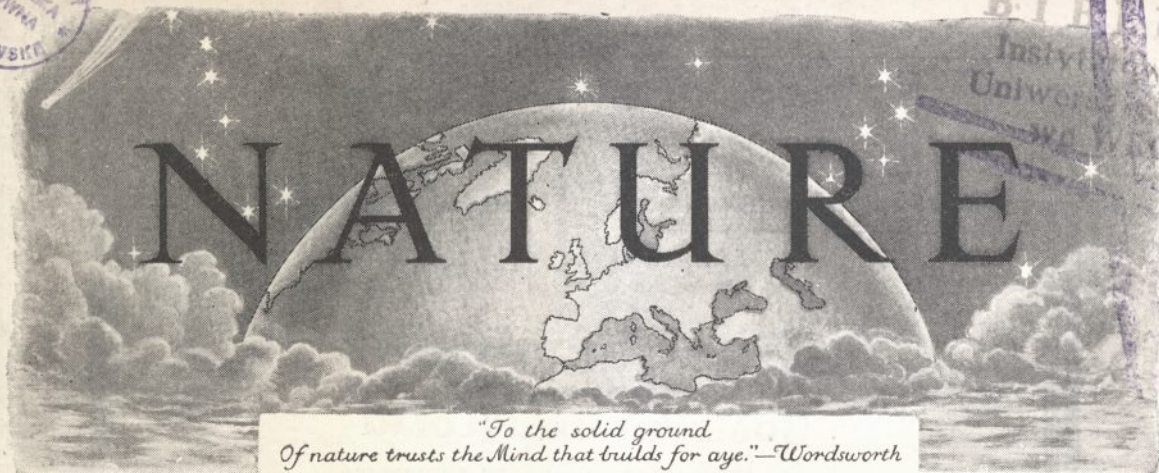


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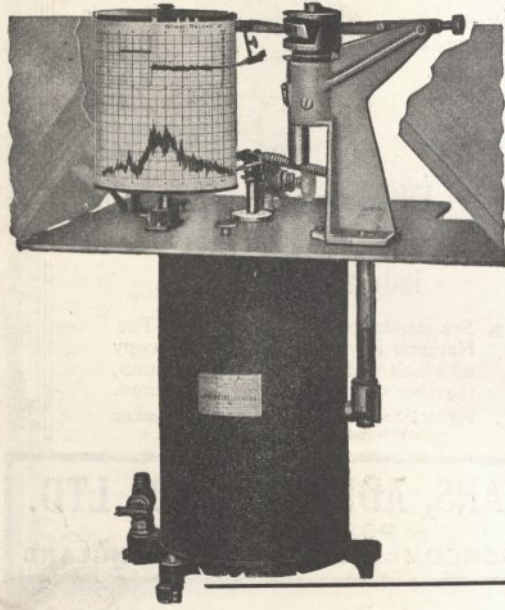
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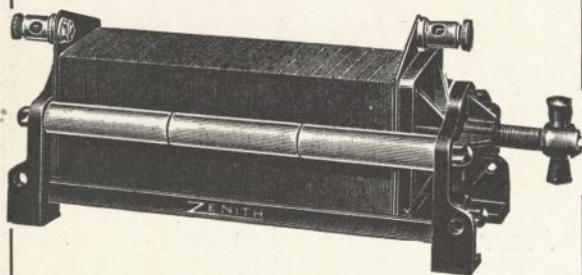
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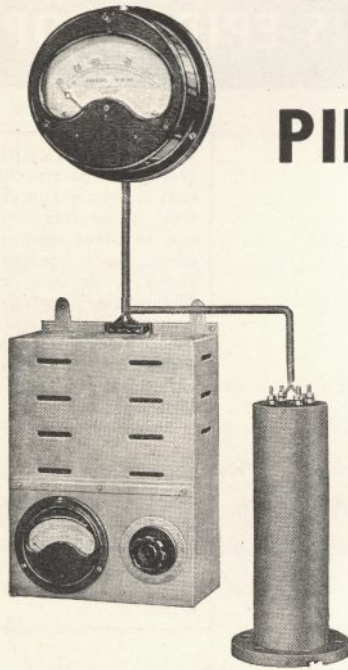
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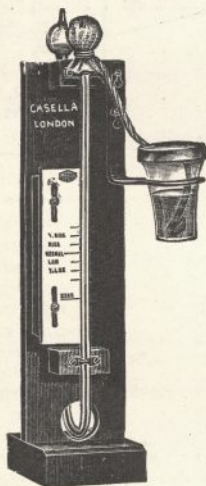
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# NATURE

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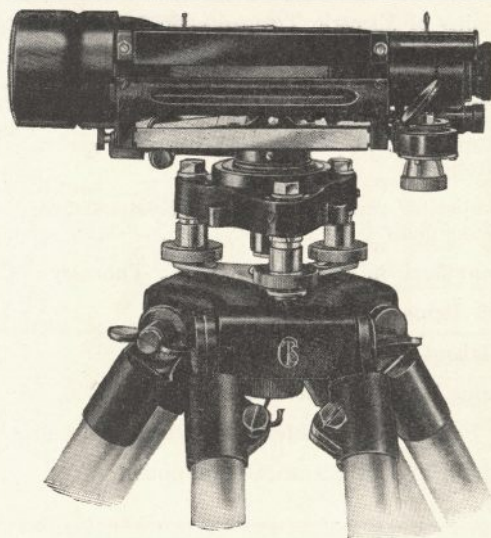
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Vol. 146

SATURDAY, OCTOBER 5, 1940

No. 3701

## EVACUATION AND EDUCATIONAL POLICY

THE well-balanced report to the Fabian Society which has been edited by Richard Padley and Margaret Cole under the title "Evacuation Survey" is the most comprehensive of a number of admirable reviews of the situation which have already appeared.\* Besides the investigations carried out by the Department of Social Science of the University of Liverpool and the articles in the *Quarterly Review* and the *Political Quarterly* which have already been commented on in these columns, there are Lady S. D. Simon's "The Children in War-Time" issued by the Workers' Educational Association and a further study "Evacuation: Failure or Reform" by F. Le Gros Clark and R. W. Toms, also issued by the Fabian Society.

The main impression which Mr. Padley and Mrs. Margaret Cole's report leaves is the lack of vision and co-ordination in the original planning. The absence of these was the prime cause of the confusion and difficulties which went far to wreck the original scheme and did the greatest mischief to the educational system. Until that position has been rectified it is idle to expect the firm action which is still required to bring order again into the field of education and prevent the perpetuation of damage to health and educational services alike.

On this point the criticism of the Government is sharp and severe. Confusion of thought appears to have characterized the conception of the scheme as well as its execution. Circulars issued by the Ministry of Health instructing the local authorities how to deal with evacuation problems convey the impression of a Government using the decentralized local government system, not as a means of

making allowances for local needs and resources, but rather as a method of shirking its own responsibility. Difficulties are admitted with no long-term programme for their solution. Heavy burdens of organization are placed on small local authorities, ill-equipped for such detailed administration. Voluntary effort is continually relied on to provide services which the Government is unwilling to organize or finance.

Of the Departments concerned with administering the scheme, the Board of Education, which alone showed sufficient imagination, was lacking in initiative, and allowed itself to be refused any major share of control. The Ministry of Home Security was obsessed with the prospect of destruction and too busy with other aspects of civil defence. The Ministry of Transport saw the whole thing purely as a technical problem; and the Ministry of Health, which was responsible for the scheme, was far too timid to develop any serious policy. Over them all was the control of a parsimonious Treasury, which correctly interpreted the Government's attitude in resisting the expenditure which would have been necessary to assist the local authorities in offering proper services for the evacuees.

The survey does not suggest that any of the steps which the Government neglected would, in the absence of the heavy bombing which was expected, have made a complete success of the scheme. The shrewd and severe criticism, however, makes it very plain that with efficient planning and proper co-operation between the many local authorities and services the scheme would have come much nearer to achieving success. The Ministries at the centre failed to supply the wise and energetic guidance that was essential,

\* Evacuation Survey: a Report to the Fabian Society. Edited by Richard Padley and Margaret Cole. Pp. viii+296. (London: George Routledge and Sons, Ltd., 1940.) 10s. 6d. net.

and it is well that we should remember that the considered judgment of the first evacuation scheme leads inescapably to the conclusion that the Civil Service, through lack of vision and constructive ability, missed an immense opportunity.

Sobering as are the reviews of the national scheme and the experiences of its working in different districts, or of the effects of the scheme on local administration or the various social services which are contributed to this volume, its main outlook and criticism are not retrospective or negative, but constructive. An opportunity was missed because, Mrs. Cole remarks, the scheme was unattractively drawn up "by minds that were military, male and middle class". They were not imaginatively alive to the real issues, human and social, underlying what was to them a mere matter of civil defence. The great value of this book is that it directs attention to the opportunities which are still before us and indicates some of the factors which require weighing and analysis.

The note of vision which characterizes the third part of the book in reviewing the outstanding problems of evacuation enables it to make a real contribution to those important aspects of education and juvenile and adolescent welfare which are with us as part of our war effort and as part of the social reconstruction which must proceed during, and not merely after, the War. The startling disparities between outlook and social habits and conditions which have been revealed to many for the first time by the evacuation have indeed to some extent loosened some of the former obstacles to reform. With a wide vision and a firm but sympathetic handling of these problems, much might yet be done to consolidate the solid gains in health which have in some districts already resulted, and to retrieve the mistakes which parsimony or sheer administrative incapacity have perpetrated. Success can only come when not merely the House of Commons but the whole country acquires a real interest in education and in the contribution to the national welfare which the school social services represent.

It is only possible to select a few of the possibilities for mention here. To take education in its narrowest sense in the first place, the outbreak of systematic bombing attacks with a main objective in the disintegration of civilian morale makes the provision of an education as complete as possible a matter of vital defence as well as a desirable end of statecraft.

It must be recognized that not all the dislocation of education has come from evacuation; but there can be no question that the time has come when full educational facilities must be restored. Even if the whole time is not spent in a school, full-time education can and must be provided both in the reception and in the evacuation areas. Moreover, it is remarkable that the importance of bringing immediately into operation the Education Act of 1936, which raises the school-leaving age to the end of the term in which the child becomes fifteen, is now being urged not only by education authorities but also by other bodies of widely divergent interests.

The development and prosecution of an adequate education policy in this way involves naturally some reorganization and co-ordination. It will not be sufficient to hand over to the Board of Education all problems connected with the evacuation and billeting of children, including nursery school children, or to return immediately to the local education authorities all school buildings which are not absolutely indispensable for purposes connected with the War. Imagination and courage and real determination as well as administrative efficiency will be demanded of the Board of Education if it is to execute the required policy with success. No longer must the Board allow itself to be treated as a poor relation and overridden by other Departments.

The question of accommodation supplies an admirable instance in point. If the scheme at present operating is to succeed at all, it must have available not merely accommodation such as billeting premises but also adequate premises for teaching. A general survey of existing premises, which might well yield much of the accommodation required for all purposes, is urgent. Preliminary examination in some of the reception areas indicates that premises are certainly to hand which could frequently be used without drastic alteration. Wise and inspired improvisation could undoubtedly better the situation.

Besides this the question of new building construction must be faced. Here it must be remembered that new buildings are permanent and change the face of the villages and small towns. They must therefore be designed to meet the future needs of the people in the villages and towns as well as the immediate situations. School buildings in many rural areas are hopelessly out of date, apart from their inadequacy to meet the situation arising out of evacuation. The policy of



building senior schools in the countryside needs reviving and implementing. Moreover, where premises are lacking or inadequate and no fresh school building has been constructed this situation could often be met by the construction of some type of hall or village centre, which could serve for teaching purposes during the War and afterwards be an asset to the neighbourhood.

The educational position arising out of evacuation abounds in such possibilities of harnessing immediate necessities to future needs and developing national assets rather than frittering away resources in improvisations. What is essential is far-sighted planning and bold leadership inspired by the conviction that a nation's youth is one of its greatest assets, and the wise training of the children and adolescents a sure safeguard of its morale. Only such a conviction will supply the drive essential to carry through the measures required to safeguard the health of the children whether in reception or evacuation areas, to ensure that the diet of the children of the nation is kept at a level affording at least adequate protection against the deficiency diseases, and sufficiently fortified by a good standard of nutrition to be resistant to epidemic infections, thus preserving us the invaluable asset of a healthy and well-developed young generation.

No less determination will be needed to repair the havoc already wrought in secondary and higher education. Here, as Helen Bentwich points out, apart from the acute difficulties imposed by the absence of suitable premises and equipment, billeting offered particular difficulties. In the absence of careful planning of billeting in relation to the actual educational facilities for secondary education in the reception areas, efficient teaching of these children proved almost impossible. Here the evacuation experience endorsed the importance of further regional co-operation in the direction suggested both in the Hadow Report and in a subsequent P E P broadsheet on the control of education.

This Evacuation Survey makes many other admirable suggestions. The chapter on psychological aspects is particularly valuable not only in respect of the warning it gives in regard to juvenile delinquency if we fail to handle wisely the question of small children and separation from their homes, but also in regard to camps and to the needs of parents or foster parents. Some teachers might well consider whether they could not relieve foster parents of some of their heavy responsibilities out

of school hours. There are emotional as well as economic problems in evacuation, and the original scheme broke down mainly on the human and domestic side. The vagaries of human relationships were insufficiently considered. Unless the State shoulders its responsibilities in these matters the opportunities for constructive work which evacuation offers will be missed as will the opportunities before the National Youth Committee.

The question really before us is whether we care sufficiently for the welfare of youth to put into its training the thought and effort which are required to meet these new opportunities. A consciousness of the importance of youth as a national asset may provide the first stimulus. Equally our plans must provide for the throwing up of leaders, and for the means by which youth can play its part not only in the national effort now but also in the development of a new social order after the War. This evacuation survey, for all its trenchant criticism of past mistakes or ineptitude, demonstrates emphatically the opportunities still confronting us in social reform in this field of education. If these opportunities are firmly seized, evacuation may yet leave the country a heritage of camp schools, village halls and clubs, nursery hostels and the like such as it has never before enjoyed. Permanent links might be established between urban and rural communities, and a sense of the values of right feeding, of air and sunshine, of child nurture and of social enterprise carried to half the homes of Britain.

To achieve this we need indeed central direction imaginatively alive to these human and social issues, and making wise and effective use of the administrative systems already available. Such direction is needed to ensure due co-ordination not only of the work of the different Government departments but also of such activities as those of the National Youth Committee and the numerous voluntary organizations concerned with the welfare of youth. We need, too, a large and wholesome display of local initiative, exploring and discovering its own solutions for difficulties as they are encountered. Supported by an increasingly enlightened public opinion we may see at last the actual beginning of compulsory day continuation schools until the age of eighteen, the elimination of some of the anomalies of local administration which have hindered the development of our educational system and the implementing of the constructive proposals of the Spens Report and of the provisions of the Fisher Act placed on the Statute Book at the end of the War of 1914-18.

## A ZOOLOGY FOR STUDENTS

### A Text-Book of Zoology

By the late Prof. T. Jeffery Parker and the late Prof. William A. Haswell. Sixth edition. 2 vols. Vol. 1. Revised by Dr. Otto Lowenstein. Pp. xxxii+770. (London: Macmillan and Co., Ltd., 1940.) 36s. net.

IT is nearly forty-three years since "Parker and Haswell" first appeared, and its usefulness has made it about the best-known text-book of zoology of its scope in the English language. During the interval much water has flowed under the bridge, and while five editions have appeared each of them has contained only relatively minor alterations. As is stated in the introduction to the present, that is, the sixth edition of vol. 1, "it was clear that this had to be based on a thorough revision of both text and illustrations". One looks forward to renewing the acquaintance of a friend of such long standing with mixed feelings; pleasure in old friendship and trepidation that the years may have wrought such changes that the friend will no longer be recognizable. The fear may be set aside, for it is the old friend though mellowed and may we say improved with acquired knowledge. Some of the old faults are still present, for example, on p. 1, Linné did not introduce the "binomial" but the binominal nomenclature, and it is preferable to regard the *specific name* as composed of two words, the *nomen genericum* and the *nomen triviale*. The same breezy lack of uniformity is retained in the legends of the illustrations; for example, pp. 400 *et seq.*, we find the same animal referred to indifferently as *Astacus fluviatilis*, *Astacus* or the crayfish. Sometimes this occurs at the beginning of the legend, at others after a preliminary phrase. There is similar diversity throughout: the generic name alone is given or the specific name; either may be in heavy type or in ordinary type or in brackets; the author's name is given in heavy type, in ordinary type, or, more frequently, omitted altogether. This treating of nomenclature as if it were a matter of indifference, while characteristically English, is unnecessary, and in a book that is bound to be used by many young zoologists it would have been as well to have followed a more consistent course.

The first edition contained 752 pages of text and 663 figures while the present one has 744 pages and 732 figures and a larger type has been employed. In spite of fewer pages and larger type, however, the use of a larger page and the elimination of a

certain amount of material, now obsolete, has allowed of the inclusion of more useful material. Of the text-figures about eighty are replacements, and since they have been chosen from a much wider range than was available forty years ago each of them constitutes an improvement. The new figures, about seventy in number, similarly add much to the usefulness of the new edition. The book appears to be remarkably free from actual errors or slips, although in the diagram of the eye on p. 36 anterior and posterior chamber are not used in the sense in which they are employed in standard text-books of anatomy—a common fault in text-books of zoology. Posterior chamber is the space between iris and lens capsule and not the cavity containing the vitreous body. On p. 207 "ora uricles" is an obvious slip for auricles. It is scarcely correct to describe *Hirudo medicinalis* as the common British species (p. 355). In a few places also another terminology might be preferred, for example, "unsymmetrical" (p. 154); the terms polype instead of polyp and zoophyte instead of hydroid in the chapter of Coelenterata sound old-fashioned. On p. 324, "deric epithelium" might well have been left as epidermis, and on p. 330 receptaculum seminis might have been left as spermatheca, since receptaculum has a different significance when applied to receptaculum ovarum.

Changes have been made in the classification which were much needed. The giving up of the old "phyla" Nemathelminthes, Trochelminthes and Molluscoidea are steps in the right direction, for the inclusion of the various groups of animals in these phyla suggested a closer relationship than is borne out by their structure. The removal of the Endoprocta, that is, Calysozoa, from the Bryozoa and the reclassification of the Insecta are more in consonance with modern views and are improvements, as is the more distinct separation of the Chilopoda (centipedes) from the Diplopoda (millipedes). On similar lines it would have been preferable to separate Hydra and its immediate allies more distinctly from the Hydrozoa.

