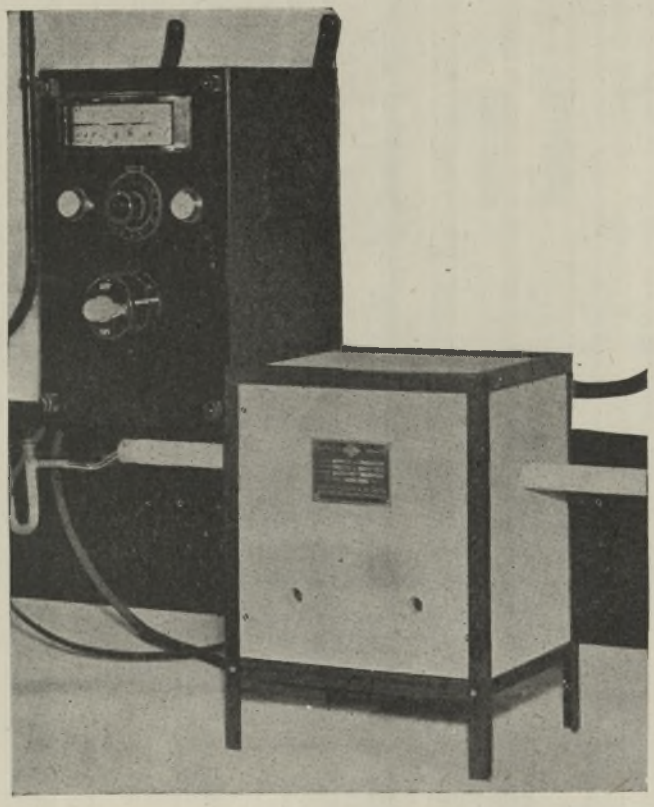
NATURE

"To the solid ground
Of nature trusts the Mind that builds for aye."—Wordsworth

Vol. 156, No. 3958 SATURDAY, SEPTEMBER 8, 1945 ONE SHILLING & SIXPENCE



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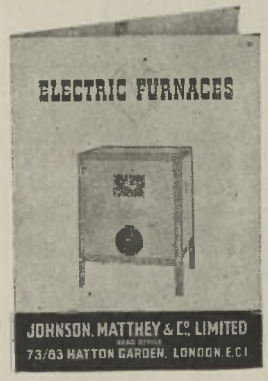

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NATURE

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CONTENTS

Editorial and Publishing Offices
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NATURAL HISTORY MUSEUMS AND RESEARCH

IN recent discussions on the place of museums in the reconstruction of our national life, attention has, not unnaturally, been concentrated on their educational functions. Less prominence has been given to their importance as instruments of research. Nevertheless, there can be little doubt that the expenditure of public funds on museums is justified as much by their contributions to the advancement of knowledge as by their services in the diffusion of information. This is conspicuously the case with the great national museums concerned with the various branches of natural history, where the specimens exhibited in public galleries are only a small fraction of the material available. The vast collections accumulated in the natural history departments of the British Museum at South Kensington, for example, or the great herbaria at Kew and Edinburgh, are of little significance from the point of view of popular education ; yet they furnish an indispensable basis, without which all work on biological systematics in Great Britain would be gravely impeded if it did not become impossible.

It is unfortunately true that the fundamental importance of taxonomy (or systematics) is not fully realized by all biologists. At many British universities the courses of teaching in zoology and botany deal with the classification of animals and plants in a very summary and inadequate fashion, while the methods and conventions of systematics are altogether neglected. It is not uncommon to meet with young professional biologists engaged in teaching or research who have only the most hazy ideas on how to set about the identification of an unknown animal or plant, and who would be completely at a loss if required to draw up a description of a new species. On the other hand, the increasing attention now given to the bearings of biology on practical affairs is leading to a general appreciation of the need for precise determination of the systematic units concerned, and to constant appeals to systematists for help in making these determinations.

It may not be inopportune, therefore, to recapitulate some elementary considerations regarding the functions of museum collections in the service of systematic zoology and botany. These considerations are very familiar to all systematists, but are too often forgotten or misunderstood by those whose work lies in other fields of biological research.

In the first place, museums are essential as depositories for the preservation of type-specimens, that is to say, the original specimens on which descriptions of new species (or lesser systematic units) have been based. No matter how carefully such descriptions may have been drawn up, the advance of knowledge will sooner or later render them inadequate, and the definitive identification of the species can only be settled by a re-examination of the type-specimens. In our everyday measurements of weights and distances, we no longer appeal to comparisons with natural objects—the weight of a grain of corn, for example, or the measure of a quadrant

of the earth's meridian—but to standard weights and measuring-rods preserved in the custody of government institutions. Similarly, the type-specimens are the final standards to which, in subsequent changes of nomenclature, the systematic names must adhere, and by reference to which in cases of dispute the original diagnoses must be expanded and amended.

This leads to another point of importance in the functions of natural history museums. The type-specimens contained in any of the national museums form only a small proportion of the collections stored in them. For example, in the natural history departments of the British Museum the total number of specimens is counted in millions, but the type-specimens cannot amount to more than a few thousands. The question is sometimes asked: "What is the use of amassing and constantly adding to these vast collections?" The answer to this is twofold.

In the first place, no matter how finely we may subdivide our systematic units—species, subspecies, varieties, forms, phases and so forth—the narrowest category will always include some range of variability. No individual animal or plant is ever completely and in all respects identical with any other. To define the limits of this variation, to discover its laws and to explore its correlations, long series of specimens are required, such as are only to be found in the larger museums, and it is there alone that such studies can be profitably pursued.

In the second place, the discovery of new forms, whether of specific or infra-specific categories, sooner or later necessitates a re-examination of the characters of the related forms already known. Every systematist knows that new species are constantly being discovered which differ from their nearest allies in respect of characters which previous workers have not thought it necessary to take into account. When this happens, a revision of the whole group, be it species or genus or family, must be undertaken. This revision and re-ordering of the forms that are supposed to be already 'known' is the most urgent task confronting systematists, and it is one that can only be profitably approached with the help of the large museums.

To sum up, a precise and detailed taxonomy is an indispensable foundation of all biological research; instruction in the elements of taxonomic practice should form part of the training of all biologists; the custody of the standards of this taxonomy is as much the business of the State as the custody of the standards of weights and measures; the maintenance of large collections carefully preserved and arranged and accessible to all qualified workers is essential if the study of taxonomy is to keep pace with the increasing demands made upon it by workers in other fields of biological science, both 'pure' and 'applied'. No one, nowadays, is likely to question the immense part which museums have to play in popular education or to grudge the expenditure of public funds required if they are adequately to discharge this function. At the same time, however, it is to be urged that the importance of the 'study collections' in the national museums for the future development of biology in Great Britain should not be lost sight of, and that the relatively small expenditure required for their accommodation, staffing and continued development should be given a high priority in the national provision for the support of scientific research.

METHOD IN SOCIAL STUDIES

Methodology of the Social Sciences

By Prof. Felix Kaufmann. Pp. ix+272. (London, New York and Toronto: Oxford University Press, 1944.) 20*s*. net.

PROF. F. KAUFMANN, formerly of Vienna and now at the New School of Social Research in New York, has long been concerned with problems of methodology. Here he attacks the most difficult of them, the methodology of the social sciences, though only in the second and shorter half of the book. In the first half he surveys the general problems of scientific method, because of his belief that its chief issues are broadly identical in the natural and the social sciences, the difference between them being merely one of degree. In the contrast between deductive reasoning and empirical procedure, around which he weaves his main argument, the author sees the key to "the solution of many apparently unrelated problems in natural and social science".

The book covers a great deal of ground, much of it familiar, and inevitably the argument is very condensed. Its central purpose is to demonstrate the meaning of methodology as an "autonomous discipline", the author having described in an earlier contribution its task as that of making explicit—"to collect, systematise and justify"—the general assumptions which in making empirical statements the man of science takes for granted. In the present work Prof. Kaufmann amplifies that statement and says that the task is to make explicit the theoretical laws implicit in social science and their interrelation with one another and with physical laws. Perhaps his position can be indicated most fairly by giving two central points in his own words: "Most methodological issues in social science are directly or indirectly concerned with some aspects of the relations between natural science and social science, particularly the extent to which the methods of the former are appropriate to the latter". But the "comparison of physical laws and social laws has been misled by erroneous preconceptions concerning the nature of the former. Physical laws have been contrasted as necessary or strict laws with mere rules or tendencies prevailing in the social field. But as soon as it is realized, first, that no synthetic proposition is necessarily valid, and, secondly, that many physical laws, among them the most general laws, are not strict (empirical) laws either, this contrast is seen to be of no fundamental methodological significance". Elsewhere the author grants that social laws are "less precise" than physical laws, but insists that the difference is one of degree, and that many "rather precise" predictions of events can be made in the social world.

