední Svratky (Les terrasses de la Svratka moyenne). Napsal Fr. Říkovský. Pp. 23. (Brno: A. Píša.)

Biologické Spisy vysoké Školy Zvěrolékařské (Publications biologiques de l'École des Hautes études vétérinaires), Brno. Svazek 10, Spis 141-150. Pp. iii+25+10+10+13+29+20+40+45+14+25. (Brno: A. Píša.) 50 Kč.

Sbornik vysoké Školy Zemědělské (Bulletin de l'Institut National Agronomique), Brno. C. 19: Příspěvek ke studiu vzrůstových činitelu kapřího plůdku se zvl. zřetelem na vliv velikosti t. zv. životního prostoru. Napsal Dr. Vasilij P. Čerňajev. Pp. 75. 13.65 Kč. C. 20: Příspěvek k otázce o vlivu prostoru na vzrůst zvířat (Contribution to the Question of the Influence of the Living-Space on the Growth of Animals). Napsal Dr. Jan Podhradský. Pp. 56. 12.80 Kč. C. 21: Vliv potažních prací na užitkovost dojnic, napsal Dr. Stanislav Koláček; Vliv potažních prací na chemické složení kravského mléka, napsal Dr. Andrej Karakoz. Pp. 78. 15 Kč. C. 22: Veřejný agronom a jeho činnost. Napsal Dr. Vladimír Štein. Pp. 64. 9.80 Kč. C. 23: Příspěvek k poznání Araneid střední Slavonie (Sur quelques Araignées de Slavonie centrale avec la description d'une nouvelle *Salticide fissidentatée* (*Roeweriella laicanica* n. g. n. sp.) et de la nouvelle espèce *Troglohyphantes diurnus* n. sp.). Napsal Josef Kratochvíl. Pp. 16. 2.50 Kč. C. 24: Hydrobiologická studia rybníků lednických. 2: Nástin poměrů algologických na Lednicku. Podává Jindřich Zapletálek. Pp. 70. (Brno: A. Píša.)

Conseil Permanent International pour l'Exploration de la Mer. Rapports et procès-verbaux des réunions. Vol. 78: Report of the Baltic Area Committee concerning the General Results of the Investigations on the Baltic Flounder. Pp. iv+28+5+45+12+15. (Copenhague: Andr. Fred. Høst et fils.) 5.75 kr.

Anales del Museo Nacional de Historia Natural, Tomo 37. Entomologia, Publicación No. 147: Las Hormigas de la República Argentina, Subfamilia Mirmicinas, Sección Promyrmicinae. Por Angel Gallardo. Pp. 37-88. (Buenos Aires.)

Proceedings of the United States National Museum. Vol. 81, Art. 1: New Bopyrid Isopod Crustaceans from Dry Tortugas, Florida. By A. S. Pearse. (No. 2924.) Pp. 6. (Washington, D.C.: Government Printing Office.)

The Science Reports of the Tôhoku Imperial University, Sendai, Japan. Fourth Series (Biology), Vol. 7, No. 2. Pp. 157-311. (Tokyo and Sendai: Maruzen Co., Ltd.)

Ministry of Agriculture, Egypt: Technical and Scientific Service. Bulletin No. 114: The Greasy Cutworm (*Agrotis ypsilon* Rott.) in Egypt. By Ibrahim Eff. Bishara. Pp. iii+55+18 plates. (Cairo: Government Press.) 10 P.T.

CATALOGUES

Degussa Products for Stringent Chemical and Thermal Requirements. Pp. 12. (London: Bush, Beach and Gent, Ltd.)

Catalogue of New Book Bargains. (No. 390.) Pp. 64. (Cambridge: W. Heffer and Sons, Ltd.)

Modern X-Ray Engineering. Section 2: Screening Stands, Tube Stands, Couches. Pp. 24. (London: X-Rays, Ltd.)

Editorial and Publishing Offices:

MACMILLAN & CO., LTD.

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

Editorial communications should be addressed to the Editor

Advertisements and business letters to the Publishers

Telephone Number: WHITEHALL 8831

Telegraphic Address: PHUSIS, LESQUARE, LONDON