It is easier in a review to direct attention to the faults of a book than to enlarge upon its virtues, and this is the more so in a new edition where past virtues are taken for granted. The present volume is still easily recognizable as "Parker and Haswell" and so characterized by straightforward, concise but nevertheless readable

text and it is illustrated by clear, illuminating text-figures. On the technical side it maintains or rather exceeds the high standard set by the first edition, and those who are familiar with the latter will recognize that this is indeed praise. On the whole a praiseworthy judgment has been exercised in what has been included and what omitted, and also between the old "Parker and Haswell" and

the changes necessitated by more modern ideas in zoology. The book is intended for the general student who studies zoology, whether in the university or elsewhere, for two years or so beyond the general first-year course. For this purpose it is excellent and will doubtless maintain the success of its predecessor and enhance its fame.

C. H. O'DONOGHUE.

## A HISTORY OF BIOLOGY

### Biology in the Making

By Emily Eveleth Snyder. Pp. xii + 539. (New York and London: McGraw-Hill Book Co., Inc., 1940.) 18s.

HOW is it that we know so much of the structure and life habits of dinosaurs and other prehistoric monsters? Why is it that scurvy, the eighteenth century scourge of seamen and others is scarcely known to-day? How was the relationship between insects and diseases discovered? How did Mendel discover the now well-known laws of heredity? Why is it that to-day surgery is comparatively safe whereas at one time about 90 per cent of the patients died of blood-poisoning?

These are only a few of the many questions in biology and such allied sciences as agriculture, medicine and hygiene which might easily be asked by almost anyone, and the teaching of biology will not be perfected until it makes it possible for almost any secondary school student to answer them. The answers can only be found by studying the history of the science. This view is obviously held also by Miss Snyder, and she has given her valuable aid to teachers and students in a book of absorbing interest by means of which they can trace the development in biological discovery, not by so many facts but (as she says) "as the product of real men whose lives for one reason or another make them outstanding in their fields".

The text is written with such compelling style that it is not necessary to have any former knowledge of biology in order to follow the history of biological discovery. The illustrations are a novel feature of the book. Nearly a hundred portraits of biologists and medical men adorn the pages. Some are especially pleasing studies and many have, so far as we know, never been reproduced in a text-book of this standard before. They range from Aristotle through such well-known men of science as Leeuwenhoek, Linnæus, Lyell, Agassiz,

Darwin, Pavlov, Galton, Bateson and Ross to the more modern workers such as Davenport, Gowland Hopkins, Conant, Blakeslee, A. V. Hill, Starling, Banting, Sherrington, Carrel, and so forth. The inclusion of the work and portraits of so many present-day workers marks the book as a distinct contribution to biological teaching. In the past few years, commendable efforts have been made to bring in the outstanding points of the history of any science by means of portrait studies; but most books seem to shun including the study of outstanding present-day workers. Other illustrations also do much to give the subject life and emphasize humanistic features of biological science. Some taken at random are: Gesner in his museum; Linnæus in his garden; consulting room of a physician of the Middle Ages; Jenner vaccinating a boy; Pasteur in his laboratory (the author stimulates the imagination in this case by reproducing the artist's impression of Pasteur in his laboratory and also a photograph from the film in which Paul Muni took the part of Pasteur; it is a pity these two are not on facing pages, since one is very much struck by the faithful reproduction in the film version); surgeon of the eighteenth century; Hales's experiment at Newgate Prison; Beebe's bathysphere.

Hints for further reading are given at the end of every chapter. At the end of the book there is a chronological list of nineteen pages. We think this would have been more valuable for reference had it been alphabetical instead of chronological. This list is followed by a glossary and the glossary by an extensive bibliography.

Many non-biologists will find this book of absorbing interest, but we would strongly recommend it to all teachers of biology in schools. Those students who have read a good School Certificate text-book in biology and this book simultaneously will leave school with a very broad outlook on biology and its important applications to human life and affairs.

## TRENDS IN MATHEMATICAL BIOLOGY

### (1) Mathematical Biology

By V. A. Kostitzin. Translated from the French by Theodore H. Savory. Pp. 238. (London, Bombay and Sydney: George G. Harrap and Co., Ltd., 1939.) 7s. 6d. net.

### (2) Advances and Applications of Mathematical Biology

By Nicolas Rashevsky. (University of Chicago Science Series.) Pp. xiii + 214. (Chicago: University of Chicago Press; London: Cambridge University Press, 1940.) 12s. net.

**R**ARELY is a scientific text-book translated from French into English, and one feels that in translating this volume from the well-known "Collection Armand Colin", Mr. Savory has issued a challenge to English biologists to make a better acquaintance with recent applications of mathematics to biology. This excellent translation is certainly of value in directing attention to a book which, according to Dr. Volterra, marks an important date in the progress of mathematical biology. The major part of the book deals with the problems of biological associations and the struggle for existence—problems which, with the help of simple and rather plausible assumptions, can be expressed as first order differential equations. The first ten chapters discuss the solution of these equations. They summarize the pioneer work of Lotka and Volterra on population growth and relations between species, including symbiosis and parasitism; and many of their results are generalized and extended, while the author's critical discussions are always of value.

Among points of particular interest are the ingenious use of Gause's data on cultures of *Paramecium* to give a further verification of the logistic law (Chapter iv), a plausible attempt to explain sudden fluctuations in numbers of small rodents (Chapter v), and the study of 'residual action' in Chapter viii (cf. Volterra's 'historical' actions). Chapter ix contains an excellent analysis of predator-prey relations and the failure of Volterra's 'classical' fluctuations to represent experimental fact; but further discussion of Gause's 'relaxation' oscillations would have been welcome, and there is no mention of Bailey and Nicholson's theoretical study of balance of populations (*Proc. Zoo. Soc. Lond.*, 551; 1935). The remaining chapters, on growth, the forms of living objects and selection, are of less interest; and in particular the assumptions used to develop

equations for embryonic and postnatal growth are open to criticism, while the theory of 'superficial excrescences' (pp. 212-14) is not convincing.

The treatment of the book is rather too didactic for so speculative a subject, and the arguments are at times obscure because over-terse. The mathematical notation is difficult but remarkably concise. Experimental analysis of biological associations is clearly urgently needed to test M. Kostitzin's mathematical predictions and the assumptions upon which they are based. Here is plenty of scope for the experimental biologist, and repetition and extension of Gause's pioneer work in this field would be of particular value.

(2) This is a sequel to Dr. Rashevsky's "Mathematical Biophysics" (Chicago, 1938), and describes recent progress in this field. In the first six chapters a new approximation method is developed for studying diffusion in a highly abstract, isolated and homogeneous 'cell', which is no longer spherical, and the results are applied to cell respiration, division and growth, cell forms and movements, and protoplasmic streaming. The new method consists in simplifying the cell beyond all recognition and then dealing only with orders of magnitude, and cannot be expected to throw much light on the complex phenomena of cellular physiology. Nevertheless, the author has followed up his postulates with remarkable ingenuity, and his conclusions are of interest because they show a certain relationship to experimental fact and suggest new lines of research.

In the abstract system under study, diffusion outwards generates forces which tend to round up a small cell but to elongate a large cell, and above a certain critical size these forces may overcome the opposing surface tension and lead to cell division or a non-spherical state of equilibrium. This critical size is found to be of the order of magnitude of actual cells. Since diffusion inwards has an opposite effect, the resultant forces generated by the substances produced and consumed in metabolism may decide whether the cell will divide. It appears that the critical size should be proportional to the inverse cube-root of the oxygen-consumption rate, a conclusion for which slight experimental evidence is adduced, while a high glycolytic coefficient should increase the readiness to divide. The nucleus is dismissed as a "local structural detail". The theory that

rapidly dividing tumour cells have an abnormally high glycolytic coefficient suggests a theory of growth (Chapter iv); but this discussion loses much of its interest in view of recent work by Boyland and Boyland (*Biochem. J.*, 33, 618; 1939), who found little correlation between growth-rate and glycolysis in different strains of grafted tumours. Study of cellular forms and movements suggests that non-spherical cells should round up after death, and experimental evidence on this point and on the effect of various drugs on cell shape would be of great interest.

The remaining chapters summarize the author's abstract mathematical theory of the functions of

the central nervous system, and discuss excitation and inhibition, reaction times, discrimination of intensities and perception of visual patterns. This work is still highly conjectural, but the conclusions reached connect up to some extent with experimental evidence.

Dr. Rashevsky's method of analysing mathematically the behaviour of abstract systems from which all irrelevant complexities have been eliminated has been so successful in physics that it holds out promise in biology; but the problems are here more difficult and we are still very far from the systematic mathematical biology which the author envisages. E. C. R. REEVE.

## GEOMORPHOLOGY

### Geomorphology

An Introduction to the Study of Landscapes. By Prof. A. K. Lobeck. Pp. xii + 731. (New York and London: McGraw-Hill Book Co., Inc., 1939.) 25s.

### A Textbook of Geomorphology

By Prof. Philip G. Worcester. Pp. viii + 565. (London: Chapman and Hall, Ltd., 1939.) 22s. 6d. net.

THE increasing use of the word 'geomorphology' may be regarded as symptomatic of the emancipation of the science from parental control; for as a hybrid science, the offspring of geology and geography, its early footsteps have hitherto been guided in the direction dictated by one or other of its parents, so that it was either 'physical geography' or 'physical geology'. Now the science has its own journal, less than two years old, and a rapidly growing literature which is steadily developing its own technique, and a personality quite distinct from its parents.

In the two books under review the subject-matter is much the same but the treatment differs vastly; it may be said that while Prof. Lobeck is a geomorphologist, Prof. Worcester still follows the tradition of physical geology. While both explain the operation of weathering and erosion in shaping the features of the earth's crust, the latter is concerned mostly with the 'process' and the former with the 'product' at each stage in an evolutionary process, tracing, with delightful clarity, the development of land-forms from youth, through maturity to old age in each structural type and under each denudational process.

In both books is recognized the importance of illustration as an aid to description, for words

alone can never adequately portray the subtle but significant variations of form in landscape. Prof. Worcester relies mainly on the photograph, supplemented by line drawings, but Prof. Lobeck brings to bear his great skill as a draughtsman and uses the block-diagram to isolate and demonstrate the physiographic essentials of a landscape. These are not simply illustrations, but are, as it were, an essential part of the text, built into it and amplifying it.

Though unnumbered, there are about five hundred of these, varying in size from 4 sq. in. to full-page drawings, and, in addition, each chapter is introduced by about a dozen beautiful photographs, illustrating the land-forms to be described in that chapter. In this way the unnatural simplification of the idealized block-diagram is corrected by the view of the actual scene, but the diagram, in its turn, analyses and explains the landscape. Treated in this way the block-diagram becomes a most effective instrument for teaching, and it is in this function that Prof. Lobeck excels. There is an early chapter, too, on scientific method and presentation which is very helpful and suggestive to teachers and learners alike. The striving after clarity, simplicity and mental tidiness sometimes leads the author into the error of excessive orderliness in what is, after all, not an exact science; as an example we may quote his recognition of 'mature stages' in each evolutionary series of land-forms; these are always carefully defined, but the definition is often highly arbitrary and not always generally accepted.

Prof. Worcester's book is much more conventional and follows the high traditions of such standard works as Salisbury's "Physiography".

A. A. MILLER.

## ELECTROMAGNETIC THEORY

### Static and Dynamic Electricity

By Prof. William R. Smythe. (International Series in Physics.) Pp. xviii+560. (New York and London: McGraw-Hill Book Co., Inc., 1939.) 40s.

FOR some time there has been a crying need for a standard text-book on electromagnetic theory, which should give a concise summary of its fundamental principles, and should illustrate them by abundant reference to problems of practical physics and technical engineering. The classical treatises by Jeans and Livens give admirable accounts of the basic laws of electromagnetism, of the mathematical analysis required in problems and of the semi-philosophical problems which lie at the root of the speculative parts of the theory. But it was not their aim to deal in any detail with practical applications or to present the results of the theory in a form adapted for use in research. This magnificent text-book by Prof. W. R. Smythe has as its express object to exhibit the theory of electricity and magnetism in direct relation to problems of research.

The reviewer has used this book in connexion with a variety of practical problems since its publication last November and has never met with disappointment. Every possible aid to the research worker has been given by the author, even to the detail of noting at the foot of each page the system of units employed thereon. The results are always given in the most practical form. Thus, for example, the magnetic field due to a circular loop is not expressed as a useless, slowly convergent series of zonal harmonics but as elliptic integrals which can be rapidly evaluated from tables.

There is a twenty-page index and a careful appendix comparing in detail the standard systems of units. Vector notation is employed throughout. There is a good introduction to the special theory of relativity and also to wave mechanics. The requisite mathematical analysis is developed as required, but space is saved by referring the student to standard tables of integrals for the more elementary results. This treatise should take its place with those of Jeans and Livens as an indispensable help to every research worker in electromagnetic theory. G. TEMPLE.

## INDIAN PHILOSOPHY

### A History of Indian Philosophy

By Dr. Surendranath Dasgupta. Vol. 3. Pp. xiii+614. (Cambridge: At the University Press, 1940.) 35s. net.

ALL those who are interested in Indian philosophy, and especially the readers of the first two volumes of this excellent standard and scholarly work, will welcome the publication of the third volume as well as the news that the manuscript of the fourth volume is ready. Prof. Dasgupta's remarkable exposition of Indian thought brings home to philosophers that the history of their subject is incompletely assessed and understood without a general knowledge at least of Eastern thought. The difficulty of perusing manuscripts in Sanskrit and other old tongues of the Dekkan Peninsula is minimized by the painstaking and judicious study carried out by Prof. Dasgupta, and the results of which are given in his great work.

The present volume deals more specifically with the religious philosophy of southern Indian schools,

which are not orthodox for the most part with regard to official Brahmin thought. The Pañcavātras, for example, are considered of a lower caste and value by the orthodox Brahmins. This volume deals in turn with the Bhaskara school, the Pañcavātras and the Arvars, the Visistadvaita, Yamunacarya, the important Ramanuja school and the Nimbarka doctrines, and the Vijnana Bhiksu. The book ends with a detailed exposition of selected Puranas and the usual bibliographies and indexes.

The analysis of these teachings shows the alertness and depth of Indian thought at its best, whatever be their orthodoxy. Problems of knowledge, of religious psychology, of moral experience are well illustrated. The discussion of the nature of time according to Venkatanatha, to take one instance, is very illuminating, and exhibits the closeness of the Indian views with some Western doctrines. In fact, the comparative value of Indian philosophy is one of the characteristics that should induce European scholars to give more time and thought to it. T. GREENWOOD.

**Gmelins Handbuch der anorganischen Chemie**

Achte völlig neu bearbeitete Auflage. Herausgegeben von der Deutschen Chemischen Gesellschaft. (1) System-Nummer 59: Eisen. Teil F II, Lieferung 2: Nachweis und Bestimmung von Fremdelementen in Eisen und Stahl. Pp. xvi+165+388. 27 gold marks. (2) System-Nummer 59: Eisen. Teil C, Lieferung 2: Prüfung der Kerbschlagzähigkeit. Pp. viii+288. 33 gold marks. (Berlin: Verlag Chemie, G.m.b.H., 1939.)

(1) **A**FTER dealing in full detail with all the commoner analytical methods for the detection and estimation of titanium, aluminium, cerium, thorium, nickel and cobalt in iron and steel, the application of more modern methods is described in the part of "Gmelins Handbuch" under notice. Although no details are as yet available in the literature for the use of the chromatographic adsorption method of analysis, which has hitherto been used almost exclusively with organic compounds, its application by Schwab to the analysis of steels appears to be so promising that details of the process are given much more fully than might have been expected. Results which have been obtained with Heyrovský's polarographic method of using a dropping mercury cathode and a large mercury anode with gradually increasing voltage have shown that, after removal of the iron from the solution, an extremely sensitive and rapid method of qualitative and quantitative analysis of other elements is available. Photographic records can be obtained, but where speed is required they may be replaced by visible readings on a mirror-galvanometer scale. Perhaps the most sensitive method of all for qualitative analysis is that of spectrum analysis, which is fully described. Standard methods adopted by Australia, Canada, France, Italy, Japan, the U.S.S.R. and the United States are tabulated at the end. No standard methods have been adopted by Germany, and Great Britain is not mentioned.

(2) The extraordinary thoroughness with which the editors of "Gmelins Handbuch" are dealing with the metal iron is clearly shown by the issue of several highly specialized sections, of which this, which deals only with the notched-bar impact test for the toughness of iron and steels, is a sample. The chemist will find little of immediate interest, but the numerous drawings of machines, photographs of actual tests, graphs of physical properties and tables of reference to original papers should make it a valuable work of reference to engineers and metallurgists.

**Chemische Physik der Metalle und Legierungen**

Von Prof. Ulrich Dehlinger. (Physik und Chemie und ihre Anwendungen in Einzeldarstellungen, Band 3.) Pp. xi+174. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1939.) 12 gold marks.

**M**UCH exact experimental work has been carried out in recent years on metals and their alloys, and the knowledge of transformations of the crystal lattice, such as occur in plastic deformation, in the separation of a new phase, or in the change from a disordered to an ordered structure, has been greatly advanced. Progress has also been made in

the description of the metallic state in terms of quantum mechanics. The stage has not yet been reached, however, at which the chief properties of a metal or alloy after a given treatment can be arrived at by deduction.

The work of Dehlinger, himself an active investigator in this field, aims at interpreting the relations between experiment and theory, especially for the benefit of the metallurgist. He treats of the thermodynamics of phase equilibria, with the distribution of electrons among the atoms, leading to the Hume-Rothery and similar rules, with the various types of structure among alloys, and with ferromagnetism. The last portion of the book deals with the kinetic aspects, such as diffusion, allotropic change, and precipitation of a new phase from solid solution. Plasticity and the mosaic structure of metallic crystals are only touched upon. Perhaps the most interesting sections are those which deal with the different forms of precipitation, including age-hardening. The book was probably completed too soon to include the important discoveries of Preston and Guinier on the nature of the initial stages of precipitation. Although German work receives most attention, an effort has evidently been made to cover the literature, and there is a useful bibliography.

C. H. D.

**British Blood-Sucking Flies**

By Dr. F. W. Edwards, H. Oldroyd and Dr. J. Smart. Pp. viii+156+45 plates. (London: British Museum (Natural History), 1939.) 15s.

**T**HE predecessor of this book entitled "Illustrations of British Blood-Sucking Flies" was written by the late E. E. Austen and published in 1906. Within a few years the edition was exhausted, and it evidently filled a definite need. Its successor is a larger and more informative work the aim of which is similar, and that is to provide information of interest to the non-specialist in the simplest possible manner. Increase in knowledge of blood-sucking flies since the 1906 volume has been great. Thus, in that year about 2700 species of British flies are stated to have been known, including 74 that are actually, or potentially, blood-suckers. In the intervening thirty-two years these figures have increased to 5,200 and 117 respectively. Much more important than mere additions of species is the notable increase in knowledge of their life-cycles and behaviour.