This is a painstaking study, and the author's views are generally stated with moderation, but many of them are debatable. Perhaps three general criticisms may be more to the point. (1) The argument is not helped in a book which is meant to be an essay in clarification by the use of terms which are clumsy

and obscure, such as 'introspectionism', 'dimensions of relationality', and so on. This is made worse by inadequate editing, which has often allowed a wrong use of ordinary words, such as 'confounded' for 'confused', etc. (2) The author endeavours to reduce the logical gap between methods in natural and social science, and generally his formal argument is plausible enough; but at times he strains it beyond the point where it could stand up to his own tests. That is often evident in his concrete illustrations. "Rather precise" is scarcely scientific, all the less so when to show the possibility of social prediction one has to come down to so naïve a level in the scale of proof as to say that "we have a rather definite idea about what will happen to a letter that we mail or to a railway train for which we have purchased a ticket"; or has to reach out beyond any legitimate range so as to claim that the biological side of man is part of social science. (3) The whole elaborate argument does not in the end get beyond the old and hard problem, with its two distinct aspects. One is the logical use of the intellectual instrument, whichever the discipline; the other is the application of the knowledge thus acquired to the building up of generally valid propositions. Here we are faced with the awkward experience that the more systematic a social discipline or school has tried to be, by the somewhat forced use of exact methods, the more dogmatic have tended to be its conclusions, so that often method became identified with doctrine. The author mentions how the controversy about scientific method between the behaviourist and the psychoanalytical schools of psychology clearly showed that each party really wanted to justify not a general method but its particular theory.

Prof. Kaufmann himself says that in this field scientific results must be judged in the light of their success. The social sciences have been much favoured in England, yet the great scholars who have pioneered and led in this field have spent little time on discussions of methodology as such. The interest in methodology has been greater among French scholars, whose logical bent inclined them to seek for universal formal laws, and especially among German scholars, always in search of some metaphysical system; and more recently in America, where bent and facilities have led to heavy labours in the statistical field. In a sense, that intense specialization in the pursuit of the 'scientific' has delayed the synthesis which alone could illuminate the heart of the social problem. Social causation is a matter of an eternally varying interrelation of things; and understanding will come to us not through any set general method, but, as hitherto, through the sensible appraisal at any given time of the several sides of man's life in society.

DAVID MITRANY.

MORBID HISTOLOGY OF THE EYE

A Pathology of the Eye

By Eugene Wolff. Second edition. Pp. vii+285. (London: H. K. Lewis and Co., Ltd., 1944.) 42*s*. net.

THE study of ocular pathology occupies a somewhat anomalous position in general pathology. In contrast to the extensive knowledge on the comparative anatomy of the eye, there is little systematized information on comparative pathology. In human pathology, the position of this specialized study is likewise unsatisfactory. Clinical ophthalmology is probably the most exact of the medical disciplines, for the diseases of the interior of the eye are almost as readily amenable to direct inspection as those of the outer eye. The wealth of biomicroscopic and fundus studies is, however, poorly supported by histological findings. Eye disease rarely leads to death, so that the special eye institutions have only very occasional opportunities of post-mortem examination, while such eyes as are removed in life generally show extensive secondary complications which have led to the removal of the eye; the primary processes themselves are not often seen under the microscope.

For these and other reasons the literature on ocular pathology is sparse and contradictory. If, in addition, ocular pathology is taken in a wider sense to include the mechanism of the disease-processes of the eye, and not merely anatomical end results, an unsatisfactory state of affairs almost reaches exasperation. Any attempt at a systematization of ophthalmic pathology must therefore be regarded with gratitude by the reader and as a Sysiphean task by the author. There are few such studies in English; that by Collins and Mayou represented the most ambitious attempt, both in scope and in its search for an etiological basis for a mass of disconnected histological features. Its obsolete histological interpretations, and its somewhat forced classification, make that book no longer serviceable. Mr. Eugene Wolff brought out a less ambitious attempt some five or six years ago. His "Pathology of the Eye" was essentially an account of what is known of the morbid histology of the common clinical conditions. Its excellent illustrations supplemented a rather elementary text, but the whole constituted an adequate text-book on the morbid anatomy of the eye. It has filled a gap for the student and practitioner, and the second edition shows considerable expansion. The author has wisely curtailed much redundant clinical information that appeared in the first edition, thus making room for further details on morbid histology. There is, however, little in this volume on the wider aspects of pathology as distinct from morbid histology.

In spite of war conditions the high standard of production noticeable in the first edition has been maintained.

SOCIAL PSYCHIATRY

Man and his Fellowmen

Modern Chapters on Social Psychology. By Dr. Samuel Lowy. Pp. xiv+194. (London: Kegan Paul and Co., Ltd., 1944.) 15*s*. net.

THE author of this book is quite evidently better equipped for discerning the social-psychological problems of our times than he is for elaborating the solutions to those problems. Indeed, his suggested solutions, apart from certain valuable exceptions, are inspired by a pathetically child-like confidence in the omnicompetence of the State. He offers no grounds to support his implied contention that the State itself is immune from those psychological ills from which the people as a whole are suffering.

No one should, however, be deterred by this criticism from buying and reading the book. In such a complex field, to point out the problems accurately, and to lay down the solutions unerringly,

would call for a superman, and such a stature Dr. Lowy would be the last to claim. But he has certainly produced a valuable, readable and acute discussion, covering a very wide range of topics, of the psychological factors which lie at the root of the troubles which disorganize, disintegrate and devitalize the social body. Though I have several reservations regarding the author's proposed remedies in detail, yet I emphatically agree with him that many of these troubles are remediable and, in principle, easily remediable. We are to-day needlessly squandering a vast amount of human spiritual energy, and the social psychologist can point the way to greatly enhanced human happiness, both for the individual and for the social group.

No one with knowledge of the facts will be likely to challenge the statement that the volume of psychological disability to-day is vastly in excess of the facilities which exist for dealing with it. Even in the mental hospitals, only a small proportion of patients suitable for psychological treatment can in fact receive such treatment. Non-institutionalized sufferers form a far larger proportion of the general population than is commonly suspected—indeed the proportion is so high that adequate therapeutic provision for them is beyond the realm of practical possibility. Prevention is always better than cure, but where the evil is widespread and increasing and cure is impossible, prevention becomes simply imperative. Dr. Lowy makes a very comprehensive survey of the field in which such preventive psychiatry should operate, and one can easily agree with him that this work is unlikely to be undertaken to an adequate extent without considerable encouragement and initiative on the part of the State. Perhaps the most immediate need is that for greatly increased popular enlightenment on the subject. This need not involve the danger, no doubt anticipated by some, that an increased interest in psychological aberrations will itself breed such aberrations, for there is a large accumulation of sober, simple, unsensational and scientifically authenticated facts which clamour for immediate application to the important business of living together efficiently and happily. There are encouraging signs of a growing demand for such popular psychological enlightenment, and it is important that this demand should be met by a form of instruction well conceived both as to method and to content.

A further edition of this book, which we may confidently expect, will provide an opportunity for the weeding out of several teutonisms which have escaped the reviser's eye. J. Leycester King.

EXPERIENCES OF A WOMAN FARMER

Four Years Harvest

By Frances Donaldson. Pp. 115+16 plates. (London: Faber and Faber, Ltd., 1945.) 7*s*. 6*d*. net.

SOME four years ago Mrs. Donaldson, tiring of town life, started farming. She had neither previous experience nor close association with the land; all the preparation she allowed herself was a six months course at the Moulton Agricultural Institute, Northampton. She did not even give herself the twelve months apprenticeship on somebody else's farm, usually recommended as the least costly way of gaining experience; she straightway purchased and stocked a Midland clay farm of 375 acres. At the end of the first year she wrote a book, "Approach to Farming", describing her experiences as a beginner; she also gave some talks for the B.B.C. and had some very direct things to say about the process and the announcers which a man would either not have noticed or not have mentioned. That part of her work was clearly successful, and her farming was satisfying enough to induce her to continue; now at the end of the fourth season she gives us another book in which she sets out quite frankly both her successes and her failures.