This volume deserves all praise: it gives the right kind of information required by the non-specialist and avoids irrelevant detail. The accounts of the species are supplemented by 45 excellent three-colour process plates. If a new edition of this work be called for, the practical aspect of the subject might receive more detailed consideration. A short section on the treatment of mosquito and other insect 'bites' by alleviatory measures or by repellents need not occupy much space but would be welcomed. We hope that the Trustees of the Museum will bear in mind the importance of issuing works, like the present one, of more general interest as well as those that only appeal to a small coterie of specialists and, sometimes, very few of them British subjects.

A. D. I.

## FARMING WITHOUT SOIL

BY SIR JOHN RUSSELL, F.R.S.,  
ROTHAMSTED EXPERIMENTAL STATION

IN the days before the War, which now seem to us so incredibly peaceful and remote, we were suddenly startled by Press announcements that an American professor had discovered how to farm without soil, and visions were evoked of intensive methods that would revolutionize crop production. One journalist went so far as to assert that all the wheat needed by Great Britain could, on this new method, be grown on an area the size of Euston Station.

When details became available the method proved to be the growth of plants in culture solutions, familiar to generations of botanical students under the name 'water cultures', and the fantastic claims had been arrived at by multiplying the area of the water culture vessel sufficiently to convert the square centimetres into acres. The claims must have been very embarrassing to Prof. Gericke, the originator of the method<sup>1</sup>, and indeed the Department of Plant Physiology of the University of California with which he is associated took the unusual step of issuing a statement with the purpose of damping irresponsible enthusiasm and restoring some sense of perspective to what was actually an interesting application of botanical science.

It is unnecessary to remind botanists that perfect plant growth is possible in culture solutions provided the proper nutrients are given and certain conditions are maintained. The difficulty is to pass from the small scale of the laboratory to the large scale of the commercial market gardener and farmer, and only those who have had to make this transition know what it means. Prof. Gericke has shown how the large-scale grower can carry out water culture; he has worked out the conditions for a number of typical American crops, and indicated the difficulties likely to arise. Those with much experience of water cultures know the difficulties of getting really good results in the laboratory. The nutrient solution must contain not only the six or seven classical elements needed in relatively large quantities, but also those elements needed in small amounts only, especially iron, boron, manganese, copper; but as these trace elements are harmful in larger quantities it is necessary to use purified salts in research work. Due regard must also be paid to the changing requirements of the plant as it develops, arising from the circumstance that a given nutrient

has different effects at different stages of the plant's life, while the reaction of the medium must also be controlled, as it tends to change during plant growth, and, if as often happens, it becomes alkaline, the iron is precipitated. The air supply to the roots is of vital importance, and steps must be taken to avoid the growth in the solution of algæ, bacteria and other micro-organisms which interfere with the proper course of the experiment. One looks to see how these difficulties are met, but apparently they cause less trouble on the large scale than in the laboratory. Prof. Gericke finds it necessary to have only one basic formula for all his crops, the salts need not be pure, no special precautions are taken about mixing them and neither aeration nor growth of micro-organisms in the solution caused trouble. Further, the solutions need not be changed frequently as in good laboratory practice; in some cases they even remained in use for a year. Distilled water, so essential in laboratory cultures, is obviously out of the question; tap or well water must be used instead, but so long as this is not heavily charged with salts it does not seem to affect the procedure.

The process is not, however, entirely simple. Iron may be thrown out of solution, or be present in inadequate amounts, and during the course of growth there may arise deficiencies of other elements. These could be detected by chemical analyses, but a simpler procedure is possible: the plant itself shows up the deficiencies by fairly characteristic symptoms which a good grower soon learns to recognize. These symptoms are described and illustrated, and this section gains in interest from the fact that the plants include some such as rice and cotton, which are not usually grown in laboratory exercises in Great Britain.

While recognizing the author's wide experience with water cultures, one cannot help wondering whether the absence of these and other difficulties may not in part be attributable to the clear and sunny skies of California, and whether large-scale experience would be equally fortunate in Great Britain, where conditions of temperature and light are often so different.

In a recently published book<sup>2</sup>, details are given to help the grower. In laboratory practice the seeds are germinated in sand, sawdust, or moist blotting paper. On the large scale a seed bed is



used, consisting of a tray of wire netting of one inch mesh and 19 or 20 gauge held on a frame 6-12 ft. long by 2-4 ft. wide, and containing moist litter—peat, fine wood shavings (wood wool), chaff, etc. After germination the seeds push their roots through the wire; the tray is then placed over the solution, and the roots dipping into it absorb the nutrients and proceed to elongate. In the laboratory water cultures are by long custom made in glass vessels—usually bottles—each containing one plant. On the large scale basins are used; so far it is not certain whether the best material is concrete, wood, sheet metal or such cheaper materials as troughs dug in the earth and lined with puddled clay. For all of them satisfactory results are claimed, especially after they have been in use, so that harmful substances have been dissolved out; in the case of metals, coating with asphalt enamel may be desirable. The whole problem of root aeration is avoided by the simple expedient of restricting the depth of the basin to six inches, and allowing sufficient space between the surface of the solution and the crown of the root to ensure movement of air. This depth also permits of evaporation and transpiration of about half the solution without detriment to plant growth. Greater depths required more of the chemicals and presented no corresponding advantage. Some of the basins described were up to 150 ft. long and 50 ft. wide.

The new method is complicated by the circumstance that each crop requires rather special treatment. Experience in ordinary cropping is no guide: two species, the author tells us, which behave similarly in soil might differ markedly in their reaction to water culture. There is also, he says, much less margin of safety in water culture than in soil; the solution "has a much lower resistance to chemical change than does the soil". Detailed instructions for a number of crops are given. The management of the seed bed is particularly important: it must be kept sufficiently but not excessively moist and the temperature conditions must be right. The crops must be closely watched for deficiency symptoms: lack of iron is made good by adding ferrous sulphate, lack of other elements apparently by adding more of the basic mixture.

Tomatoes are said to be among the best 'subjects', and some glowing descriptions are given of results obtained. In good glasshouse practice in England yields run about 6 lb. of fruit per plant: the author claims an average yield of 16 lb. and his highest yield was 27.4 lb. Potatoes in Great Britain average about 7 tons per acre, but a good grower will not uncommonly obtain 12 tons per acre: the author claims 48 tons per acre. Obviously if results of this order were generally obtainable

the new method would revolutionize food production.

Incidentally, Prof. Gericke claims that the produce obtained by the new method is of high quality and of full nutritive value, thus ranging himself against those who regard humus as necessary for healthy crop production.

All those who have long been associated with agriculture are familiar with claims of new and vastly improved methods of production periodically put forward: after a short period of public interest they have practically all faded away: on the large scale they did not work. It still remains to be seen what will happen to this latest addition to the list. Three tests have already been made in Great Britain by competent and recognized authorities. From the Cheshunt Experimental Station<sup>3</sup>, which specializes on crop-growing under glass, and has had very wide experience with tomatoes and cucumbers, it is reported that the new method yielded 3-4.7 lb. of tomatoes per plant according to the variety, this being lower than is obtained in ordinary soil culture, but 160 lb. of cucumber per plant, as against about 50 lb. in normal practice. Millard and Stoughton at Reading<sup>4</sup> obtained as good yields of tomatoes with the new method as with the old, and better results with gladioli; they could, however, find no evidence of the high yields claimed in California, and doubt whether English conditions of light and carbon dioxide supply would permit of them. Templeman and Watson<sup>5</sup> did not obtain as good yields as in soil. All these experiments go to show that in English conditions, at any rate, the method is not as promising as is claimed, though it may still have its uses for special purposes.

Among these may be town gardening. A Pelican Special has been issued giving in diary form Mrs. Hillyer's trials made for amateurs at her house in Hampstead, and therefore likely to appeal to townspeople who are interested in gardening and are fond of trying something new, but who lack garden space<sup>6</sup>. It is evident that she enjoyed the work, and her energy and enthusiasm enabled her to overcome many difficulties. In her view the new method provides a fascinating hobby, and indeed she thinks it offers "immensely more". The *Daily Mail* has given her space on the roof of its offices, and the services of its expert, Mr. Izzard. Here at least may be possibilities for development.

<sup>1</sup> NATURE, 141, 536 (1938).

<sup>2</sup> The Complete Guide to Soilless Gardening. By W. F. Gericke. Pp. xvi+285. (London: Putnam and Co., Ltd., 1940.) 12s. 6d. net.

<sup>3</sup> Annual Report, 1939, p. 13.

<sup>4</sup> *Sci. Hort.*, 7, 174 (1939).

<sup>5</sup> *J. Min. Agric.*, 1938-39, 45, 771 (1938-39).

<sup>6</sup> Hydroponics: Food without Soil; a Journal of Experiments, 1938 to 1940. By C. Isabel Hillyer. (Pelican Special S63). Pp. 116. (Harmondsworth, Middx., and New York: Penguin Books, Ltd., 1940.) 6d. net.

## FUNDAMENTAL ASPECTS OF RADIO COMMUNICATION

A JOINT meeting of the Institute of Radio Engineers and the American Section of the International Scientific Radio Union was held at Washington, D.C., on April 26, 1940. Fifteen papers on the more fundamental aspects of radio communication were presented.

H. T. Stetson, of the Massachusetts Institute of Technology, Cambridge, Mass., reported on a comparison of field strength measurements with auroral occurrences and ionospheric disturbances during 1930-40. His results indicated that, beginning six days before the date of the aurora, field strengths of 770 kc./s. were abnormally high with a maximum intensity occurring on the average four days before the date of the occurrence of the aurora. From three days before until two days after the auroral occurrence field strengths decreased to a minimum and remained abnormally low until about six days after. For higher frequencies involving the  $F$  layers the auroral occurrences were compared with the transmission disturbance figures of the Bell Telephone Laboratories. Transmission disturbance was a minimum four days before the auroral occurrence, rose rapidly to a maximum one-half day following the dates of auroras, and then subsided to near the average value six days after the dates of the auroras. These results led to the conclusion that maximum transmission disturbance follows auroral phenomena and that the  $F$  layers are affected on the average about one day earlier than the  $E$  layer, based on more than three hundred days of observations utilized.

J. Bartels of the Carnegie Institution of Washington, N. H. Heck of the United States Coast and Geodetic Survey, and H. F. Johnston of the Carnegie Institution of Washington, all of Washington, D.C., described a new measure of geomagnetic activity, the three-hour-range index  $K$ . Each collaborating magnetic observatory assigns to each of the eight three-hour intervals of the Greenwich day one of the integers 0-9 as a range index  $K$ , by a method which effectively separates the two main solar influences on the ionosphere, namely,  $P$  (supposedly due to particles, and strongest in polar regions) and  $W$  (supposedly due to wave-radiation, restricted to the daylight hemisphere). It was described how  $P$  was measured by  $K$ , and a scheme for a geomagnetic record of  $W$  was sketched.

J. H. Dellinger and N. Smith of the National Bureau of Standards discussed the reliability of predictions of ionospheric characteristics and radio transmission. Starting more than a year ago, pre-

dicted values of critical frequencies and maximum usable frequencies were published monthly for the month following that of publication, in the *Proceedings of the Institute of Radio Engineers*. These published predictions were compared with the values afterwards measured. The results showed that the expected accuracy originally stated, 15 per cent, had been well met. The limit of accuracy is determined by the minor unpredictable variations of solar activity from its trend in the 11-year cycle.

L. V. Berkner and S. L. Seaton of the Carnegie Institution of Washington reported some phenomena in the  $F_2$  region during geomagnetic disturbance. The ionospheric effects of ionosphere storms at an equatorial station were found to be similar to the well-known effects in temperate latitudes at night, but in the daytime the critical frequencies increased during a storm instead of decreasing, as they usually do in a temperate latitude.

In a paper by Messrs. Gilliland and Taylor, of the National Bureau of Standards, results were reported on ionosphere measurements during the eclipse of April 7, 1940. The recombination coefficient in the  $E$  layer was found to be approximately  $10^{-8}$  and that in the  $F_2$  layer less than  $10^{-10}$ .

Olof E. H. Rydbeck of Harvard University showed that from a wave-mechanical interpretation of the propagation of electromagnetic waves in an ionized medium it was possible to calculate the true height of reflection from the virtual-height-frequency records. Thus the actual electron distribution could be obtained from experimental data.

K. A. MacKinnon of the Canadian Broadcasting Corporation, Montreal, Canada, reported some field intensity measurements of 540-kilocycle ground-wave propagation over the high-conductivity prairie provinces. The ground conductivities approached  $10^{-12}$  electromagnetic units with a maximum near south central Saskatchewan. In certain directions the earth was electrically uniform to distances of about 400 miles.

I. E. Mouromtseff of the Westinghouse Electric and Manufacturing Co., Bloomfield, N.J., discussed forced-air versus water-cooling of large vacuum tubes. Mechanical and thermal limitations of air cooling devices were described. General rules for designing an air cooler were described.

Prof. E. L. Chaffee of Harvard University discussed space-charge relations in triodes and the characteristic surface of large vacuum tubes. It

was shown theoretically and from experiments that the plate, grid, and total currents, in the absence of secondary emission, varied as the  $3/2$  power of the plate voltage along lines of constant  $L = e_{g0}/e_{p0}$ , where  $e_{g0}$  and  $e_{p0}$  were measured from a displaced origin. The three currents were then expressed in the form  $i = Ae_p^{3/2} (1 + \mu L)^{3/2} F(L)$ . The entire system of static curves for each current can be expressed by a single curve. A simplification in the experimental determination of the static curves was suggested, permitting the static curves to be plotted from a few measurements at low power. The effects of secondary emission were discussed and curves were given which would aid in the design of tubes in which secondary emission from the plate was suppressed.

Prof. W. G. Cady of Wesleyan University, Middletown, Conn., reported a new method for the determination of the axes of quartz crystals by means of etch figures. A. de Gramont has shown that when a beam of light is passed through a quartz-crystal slab, one face of which has been etched with hydrofluoric acid, the rays are refracted in different directions, so that a lens placed close to the crystal projects on to a screen an image that is characteristic of the particular face that has been etched. If the etched surface is normal to the optic axis ( $Z$ -axis) the pattern takes the form of a three-pointed star, the points indicating the direction of the  $X$ -axis with a precision of about a degree. In repeating Gramont's experiment the author found that the pattern could be viewed directly through a powerful lens, for example, a  $1/4$ -in. microscope objective. The method furnished for the first time a simple and accurate optical method for finding the direction of the electric axis on a  $Z$ -cut slab of quartz.

Prof. Karl S. Van Dyke of Wesleyan University, Middletown, Conn., discussed the use of an etched sphere of quartz in identifying the orientation of quartz plates. He pointed out some discrepancies and contradictions in published papers, particularly as they related to the distinction between right and left quartz and the temperature coefficient of various 'cuts' of quartz resonators. This paper aimed at rectifying the discrepancies and contradictions which appeared in and caused confusion in the literature. Numerous papers involving discrepancies were specifically cited. All the factors concerned, etch figures, optical rotation, electrical polarization, and resonant frequencies, were in entire agreement with the elastic constants given by Voigt, and his equations for rotating the axes of reference, when used with his conventions as to axes and signs of angles. Taken together they made it possible to determine the peculiar and sometimes unstated conventions used by others in their published data.

C. R. Englund, A. B. Crawford, and W. W. Mumford of Bell Telephone Laboratories, Holmdel, N.J., discussed the diurnal variation of ultra-high-frequency optical-path transmission. Continuous records of ultra-high-frequency transmission on frequencies of 75 and 150 megacycles per second over a good 'optical' path showed variations in the received field. These variations were explained as being caused by wave interference, an interference which varied with the changes in the composition of the troposphere. The diurnal meteorological factors which affected the transmission were discussed.

Andrew Alford of Mackay Radio and Telegraph Co., New York, N.Y., and Sidney Pickles, International Telephone Development Co., New York, N.Y., described an ultra-high-frequency voltmeter of new design. This was made up of a current-indicating instrument associated with a closed quarter wave-length of line. The quarter wave-length of line was adjustable for a range of frequencies. The instrument was calibrated and held calibrations within the limits of engineering accuracy. Voltages instead of currents were then used with calculated surge impedances to measure transmitted power.

R. W. George of R.C.A. Communications, Inc., Riverhead, L.I., N.Y., reported on field intensity of motor-car ignition between 40 and 450 megacycles per second. The average field intensity varied about 2 to 1 over the frequency range. Vertical and horizontal polarization were compared and showed slightly greater field intensity for vertical polarization. New cars, old cars, and trucks showed no large differences of ignition field intensity.

Andrew Alford of Mackay Radio and Telegraph Co., New York, N.Y., discussed currents induced in wires by high-frequency electromagnetic fields. The experiments and theory showed that, except in special cases when resonance phenomena predominated, the induced currents were not even approximately sinusoidally distributed and that, therefore, theories based on the *a priori* assumed sinusoidal distributions were limited to wires of certain special resonant wave-lengths.

During the morning of April 27 an ionosphere conference of about forty persons was held at the Department of Terrestrial Magnetism, Carnegie Institution of Washington. The principal subjects discussed informally were: results of ionospheric observations during the solar eclipse of April 7, 1940; effects of magnetic storms on transmission conditions; methods for determining true heights of ionosphere layers; methods for predicting magnetic and ionospheric conditions; measures of radio transmission disturbance; the new range-index for measuring magnetic activity; present status of the Lorentz polarization correction.

## OBITUARIES

Prof. E. W. W. Carlier

**PROF. E. W. W. CARLIER** died on September 2, 1940, in his seventy-ninth year at his home in Warwickshire. In him has passed away an outstanding personality.

Prof. Carlier was of French extraction, being the only son of Antoine Guillaume Carlier, officier d'Académie. He was born at Norwich in 1861, and received his early education at the King Edward VI School there. Later, he went to the Lycée de Valenciennes, where he graduated Baccalauréat és Sciences. He began his medical education at the University of Edinburgh at the age of twenty-one, and took the degree M.B., C.M., with honours in 1886. After this, he was asked to join the junior staff in the Department of Physiology. He obtained the M.D. degree with first-class honours and gold medal in 1891. In 1895 he was appointed senior lecturer in physiology.

In 1899 he went to Birmingham as professor of physiology in Mason College, which in 1900 became the University of Birmingham. He held the professorship of physiology in the University of Birmingham until his retirement in 1927, when he was elected emeritus professor.

During 1909-14, Prof. Carlier was examiner in physiology for the first fellowship examination of the Royal College of Surgeons. He was vice-president of the Physiological Section of the British Medical Association at Ipswich in 1900, and at Birmingham in 1911. He was a member of the Royal Society of Edinburgh, and of the Royal Entomological Society. For seven years he was honorary secretary of the Scottish Microscopical Society and vice-president for one year.

In 1895 he married Hannah Culver of Hughenden, who died in 1929. He leaves a daughter and two sons.

When he was at the University of Birmingham Prof. Carlier was instrumental in the building and equipment of a new histological laboratory, which was admirably adapted to its purpose. He conducted the classes in histology himself; his descriptions of the slides were a marvel of lucidity; he saw to it that first-rate material was supplied, and many of his own magnificent preparations were distributed to the students, whose work he superintended individually. At each session students were privileged to examine slides from his unique private collection, which is of European reputation, and which, at the request of the British Museum, is now being sent there.

Prof. Carlier carried out a large amount of research work, many of his papers being published in Germany and France. Perhaps his greatest contribution to physiology was the combination he made of experimental and histological methods as exemplified in his discovery of the functions of the nucleolus in cellular fatigue, his work concerning the changes

observable in the gastric secreting cells during digestion, and the secretion of ferments by the liver cells.

Besides physiology, Prof. Carlier took a keen interest in other branches of science, particularly natural history; he was seven times president of the Birmingham Natural History and Philosophical Society. He made a special study of entomology, and since his retirement was engaged in research on the Lepidoptera. He had a very fine collection of butterflies. He was an enthusiastic gardener, and his class was often cheered by the sight of some special flower in his buttonhole or on his table. At the age of seventy he began a research on the Rotatoria, Rhizopoda, and Heliozoa, for staining which he invented a laborious, but very effective process.

Prof. Carlier had a tall and imposing appearance, and students at first were apt to be intimidated by his somewhat abrupt manner and penetrating look, but they soon discovered his genial kindness, readiness to help in any difficulty, and genuine liking for young people. Women owe him a debt of gratitude in that he upheld their claim to a medical education when this met with much opposition.

Prof. Carlier was deservedly popular, and was held in affectionate esteem by his colleagues, laboratory assistants and students. He will be missed by a large number of friends.

HILDA WALKER.

Dr. W. E. Harper

**DR. WILLIAM EDMUND HARPER**, who died on June 14, at the age of sixty-two, had been director of the Dominion Astrophysical Observatory since 1936. Dr. Harper was born in Ontario on March 20, 1878, and graduated from the University of Toronto in 1906. On that day he received word of his appointment to the staff of the Dominion Observatory at Ottawa. For thirteen years he was engaged there in the determination of the orbits of spectroscopic binaries, and on his transfer to Victoria, when the Government sponsored the 72-inch reflector, he continued the same work. In 1924 he was made assistant director, and finally director in 1936. From the time of his graduation until his death he was intimately associated with the development of astronomy in Canada. Before his death he had determined the orbits for more than a hundred binaries. No other astronomer has approached this number. His contributions to this part of astronomy constitute approximately one quarter of the known orbits. Among other major pieces of work were the determination of 1,100 spectroscopic parallaxes and the measurement of over 7,000 plates for radial velocity.

Dr. Harper took a very active part in popularizing astronomy in Canada. He was a member of the Royal Astronomical Society of Canada and served



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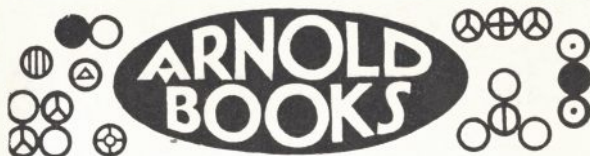
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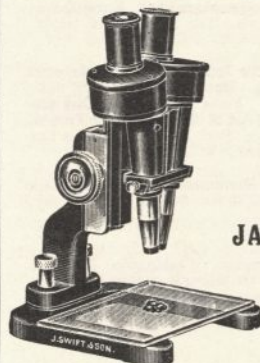
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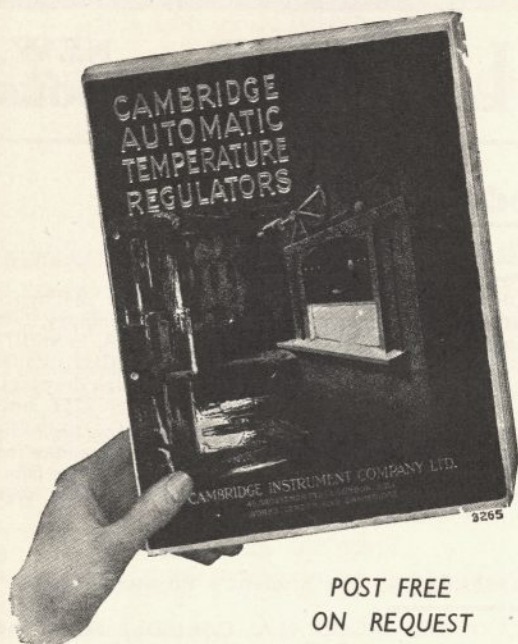
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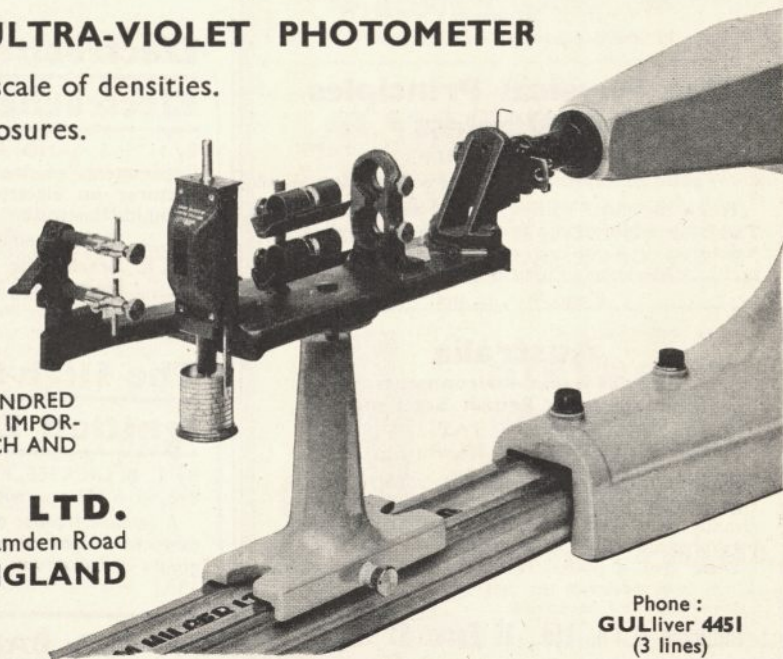
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on the executives at Ottawa and Victoria and was president of that national society for the years 1928-29. He also sponsored a series of popular astronomical articles for the Press, and the revenue from these articles was devoted to a trust fund for the encouragement of amateur astronomy under the auspices of the Society. For many years he gave monthly radio talks on astronomical topics which did much to stimulate interest in the subject throughout the Dominion and even farther afield.

Dr. Harper's services to astronomy were well recognized throughout the astronomical world. In 1913 he was made a fellow of the Royal Astronomical Society of Canada. In 1924 he was elected to the Royal Society of Canada, and in 1935 the University of Toronto, on the occasion of the dedication of the David Dunlap Observatory, conferred on him the degree of doctor of science. In 1938 he was appointed as official Canadian delegate to the General Assembly of the International Astronomical Union at Stockholm. It was while absent on this trip that he was taken seriously ill with pneumonia. For several weeks he lay critically ill in Rostock Hospital and the international crisis finally necessitated his removal by ambulance to Denmark and thence to England. He returned to Canada in October somewhat improved and attempted to carry on, but suffered a serious relapse the following spring which a year later proved fatal. In his death, Canada has lost a very worthy citizen and a distinguished man of science.

R. K. YOUNG.

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Mr. Wilson was fifty-four years of age. He graduated at the University of Edinburgh and gained the national diploma in dairying. He obtained a Carnegie scholarship for research in mycology at the Heriot Watt College, Edinburgh, and in 1910 became a lecturer in agriculture for East Lothian and Peeblesshire. In 1911 he became lecturer in agriculture and dairy farming at the East Anglian Institute of Agriculture, Chelmsford, where he performed splendid work in enhancing the reputation of the Winter School and Dairy School. In 1914, after holding an inspectorship in the Education Branch of the (then) Board of Agriculture, Mr. Wilson returned to the East Anglian Institute as principal and agricultural organizer for Essex. Several administrative appointments were held concurrently with the principalship at Chelmsford, and in 1920 Mr. Wilson was elected a member of the Council of Agriculture for England.

In October 1922 on the resignation of Principal M. J. R. Dunstan, Mr. Wilson was appointed to the principalship of the South-Eastern Agricultural College at Wye. From the day of his arrival Mr. Wilson continued to build the reputation of the College both as an educational and research centre. His constant

interest in every aspect of the College's many activities was evinced by the enthusiasm with which he described to others the work that the various members of his staff were doing. He was always ready to devote time and energy to solving the difficulties of research workers, teachers and students alike, and was never too busy to discuss with any member of the College the problems or interests of his particular branch of study or research, and to bring the keenness and enthusiasm of his own nature to bear with vitalizing encouragement upon the question at issue. At all times Mr. Wilson was an idealist, he expected the best and believed the best of everybody. He was a great believer in the educational value of the pursuit of the solution of original problems in horticulture and agriculture and he encouraged students to take this view in their work. He kept in close contact with old students and was enthusiastic about their successes and ever ready to help them to progress in their careers.

At the outbreak of War Mr. Wilson threw himself into the task of training members of the Women's Land Army, and the kindly and understanding way in which he carried this out was much appreciated. It was a great satisfaction to him to re-open the College in January for the ordinary courses and a corresponding disappointment when it was found impossible to continue this autumn. He felt deeply the break with students and with members of his various staffs who were taking up new work, and no doubt this told heavily upon him. One who never spared himself, he was loved and respected by all who knew him, and heartfelt sympathy goes out to Mrs. Wilson and members of the family in their bereavement.

WE regret to announce the following deaths :

Prof. Max Cloetta, formerly director of the Pharmacological Institute, University of Zurich, aged seventy-two.

Mr. E. P. Van Duzee, curator of the Department of Entomology, California Academy of Sciences, on June 2, aged seventy-nine.

Prof. J. Goldschmidt, formerly director of the Berlin Institute of Criminology, aged sixty-six.

Sir Robert Hadfield, Bart., F.R.S., metallurgist and industrialist, on September 30, aged eighty-one.

Mr. F. C. Hart, manager of the Optical Lantern Department of Messrs. Newton and Co., Ltd., scientific instrument makers, on September 4, aged sixty-three.

Mr. F. H. Hooper, formerly editor of the "Encyclopædia Britannica", manager during the War of 1914-18 of the New York office of the Ministry of Food, on August 16, aged seventy-eight.

Mr. Cherry Kearton, the pioneer in popular natural history photography, on September 27, aged sixty-nine.

Colonel J. J. M. Shaw, consulting surgeon to the Army of the Middle East, a member of the National Radium Commission, aged fifty-four.

## NEWS AND VIEWS

## A Standard of Protection against Incendiary Bombs

IN response to a demand for materials and treatments of comparatively low cost which would afford a useful degree of protection against incendiary bombs, though not necessarily as high as that required of the incombustible material conforming to specification BS/ARP No. 27, the British Standards Institution has issued a new specification designated BS/ARP No. 47. This deals with the testing of incombustible material providing a minimum standard of protection against incendiary bombs. The specification fixes a standard of protection such that materials conforming therewith will (a) markedly reduce the lateral spread of fire on protected surfaces; (b) markedly retard or even prevent entirely the outbreak of a destructive fire; and (c) markedly reduce the damage to protected timber floors, usually confining it to the slow burning and charring of a square foot or so of boarding. It is emphasized that the adoption of protection to the standard fixed by the specification does not obviate the necessity for active defence against bombs by the stirrup hand-pump or other fire-fighting appliance. By retarding the effects of the bomb, the time during which it or the resultant fire may be effectively dealt with is appreciably increased. Copies of the specification are obtainable from the Publications Department of the British Standards Institution, 28 Victoria Street, London, S.W.1.

## Empire Drug Cultivation

THE memorandum on medicinal herb production recently issued by the Ministry of Health (NATURE, Sept. 21, p. 397) confined its observations to the four important drugs, belladonna, digitalis, hyoscyamus and stramonium. It is not surprising that other authorities have taken up the matter at the point where the Ministry left off. An official body representative of the medical profession has recommended that in addition to the four drugs which the Ministry of Health has taken under its care, the production of the following items of vegetable materia medica should be encouraged in Great Britain: anethum, caraway, chondrus (Irish moss), colchicum, Filix-mas, valerian, hamamelis, taraxacum, pyrethrum, psyllium, Datura tatula, fennel and liquorice; that the collection of seaweeds, as a source of iodine, should be undertaken on a large scale. The same official body also recommends that the production of the following drugs should be pursued within the British Empire: agar, bitter orange peel, benzoin, balsam of tolu, calumba, camphor (natural and synthetic), cantharides, mirabilis, cascara sagrada, cinchona, chrysarobin, cocaine, creosote, derris, ephedrine (natural and synthetic), ergot, gentian, liquorice, hamamelis,

Hyoscyamus muticus, ipecacuanha, jaborandi, krameria, lobelia, menthol (natural and synthetic), almond oil, star aniseed oil, oil of cade, oil of chenopodium, oil of lemon, oil of peppermint, turpentine and colophony, psyllium seeds, rhubarb (*Rheum raponiticum*), santonin, squill, storax, thymol (natural and synthetic) and tragacanth.

## Mycenæan Origins and Chronology

THE beehive tomb or *tholos* at Mycenæ known as the "Treasury of Atreus" is one of the most important monuments of the Bronze Age in Greece, and the finest example extant of Mycenæan architecture. Its significance in the reconstruction of the course of development of the early civilization of the eastern Mediterranean was further emphasized when Sir Arthur Evans, on the evidence of a beehive tomb then recently discovered in Crete, attributed the Treasury of Atreus to a Minoan derivation, assigning it to an earlier date than that generally accepted and making it the archetype of which other and inferior beehive structures at Mycenæ were degenerating derivatives. This conclusion ran counter in particular to the results of excavations in the dromos, the walled passage approach to the Treasury, carried out by the British School of Archaeology at Athens in 1920-23. On general grounds and in view of their numerical distribution, the beehive tombs might well be, it seemed, a product of the Mainland or Mycenæan civilization, while the excavations pointed to a date not later than 1350 B.C. This date harmonized with a logical and natural evolution in architectural development which emerged from study of the three groups of beehive tombs.

With the view of meeting objections to this view raised by Sir Arthur Evans and Prof. J. L. Myres, based in the main upon a hypothetical reconstruction of the dromos, a further examination of the dromos was undertaken in 1939, of which the results have been reviewed by Mr. A. B. Wace in *Antiquity* of September. They would go to show conclusively that the Treasury of Atreus is to be assigned in date not to the close of the Middle Minoan period in the late seventeenth century B.C., the great building period at Knossos, as Sir Arthur Evans argues, but to a date not before 1350 B.C. The evidence is derived from household refuse in a cleft which was cut through by the builders, and in which the pottery fragments and other relics are shown to range in date from 1450 to 1350 B.C. This refuse is of further interest in that it is derived from a group of houses belonging to a well-to-do residential quarter, standing on the ridge above the Treasury. This residential quarter is the first of its kind so far found at Mycenæ outside the citadel walls.

### Archæology and Tradition

How far it is justifiable or even permissible to make use of tradition or 'folk-memory' in the interpretation of archæological data and the results of archæological excavation has been the subject of much argument. Some, like Lord Raglan, regard it as almost or completely valueless, while others would concede that in the reconstruction of pre-history, legend and folk-lore may sometimes afford a valuable clue to cultural or racial impact and subsequent changes in style, technique and practice. The question is one of no little importance in the pre- and early history of the British islands, where the traditions and lore of the Celtic-speaking peoples should be a mine of information as yet far from fully explored from this aspect. It is not often, however, that it is possible to bring a tradition to the bar of judgment and decide upon its value so conclusively as have Dr. F. J. North and Mr. W. F. Grimes in "The Legend of Llys Helig—its Origin and Significance" (Supplement to the Proceedings, Llandudno, Colwyn Bay and District Field Club, Llandudno, 1940. Pp. x+67, with 8 pls. Price 5s.).

Helig, the story goes, was a king of North Wales who flourished towards the end of the sixth century of our era, though the statements as to his lineage, etc., allow a margin of variation of some centuries in dating. At this period, it is said, an inundation overwhelmed his lands and a considerable portion was irretrievably lost. Llys Helig is the name given to a patch of seaweed-covered stones to be seen when the tide is at its lowest out to sea off Penmaenmawr. It is popularly regarded as the site of Helig's palace; and in 1864 an account of an expedition to view the 'sunken ruins' by Mr. Charlton Hall described them as "a grand old hall of magnificent dimensions". The authors of the present account have made an exhaustive analysis of the literary, historical, geographical, geological and archæological evidence, which points to the conclusion that much of what has been adduced as evidence is inadmissible; and that such valid evidence as there is demonstrates conclusively that the spot where the stones occur could not have been occupied by human beings at any period to which the legend is supposed to relate; while the final verdict of geologist and archæologist is that Llys Helig itself is a heterogeneous and unsorted assemblage of boulders representing the debris of a denuded hillock of boulder clay, and never has been the component part of any building or structure, even such as a weir.

### Seals in the Ancient East

SEALS and sealings are so frequently the subject of reference and their importance so often stressed in accounts of archæological investigations in the ancient East which are directed to the interest of a public comprising others than the expert, that any attempt to extend a knowledge of the historical and cultural importance of the subject as well as of the intrinsic merits of the seals themselves is deserving of every encouragement. Dr. Henri Frankfort's excellent work, though by no means heavy reading,

is probably too detailed for all but those who have made some headway in the subject. For those who are interested whether in the historical value or the æsthetic merits of the ancient seal has still to be aroused, a recent leaflet of the Field Museum of Natural History, Chicago ("Ancient Seals of the Near East" by Richard A. Martin. Leaflet 34, 1940. Pp. 4, with 24 illustrations and explanatory text. 25 cents) is an excellent provocative.