The human aspects of farming loom far more largely in the book than the technical problems, and Mrs. Donaldson not only knows her mind but also has a vivid way of expressing it. She was not at all impressed by the 'technicians': "I think there is no one so smug, so unreasonably conceited, so bigoted and so invulnerable . . . in order to strengthen his self-importance he is driven to obscure, to render exclusive and immeasurably difficult that which he knows". Nor are officials more pleasing in her sight, with one single exception who, "curiously enough, was a man of distinction, personality and brains". The filling up of forms, which under the present system of controls in Britain has become almost a new industry, invokes some scathing comment: "there is something peculiarly nasty about form filling. If you wish to apply for a few yards of piping to lay some water on to a field you have to fill in the same form as you would use if you wished to build a £100,000 factory". Yet at the end of the book Mrs. Donaldson advocates nationalization and more form filling, more control, which of course would mean more officials. If all this came about we should await with interest another book from Mrs. Donaldson setting out her further experiences with the very considerable clarity she commands.

The reader will have judged that the author is a lady of marked personality and will readily understand that, having selected a farm staff that she liked, found some good farming friends to advise her, and arrived at a system of farming that she liked, she is making a success of it. This is all to the good, for there is no doubt that an infusion of women into the agricultural community would strengthen it. For many years now there have been successful women farmers; but it is only in recent times that the general public has known much about them. But it should not be inferred from Mrs. Donaldson's book that farming can be successfully tackled by any woman after only six months training. She has been fortunate in her time of starting: it has been a period of rising prices and of considerable willingness on the part of members of the agricultural community to help each other, while the War Agricultural Committees have been in a position to undertake work requiring big implements such as combines and dryers, the advantage of which Mrs. Donaldson gracefully acknowledges. There was a similar favourable period in the War of 1914–18 and for a time afterwards. But then came the slump. Whether that will happen again no one can tell. Meanwhile any woman who thinks of taking up farming would do well to read Mrs. Donaldson's experiences, for she will learn from them about the wide range of difficulties, technical and human, with which she will be confronted, and of the ways in which they were overcome. E. John Russell.

Society of Chemical Industry

Annual Reports on the Progress of Applied Chemistry. Vol. 28, 1943. Pp. 517. (London : Society of Chemical Industry, 1944.) 20*s*.

THIS volume surveys progress under the following principal headings : chemical engineering, plant and machinery ; fuel ; gas, destructive distillation, tar, and tar products ; mineral oils ; intermediates and colouring matters ; fibres, textiles, and cellulose ; pulp and paper ; acids, alkalis, salts, etc. ; glass ; ceramics, refractories, and cements ; iron and steel ; non-ferrous metals ; electrochemical and electrometallurgical industries ; fats, fatty oils, and detergents ; plastics ; resins, drying oils, varnishes, and paints ; rubber ; leather ; soils and fertilizers ; sugars and starches ; the fermentation industries ; foods ; fine chemicals and medicinal substances ; photographic materials and process ; sanitation and water purification. F. Rumford concludes that the study of chemical plant design is being neglected, or at least under-publicized, in Great Britain. W. W. Goulston refers to the influence of the cargo aeroplane and the application of jet propulsion on the future production programme of the petroleum industry. J. Grant welcomes plans for the formation of a research association for the paper-making industry. P. Parrish and F. C. Snelling anticipate a large post-'armistice' demand for fertilizers and remark on the enthusiastic reception in Britain of National Growmore fertilizer. J. Woolman records the use of the electron microscope for investigating the structure of steel. J. Hofton points out that security needs may have given the impression that Great Britain is 'tailing along' behind the United States in developing the plastics industry. T. R. Dawson states that the search for rubber-bearing plants has added little to the prospect of supplies. B. M. Brown mentions the substitution by British brewers of part of the barley malt by unmalted oat flakes. N. Evers emphasizes the importance of recent expansion in the production of mepacrine (the substitute for quinine) and penicillin.

Science and the Idea of God

By William Ernest Hocking. (John Calvin McNair Lectures.) Pp. xi+124. (Chapel Hill, N.C. : University of North Carolina Press ; London : Oxford University Press, 1944.) 9*s*. 6*d*. net.

IN *Nature* of May 1, 1943, there appeared a survey of an American manifesto on Education for Citizenship, in the course of which special attention was directed to the contribution of Prof. W. E. Hocking of Harvard. The theme of his choice was the role of philosophy in that branch of education. This seemed an odd choice until he made it clear that he regarded philosophy, not as a luxury subject with no bearing on the daily bread of education, but as the sum of men's working beliefs, implicit in "every editorial, every play, every sermon, every novel, almost every conversation". He united learned acquaintance with the great philosophers and determination to see things with his own eyes, and he struck out his own line.

Prof. Hocking's latest book takes us back at once to the "conflict between religion and science" which waged last century. The conflict seems to have subsided on terms of mutual toleration. The scientific man is apt to get on with his job on the understanding that God never interferes. Religion replies that this is "equivalent to tolerating a dead God". Prof. Hocking sharpens this issue by putting it in the form of a dilemma : (1) God must not interfere in scientific business ; (2) God cannot be an inactive cipher in human affairs. He then takes the reader through a closely knit argument, designed to show that science and religion, though sharpening and then solving their contemporary dilemmas, are "brought into a fertile union in which the idea of God is enriched". The book is not, and could not be, easy reading ; but it will make a stirring appeal to many a man of science.

Politics and Morals

By Benedetto Croce. Translated from the Italian by Salvatore J. Castiglione. Pp. v+204. (New York : Philosophical Library, Inc., 1945.) 3 dollars.

FROM the bibliography of Croce by Castellano (1936) it may be inferred that most of the essays here translated appeared in 1925 ("Elementi di Politica"), but that some of those added to the 1931 volume ("Etica e Politica") are included. Translator and publisher omit this and all other information.

Croce's writing is diffuse and his method rhetorical, but he has something valuable to say, and what he wrote after the first World War may be relevant to the aftermath of the second. History, for Croce, is a process of conflict between rival tendencies and aims in the course of which the human spirit creates itself and attains freedom. One aspect of this conflict is that between mere force or political power and moral ideals. Perhaps the most valuable point he makes is that political theories are always in the first place political programmes, and only in the second are they attempts to find a rational basis for them. Even so they generally suffer from fallacies of abstraction, imitating the abstractions of natural science without the technical justification these have in their own sphere. Recent efforts to label political theory 'sociology' do not alter the case. A. D. RITCHIE.

The Bates Method for Good Sight without Glasses

By Dr. William H. Bates. Pp. 160. (London : Faber and Faber, Ltd., 1944.) 10*s*. 6*d*. net.

THOSE who are at all interested in the subject of this book are probably very well acquainted already with Mr. Aldous Huxley's book "The Art of Seeing". One of Mr. Huxley's motives in writing that book was to repay "a debt of gratitude to the pioneer of visual education, the late Dr. W. H. Bates, and to his disciple, Mrs. M. D. Corbett", to whose skill as a teacher he owed the very heavy debt of improvement in his own vision when his case seemed hopeless. Mr. Huxley's general position, following Dr. Bates, is that the orthodox ophthalmologist has paid exclusive attention to one aspect of the complex process of seeing, the physiological, and has ignored the mind, which makes use of the eyes to see with. Unfortunately, Mr. Huxley is incapable of writing anything but a very clever book ; a short and easy set of advice and suggestions would have been far more acceptable to many a reader.

The original edition of Dr. Bates' book was published more than twenty years ago. This new and revised edition omits unnecessary technical material, but includes all that is deemed necessary for a layman's use. Dr. Bates based his theory of course upon visual re-education, instead of mechanical aid in the form of glasses. The object of this brief notice is simply to pass on this information. No attempt is made to decide the issue "when doctors disagree".

SCIENCE IN THE U.S.S.R.*

GEOLOGY AND PALÆOBOTANY

By W. N. EDWARDS
British Museum (Natural History)

MUCH has already been written on the expansion of geological research and the development of mineral resources in the U.S.S.R. during the last quarter of a century, and the Seventeenth International Geological Congress held in Moscow in 1937 provided an opportunity for viewing some aspects of that work in the field and in the laboratory, while the sessions and the publications of the Congress summarized achievements to that date. In June of the present year some British geologists were invited to resume personal contact with Russian colleagues, and to learn something of their recent progress on the occasion of the 220th jubilee celebrations arranged by the Academy of Sciences of the U.S.S.R., only a few weeks after the cessation of hostilities in Europe.