Twenty-two sealings are illustrated from reproductions in the frieze of the Babylonian Hall of the Museum. They cover some of the finest examples in the major periods in Near Eastern glyptic art from the fourth millennium B.C. (Jemdet Nasr) to the third-fourth century A.D. (Sassanid), when the pictorial stamp seal of the Near East was drawing near its end. Among the more notable examples included are seals of the Agade period when the art reached its highest expression, the Ur-Nammu seal of the twenty-third century B.C. with its remarkably fine type of Babylonian writing, the highly ornamental Hittite seal of the fourteenth century B.C. in which four Gilgamesh figures in a wheel recall the early origin of the swastika, and last but not least for its historical significance the Harappa seal, showing elephant, rhinoceros and crocodile, found in Mesopotamia but unquestionably imported from the Indus Valley. The explanatory text which accompanies each illustration gives such historical and mythological detail as is adequate for understanding of the subject-matter of each seal impression. Technically the illustrations are almost beyond criticism.

### Mound Builders' Temple, Ohio.

EXPLORATION of a mound near North Benton, Ohio, has brought to light the remains of a structure identified as a temple in which a number of objects are apparently new to knowledge of the culture of the Mound Builders. The mound was excavated by Mr. Roy Saltman and Mr. Willis H. Magrath. It has been assigned by Mr. Richard I. Morgan, curator of archæology in the Ohio State University, to the Hopewellian phase, the most advanced of the Mound Builder culture, which extended from Ohio down the Mississippi and Tennessee valleys. In an account of the excavation (*Scientific American*, August 1940), it is stated that within a circle of stone slabs there was evidence of an inner wall of wood in the form of charred stumps, which had supported a circular building nearly 70 ft. in diameter. A corridor from a gateway in the west side led to a fireplace in the middle of the temple floor. Stone altars and clay cones flanking the corridor bore charred bones and offerings of stone implements, mica, galena and copper.

The most striking feature of the temple was the figure of an eagle of white sandstone flags on an understructure of moulded clay, which measured 32 ft. across and 16 ft. from head to tail. It was headed towards the rising sun. Overlying the wings were two human skeletons, male and female. Numerous broken fragments of human skull bones and similar fragments on the nearby altar stone suggest

human sacrifice as part of a burial ceremonial. Not only is the eagle figure unique, but also human sacrifice is a new element in finds in other branches of the Hopewellian culture. The culture of the Mound Builders, which developed between the beginning of the Christian era and Columbian times, had disappeared before the arrival of Europeans. The suggested connexion between this culture and that of Mexico and Central America might well account for the appearance of human sacrifice, to which the inhabitants of Mexico were particularly addicted.

#### Murder by Children and Adolescents

IN his inaugural thesis (*Thèse de Paris*, No. 108; 1940), Dr. Louis Begon, who records seven cases of attempted murder committed by males aged fourteen to nineteen, states that the motives for murder at this age show a much greater variety and are much more complicated than in the case of adults. The medico-psychological examination of cases of murder by young persons is of considerable practical interest both as regards the outlook of the case and the prognosis. The offenders may be classified in three different groups. The first consists of those guilty of a single offence. In such cases the prognosis is good, and a relapse is not likely to occur, provided that a change is made in the environment, which has an important influence on the determination of the act. The second group consists of those in whom murder is the result of disease. In such cases internment is required. The third group is formed by abnormal persons who are not really insane or suitable for detention in an asylum, but are dangerous individuals against whom society should be protected, in the absence of which protection a recurrence will probably happen.

#### Tuberculosis in Mental Hospitals

IN a paper (*Amer. J. Psychiat.*, 96, 1335; 1940) based on his experience of pulmonary tuberculosis in mental hospitals during the last nine years, Dr. C. A. Wicks states that though the tuberculosis mortality rate for patients in the Ontario mental hospitals has shown a tendency to decrease since 1934, in 1936 the rate was fourteen times greater than that for the province as a whole. Approximately 2.5 per cent of 2,908 patients admitted to the Ontario mental hospitals during 1938 required isolation on account of X-ray findings in the chest. From the tuberculosis situation as it existed in January 1939 it was estimated that a central tuberculosis mental hospital would be required to accommodate approximately 5.2 per cent of the patients in Ontario mental hospitals. X-ray examination of the chest in 2,542 staff in the Ontario mental hospitals in 1937-38 showed that 0.6 per cent required treatment for tuberculosis. Since 1933, about 0.5 per cent of the employees have needed such treatment every year. About 1.7 per cent of 839 apparently healthy applicants or new staff in the Ontario mental hospital service during the calendar year 1938 showed X-ray

evidence of pulmonary tuberculosis which was active or possibly active, thereby rendering them unacceptable for employment.

#### Public Health and Advertising

IN a paper read before the Health Officers' Section of the American Public Health Association (*Amer. J. Public Health*, 30, 880; 1940) Dr. K. E. Miller, medical director, U.S. Public Health Service, remarks that unrestrained advertising becomes a matter of public health concern primarily in connexion with those products which either directly or indirectly affect public health, such as foods, drugs and cosmetics. He points out that one of the most potent means for regulating unfair practices and protecting public health interests consists in the control of false and misleading advertisements, especially of those products which may be injurious to health. Apart from changes in the existing laws, State and local health forces can make valuable contributions to the success of the campaign against dangerous nostrums and the advertising of other medicinal products.

#### Fatal Accidents in the United States

ACCORDING to the *Journal of the American Medical Association* of August 10, p. 470, the United States Bureau of the Census recently published a statistical study of fatal accidents in the six years 1933-1938. In 1933, fatalities from accidents totalled 90,932, and thereafter the number rose to a maximum of 110,052 in 1936. Then it decreased to 93,805 in 1938. Deaths caused by fires, which ranked seventh among all accidental causes during 1933-37, advanced to the sixth place in 1938. Figures for the successive years were 1,521 in 1933, 1,752 in 1934, 1,581 in 1935, 1,913 in 1936, 1,688 in 1937 and 1,650 in 1938. There were more victims from fire in the age group 5-9 than in any other group in 1938; there were 129 deaths in this group, which was 7.8 per cent of all persons burnt to death. The next largest number was in the group 50-54 with 109 deaths. Only 18.3 per cent of deaths from injury by fall occurred among persons less than forty-five years of age, who form 77 per cent of the population, but 55.8 per cent of the motor fatalities and 91.3 per cent of aeroplane fatalities were in this younger group.

#### Improvement of Grassland

GRASSLAND improvement is the main theme of the July number of the *Scottish Journal of Agriculture* (23, No. 1, H.M. Stationery Office. 1s., postage extra). Viewing the subject as a whole, a moderately long-term policy for higher farming is advocated, since facilities for improvement are now specially favourable, and stock-carrying capacity must be increased and fertility built up for the future. As a means of maintaining hill grazing as an economic proposition, the introduction of cattle, or a considerable increase in their numbers, is suggested. Bracken control is also dealt with in some detail, and the various machines recently used for this purpose described. With regard to the renovation of old pasture, practical

experience has shown that ploughing is preferable to surface harrowing, and that seed-bed consolidation is essential for success. The suitability of mixtures for re-seeding, and the chemical aspect of grassland improvement are also considered. An article on ensilage and grass drying completes the other side of the picture, the different methods of conserving grass and their relative feeding values being fully described and discussed. Among other subjects of current interest in this number of the *Journal* is a well-illustrated account of a new method of trapping and destroying rabbits on a large scale. The *Journal* is now to be issued half-yearly instead of quarterly.

#### Vocational Training and Black Rust Control

THE classical struggle of the United States Department of Agriculture against the black rust disease (*Puccinia graminis*) of small grains, forms the subject of a leaflet (No. 1, Revised 1939) entitled "Teaching the Control of Black Stem Rust of Small Grains in Vocational Agriculture Classes". This has been prepared by the Vocational Division of the Office of Education, U.S. Department of the Interior. Destruction of common barberry, the alternative host plant of the fungus, still requires to be practised, and a teaching plan for the portrayal of this need is detailed in the leaflet. The life-history of the fungus and its devastating effects are shown by effective diagrams and small photographs, and even the most unimaginative teacher could scarcely fail to thrill a class if he followed the suggestions put forward. Co-operation with the U.S. Department of Agriculture has been closely maintained, with the result that a valuable source of specialist information is provided for the general teacher.

#### Animal Husbandry in India

THE report has just been published of the *Proceedings* of the third meeting of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry in India (Simla: Gov. India Press, 1940). The meeting was held at New Delhi during February 20-23, 1939, and the variety of the nineteen topics discussed indicates the complexity of India's problems and the research activities which have been stimulated through the influence of the Imperial Council of Agricultural Research. Reference to the *Proceedings* and the discussions recorded there show how valuable to the investigators and agriculturists concerned must be the pooling of information from all the corners of the land which takes place at such meetings and helps to determine the lines upon which particular investigations must be conducted. But we must add that the form in which the *Proceedings* are published leaves much to be desired: there is no index to the subjects or authors mentioned in these 307 pages, and even the list of topics has no page references to guide the inquirer; so that, for example, we find the discussion on the warble-fly on p. 88, and the introductory remarks on which the discussion was based on p. 155, with a title which, as printed, is unintelligible.

#### Pictorial Illustration for Engineering Draughtsmen

IN the drawing office a rigidly conventional system of orthographic projection is employed which tends towards the suppression of ability in pictorial representation. To the draughtsman himself his conventional views are sufficiently expressive and communicative, but occasions arise when greater realism is necessary in order to inform and impress the uninitiated. For guidance in this unaccustomed field, the Association of Engineering and Shipbuilding Draughtsmen has issued a new publication entitled "Freehand Drawing and Pictorial Illustration for Draughtsmen" by W. H. Kerry and E. W. Stott (London: The Draughtsman Publishing Co., Ltd. 2s.) which shows how in a number of typical cases pictorial sketches can be prepared. A chapter devoted to "Perspective Construction", on which the subsequent treatment is based, is followed by a statement of the nature and classes of work which the engineering draughtsman may be called upon to treat pictorially, and the purposes for which this method of treatment is necessary; as, for example, the illustrations required by the Patent Office. The main subjects are dealt with under the titles "Treatment of Machine Details", "Conventional Treatment" and "Illustration for Reproduction with an Outline of some of the Printing Processes", and the whole forms a sequence of practical instruction which must prove invaluable to the draughtsman who is unskilled in this unfamiliar field and uninformed regarding the methods to use for different conditions of reproduction.

#### Properties and Applications of Witherite

IN *Engineering* of September 13 there is an interesting article on the properties and applications of witherite (barium carbonate). It is stated in a handbook issued jointly by the Holmside and South Moor Collieries, Ltd., and the South Moor Collieries, and the Settlingstones Mines, Ltd., that witherite is found in economic quantities only in the northern part of England and that the mines producing it supply the world demands for the mineral. The material derives its name from that of Dr. W. Withering, a Birmingham physician and amateur geologist, who in 1784 when examining samples taken from an old lead mine at Alston Moor, on the borders of Cumberland and Northumberland, first recognized the mineral to be chemically distinct from barytes.

Large quantities of witherite are used annually in the preparation of precipitated barium sulphate (permanent white) which is employed in the paper industry for the manufacture of highly glazed coated papers. It is also used in the printing ink and colour industries, in the manufacture of paints and as a filler in the rubber, linoleum and other industries. Among other engineering applications of witherite is the softening of water for boiler feed. It is specially useful when scale-forming and corrosive waters are encountered. Thus sodium and calcium sulphates are converted into the carbonates of these metals, with the precipitation of insoluble barium sulphate. Ground witherite mixed with wood charcoal, usually

in the proportion of 40 per cent of the former and 80 per cent of the latter, has been used for many years as an energizer for carburizing compounds in the case-hardening industry. Considerable proportions of barium oxide, in some cases nearly 50 per cent by weight, enter into the composition of crown and flint optical glasses used for the production of lenses. Finely divided barium carbonate is also claimed to increase the resistance of cement to the action of sulphate-containing waters.

#### Credit and the Family Budget

THE Office of Education, United States Department of the Interior, has issued a bulletin "Credit Problems of Families" (Vocational Division Bulletin No. 206, Home Economic Series No. 23) to aid teachers of home economics in guiding students in an understanding of the place of credit in family financial management and in the solution of their own credit problems. Credit has played an increasing part in recent years in the financial plans of American families, and this study, which covers both credit for everyday use and long-term uses of credit, is intended to assist the understanding of the principles governing the sound use of credit. Numerous suggestions to teachers are included.

#### Help for Scientific Research in Canada

THE Canadian Government has announced the appointment of nine members to administer funds presented by patriotic citizens for assisting technical projects and scientific investigations now being undertaken or proposed by the National Research Council with the object of increasing the efficiency of the Canadian war effort. The chairman is Dean C. J. Mackenzie (acting president of the National Research Council), and the members include Sir Frederick Banting, Mr. J. S. Duncan (Deputy Minister for Air), Prof. Maas (head of the Physics Department of McGill University), and Colonel Allen Magee (executive assistant to the Minister of National Defence). Funds given or promised amount to £225,000.

#### The *Sedov* on a New Expedition

THE Geographical Department of the Northern Sea Route Administration (U.S.S.R.) has sent out the icebreaker *Sedov* on a new expedition to the north-eastern part of the Kara Sea. It will be remembered that the *Sedov* returned to Murmansk on January 29, 1940, after a remarkable drift in the Arctic of twenty-seven months duration. The head of the new expedition is Mr. V. I. Vorobyev. The purpose of the expedition is to study one of the most important parts of the Northern Sea Route in the Kara Sea—from Izvestia Tsik Islands to Russky Island. The total length of this part is about two hundred nautical miles. The expedition is to carry out hydrographic and hydrological research: it will make systematic soundings of the depths of the sea, study the currents, wind regime, ice conditions, and carry out magnetic observations.

#### Announcements

DR. K. E. BULLEN, lecturer in mathematics at University College, Auckland, New Zealand, known for his work in seismology, has taken up an appointment in the Department of Mathematics of the University of Melbourne.

SIR ARTHUR HURST will deliver the eighteenth Norman Kerr Lecture to the Society for the Study of Inebriety on October 8 at 4 p.m. in the Friends House, Euston Road. His subject will be "Alcohol and the Organs of Digestion".

IN consequence of the War, it has been decided to postpone, for the present, the Chadwick Public Lectures which were to have been delivered this autumn.

THE following are serving as officers of the Society of Chemical Industry for 1940-41: *President*, Prof. J. C. Philip; *Honorary Treasurer*, Dr. L. H. Lampitt; *Honorary Foreign (or Overseas) Secretary*, Dr. Wm. Cullen; *Chairman, Bureau of Chemical Abstracts*, Dr. L. H. Lampitt; *General Secretary*, H. J. Pooley, Clifton House, Euston Road, London, N.W.1.

THE average mortality rate from all causes in the large cities of the United States for the four weeks ended June 15, based on data received from the Bureau of the Census, was 10.9 per thousand inhabitants. The average rate for this period in the five preceding years was 11.0.

THE Medical Research Council has received four motor-vehicles specially equipped for medical work from the United States. These were originally purchased by the American Quakers and the International Commission for the Assistance of Child Refugees for use in France. The vehicles now are to be used principally in the work of the Emergency Blood Supply depots in the neighbourhood of London.

DR. F. HOYLE, St. John's College, Cambridge, writes: "I have noticed an error in a letter by Lyttleton and myself on 'The Evolution of the Stars' appearing in NATURE of July 20, p. 97. The sentence 'Thus the effect of collisions is to excite the vibrational and rotational levels of the  $^3\Sigma$  state of the molecules, and this internal energy can be radiated by quadrupole transitions to the ground state of the molecules', should read: 'Thus the effect of collisions is to excite the vibrational and rotational levels of the  $1^1\Sigma$  state of the molecules, and this energy can be radiated by quadrupole transitions as an infra-red spectrum'."

ERRATUM. In the obituary of Prof. A. E. H. Love in NATURE of September 21, p. 393, three lines from foot of second column, for "Anthony Berry" read "Arthur Berry".

## LETTERS TO THE EDITORS

*The Editors do not hold themselves responsible for opinions expressed by their correspondents. They cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.*

IN THE PRESENT CIRCUMSTANCES, PROOFS OF "LETTERS" WILL NOT BE SUBMITTED TO CORRESPONDENTS OUTSIDE GREAT BRITAIN.

## Origins of Electric Transmission by Resonance

THE death of Sir Oliver Lodge, full of years and honour, recalls brief episodes in the early development of wireless telegraphy. One remembers Lodge describing how he and his assistant at Liverpool were experimenting with a Hertzian spark vibrator: another such vibrator, a duplicate of it, happened to be at the distant end of a long lecture bench, and they noticed an extraordinary development of receptive sparking in it. With the simplicity of genius Lodge recognized that this was due to resonance, for the period of vibration in the receiver must be the same as that of the identical transmitter. One result was a master patent, which was for long a thorn in the side of practical adventurers. (The Bell telephone happens to be another instance of reciprocity of emitter and receiver.)

One may ask, did Hertz in his classical experiments on wave-lengths take this very striking role of Fourier resonance into his chain of ideas? (FitzGerald had remarked on it five years earlier.) His broken ring receiver would probably have had to be inconveniently large to bring it into resonant relation. One seems to remember that it gradually occurred to informed minds that the vagaries of reception were due to the disturbance selected by the receiver being largely a Fourier component of its own wave-length, as that one was intensified by resonance, so that the wave-length observed would be that of the receiver, not the emitter; a principle now of utility in the other direction to prevent sympathetic leakage into adjacent systems.

During a lecture by Lodge at the Royal Institution, a vibrator on the table was observed to excite sparks on the gold-patterned paper on the walls: but these were perhaps more likely ordinary electrodynamic effects due to completion across a gap of metallic circuits. The converse case was D. E. Hughes's much earlier uninstructed detection of electric waves at the appropriate much greater distance, from which he was dissuaded by the conservative frame of mind of Stokes, strikingly effective also on the mentality of his disciple Lord Kelvin, though he was himself the detector of fluorescence.

In the well-known contemporary account of Hertz's discovery by G. F. FitzGerald of Trinity College, Dublin, which now happens to be accessible here in his Collected Papers, I find, however, some reference to tuning of the receiver. One remembers, by the way, the excitement then produced in Dublin by the direct reception of the news of a regatta in the Bay from Marconi who was a guest on the flagship. FitzGerald was a close friend and indeed instructor of Lodge, who after his premature death

became a life-long apostle. The wave properties of electric transmission on analogy with those of light were closely pursued in his few later years in FitzGerald's laboratory, which then included the present Provost of that illustrious College.

These considerations are largely out of date in practice, but though simple they are far from obsolete in theory, which should avoid abstruseness.

JOSEPH LARMOR.

Holywood,  
N. Ireland.  
August 23.

## Structure of Liquid Argon

MOST of the X-ray investigations of liquids have led to a distribution function which cannot be compared directly to the corresponding distribution of atoms in the solid since one peak in the liquid distribution function usually corresponds to several peaks in the distribution function of the solid. For this reason we investigated several years ago the structure of molten salts such as potassium chloride and lithium chloride where one can assign to each peak in the liquid distribution function one peak in the distribution function of the solid. We have shown that the co-ordination in the liquid and the solid is the same; number of first neighbours  $N_1$  in the solid equals 6 and in the liquid 5.8. The number of second neighbours  $N_2$  in the liquid (K-K or Cl-Cl) is already greatly disturbed; in the solid there are 12 and in the liquid 9.8.

Since the development in recent years of a more refined theory of liquids<sup>1</sup> has permitted the prediction of the number and position of nearest neighbours in a normal liquid, it was of particular interest to study the structure of liquid argon.

Because liquid argon at atmospheric pressure is only stable over a temperature range of 3.5° (boiling

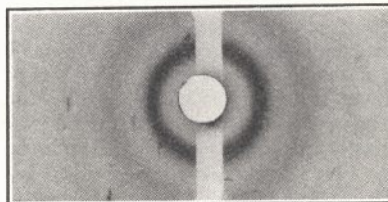


Fig. 1.

DIFFRACTION PATTERN OF LIQUID ARGON SHOWING DIFFRACTION RINGS AT  $(\sin \theta)/\lambda = 0.152, 0.284, 0.410$  AND A FAINT RING IS INDICATED AT 0.59. THE LAUE SPOTS ARE DUE TO THE MICA WINDOWS.

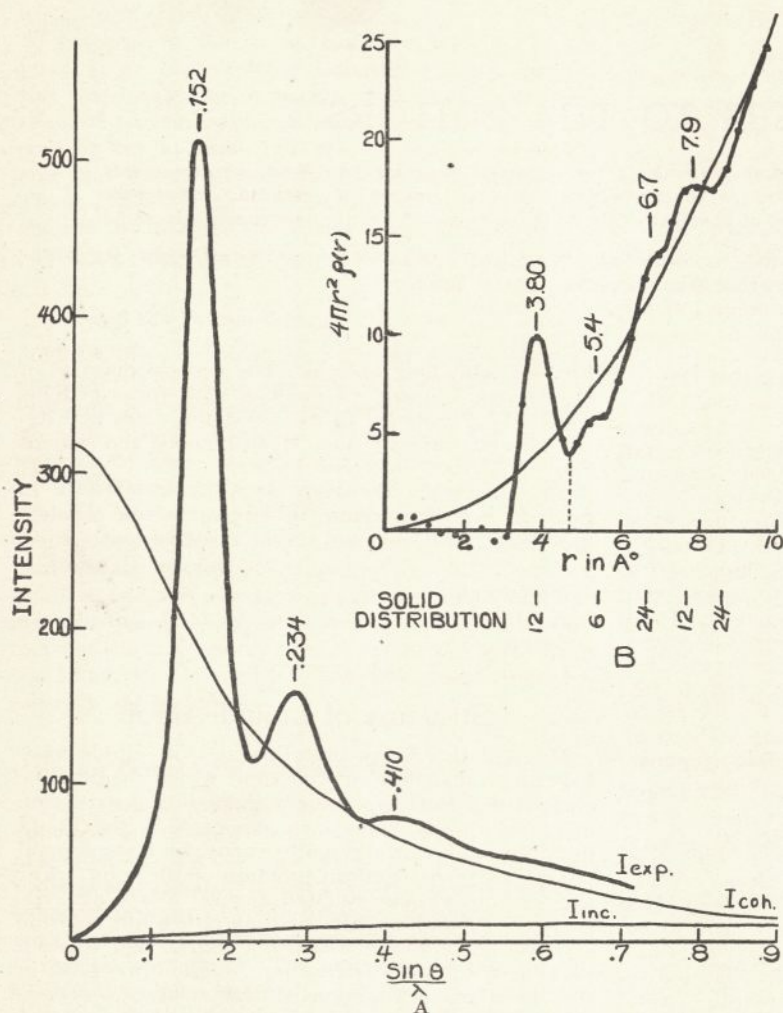


Fig. 2.

$I_{exp.}$  (A) SHOWS THE MICROPHOTOMETER TRACE OF THE DIFFRACTION PATTERN REDUCED TO INTENSITY AND CORRECTED FOR ABSORPTION AND POLARIZATION. PEAKS AT  $\sin \theta/\lambda = 0.152, 0.234, 0.410$ , A FAINT INDICATION OF A PEAK AT 0.59. B SHOWS THE DISTRIBUTION FUNCTION OF THE LIQUID AND AS A COMPARISON THE DISTRIBUTION IN THE SOLID IS LISTED BELOW THE ABSISSA.

point  $-185.7^\circ\text{C}$ . and melting point  $-189.2^\circ\text{C}$ .) a special container for the liquid was constructed which made it possible to apply pressures slightly above atmospheric pressure during the exposure.

Pure gaseous argon is introduced into the cell and is there condensed under a pressure of 910 mm. mercury and at a temperature of  $89.2^\circ\text{K}$ . The liquid argon is held in a layer of about 1.3 mm. thickness between two mica windows, 0.01 mm. thick. The mica windows are sealed with indium gaskets to the copper walls of the cell proper which is cooled by a continuous stream of liquid air. This arrangement permits making a definite absorption correction (plane parallel layer) for the intensity measurements of the diffracted X-rays, and the diffraction pattern of the cell walls does not interfere with the liquid pattern itself. The absorption and the scattering of the cell walls are small compared to the corresponding values for the liquid. Monochromatic silver  $K\alpha$  radiation reflected from a rock salt crystal was used in a

vacuum camera, thus eliminating air scattering and continuous background.

The diffraction pattern, recorded photographically, shows three distinctly visible rings and a fourth ring is revealed upon closer inspection (Fig. 1).

Fig. 2 shows the experimentally observed intensity ( $I_{exp.}$ ) properly corrected together with the coherent ( $I_{coh.}$ ) and incoherent ( $I_{inc.}$ ) scattering to be expected theoretically matched at  $(\sin \theta)/\lambda$  of about 0.7 for quantitative analysis.

From a Fourier analysis the atomic distribution curve in the liquid has been obtained and is shown in Fig. 2 B. The first neighbours are to be found at 3.8 Å. (3.82 Å. in the solid). The area under this peak gives the number of the first neighbours. From the various patterns which we have obtained this number was determined as 9.6, 10.1 and 10.3 nearest neighbours<sup>2</sup>. Further concentrations corresponding to the outer neighbours occur at 5.4, 6.7 and 7.9 Å. The number of neighbours and their distances, as they occur in the solid (Fig. 2 B), indicate how far the liquid structure retains the arrangement found in the solid.

The results show that the type of co-ordination, as found in the solid, is retained in the liquid, but the transition solid-liquid in argon produces a disorder already pronounced in the reduction of number of first neighbours, as compared to  $N_1 = 12$  in the solid.

Theoretical investigations<sup>3</sup> indicate that such a reduction in  $N_1$  is necessary to account for the thermodynamical data. Recent investigations by O. K. Rice<sup>3</sup> lead to 10-10.5 nearest neighbours for argon in the temperature range of our experiments, in good agreement

with the results obtained.

The substance of this work was reported at the Pittsburgh meeting of the American Physical Society during June 20-22, 1940.

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E. P. MILLER.

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Purdue University,  
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August 20.

<sup>1</sup> Fowler, R. H., and Guggenheim, E. A., "Statistical Thermodynamics", § 808, and following.

<sup>2</sup> Eisenstein, A., and Gingrich, N. S. (*Bull. Amer. Phys. Soc.*, 15, No. 2; April 1940) in a preliminary report give 7 atoms at 3.9 Å. as nearest neighbours. This result, which seems rather difficult to reconcile with the theoretical predictions, was obtained with an experimental arrangement different from ours and in a different  $p$ - $T$  range. It might be pointed out that at higher molal volume the curves of Rice<sup>3</sup> indicate a possible change in co-ordination, but scarcely so low as the preliminary results of these authors indicate.

<sup>3</sup> Fowler and Guggenheim, *loc. cit.*, and Rice, O. K., *J. Chem. Phys.*, 7, 136 and 883 (1939).



## Resonance in the Chloracetic Acids

IN a letter in NATURE, H. O. Jenkins<sup>1</sup> has discussed the dissociation constants of the chloracetic acids, and concluded that the electrostatic inductive effect cannot account for the strength of the di- and trichloroacids, although that of the mono-acid is quantitatively explicable on this basis<sup>2</sup>, since "no functional relationship can be traced between  $\mu_R$  (resultant moment of the C-Cl links) and  $K$  (dissociation constant)". This conclusion is, however, incorrect; for, if the bonds are tetrahedrally arranged around their carbon atom, the change in the electrostatic potential  $\psi$  ( $= \mu \cos \theta / r^2$ ) at the carboxyl group (which is the inductive effect), should be proportional to the number of C-Cl links present, if  $\mu$ ,  $\theta$  and  $r$  remain unchained for each link. That is, we should have

$$pK = pK_0 - qx, \quad (1)$$

where  $pK$  is the negative logarithm of  $K$ , for  $x$  chlorine atoms,  $pK_0$  that of acetic acid, and  $q$  a constant; that is, the Ostwald-Wegscheider rule, although the resultant moments of the corresponding chloromethanes are not as 1:2:3.

The results given below show that the factor  $q$  decreases with  $x$ ; hence the di- and tri-acids are weaker than they should be on this simple hypothesis, while Jenkins represents them as abnormally strong. This diminution in  $q$  can easily be explained. Smyth and McAlpine<sup>3,4</sup> pointed out that the dipole moments of the C-Cl links in  $\text{CH}_2\text{Cl}_2$  are less than that of this link in  $\text{CH}_3\text{Cl}$  because of the mutual effect of the dipoles, and that this effect would probably be linear in the number of C-Cl links present. Hence we might expect

$$pK = pK_0 - sx + t(x - 1). \quad (2)$$

The available data on these acids are given in the accompanying table ( $pK_r = pK - pK_0$ ):

	$pK$			$pK_r$		
	H <sub>2</sub> O	MeOH	EtOH	H <sub>2</sub> O	MeOH	EtOH
CH <sub>3</sub> COOH	4.757 <sup>5</sup>	9.762 <sup>7</sup>	10.44 <sup>7</sup>	0	0	0
CH <sub>2</sub> ClCOOH	2.861 <sup>6</sup>	7.838 <sup>7</sup>	8.51 <sup>7</sup>	-1.90	-1.92	-1.93
CHCl <sub>2</sub> COOH	1.30*	—	6.89 <sup>7</sup>	-3.46	—	-3.55
CCl <sub>3</sub> COOH	—	4.92 <sup>8</sup>	—	—	-4.84	—

\* Ostwald's value.

The alcohol values must be considered since no accurate value for trichloroacetic acid in water is available. As mean values for  $pK_r$ , therefore, we have -1.92, -3.50, -4.84. The equation (2) given, with  $s = -1.92$ ,  $t = 0.30$  predicts (-1.92) -3.52, -4.82 within the experimental error.

Further, since  $t$  is related to the bond-polarizability, for the fluor-acids it should be smaller, for the bromo- and iodo-acids larger, than for the chloro-acids. The only extant data are for propionic,  $\alpha$ -bromopropionic, and  $\alpha$ -dibromopropionic acids<sup>9</sup>:  $pK$  4.87, 2.97, 1.48<sup>9</sup>. If equation (2) is valid,  $s = -1.90$ ,  $t = 0.41$  as compared with 0.30—in the right direction. It is suggestive that Wegscheider<sup>10</sup> found the largest deviation from equation (1) for substituted benzoic acids if the groups were 1:2:3, or 1:2:6 (carboxyl at 1), when the mutual interference must be a maximum. Exact calculation of the  $t$  term is not at present possible, but the order is reasonable<sup>3,4</sup>.

Although explanations in terms of resonance and polarizability are not fundamentally opposed, Jenkins' relations between  $pK$  and  $n$  are of doubtful signi-

ficance; resonance energy is not, in general, linear in the number of canonical forms. Finally, the resonance possibilities of the undissociated acids are very similar to those of their anions.

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The University,  
Manchester.

<sup>1</sup> Jenkins, NATURE, 145, 625 (1940).

<sup>2</sup> Kirkwood and Westheimer, J. Chem. Phys., 6, 506, 513 (1938).

<sup>3</sup> Smyth, C. P., and McAlpine, J. Chem. Phys., 1, 190 (1933).

<sup>4</sup> Compare also Sutton and Brockway, J. Amer. Chem. Soc., 57, 473 (1935).

<sup>5</sup> Harned and Ehlers, J. Amer. Chem. Soc., 55, 652 (1933).

<sup>6</sup> Wright, J. Amer. Chem. Soc., 56, 314 (1934).

<sup>7</sup> Minnick and Kilpatrick, J. Phys. Chem., 43, 259 (1939).

<sup>8</sup> Goldschmidt, H., and Aarlot, Z. Phys. Chem., 117, 312 (1925).

<sup>9</sup> Walden, Z. phys. Chem., 10, 650 (1892).

<sup>10</sup> Wegscheider, Monat. Chem., 23, 288 (1902).

## Nature of the Cyanide-stable Portion of Cellular Respiration

IN a recent and interesting review by Commoner<sup>1</sup>, on the cyanide inhibition of cellular respiration, it is suggested that the cyanide-stable respiration is mediated through the yellow-enzyme system and is concerned with the oxidation of fatty substances, that is, compounds with a low O/C ratio. As tentative support for this hypothesis Commoner instances the relatively high  $Q_{O_2}^N$  of liver, kidney and heart, the high flavin content of these tissues, and their low respiratory quotient ( $R.Q.$ ) values.

Unfortunately, in advancing these ideas, no account has been taken of the possible contribution of purine oxidation to the cyanide-stable respiration. In the case of ox-liver it may be shown that such oxidation possibly accounts for the whole of this cyanide-stable respiration. From previous data of mine<sup>2</sup> the  $Q_{O_2}$  of 'minced' ox-liver may be calculated to be 1.8, of which the greater part was shown to be due to purine-base oxidation, and which is only slightly inhibited by cyanide. This value for  $Q_{O_2}^N$  agrees quite well with that of 1.5-2.4 deduced by Commoner. For ox-liver, where uricase activity is absent, the  $R.Q.$  for purine-base oxidation is nil, so that if such oxidations account for any great part of the total respiration, the  $R.Q.$  value for the whole tissue will be much lower than unity. The low  $R.Q.$  values for liver do not therefore necessarily prove that fat oxidation is predominant. The high flavin-content of these tissues may also be accounted for by its xanthine oxidase activity in view of the identification of this enzyme as a flavin.

The evidence quoted in favour of Commoner's hypothesis is thus equally in favour of the view that the cyanide-stable respiration in mammalian tissues is to be identified with purine-base oxidation.

It is worth while pointing out that, with some plant tissues, notably those of carrot leaf and tea leaf, considerably higher concentrations of cyanide ( $m./100$ ) are required to bring about maximum inhibition of respiration. I have also recently shown that  $m./100$  cyanide is necessary for full inhibition of oxidation of catechols and  $p$ -phenylenediamine by a preparation of tea oxidase believed to be a cytochrome oxidase.

If, as seems likely, a cytochrome system is operating in these tissues the cyanide sensitivity of cytochrome must vary considerably according to the nature of the tissue. Until this variation has been properly

investigated it seems premature to speculate upon the nature of the cyanide-stable portion of respiration as we may have here a case of incomplete inhibition of cytochrome oxidation by cyanide. There is also the possibility that in one tissue there may exist more than one cytochrome oxidase, varying in sensitivity towards cyanide.

Further details as to the cyanide sensitivity of the tea oxidase and its similarities to cytochrome oxidase will be published elsewhere.

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Cinnamara, Assam.  
June 21.

<sup>1</sup> Commoner, B., *Biol. Rev.*, **15**, 168 (1940).

<sup>2</sup> Roberts, E. A. H., *Biochem. J.*, **30**, 2166 (1936).

## Faunistics and Ages of the East African Islands

On an ordinary map the three low tropical islands of Pemba, Zanzibar and Mafia appear to bear a similar relationship to the African continent, from which they are all distant less than thirty miles. In fact, however, while the last two islands are on the continental shelf, Pemba is surrounded by water 2,500 ft. deep. Geological opinion is unanimous that Zanzibar and Mafia have been separated from the mainland only since Pleistocene times, but the geological history of Pemba is more uncertain. It has been maintained by Stockley<sup>1,2</sup> that this island has not been connected with Africa at least since Miocene times and his views have obtained wide currency. Actually the geological evidence on which this view is based is not very conclusive; for it is limited to the apparent non-existence of an unconformity between the (non-fossiliferous) Wete beds and the Chakechake beds which are dated as early Miocene.

Recently with the help of the British Museum (Natural History) we have examined the existing check-lists of the island vertebrates<sup>3</sup>. We find that many species have been admitted on inadequate or mistaken evidence while, on the other hand, many have to be added as a result of recent years collecting. We have analysed the revised check-lists and considered the results in conjunction with the fact that: (a) evergreen forest, probably the predominant formation in the islands in the past, has been greatly reduced in all of them, (b) owing to the topography and the currents the chances of Pemba's being colonized from the mainland (or another island) are, under present conditions, much smaller than those of the other islands. We find that the island faunas are all much poorer than that of the comparable strip on the mainland coast, with important families unaccountably absent, especially in Pemba. In specific composition the island faunas are entirely East African, except for certain Mascarene affinities, most of which appear in Pemba although there is none in Zanzibar. These peculiarities of Pemba are, however, contrary to expectation, exhibited almost entirely by flying animals, which tends to reduce their zoo-geographical significance. The most striking feature of the faunas is that endemism is low in all three islands and in all the vertebrate classes it is mostly subspecific and it is in no case generic. In addition to the single-island endemic subspecies

there are several that are confined to Pemba + Zanzibar or Zanzibar + Mafia.

The faunistic evidence is thus in entire accord with the view that Zanzibar and Mafia are Pleistocene islands, and on the whole is strongly against the view that Pemba has been isolated since the Miocene or indeed much longer than the other islands. This conclusion would support the view<sup>4</sup> that the submarine scarps of Pemba may be connected with the extensive Pleistocene rifting in East Africa.

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Tanganyika Territory.  
July 9.

<sup>1</sup> Stockley, G. M., "Report on the Geology of the Zanzibar Protectorate", Zanzibar (1928).

<sup>2</sup> Stockley, G. M., *Tanganyika Notes Rec.*, **3**, 82-86 (1937).

<sup>3</sup> Voeltzkow, A., "Reise in Ost-Afrika in den Jahren 1903-1905". Abt. 1, Stuttgart (1923).