Although activities during the past few years have been dominated by the necessity for prospecting for new deposits of various strategic minerals and for further developing previously known deposits, a great deal of incidental stratigraphical, palæontological and tectonic work has been accomplished. The end of the War therefore brings a rich harvest of important monographs and maps awaiting publication, while the release from the urgent necessity of dealing with practical demands means that now, as the veteran Academician V. A. Obruchev said at Moscow, "it is the theoretical problems that claim our closest attention".

The geological map of the whole of the Soviet Union on the scale of 1 : 5,000,000, edited by D. V. Nalivkin and published in 1937, was partly based on a series of regional manuscript maps on larger scales, and many of these maps have since been published. The Central Geological Prospecting Institute, directed by I. I. Gorsky, is now in process of issuing the sheets of a map again planned to cover the whole of the U.S.S.R., this time on a scale 1 : 1,000,000 ; European Russia is already completed, as well as considerable areas of central Asia. A new map of the Urals (in preparation) will endeavour to show stratigraphy, tectonics, useful minerals, drift and lithology on the same map. The only regions where geological surveying has not been carried out in any detail are certain areas of north-east Siberia, where the frozen terrain is exceedingly difficult ; these regions will probably be left until last in the programme for mapping geologically the whole of the U.S.S.R., but are by no means being neglected in the meantime, for a special Institute for the Study of Permanently Frozen Ground has been set up by the Academy of Sciences under the direction of V. A. Obruchev, with headquarters in Moscow and field stations at Igarka and Yakutsk.

Among publications of the past decade, pride of place should be given to the several different series of volumes planned to cover all aspects of geological science for the whole of the Soviet Union. "The Geology of the U.S.S.R.", edited by J. S. Edelstein, is arranged on a regional basis and will extend to twenty-seven volumes, of which six have appeared so far, on the Urals, Donetz Basin, Kuznetzk Basin, Transcaucasia (two) and Eastern Kazakstan. "The Stratigraphy of the U.S.S.R.", of which volume 1 on the Pre-Cambrian appeared in 1939, will be completed in fifteen volumes. In addition to "The Palæontology of the U.S.S.R." and the "Monographs of Palæontology", there is an "Atlas of the Leading Forms of the Fossil Faunas of the U.S.S.R.", of which some four or five volumes have appeared and another half-dozen are ready for publication. There are also series on the "Minerals", the "Petrography", the "Pegmatites", and the "Soils of the U.S.S.R.", "The Mineralogy of the Urals", and Obruchev's "Geology of Siberia" in three volumes. Six volumes of the Proceedings of the Seventeenth International Geological Congress were issued in 1939 and 1940.

Soviet geology has suffered the loss by death of three of its most distinguished leaders during the last year : A. A. Borissiak (1872–1944), who after an early career in stratigraphy and tectonics became the leading vertebrate palæontologist in the country, V. I. Vernadsky, the veteran mineralogist (see *Nature*, March 10, 1945), and A. E. Fersman (see *Nature*, July 7).

In palæobotany, much important work has been done recently on the floras of successive horizons in the upper Carboniferous and Permian of the Asiatic parts of the Soviet Union. A question which has interested palæobotanists for nearly half a century is the supposed occurrence of elements of the southern hemisphere *Glossopteris* flora in Siberia. *Glossopteris* itself was first reported, but not figured, by Amalitzky, who was not a botanist. Since then a number of other *Glossopteris*- and *Gangamopteris*-like forms have been described by Zalessky and others; but many palæobotanists outside the U.S.S.R. have long felt dubious about the value of these records. The whole problem still awaits detailed examination, but recent and still largely unpublished work by Maria Neuburg, who kindly showed me some of the material on which her conclusions were based, proves that some at least of the supposed glossopterids are absolutely distinct.

A promising discovery of a rich upper Triassic deposit of plants with well-preserved cuticles has been announced by Prinada, and S. N. Naumova has ready for publication an extensive monograph on the spore- and pollen-content of strata of various geological horizons. The detailed description of Upper Cretaceous and Tertiary fossil plant assemblages and the delimitation of past floral provinces is being continued by A. N. Kryshtofovich and others. Kryshtofovich has recently published, as one of the volumes in the "Palæontology of the U.S.S.R.", a complete index of the fossil flora, which includes every reference to fossil plants of all ages from all parts of the Soviet Union ; with the vast increase in the literature of the subject such works are absolutely indispensable.

Two very able young palæobotanists lost their lives on active service during the War : K. K. Shaparenko, who had written on *Ginkgo* and on *Liriodendron*, and A. V. Yarmolenko, noted for his work on upper Cretaceous plants and particularly on fossil woods.

The flexibility in the organization of scientific research in the Soviet Union, leading frequently to the combination of previously separate bodies or journals,

* Continued from page 259.

and the habit of changing the names of institutions, is apt to be confusing to outsiders. The Academy of Sciences presented all those who attended the Jubilee Celebrations with a finely produced volume of more than three hundred pages which describes in detail all the sections and institutes of the Academy itself; this is a most useful and up-to-date work of reference but is not, of course, all-embracing. The compilation of a directory of all scientific institutions, giving not only their present but also their previous names, addresses, functions and publications, would be an inestimable boon.

PHYSICAL CHEMISTRY

By Prof. C. N. HINSHELWOOD, F.R.S.
University of Oxford

A VISIT to the scientific institutes of Moscow and Leningrad leaves one with several vivid impressions. Perhaps the strongest is that of a numerous and enthusiastic community of scientific workers, led by the most eminent scholars of the country, housed in excellent buildings, well equipped with all the facilities necessary for their work, and enjoying a nation-wide prestige which must be almost unprecedented in the history of learning.

The institutes have passed through a period of great difficulty, having been uprooted by war and evacuated to other parts of the country: as one of the directors remarked, "Two evacuations are about the equivalent of one earthquake". Nevertheless, the return to normality has gone on with remarkable speed: and new institutes seem to arise in the course of a few months. On the outskirts of Moscow, overlooking the river, and adjoining what will presently be a splendid park, stand the laboratories of Academician Kapitza and of Academician Semenov. The latter laboratory has been converted from a very fine old house and has been entirely refitted in a very short space of time to accommodate work which is now being permanently transferred from Leningrad to Moscow. The appreciation of the fact that scientific work flourishes best in serene and agreeable surroundings seems to be general. The psychology is sound, and we must hope that a similar understanding will be shown by those responsible for establishing new research centres in Britain.

It was also interesting to observe that, despite the exigencies of war, there had been a general realization of the importance of maintaining long-range fundamental research; indeed, while admiring the breadth of view which seemed to have been shown by those directing the general policy, one wondered a little uneasily whether too much of the future in our own country might not have been sacrificed to immediate needs.

Various members of the Academy of Sciences discussed quite frankly with their visitors certain aspects of their present arrangements which they have found not quite satisfactory and which they are in process of modifying. There is, for example, a feeling that in the past the organization of the work in laboratories was rather too centralized, and that for the best results rather more decentralization is beneficial. Another aspect of the same thing is that the great institutes have tended rather to overshadow the universities in research, and that the position of the latter will probably need strengthening. On the other hand, students from the universities actually do part of their work in the research institutes, so that a measure of valuable co-operation comes about. One can scarcely expect that in a vast and rapidly evolving country like the Soviet Union any of the forms of society have yet reached their stable level; but it is most gratifying to feel that in scientific matters the future seems, so far as can be judged, to be largely in the hands of the best men of science themselves.

It is only possible to mention specifically a few of the institutes and laboratories in which physico-chemical work is in progress. In Moscow there is the Institute of Academician Frumkin, which deals with problems of colloid science, taking the expression in the widest sense, which includes the study of adsorption, catalysis and electrokinetic phenomena. Beautiful experiments on the motions of charged mercury droplets in different solutions were demonstrated by Frumkin himself and discussed in a lecture during the anniversary celebrations of the Academy last June. In Moscow also are two new institutes, one presided over by P. Kapitza, known as the Institute for Physical Problems, and the other the Institute of Physical Chemistry, presided over by N. Semenov (whose name, English chemists should know, is pronounced Semyónov). The work of the former deals largely with low-temperature phenomena, and although much of it, especially the brilliant investigations on the properties of liquid helium, is of the greatest interest to physical chemists, it is perhaps best dealt with under the heading of physics. The Institute of Academician Semenov, recently transferred from Leningrad, houses a school of workers who, under the inspiration of their chief, have made one of the most characteristic of the Russian contributions to modern physical chemistry, namely, the intensive study in all their aspects of the phenomena of flame, combustion and explosions. The work of Semenov on the theory of branching reaction chains and the interpretation of explosion limits, thermal and non-thermal explosions, degenerate explosions and so on, is too well known to need description. Some of the more recent work has included ingenious studies of the way in which chemical reactions may be initiated upon a solid surface and propagate themselves into the whole volume of the material. Another development is the study of the surface electrical conductivity as a means of investigating films in which catalytic reactions occur. Much interesting work is being carried out on the part played by hydrogen atoms and hydroxyl radicals in reactions (some of this work in the Semenov Institute, some in the Frumkin Institute). It would be extremely difficult in a short account to mention individual workers; but perhaps I might remark how illuminating I found the contributions of Zeldovitch on the fascinating but extremely difficult problem of the rate of propagation of flame through combustible mixtures. This subject is of the greatest practical importance and of considerable theoretical interest, and the recent contributions maintain the traditions of the Semenov school.

It is not surprising at the present time to find much work of a physico-chemical nature going on in the Organic Chemical Institute in Moscow, especially in the high-pressure laboratory and in the sections dealing with catalytic reactions (Balandin and others).

In Leningrad it is hard to say whether the great Physico-Technical Institute, of which the head is

Academician Joffe, is of greater concern to physicists or to physical chemists. A great variety of problems are under investigation and many of them with a view to their ultimate practical application, but without any sacrifice of the fundamental scientific approach. Among the most important are: (1) the study of the remarkable properties of the thallium sulphide photo-cell, (2) the study of fibres and high polymers, and (3) a very intensive investigation of the properties of that important class of substances known as semi-conductors. In talks with some of his guests last June, Joffe explained some very liberal-minded views on the organization of research. While explaining that science was carried on for the benefit of the community, he expressed ideas on the practical realization of its aims from which the most individualistic would have had little cause to dissent.

In all the various institutes there is a lively appreciation of most of the problems which have occupied English-speaking countries of late years, and characteristic contributions are being made to most of them: kinetics and the transition state theory (Syrkin, Roginsky, Temkin and many others), photochemistry (Terenin, Kondratiev), and so on.

To watch the evolution of this great consciously directed effort will be of extraordinary interest in the next few years. In this connexion another matter arises. The knowledge of English is very widespread among our Russian colleagues. Is it not high time that we began to provide the corresponding advantage for our own younger generation of scientific men?

SURFACE CHEMISTRY

By Prof. N. K. ADAM, F.R.S.
University College, Southampton

DURING the recent celebrations of the 220th anniversary of the foundation of the Academy of Sciences of the U.S.S.R., I had the opportunity of seeing something of the very extensive and thorough researches which are in progress in surface chemistry in that country. Naturally, most of this work is being done in the Institute for Colloid and Electrochemistry, in Moscow, which is directed by Academician A. N. Frumkin; but some work on surface phenomena is going on elsewhere also.

Two lines of work appeared of exceptional interest on account of their novelty and their potentialities for extension and for practical application; these are the investigation of the promoting effect of small amounts of adsorbed gases on the catalytic power of metals, by S. Z. Roginsky and others, and of the influence of films adsorbed in the sub-microscopic cracks in solid surfaces on the tensile strength and hardness of solids, by P. A. Rehbinder and his team. Roginsky[1] finds that, as a rule, really clean metallic surfaces of platinum, nickel or tungsten have little or no catalytic power; but if a small quantity of oxygen, hydrogen or nitrogen is adsorbed on the surface, they become excellent catalysts for such reactions as the hydrogenation of ethylene. The adsorption of larger amounts of gas reduces the catalytic power, which finally diminishes to zero again when a large quantity of gas has been adsorbed. The maximum catalytic power is attained at a quite sharply defined concentration of gas adsorbed on the surface; when the amount of gas adsorbed is half, or double, that required for maximum catalytic power, the rate of the reaction is often only one fifth to one tenth of the maximum, sometimes even less. It is claimed that these catalytically active adsorbed layers, or patches covered by adsorbed layers, are remarkably stable and persist for some considerable time during which the catalysed reaction is taking place.

Rehbinder[2] has shown that such adsorbable substances as long-chain fatty acids very greatly increase the facility of slip in the glide planes of monocrystalline wires of metals, even when these are as thick as one millimetre; and also decrease greatly the tensile strength and hardness of such solids as mica, particularly when the solids are being deformed by stress. This is due to the penetration of the 'Griffith' micro-cracks found in the surface of all solids by adsorbed films, wedging open these cracks and consequently weakening the solid; and, one is tempted to suggest, possibly lubricating the slipping of one layer of the solid over another. This phenomenon may prove to be of importance in connexion with the use of fatty acids and similar substances for lubricating purposes.

One very interesting consequence of this adsorption in micro-cracks is shown when a polarizing electric potential is applied to a solid immersed in a solution of an electrolyte[3]. At that polarizing potential at which the electric charge on the solid becomes zero, there is no adsorption of ions on the solid surface from the electrolytic solution, and consequently no diminution of hardness of the solid. As the potential departs from this value, either positively or negatively, so does the concentration of adsorbed ions increase, with a consequent decrease in hardness of the metal. In fact, the curve showing the dependence of the hardness on the polarizing potential has a roughly parabolic form with a maximum hardness at the 'null' potential, in exactly the same way as the electrocapillary curve of mercury in solutions of electrolytes shows a maximum of interfacial tension. The maximum of hardness is found to be influenced by the presence of ions with high specific adsorbabilities, or by neutral organic substances, in a way very similar to that in which such substances affect the electrocapillary curve. Thus something closely similar to the electrocapillary effect can now be studied with solids. In one case at least, tellurium[4], it is said that the maximum of hardness occurs at a *positive* value of the polarizing potential, an unusual sign for the potential at the maximum.

Extensive studies on the viscosity and other mechanical properties of monolayers on water[5] as well as their influence on the stability of bubbles[6] are in progress, the results confirming and extending earlier work: A. A. Trapeznikov is also studying the effect of temperature on the spreading pressure of solids on water in very great detail[7], finding new phenomena which he claims are due to the hydration or entry of water into the solid or liquid fatty substances which spread, in the bulk phase as well as in the monolayers. V. Levich, in a mathematical investigation[8], concludes that the damping of ripples by surface films can be ascribed to their low compressibility.

B. Derjaguin is continuing a long research[9] on the distance to which the influence of a solid surface extends into liquids in contact with the solid, using a variety of methods. These include measurement of the thickness of layers of liquid remaining under definite conditions of draining, between an air

bubble and a glass plate against which it is pressed, or between two air bubbles; in other experiments the thickness of liquid remaining on a glass plate, or in a wedge-shaped slit, when a strong current of air blows most of the liquid away, is measured. Optical interference methods are used; and although complex hydrodynamical effects are clearly involved, there seems good evidence that some degree of structure, with considerable anomalous viscosity, persists far into the liquid in such cases as solutions of aluminium naphthenate, and perhaps other long-chain substances, in mineral oils. The effect may perhaps extend as far as half a micron into the liquid. This work also may be of importance in the theory of lubrication.

A. Schuchowitzky has applied statistical methods to adsorbed layers at the surface of solutions[10], and A. B. Taubman[11] draws deductions from surface tension – concentration curves as to the orientation of many organic substances dissolved in water, including heterocyclic compounds, at the air – water surface.

S. Roginsky is attempting to develop a general theory of the conditions for activation of heterogeneous catalysts[12]. At present, this appears to be couched in somewhat generalized terms, but one important point is the claim that the 'degree of supersaturation', a term used for the decrease of free energy, or extent of departure from equilibrium conditions, in the reaction by which the catalyst is formed, is a prime factor in determining its catalytic activity. This supersaturation is measured, in the case of a catalyst such as nickel oxide formed by dissociation of nickel carbonate, by the expression $RT \log_e p_e/p$, where p_e is the equilibrium dissociation pressure of carbon dioxide (or other gas given off during the dissociation) and p the actual pressure prevailing in the atmosphere above the dissociating solid when the catalyst is formed; T is the absolute temperature at which the catalyst is formed. It would appear possible that the reason why this so-called 'supersaturation' of the dissociation, leading to the formation of the catalyst, is important is simply that, if the pressure during formation is very much lower than the equilibrium pressure, the catalyst is formed very rapidly, so that its atoms are arranged in an irregular manner and cannot easily re-arrange themselves to a more stable, and less catalytically active, structure.