<sup>4</sup> von Staff, H., "Wiss. Ergeb. Tendagurn-Expedition 1909-1912", Berlin (1914).

## Camouflage in War-time

IN NATURE of August 3, p. 168, Mr. C. H. Rowe, criticizing schemes of camouflage painting in Great Britain, made a suggestion, based apparently on hearsay only, which implied that the interests of the Paint Manufacturers' Association was partly responsible for what he considered to be unscientific camouflage.

For the information of readers of NATURE, I must explain that the National Paint Federation is not consulted, and has no influence, on the selection of the shades of colours used or the camouflage scheme decided upon, and, moreover, has been instructed that it is not to act in an advisory capacity on such matters. Its duty is to provide paint to the shade of colour selected by, and made to a specification approved by, the Government Department concerned.

We cannot, therefore, accept credit for the excellence of many of the schemes that have been carried out in Great Britain, or blame for any failures.

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I HASTEN to apologize to Mr. S. K. Thornley and to readers of NATURE for the statement made in my letter. The fact that I made clear that my information was entirely hearsay, and that it was from a source which I have had, hitherto, no reason to consider unreliable, does not absolve me. I should, of course, have consulted the Paint Federation first.

Mr. Thornley's prompt denial of responsibility is very welcome, but perhaps he will go further and tell us who it is that approves the specifications for the shades of colour and the paint for Army camouflage ordered from his members. If he can do this, we may be one step further in tracking down the monster of khaki and green 'kidneys' to his lair.

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## RESEARCH ITEMS

## Roman Policy in Northern Britain

THE extent to which recent archaeological excavation demonstrates the development of policy in Roman Britain and the underlying causes, upon which recorded history is supplemented, is indicated by I. A. Richmond in *Antiquity* of September 1940. The political character of northern Britain in the period is determined by two closely related factors—forest and fell—which gave cover to enemies and prevented the growth of flourishing agricultural communities capable of developing social instincts receptive of civilization. From A.D. 43–69 the Romans depended upon alliance with the independent Brigantes centring in West Yorkshire. The problem of controlling the north did not arise until the alliance was broken by the Brigantes themselves. York was then occupied, permanent advance posts established, and Rome committed to the policy of Highland conquest which culminated in the conquest by Agricola of the country south of the Caledonian Highlands and the building up of an elaborate network of roads and a system of forts manned by auxiliaries acting as a police force. The reduction in the legionary forces weakened this system until A.D. 122 when the frontier was withdrawn and Hadrian's Wall was built, at first in turf and then in stone. This produced, however, a stalemate which led to a reversion to the policy of annexing southern Scotland. A turf wall was built by Antoninus between Forth and Clyde, with outposts beyond, controlling routes to the Highlands. The resulting tranquillity allowed the growth of prosperity and orderly life among the Brigantes. At the close of the second century Roman imperial politics drained Britain of troops. This led to tribal incursions from Caledonia and disasters lasting for ten years until order was restored by Severus in a peace which endured for a hundred years, and brought with it a change in outlook. Local recruitment for the auxiliaries converted them from a dominating to a territorial force, while the border tribes became Roman protectorates. The tribe was merging into the nation. The final stage came when the Piets broke through the Wall; and after their devastations had been checked, Rome delegated the north to a strong local administration in which the Brigantes enjoyed an Indian summer of prosperity, and communal instincts were fostered by a steady inculcation of responsibility.

## Pre-Portuguese Bronze Castings from Benin

AT the time of the conquest of Benin and for some time after, it was assumed that the Beni had learned their bronze casting from the Portuguese. This is not justified by a comparison with contemporary Portuguese technique. From about A.D. 1150 until A.D. 1280 all bronze and brass work at the court of Benin was made at Ife, but eventually Oba Oguolu sent to Ife for a worker to establish bronze and brass work in his country. Ighe-igha was selected to go to Benin. Not only was he a great artist but he was also a great teacher; and at his death he was deified and to this day he is worshipped by the brass smiths at Idunmwu Igun Eroumwu, the quarter of the royal brass founders. Three examples of early

bronze casting have been described by Eva L. R. Meyerowitz (*Man* of September 1940). They are in the possession of the Oba of Benin and were excavated in recent years when additions were being made to the royal palace which stands on the ancient cemetery. Of these the first is a badge of office of a priest of Olokun. These badges in older days were housed in a shrine dedicated to the god Olokun in Benin and carried by the priests on ceremonial occasions. The badge is a large bronze casting in semi-circular shape showing Olokun, god of the waters, supported by two attendants, a characteristic theme in Benin art. The Obas identified themselves with Olokun, but their representations are to be distinguished from those of the god by the fact that their feet are human while the limbs of the deity usually branch out into catfish. For stylistic and other reasons this specimen is assigned in date to A.D. 1350–1450. The second example is a badge of the Shango priests, a large bronze casting of semi-circular shape with a ram's head. It probably belongs to the same period. The third casting is a triple dagger surmounted by three heads, representing Olokun on the left, Elusu with a fish body in the middle and Olokun's second wife on the right. Elusu, a sea-goddess, is mainly worshipped at the coast around Lagos, and it may be that this dagger did not originate in Benin.

## Antihormones

THE term hormone is widely known to the layman as is the fact that these substances can be used in the treatment of certain disturbances of the endocrine system, but what is not so generally realized is that animals can also produce neutralizing substances to which the name antihormones has been applied. J. B. Collip, H. Selye and D. L. Thomson have furnished a very useful survey of what is known of these substances (*Biol. Rev.*, 1940), particularly the antagonotropic and antithyrotropic hormones, since these have been the subjects of the most intensive researches. The authors emphasize that it has been definitely established that "pretreatment with certain hormones will cause the appearance in the blood of principles antagonistic to these hormones". The presence of neither the primary organ itself, that is, the gonad or the thyroid gland nor of the hypophysis is necessary to the production of these substances. Whether they are antihormones or antibodies as some authorities claim is difficult to determine, and in any event is perhaps largely a question of definition, but they are definitely specific in their action. In addition to the main antihormones of these two groups which are fully dealt with, the possible existence of a number of others is considered.

## A New Bird from Virginia and its Fate

THE first new species of bird to be discovered in the continental United States in twenty-one years has just been found in West Virginia by Karl W. Haller, according to the Smithsonian Institution news service. The new species, *Dendroica potomac*, resembles the yellow-throated warbler in colouring, but its song is like that of the parula warbler. It is

odd that a fairly conspicuous bird, not particularly shy in its habits or habitats, should have remained unrecognized for many generations, but it may have escaped notice because of its resemblance to other warblers. There is the other possibility that this new species may be that rarely observed new creation, a fertile cross between two species. The species is founded on two specimens. Mr. Haller was attracted first by the song of a male bird, which he shot. "The real significance of the find came when another bird was shot . . . a female almost identical with the male, and unquestionably fertile. She would soon have laid eggs if not collected." So for all we know, possibly one of Nature's rare achievements, a fertile cross, may have been exterminated even before it was described. But at any rate it is represented by a name in scientific nomenclature, a description, and two skins in a museum.

#### Reactions of Miracidia of Sheep Liver-fluke

In the course of experiments testing some reactions of the ova and miracidia of *Fasciola hepatica*, Henry J. Griffiths exposed many representatives of eleven species of Canadian molluscs to miracidia (*Canadian J. Research*, 17, 205; 1939). Individual molluscs were exposed and kept under observation during exposure, being killed later and examined for stages of the parasite. These examinations as well as attempted mass infections in 25 tanks of snails yielded no evidence that any of the species harboured the liver-fluke. Yet on exposure to miracidia all the species were attacked, those belonging to non-Lymnæa groups almost as readily as the Lymnæa types themselves; but the parasite, which attached itself to any exposed portion and might remain attached for 10 minutes endeavouring to penetrate the host's tissue, ultimately dropped off. Although the attacks were deliberate in many cases, in others they were accidental, and miracidia were often seen swimming close to the snails, and even to a known vector *Gyraulus ferruginea*, without showing any sign of attraction or of attempt at attachment. This is in agreement with the conclusions of Mathes, that although miracidia avoid hard bodies such as stones, they show no sign of chemotaxis in finding the intermediate host.

#### The Eriophyidæ or 'Gall-Mites'

DR. KEIFER'S "Eriophyid Studies" (Pts. 1-9; *Bull. Dept. Agric.*, Sacramento, Calif., U.S.A., 1938-1940) constitute one of the most important contributions to this subject published, even surpassing those of the great Viennese zoologist, Dr. Alfred Nalepa. He describes numerous new genera and more than one hundred new species. Those who may have overlooked these valuable and very well illustrated papers, containing 139 plates of more than 1,000 figures, will be pleased to learn that Dr. Keifer proposes at a later date to republish these "Studies" as an "organized whole". Dr. Keifer regards the term 'gall-mites' "a misnomer for the group, as less than 10% of the species cause plant deformations".

#### Cytological Studies of Salix Hybrids

A. HÅKANSSON (*Hereditas*, 24, 1-31; 1940) has published the results of his cytological studies of hybrids between species of *Salix* which were made by Heribert-Nilsson. Among the hybrids were two which arose from crossing eight different species of *Salix* together. These two shrubs were tetraploid and had

a regular meiosis. Some other hybrids involving several diploid species were diploid and showed a regular meiosis. In the  $F_2$  of the cross *S. viminalis* × *S. caprea*, both of which are diploid, there was a shrub with a similar morphology and cytology to the tetraploid species *S. cinerea*. Even the cross *S. viminalis* × *S. phylicifolia*, a cross between a hexaploid and a diploid species, produced a tetraploid plant which had a regular meiosis.

#### Structure and Formation of Antibodies

A PAPER propounding a theory of the structure and process of formation of antibodies was read by Linus Pauling before the annual meeting of the U.S. Academy of Sciences held during April 22-23. This is based on structural information about simpler molecules, and is considerably more detailed than any earlier theory. The theory accounts for many facts, such as the observed antibody-antigen ratios in precipitates, the inhomogeneity of antibodies to a given antigen, and the independence of action of antigens in an immunizing mixture. Among the predictions based on the theory are the following: that the denaturation of antibodies is irreversible; that different antibodies on denaturation and attempted denaturation become identical; that decrease in specificity of the antibody and decrease in antigenic power (amount of antibody produced) accompany increase in number of strong groups in the antigen; that a non-protein and non-polysaccharide substance may have antigenic power if it contains suitable groups and its molecules or particles are sufficiently large; that the synthesis of antibodies *in vitro* might be achieved by denaturing serum globulin and removing the denaturing agent in the presence of an antigen or haptene.

#### The Probability Concept

THE probability concept was considered in a paper read before the annual meeting of the U.S. National Academy of Sciences (April 22-23) by E. C. Kemble. The long-standing controversy over the nature of probability may be resolved by the type of operational analysis so fruitful in physics. Probability is related to our subjective sense of expectancy in much the same way that a thermometer reading is related to our subjective sense of heat and cold. Probability can be defined as a number derived by standardized mental operations from a definite state of information. In so far as it is dependent on information it is subjective. In so far as the evaluation of probabilities from given data is standardized in a manner acceptable to many persons the concept becomes objective. There is no *a priori* necessity for a single rule for evaluating probabilities from all states of information, and one must admit that where the information is vague no calculation of an acceptable probability is possible. Evaluation of probabilities on the basis of a principle of indifference is appropriate to one type of informational situation, whereas calculation from relative frequencies in a collective is appropriate to another. There is use for both types of probability in practical and scientific matters. Either one can be used with the standard calculus of secondary probabilities from primary probabilities. However, there is a sharp distinction between the totality of implications which can be drawn from the two corresponding states of information. Failure to observe this distinction is a common and serious error in probability calculations.

## EASTER ISLAND ORIGINS\*

A FRANCO-BELGIAN expedition, initiated by the Institut d'Ethnologie and the Muséum national d'Histoire naturelle of Paris and supported by the Government and scientific institutions of Belgium, was engaged during 1934-35 in the investigation of the archæology and ethnology of Easter Island. The members of the expedition were Alfred Métraux, Charles Louis Watelin (archæologist), Dr. Henri Levachery of the Musées Royaux d'Art et d'Histoire, and Dr. Israel Drapkin, of Chile. Owing to the death of M. Watelin on the outward voyage, the work of archæological investigation fell to Dr. Levachery, and will be the subject of separate treatment.

In few places in the Pacific does so little remain of the ancient culture as in Easter Island. The present population of 456 natives is entirely derived from the 111 natives left after the abandonment of the island by the French missionaries in 1872. There is thus little chance for the preservation of old traditions. One living person alone survives who witnessed the functioning of the old culture; and she is now more than one hundred years old and of uncertain memory. The principal repository of tradition is the oldest man on the island, who provided the Routledges with their information and is now sixty years of age.

On the racial character of the Easter Islanders two divergent views, based on the evidence of cranial material, are held. Of these, one, while recognizing a Polynesian connexion, seeks to tie up the Easter Islanders with Melanesians or Australians. The second denies the validity of a relationship with non-Polynesian groups, but fails to confirm their Polynesian origin. Dr. I. Shapiro, after a brief review of the evidence, here inclines to the conclusion, based on the evidence of his own measurements of the living, that the Easter Islanders are "definitely Polynesians of a somewhat specialized and exaggerated type, isolated by migration and intensified by inbreeding". Blood-groupings, not yet published, confirm the relationship with Polynesia rather than Melanesia. It is noted that the grammar of the Easter Island language is typically Polynesian and presents no striking individuality.

According to native tradition Easter Island was peopled by Hotu-Matua, who came with two canoes from the west and had been a king in Maraerenga. He was not indeed the first man to land on the island for six other men had preceded him. To Hotu-Matua is attributed the introduction of cultivated plants and all land animals known to the natives, though many of both were demonstrably introduced by Europeans. Among other culture elements assigned to the origination of this hero are the signs of the famous Easter Island tablets. It is considered probable that before the coming of the Europeans there is no reference to Easter Island in the traditions of other islands of Polynesia.

Had Easter Island kingly traditions similar to those of other parts of Polynesia, most of its mysteries might be solved. They do not, however, exist; and the results of the investigations that have been made

have produced only lists of kings, arbitrarily formal and with only uncertain and conjectural geneological sequences.

Next to the stone statues the most famous products of Easter Island art are the wooden images representing emaciated or decaying human beings. Although of ancient origin, the more exaggerated and grotesque have been manufactured to suit the tastes of visitors. The carving of these figures is the only regular industry of the island. The bird-man images—the bird-man is one of the most frequently represented figures in the petroglyphs—demonstrate the extent to which conventional motifs were imposed upon all Easter Island wood carving. Like the stone images, the wooden figures are enigmas and their true significance was not even clear to the natives fifty years ago. They were kept in the houses, and were in the nature of secondary deities. There are natives who still conceive that they are identical with spirits of the dead. Such wooden images of humans are common to the cultures of eastern and central Polynesia, but the emaciated condition of the Easter Island images is foreign to other Polynesian art, except that of Chatham Island.

One object of the expedition was to record all the petroglyphs which could be discovered. In all, 300 were noted. At Orongo, where petroglyphs were first recorded and studied, the bird-man, with the head of a frigate-bird on a crouching human body, is represented in most of the petroglyphs. Only here are the drawings in high relief. Elsewhere they are pecked, and most of the designs represent sea animals. The most spectacular group is near Hanga-o-bonu. It is composed of intermingled motifs which include boats. Human figures are rare. The style of the designs resembles that of the signs on the wooden tablets.

The funerary cairns or *ahus* are the most common monuments in the island, and give it most of its individuality. Probably they correspond to the *maraes*, or sanctuaries of central Polynesia. There are four types, but all are essentially mounds of stones. The large image *ahus*, in which a retaining wall has developed from the heap of stones, are the masterpieces of Easter Island architecture. These structures have numerous affinities with religious structures in other parts of Polynesia.

Cut stones are used extensively on Easter Island. In three other regions only in Polynesia—the Marquesas, the Society Islands, and Tonga—was stone cutting well developed. The excellence of Easter Island stone cutting is due to the use of hard vesicular basalt. It shows an elaborate technique.

The quarry of the giant statues on Rano-raraku crater is one of the most spectacular places in the island, and the fame of Easter Island rests largely upon it. From here come almost all the statues or *ahus*. The quarry on the western slope contains a helter-skelter of unfinished statues, of niches from which finished statues have been removed, and of statues in process of removal. There are 157 statues in different stages of completion. It is possible, owing to their great size, that some were never intended for removal. The images of Rano-raraku which stand below the crater, sixty in all, are not only

\* Ethnology of Easter Island. By Alfred Métraux. Honolulu, Hawaii. Bernice P. Bishop Museum. Bull. 160. Pp. vii + 432 + 7 pls.

the largest, but also they alone, among all the giant statues of Easter Island, have not been pulled down. Small stone images are scarce, and differ widely in style from the statues; but they are probably ancient. The heads of many of the statues once bore a big cylinder made of red vesicular tuff as a head-dress. These range from 1.2 m. to 2 m. in height, and from 1.6 m. to 2.7 m. in diameter. Some had a knob or boss at the top. A slight concavity at the bottom fitted on the head of the statue. It is thought they were a crude attempt to ornament the statues with a structure similar to the top-knot.

The carving of human images from wood and less often from stone is one of the culture traits which distinguish eastern and marginal Polynesia from western Polynesia, where carving of human figures is less developed. Large stone images are carved only in the Marquesas, Raiavavae, and Easter Island. Elsewhere in Polynesia wood carving preceded stone carving. The first immigrants to Easter Island probably came from eastern Polynesia, and were there acquainted with carving human figures from wood.

In the religious beliefs the bird-man cult held a most prominent place until the second half of the nineteenth century. As reconstructed from second-hand information it has no parallel in the rest of Polynesia. Though incarnation of gods in animals is a fundamental character in Polynesian religions, nowhere else do open competitions result in the election of a sacred man.

The tablets of the Rongarongo man—the famous wooden tablets covered with hieroglyphs—had associated with them sacred chants, which were sung by learned men or bards. Comparative study suggests that they are not so much inscriptions of the words of the chants as mnemonic. They are a puzzle to science, and the most complicated problem of Easter Island culture. Some tablets dealt with ceremonies, others were parts of ceremonies themselves. They were never read, but were used during chanting. No

methodical analysis of the script has as yet been made. It is not phonetic or syllabic, but it may be a form of pictography. There is no doubt that the signs are symbolic and not decorative.

Parallels to the Easter Island tablets are found in the mnemonic devices of the Marquesas, which consist of a cylindrical bundle woven of coconut fibre, from which hang knotted cords. This bundle is often shaped like a human figure, and is supposed to contain the story of the gods. Other truly analogous mnemonic devices were developed in the Cook Islands, Tuamotus, the Society Islands, etc.