Finally, despite the heavy duties of direction of a very large and active institute, its leader, A. N. Frumkin, is continuing active research in a number of different directions[13], with many collaborators. These include work on the amount of oxygen which must be adsorbed on pure iron to confer passivity; continuation of work on the capacity, and general theory, of the electrical double layer; on the oxidative properties of charcoal leading to the formation of hydrogen peroxide; on overpotential, wetting and swelling of graphite, electrokinetic behaviour of activated charcoal and of mercury droplets in aqueous solutions. At one of the scientific meetings of the Congress he delighted the audience with a cinematographic record of the motion of mercury drops falling at right angles to the field between two electrodes; at first these are attracted to the anode, but as they approach this closely, their surface becomes so heavily oxidized that their charge changes sign and they are repelled.

In other institutes I saw work on the rounding off of rock-salt crystals at high temperatures, under the action of surface tension; and ingenious methods for measuring the concentration of free hydrogen atoms or hydroxyl radicals in burning gases (Semenov). A long, thin glass capillary, coated on the outside with a catalyst which produces rapid recombination of the free atoms or radicals on the surface, with a thermocouple inside, measures the heat produced by this re-combination, and from this the concentration of atoms or radicals is deduced. Allowance can easily be made for the heat produced by the burning gases by inserting a second, similar capillary containing a thermocouple but without any catalyst on the outside, close to the first.

The research institutes organized to study some particular branch of science are well, indeed almost lavishly, equipped and staffed; and although the primary object of these institutes is pure scientific research, the necessary liaison with all departments of industry appears good enough to enable scientific discovery to be put into industrial operation in any direction and on any scale desired, with a minimum of delay. The policy of the Soviet Government—to support scientific research on a very generous scale, for its own sake as well as for its actual or potential technical applications—appears thoroughly sound, as a long-range policy for a co-operative society.

The Russians claim to plan their scientific research, but one sees little sign of any restriction of individual initiative; individual scientific workers of proved ability or promise appear to have a very free hand in their choice of fields of research; and they are encouraged and expected to continue in a line of work for a very long time indeed, perhaps for five or ten years or even more. The contrast with so many industrial and even Government research establishments in Britain, where fundamental scientific research is so often relegated to a very low priority, and even if attempted is under continual threat of suppression or interruption after a few months or less because of the danger that it will not be immediately remunerative to the particular industry or department which undertakes the research, is somewhat disquieting to those who have the ultimate interests of British technical efficiency as a whole at heart. Naturally, the enthusiasm and the scientific 'morale', as well as the friendliness, of the workers in the Russian scientific institutes, is at a very high level, and was a real pleasure to see.

(The papers below comprise only a selection of those published on the topics mentioned.)

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(*To be continued.*)

POST-WAR FOREST POLICY IN INDIA

By Prof. E. P. STEBBING
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EIGHTY years have passed since the Indian Forest Service was inaugurated under the auspices of Sir Charles Wood, Secretary of State for India, Lord Elgin, Governor-General of India, and Mr. (later Sir Dietrich) Brandis, its first Inspector-General of Forests. It was the first forest service in the British Empire and Dominions, and the first attempt by the British Government to introduce a correct forestry administration into a country over which it ruled. Various factors, including the steady recruitment of its gazetted service from home and the high standard of training demanded by the India Office for its forest probationers, have gone to produce the forest service and the great forest estate it controlled up to the outbreak of the War of 1914–18. Perhaps one of the chief causes, accounting for the steady progress in achievement for the well-being of the forests and the people, so large a proportion of whom are dependent in many ways on efficient forest management, has been the presence of an Inspector-General of Forests as adviser to the Central Government without intermission down through this long term of years. Many a period of storm and stress, as one looks back, threatening one or more forest regions in different parts of India, were safely negotiated through the presence at the ear of the Central Government of a cool and far-seeing forestry administrator who, with his great experience, could weigh impartially the pros and cons of any policy suggested by a local administration, and advise accordingly.

It was not until 1894 that the aims which had influenced the work of the Forest Department were voiced in Circular No. 22F. "A Note on 'Post-War Forest Policy for India'" was written last year by Sir Herbert Howard, Inspector-General of Forests (Manager, Government Press, New Delhi, 1944). The Inspector-General thus summarizes the principles embodied in this memorandum: (*a*) First and foremost, the preservation of the climatic and physical conditions of the country come before all other objects. (*b*) The preservation of the minimum amount of forest necessary for the well-being of the country is second only to (*a*) above. (*c*) Agriculture and cultivation come before forestry in the use of the soil. (*d*) The satisfaction of the requirements of the local population, given either free or at competitive rates, comes before revenue. (*e*) With the above objects fully provided for, the realization from the forest area of revenue to the greatest amount which efficient management permits.

If the order of the above objects of a correct forest management in a country is examined, it will be observed that after thirty years of forestry administration in the different parts of India, the Central Government and its adviser had fully appreciated that the chief role of the forest—Nature's forest which had not been grown by man—in a countryside was not the provision of revenue, and that the maintenance of an adequate forest staff should not be dependent upon the amount of revenue which came from the forests; that, in other words, the *raison d'être* of the forests of a region might fulfil far greater and more important objects than the mere provision of money. It would be incorrect to say that the excellent rules laid down in this circular were carried out to the letter all over India. There were serious back-slidings. But the present great forest estate of the country is witness to the fine work achieved, and that, to a considerable extent, the value of the forests and of the work is appreciated by the people.

Although more could not be expected at the time, the Circular of 1894 only related to the forests under the control of the forest service, that is, the reserved forests placed under a regulated management based on a sustained yield. This meant that private forests, as also the considerable forest areas under the Indian States, remained outside all Government forest supervision, though during the present century some of the Indian States had begun to recruit Indians trained in the forestry schools of Britain.

Howard's note is written for British India, but much of it has equal application to the Indian States. It is divided into two parts: Part 1, a review of present conditions, and Part 2, the Inspector-General's suggestions for the future. These are both considered under (1) the Government in relation to forestry; (2) existing forest policy; (3) existing demands on and supplies of forest resources; (4) floods, erosion and desiccation; (5) forest research; (6) forest education; (7) creation of a federal forest service; and (8) minor forest produce. From the point of view of general forest policy, it is the first four of these that are of primary importance, the others, important as they are, being more for internal consideration. It will be necessary here to confine ourselves to Howard's suggestions in Part 2.

Under the minimum forest area necessary for the well-being of a country—a subject probably now of the first importance to almost every highly populated country on the globe—Howard shows that the area of forest under Government control comprises only 14 per cent of the area of British India. Certain provinces, such as Assam, have large areas of the so-called State unclassed forests, which are not under professional forest management; but for India as a whole the forests are badly distributed. Except for the Central Provinces, Bombay and Madras, roughly speaking, south of a line from the Gulf of Cambay to Calcutta the forests under the Indian Forest Service consist of those along the foothills of the Himalaya, a narrow band only, the Assam forests and the Sundarbans, south of Calcutta, and smaller areas on the banks of the Indus, in the south of the United Provinces and in Bihar and Orissa. Reliable figures for the privately owned forests do not exist; but it is doubted whether the total including the Government forests would exceed 20 per cent; while there is no sort of forest management in the private forests, which are rapidly disappearing under the hand of the unchecked timber-felling contractors or the unchecked grazing accompanied by fire in the hot season at the hands of the villagers. In European countries the average forest area in a State, including State, communal and private forests, amounts to 26 per cent. In British India, a fundamentally agricultural country, the total area of forest is less than that required, and its distribution is bad.