The mystery of Easter Island rests on the assumption that the culture of the island was too elaborate to have been invented by the inhabitants found there by the first European visitors. It was assumed that the monuments of the island were the expression of a civilization which had been destroyed either by a natural disaster or by invasion. It has been assumed also that the Polynesians represent a second wave of invasion; but of any theories of the origin of the original inhabitants the only one worthy of scientific consideration is that they were Melanesians. The parallels, adduced in support, however, are vague and indefinite.

As the result of the careful and exhaustive investigations by the Franco-Belgian expedition of the ethnological data now available, including material culture, past and present social structure, and religious belief, it is concluded that Easter Island was occupied by a single wave of immigrants belonging to the Polynesian race. Each region of Polynesia stressed and perfected an aspect of its culture—the Marquesas tattooing and the Maoris wood carving, and jade ornaments; and so also Easter Island came to develop giant statues without the interpolation of a sunken continent or a Melanesian invasion. Easter Island, in fact, is a local Polynesian culture which developed from an archaic and undifferentiated Polynesian civilization.

## FLIGHT AND HABITS OF THE HUMMINGBIRD

SOMETHING close to perfection in flight has been achieved by the tiny hummingbird, the small but relatively powerful wings of which make possible speeds of close to fifty miles an hour and ability to manoeuvre in the air probably superior to that of any other flying creature. This is explained by Dr. Winsor M. Tyler in a bulletin recently issued by the Smithsonian Institution, in which are described the habits of the familiar ruby-throated hummingbird, the only species ever encountered in the Eastern United States.

The wing beats sometimes are at a rate of seventy-five a second. The bird can take off from a perch in about seven-hundredths of a second. It can remain almost still in the air with about fifty-five wing strokes a second.

Perhaps the hummingbird's greatest achievement, however, is its ability to fly backward. This has often been reported and as often questioned as impossible; but recent photographic technique has shown that the reverse flight is an actuality. This is explained as follows:

"In backing away from a flower or feeding tube the hummingbird stands almost vertically in the air with its tail pointing downward and a little forward. In this pose its wings beat horizontally, and what would be the downward half of each complete wing stroke if the bird's axis were parallel to the ground forces the air forward, away from the bird's breast in its upright position, and drives the bird backward. Then, on the return half-stroke, the whole wing is rotated at the shoulder joint so that its upper surface strikes the air, and, driving it downward, balances the pull of gravity."

Other sidelights on this creature's ways of life are explained by the author. The hummingbird's spring migration northward keeps pace with the opening of its favourite flowers. Males and females usually migrate in separate groups. In fact, they remain apart most of the time, except for brief mating periods. The nest is a model of bird artistry, lined with soft plant down and covered on the outside with bits of lichen. It is usually entirely the work of the female.

The newly hatched bird is no bigger than a pea and entirely naked. The young probably are born blind. Growth is very rapid, and in less than two weeks the young birds are almost as big as their parents and able to leave the nest.

The hummingbird sips the nectar from blossoms, but a good part of its food consists of insects. Presumably it was originally exclusively an insect eater, specializing on those types likely to be found around blossoms. In this environment the bird has acquired an unappeasable taste for sweets. A single individual has been observed to devour two teaspoonfuls of sugar daily. A human being with a comparable capacity would devour about fifty pounds.

They show a strong preference for red flowers. This, the author believes, is not due to the attractiveness of the colour *per se* but to the fact that it is always the most striking against a green background.

Hummingbirds often seem to be nervous and irritable. They are intolerant both to each other and to other birds. In spite of their smallness they will attack much larger birds which invade their neighbourhood, relying on their marvellous dexterity of flight to win the conflicts. The special form of attack against a larger bird is a form of 'dive bombing'.

The song is high-pitched and has a "petulant" quality, reflecting the bird's irritable nature. Sometimes the notes are "angry-sounding, mouse-like squeals".

Because of its tiny size the hummingbird meets perils unknown to other birds. There are instances recorded where it has been caught in spider webs. It may become impaled on thorns or stuck to thistles or milkweeds. One instance is cited in which a bird was attacked and destroyed by a dragonfly.

## 'ISLAND' FAUNAS ON THE MEXICAN PLATEAU\*

PROF. EDWARD H. TAYLOR,

UNIVERSITY OF KANSAS

**A**NIMAL life of Mexico is greatly diversified, and may be primarily divided into the lowland types and highland types. The lowland animals are largely an influx from Central America, after the union of Mexico and Central America. The highland fauna is itself extremely diversified. Considering primarily the herpetological faunas, very few species, if any, have spread over the entire highlands. A great many of the species appear to be distributed in groups occupying very limited areas—much like the distribution of animals in a group of islands. Thus south of the Balsas River there is an area that can boast of 64 species—some 22 snakes, 20 frogs and toads, 22 lizards, not to be found elsewhere in the world; and a total absence of salamanders.

To the east a distance of perhaps two hundred miles in the higher part of the adjoining State of Oaxaca is another 'island', perhaps half as large as the preceding, that has 31 species of reptiles and amphibians not known elsewhere—including 7 salamanders, 10 snakes, 9 lizards and 5 frogs. The exploration of this 'island' has scarcely begun.

The highland region about the City of Mexico and to the east, including the great volcanoes of Orizaba and Popocatepetl, the highest, coldest part of the plateau, has some 25 amphibians and reptiles not known elsewhere, including 5 salamanders, 10 snakes, 10 lizards, and 8 frogs and toads. Just north of this plateau cap is an area which includes much of the State of Hidalgo, which has some 30 species that are not known elsewhere in the world, and still is little explored. Farther north around the city of Saltillo is another, similar, but as yet little-explored, area with several species confined to the highlands of this region. Other similar 'islands' occur in the little-explored western Sierra.

Thus in this highland mass of Mexico these groups total about 280 species of reptiles and amphibians, known from nowhere else in the world, each group

occupying its own limited area. Moreover, most of these areas are not contiguous with adjacent 'islands', but are usually separated by some distance. In the Rocky Mountains north of New Mexico and Arizona—a territory nearly as great as that of the Mexican highland—there is apparently not a single endemic species of Reptilia or Amphibia that has evolved.

This 'island-like' grouping of the reptiles and amphibians is not due to strongly differentiated physical or environmental factors of rainfall, temperature, etc., that might normally be expected to limit animal groups into faunal districts; it may in some measure reflect altitude; but they are not typical 'fauna regions'. It would appear that this has been due to ancient isolation.

That these island-like conditions of distribution obtain on the Mexican highlands strongly suggests that much of the evolution of Mexican animals took place prior to the uplift of the highlands; that in this region prior to the uplift there existed groups of islands surrounded by shallow seas—an archipelago perhaps similar to the West Indian Islands of to-day, that had been formed by subsidence of a once continuous land mass that had a rather homogeneous fauna.

Evolution continued for long periods, each island isolated from its neighbour changing the original stock as it could. Then with re-elevation the faunas still reflected their individuality by these island-like areas on the highland.

Further study of the faunas points strongly to the presence of two islands where the present peninsula of Lower California exists to-day, and the probability that the upper was joined to the Mexican mainland and separated from California; that the union between Central America and Mexico was not made until long after the uplift of the Mexican highlands; that the western coast has been sinking in relatively recent times, as shown by close relationships between the faunas of small islands and the mainland along the western coast.

\* Substance of a paper read before the Eighth American Scientific Congress held at Washington during May 1940.

## DECONTAMINATION OF ELECTRICAL EQUIPMENT

THE Government has published full instructions for decontamination of electrical equipment, but, of necessity, these relate only to general conditions and do not deal in detail with the many specialized materials used by the electrical industry. In order to obtain more definite guidance on decontamination of equipment, the North Eastern Electrical Supply Co., Ltd., convened a committee to study this question. A report was submitted to the Ministry of Home Security and was amended according to its observations. The final report approved by the Ministry is now being issued by the Electricity Commission and should form a valuable guide to the industry.

After briefly reviewing the general principles of decontamination, the report states that there will be no immediate danger from the continued operation of contaminated plant, except in the case of bad contamination, when the electrical contamination of the plant itself may alter. There is, however, danger to personnel from the vapour which may arise from the contaminated gear if it becomes warm. The first action is directed towards removing the danger to personnel. Where it is impossible to shut down the plant to carry out complete decontamination, as much as possible should be done and danger notices should be placed on the remaining contaminated parts, with suitable ventilation provided to remove the vapour being given off. Successful decontamination is chiefly dependent on prompt application of the necessary treatment.

Insulating panels and metal can be cleaned by rags soaked in solvent and removing the excess solvent by clean rags. Sometimes solvents are effective. It is necessary in bad cases to strip the surface. Coils should be treated with solvents preferably sprayed on and afterwards wiped dry. In the case of electrical machines, they should be cleaned with solvents as much as possible, and then given a run at full load. The heat generated will vapourize any remaining liquid and so complete the decontamination. Adequate ventilation must be provided to remove the vapour and a gas inspection officer may be required before the plant can be declared free from contamination.

Lead-covered cables can be cleaned with solvents; but when the sheath is damaged the cable should be replaced. In the instructions the effect of blister gases on various insulating materials is shown in a lengthy table. In general, mustard gas penetrates a material, either by creeping along pores or fibres as in paper and brickwork, or by dissolving in the material as in bitumen, paraffin wax, etc. The first-mentioned class allows the gas to evaporate and can be affected by the destructive action of moisture on the gas. The latter class retains the gas for a long time, and only complete destruction is satisfactory. With regard to the type of solvent to be used, light oils have the advantage of being neither toxic nor inflammable. Paraffin is cheap and easily obtainable. A footnote is added to the report on the decontamination of areas affected by calcium arsenide. The most practical method is to hose the area liberally with water. This will at once liberate the arsine gas, which will be rapidly dispersed. Respirators must be worn but anti-gas clothing is unnecessary. On electrical apparatus the powder must be swept off and a blower used on the inaccessible places.

## FORTHCOMING EVENTS

Tuesday, October 8

INSTITUTE OF FUEL (at the Connaught Rooms, Great Queen Street, London, W.C.2), at 2.15 p.m.—Mr. W. Boon: "Some Thoughts on Coke".

ILLUMINATING ENGINEERING SOCIETY (in the Lecture Theatre of the Royal Institution, 21 Albemarle Street, London, W.1), at 2.45 p.m.—Prof. J. T. MacGregor-Morris: "The Arc as a Standard of Light" (Presidential Address).

## APPOINTMENTS VACANT

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

TEACHER OF MATHEMATICS, PHYSICS AND PHYSICAL TRAINING at the Barnsley Mining and Technical College—The Principal, Technical College, Church Street, Barnsley (October 9).

DEPUTY BOROUGH ELECTRICAL ENGINEER—Mr. G. R. Spurr, Borough Electrical Engineer, Electric House, Church Hill, Walthamstow, E.17 (October 18).

DEPUTE ENGINEER AND MANAGER OF THE ELECTRICITY SUPPLY UNDERTAKING—The Engineer and Manager, Electricity Supply Department, Dewar Place, Edinburgh 3 (October 18).

GRADUATE LECTURER IN ENGINEERING—The Principal, Wigan and District Mining and Technical College, Wigan.

ASSISTANT ENGINEER for the DRAINAGE AND IRRIGATION DEPARTMENT, Malaya—The Crown Agents for the Colonies, 4 Millbank, London, S.W.1 (quoting M/9316).

ASSISTANT MASTER for GENERAL SCIENCE AND MATHEMATICS at the Bath Technical College—The Director of Education, Education Department, Guildhall, Bath.

TEACHER OF ENGINEERING (PRACTICAL MATHEMATICS, ENGINEERING DRAWING AND ENGINEERING SCIENCE) at the Falmouth Day Continuation and Technical School—The Clerk to the Governors, District Education Office, Falmouth.

## REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

### Great Britain and Ireland

Edinburgh and East of Scotland College of Agriculture. Calendar for 1940-1941. Pp. 66. (Edinburgh: Edinburgh and East of Scotland College of Agriculture.) [249]

British Museum (Natural History). Economic Leaflets No. 4: Psocids, Book Lice, Dust Lice, etc. Pp. 4. 4d. Economic Leaflets No. 5: Crickets. Pp. 4. 1d. (London: British Museum (Natural History).) [249]

### Other Countries

Bulletin of the American Museum of Natural History. Vol. 76, Art. 9: Lagomorpha and Rodentia other than Sciuridae, Anomaluridae and Iriduridae, collected by the American Museum Congo Expedition. By Robert T. Hatt. Pp. 457-604+plates 7-19. Vol. 77, Art. 33: A Revision of the Rotatorian Genera Brachionus and Platyas, with Descriptions of One New Species and Two New Varieties. By Elbert H. Ahlstrom. Pp. 143-184+plates 2-20. Vol. 77, Art. 4: Studies on the Earliest Primates. By George Gaylord Simpson. Pp. 185-212. (New York: American Museum of Natural History.) [179]

Imperial Council of Agricultural Research. Miscellaneous Bulletin No. 35: Progress of Veterinary Research in India during the Past Twenty-five Years. By F. Ware. Pp. ii+37. (Delhi: Manager of Publications.) 1.2 rupees; 1s. 9d. [179]

Records of the Botanical Survey of India. Vol. 5, No. 5: Plants of the Lloyd Botanic Garden, Darjeeling. By Dr. K. P. Biswas. Pp. iv+369-478. 3.14 rupees; 6s. 3d. Vol. 14, No. 1: A Revision of the Labiatae of the Indian Empire. By Dr. S. K. Mukerjee. Pp. iv+228+VIII. 5 rupees; 8s. (Delhi: Manager of Publications.) [179]

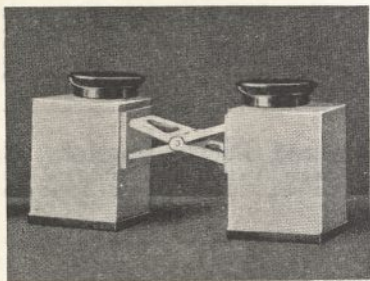
New Zealand. Fourteenth Annual Report of the Department of Scientific and Industrial Research. Pp. 100. (Wellington: Government Printer.) 2s. [179]

Memoirs of the Geological Survey of India. Palaeontologia Indica, New Series, Vol. 30, Memoir No. 1: The Jurassic Brachiopoda of the Namyian Beds of the Northern Shan States, Burma. By Dr. M. R. Sahn. Pp. v+46+4 plates. (Calcutta: Geological Survey of India.) 2.10 rupees; 4s. 3d. [189]

Melk in het buzonder als Zingelingenvoedsel. Door Dr. J. H. de Haas an Ir. O. Meulemans. (Uit de Kinderkliniek der Geneeskundige Hoogeschool te Batavia.) Pp. vii+104. (Batavia: M. Vervoort.) 2.75 f. [199]

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 99: Studies on Chemical Weed-Killers with Special Reference to Skeleton Weed. By C. G. Greenham, Dr. G. A. Currie and F. E. Allan. Pp. 48. (Melbourne: Government Printer.) [259]





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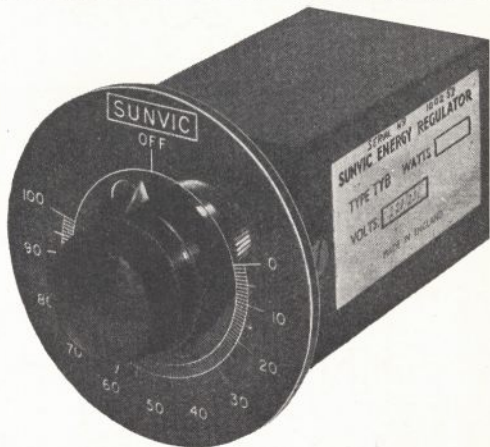
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### OFFICIAL ANNOUNCEMENTS

#### THE RECENT SOVIET CONFERENCE ON GENETICS

Lecture by Prof. J. B. S. Haldane, F.R.S., Saturday, October 5, 2.30, Caxton Hall. Tickets, 1/-, from S. C. R., 98, Gower Street, W.C.1 (Euston 2815).

#### BRITISH POSTGRADUATE MEDICAL SCHOOL

Owing to the calling up of the Librarian, a temporary librarian is required for the duration of the war. Applicant must be a trained librarian, with experience of medical reference work and knowledge of languages; salary, £5 per week. Applications from candidates liable for military service, or likely to become liable in the course of the war, will not be considered. Further particulars may be obtained from the Dean, British Postgraduate Medical School, Ducane Road, London, W.12, to whom applications, with copies of testimonials, should be sent not later than October 16, 1940.

#### THE UNIVERSITY OF LEEDS DEPARTMENT OF AGRICULTURE

Applications are invited for the appointment of three temporary field men, whose duties will include the sampling of soils in Yorkshire, and rendering other assistance to the advisory chemist.

Applicants must possess a degree in agriculture or agricultural chemistry; experience of soil surveying will be an added qualification. The successful candidates will be required to commence as soon as possible.

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Applications, together with copies of two recent testimonials, should reach the Registrar, the University, Leeds 2, by October 15, 1940.

#### UNIVERSITY COLLEGE, NOTTINGHAM

Applications are invited for the position of Laboratory Steward in the Department of Botany. Commencing salary: £3-£3 10s. per week, according to qualifications. Staff pension scheme. Further particulars and form of application, which must be returned not later than Wednesday, October 16, may be obtained from the Registrar.

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Lewkowitsch Bibliographical Bureau (Director: J. Lewkowitsch B.Sc. A.R.C.S.), Barn House, Barn Hill, Wembley Park, Middx. (ARN 3956). Abstracts of papers, summaries of literature, bibliographies. Periodical reports of current literature. Bibliographical researches. Chemistry, Biochemistry, Physics, Geology, Botany, Biology. Any language. Accuracy and completeness. Moderate Terms.

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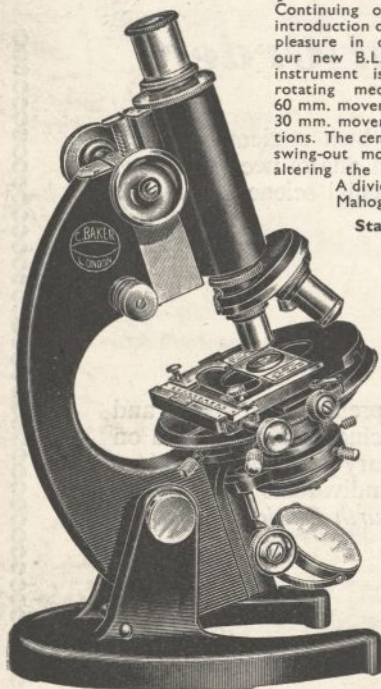


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