Howard points out that the existing forest policy does not include suggestions that the forest area of the country should be increased chiefly by additional Government forest reserves. The present policy restricts itself to the ruling that agriculture

should not be allowed to encroach on reserved forest to the extent of reducing the forest area below the minimum required for the well-being of the country, considered to be 20–25 per cent. Allusion is made to erosion and floods caused by the removal of forest growth in considerable parts of the outer Himalaya and other hill areas in the country, necessitating an increase of forest as an aim of post-war policy. Three ways are suggested : (*a*) by afforesting or improving impoverished areas of Government waste lands ; (*b*) by bringing more private and communal lands, where available, under forest by propaganda and assistance in their management ; (*c*) by the legal control of the management of private and communal forests to prevent deforestation. The Indian Forest Act contained clauses providing for control over private forests, but forest officers had found it practically impossible to enforce them. In some provinces fresh legislation is being drafted to provide for practical supervision. The suggestions of the Inspector-General are : (1) The acceptance of the aim that 20–25 per cent of British India should be brought under correct forest management, and so far as possible in each of the provinces ; (2) the enactment of a Private Forest Act to supplement the present India Forest Act in each province.

Chapter 3 of the post-war proposals discusses supplies and consumers under : (*a*) general consumers, mainly urban, whose needs are mainly met by the timber trade ; (*b*) local village consumers residing close to a source of forest resources ; and (*c*) ordinary village consumers who live far distant from any source of forest produce. No serious problem is involved, says the writer, in respect of the first two of these classes, either the chiefly urban or the villager residing near the forest areas. It is the third class of consumers who has been inadequately provided with forest materials, in several cases, for periods which run into centuries, as, for example, in Bengal. The post-war proposals in reference to this class are of the first importance. It is estimated with more certainty than is the case with most estimates of this type that large parts of the Punjab and the North-West Frontier Province, probably 90 per cent of the plains' villages in the United Provinces, all the centre and west of Bengal, much of Bihar and the coast lands of Orissa and possibly half the Bombay Presidency contain populations with an almost completely unsupplied demand for forest produce, firewood in particular. Lack of fuel in India has involved the use of cow-dung for cooking purposes, for example, for centuries in large areas of Bengal ; it is estimated that somewhere about 43,000 square miles, or 13 per cent of the whole of the cultivated tracts of India, could be manured if wood fuel were available to the peasant for cooking purposes. In other words, for large areas or sections of the countryside, if fuel can be made by the formation of plantations, fuel forests, or minor forests (the name by which they are called is immaterial) in small blocks carefully sited so as to be evenly situated over the forestless area concerned, a very considerable amount of manure will be directed to its rightful purpose, the land.

This proposal, the most vital one in the Inspector-General's post-war forest policy report, it is estimated, will mean the creation of 100,000 square miles of additional forest—a sufficiently formidable scheme when it is remembered that the forest staff will have to make themselves conversant with the soils of a particular tract on which it is wished to site a future block (of no large size, but compact) of forest for the provision of fuel and small house timber. Usually in India hitherto, in the districts, land has been classified into cultivated and uncultivated lands solely from the agricultural point of view, the latter being subdivided into cultivable waste other than fallow and land not available for cultivation. It is suggested that uncultivated lands should in future be classified as : (*a*) waste lands other than fallow on which minor forests could be grown (that is, fuel forests), and (*b*) land not available for forest cultivation. It is considered that such a classification will not require any elaborate machinery, since the selection of areas to be utilized for these fuel reserves could be left to the forest officers, who would be responsible for the actual planning of operations. I am given to understand that Bengal has already made considerable headway in this matter, the parts of the country intimately concerned in this matter having been investigated by the Chief Conservator of Forests and members of his staff and preliminary proposals drafted. If the work is to meet with success from the outset, as is most desirable, it would appear essential that an increase of forestry staff should be made, and that carefully selected members should be detailed to carry out these far from easy operations, which will be of such vital importance to the community and the country.

On the subject of the reserved forests of India as a whole, such was the degree of efficiency reached in their management that the Inspector-General is able to write that little is required to restore the departure from normal, that is, the excess war fellings ; a 40–50 per cent reduction in pre-war yields for a period of five to ten years may in some cases be necessary. The true position can be determined by the revision of the working plans, which must therefore be accelerated after the War. What other country in the world with the possible, though doubtful, exception of one or two in Europe, could make such a confident statement about its war fellings and give such an estimate of the period—and so short a period—in which the excess could be brought to normal again ? With such a forest record India will fully deserve all the assistance she can be given in her new effort to bring about a more even distribution of her forests, particularly those providing more especially, if not solely, for her huge agricultural population. For a higher fertility of her soils will furnish at least one answer to the question as to how she is to maintain her increasing population.

Space will not permit of following the Inspector-General's suggestions on floods, erosion and desiccation, forest research, forest education and minor forest produce. It is proposed—and the proposal has now been carried out—that the posts of Inspector-General of Forests and president of the Forest Research Institute and Colleges, which were amalgamated in 1925, with headquarters at Dehra Dun, should be separated, the Inspector-General going back to the headquarters of the Government of India at Delhi and Simla. This was a most desirable move. The idea of a federal service, which had already been suggested by Sir Jogendra Singh, was to provide for the staffing of posts under the Central Government and possibly interchangeable with men from the provinces. It would mean that the majority of the gazetted officers at the Forest Research Institute and posts such as the Andamans, Coorg, etc., and special forest officers to draw up working plans and give professional advice to individual States and agencies, would be placed on a federal list. Sir Jogendra's

suggestion appears to be eminently practical and one well worth bringing to realization.

The picture would be overdrawn if it were said that this report on post-war forest policy for India and the suggestions contained in it are in many directions the most important document drawn up for India's forests since the dispatches of the Secretary of State for India and the Governor-General written in 1862, dispatches which brought about the inauguration of the Indian Forest Department.

NUTRITION IN JAMAICA

IN a report prepared by the Nutritional Committee of the Jamaica Branch of the British Medical Association, Dr. W. E. McCulloch and his colleagues have explored the future position as to nutrition and agriculture in Jamaica, when the resolutions of the Hot Springs Conference come to be implemented.

While there is little or no difficulty in formulating a dietary of what the people should eat within the list of available local and imported foods, difficulties begin when the 'how' has to be considered. It is here that one comes up against what is probably a problem common to all those countries which depend very largely on agricultural exports for their economic existence—the conflicting interests of local nutrition and the export trade. This problem is most critical in those countries which, like Jamaica, are densely populated. The suggestion made in the report under notice for the solution of this problem is the intensification of agricultural production.

Considering the report in detail, the Committee accepts the findings of the 1937 Nutritional Committee of Jamaica, and remarks that the condition has been accentuated by the War, which has limited imports. The two main findings of the 1937 Committee were that the nutritional state of a distressingly large proportion of the labouring classes must be classed as definitely bad, and that the chief features of the island's unbalanced dietary were the deficiencies of animal protein and animal fats and the excess of starchy foods.

As a standard at which to aim, the Committee adopted Plan 1 of the Hot Springs Conference (which is relatively economical and suited to a poor population) and has translated it into tons of foodstuffs necessary to feed the Jamaican population of 1¼ millions. This estimate has been compared with what Jamaica actually ate in 1942. The calculated daily calorie consumption was 1,779, as against the Hot Springs standard of 2,688. Substances eaten in excess of requirements were those of a bulky nature such as ground provisions (yams and roots of various sorts) and vegetables and fruits (other than citrous fruits); while the chief deficiencies (per man per day) occurred with milk, 1/7 oz. as compared with 20 oz.; eggs, 5 per man per annum compared with 228; fats, ½ oz. compared with 2 1/5 oz.; grain (as flour), 2⅔ oz. compared with 10 oz.; and meat and fish, 2 oz. compared with 4 oz.

The Committee then goes on to translate these deficiencies in food requirements into acres required to produce them on the basis of the present production per acre; for example, a ration of 20 oz. (1 pint) of milk per day means 60 million gallons per year, which at present production-rates means 158,750 milking cows, or including dry cows and heifers reared for replacement, 264,000 cattle. This number of cattle would require 792,000 acres to maintain them. The total acreage required (allowing for the importation of 50,000 tons of wheat and 15,500 tons of rice) under existing methods of agriculture would be as follows (in thousand acres): cereals, 83; roots, 20; pulses, 20; citrus, 3; milk, 792; beef, 1,836; a total of 2,754,000 acres. With additions for other things such as green vegetables, the total would exceed 3,000,000 acres. The actual acreage available in Jamaica, excluding some 586,000 acres in forest, towns, etc., is 2,250,000 acres, and much of this is not suitable for permanent cultivation.

Moreover, the economy of Jamaica is based on the production of agricultural produce for export to provide money for the importation of manufactured goods, flour, etc. These crops (as for example, sugar cane, 100,000 acres, and bananas, 150,000 acres) utilize the best available land for their purpose, and in total require 350,000 acres. It is thus clearly demonstrated that competition for land between export crops, food for domestic livestock and potential food for man has already reached a stage in Jamaica where it is impossible of solution if the present methods of agricultural practice continue. This is the outstanding conclusion of the Committee.

The Committee recommends therefore a complete revolution in Jamaica's agricultural system, which would include improved and more intensive methods of production. In particular, the first requirement is to increase the efficiency of the livestock industries, since there is an appalling competition for land between man and cattle. It is pointed out that Jamaica can no longer afford 2-3 acres to feed one cow giving about 300 gallons of milk, or a range steer to produce some 500 lb. of meat. A swing-over from beef to milk production is also recommended. Increased production of peanuts and soya beans would do much to supplement the meat supply. The productive land should be used in a cycle which includes cattle, but the land cannot be permitted to be used solely for beef cattle. The local production of rice on reclaimed swamps and the production of food yeast from molasses are among other items suggested; but it is pointed out that while the addition to the ration of vitamin B_2 from yeast will be an advantage, it will not reduce the need for the other constituents of a good ration for children. The Committee quotes in detail Dr. Platt's recommendations for an immediate aim for nutrition in Jamaica, but considers that these will not altogether satisfy the social needs or meet economic requirements, and so it proposes an amended dietary as a basis for agricultural policy. It is convinced that the increased production required to meet the 'intermediate diet' could then be attained by increased output of produce per acre; increased acreage should not be required. The Committee concludes by saying that it considers that by increased efficiency and harder work, the aims of nutrition and economics are attainable in the next few years, and that both can be made to fit into the requirements of the land and the farmer. Neither efficiency nor hard work can, however, be achieved unless good food is plentifully available to rich and poor alike. If higher standards of efficiency and greater output *per capita* of population as well as per unit of land cannot be achieved, then the outlook for Jamaica cannot be regarded as anything but poor.

The Committee's report is a most interesting and important document, and worthy of study by all those who are engaged in nutrition or agriculture; it can well serve as a model in method for those who are considering such problems.

OBITUARIES

Dr. Gustav Senn

Dr. Gustav Senn, professor of botany in the University of Basel, died there suddenly on the morning of July 10. His colleagues and other friends were preparing a *Festschrift* to be given him on November 9, his seventieth birthday.

Gustav Senn wrote his inaugural dissertation in 1899 on certain colonial unicellular algæ; and he dealt about the same time with several families of the lower algæ for Engler and Prantl. In several subsequent papers he discussed the arrangement of chlorophyll and 'chromatophores' in algæ and in higher plants. He wrote a useful little Flora of the Western Alps about forty years ago, and published a number of papers on the special physiology of Alpine plants in relation to light and temperature.

But Senn was chiefly remarkable for his admirable knowledge of Greek, and for his devotion to Theophrastus and other lesser sources of Greek botany; herein he was the legitimate successor to the last of our own scholar-botanists, Sir William Thiselton-Dyer. Senn had ambitious schemes in hand, including a revised text and translation of Theophrastus; but he was a slow and most cautious worker, and has left a deal of work undone. The last time I saw him, just before the War, we talked of a difficult and confused part of Theophrastus' work on "The Causes of Plants"; he had cut up and pieced together several pages of the book, and as he thought, and as it seemed to me, the re-arranged paragraphs fell simply and obviously into two separate versions of the story.

Among Senn's classical papers was one on the Theophrastean pine trees of the north-east Mediterranean: that is to say, on the stone pine, the Corsican pine and the Aleppo pine, in Macedonia, in Arcady and on Mount Ida. Another deals with "Theophrasts Differential-Diagnosen für laubwerfende Eichen"; in other words, on the various deciduous oaks, and their somewhat peculiar limitations of habitat and distribution. The number of species to be dealt with is considerable, including *Q. Robur*, *Aegilops*, *Cerris*, *lanuginosa*, *pedunculata*, and perhaps one or two more; and Senn's identification of the Greek names differs in several instances from Dyer's. In yet another paper, on the Greek fir trees, Senn argues (again against Dyer) that what Theophrastus calls the male and female fir are really distinct species. One is the common Greek fir tree, *A. Apollinis*, Link, of which *A. cephalonica* is a local form; the other, *A. alba*, Miller (= *Pinus Picea*, L.), grows further north, and forms great woods in Macedonia. A better-known and still more curious paper is one on "Oak-galls in the Historia Plantarum of Theophrastus", published in the *Transactions of the Royal Society of Edinburgh* in 1941 (see *Nature*, April 17, 1937, p. 684). Theophrastus mentions ten kinds of gall on various oaks, giving a very few words to each; and Senn succeeds in identifying every one of these, the common oak apple being the only one of which the identification remains a little dubious. Dyer identified, with more or less certainty, a vast number of Greek names of the higher plants; but he gave no heed to such things as galls, nor to the various fungi and fungoid diseases to which Theophrastus makes passing allusion. Here Senn stood alone. I asked him once if he could explain two diseases of the fig-tree which Theophrastus mentions—the so-called 'rot' (or *sphacelismus*), in which the roots turn black, and the *krados*, in which the leaves do so. He told me that the one was what the French call *la pourridie* (*Dematophora necatrix*, R. Hartig); and the other was caused by *Fumago vagans*, Pers., the sign of which is a sooty dust upon the leaves. Let the revisers of "Liddell and Scott" take note of these!

D'Arcy W. Thompson.

Prebendary Lonsdale Ragg

The death of the Venerable Lonsdale Ragg at the ripe age of seventy-nine years has deprived forestry and botanists in general of one who for many years had fostered by all means in his power an interest in trees. He was born in 1866, the son of a country clergyman in Shropshire, and no doubt his upbringing in that delightful county did much to influence his work in future years. His clerical career was distinguished, for he was Prebendary of Buckden in Lincoln Cathedral and had been Archdeacon of Gibraltar since 1934. He was, in fact, particularly interested in the Mediterranean countries, and in his earlier years had served in various chaplaincies in Italy and elsewhere, publishing many theological theses on the history of religion in that region.

To a wider public, however, Lonsdale Ragg was known for his interest in trees, and particularly for his beautiful illustrations of tree-life. He had been editor of the quarterly magazine *Tree Lover* from 1932, and its pages are full of his contributions and of his delightful sketches of trees. These black-and-white illustrations of typical trees were not only most artistic, but were also very accurate as to detail. Although he usually concentrated on depicting particular specimens, some of his work shows that he was also equally competent in producing more general scenes, as is exemplified by his scenes of "Bath after the Blitz" and "The Charm of Foliage"—a drawing of Sydney Gardens in Bath. It was in this city that he had made his home in recent years, and its picturesque surroundings gave him ample scope for practising his art. Many of his sketches consist of details of the trunk and lower branches of some particular giant, and he was particularly interested in famous and historic trees, especially large and well-grown specimens. There is a sketch of a specimen of *Robinia pseudoacacia* at Warminster, with a height of 85 ft. and a girth of 21 ft. 6 in., which is typical of his work.

Lonsdale Ragg kept up his interest in trees until the end of his life. He was a frequent visitor to Kew until recently, when increasing infirmity rendered the journey from Bath under war-time conditions difficult. He was indeed a tree lover, and one of his last communications with the Royal Botanic Gardens concerned the dimensions of a specimen of Monterey cypress which he had discovered near Lyme Regis. He had hoped that this was the largest specimen in the British Isles and was somewhat disappointed when it was pointed out that larger specimens existed.

As a man Lonsdale Ragg possessed great charm, and his enthusiasm together with his old-world courtesy endeared him to all with whom he came in contact. His writings, his sketches and above all his delightful personality will be missed by all tree lovers.

G. Evans.

Sir William H. Ellis, G.B.E.

Sir William Henry Ellis, who died at Sheffield on July 4 at the age of eighty-four, was the fourth son of John Devonshire Ellis, one of the original partners in John Brown and Company, armour plate and steel manufacturers of Atlas Works, Sheffield.

Sir William was born at Thurnscoe Hall in the county of York on August 20, 1860. He was educated at Uppingham School, and entered the works of Tannett Walker and Co., Ltd., of Leeds, in November 1878, passing through their various shops and drawing office. In 1882 he had charge, on their behalf, of the erection of a vertical blowing engine at some copper smelting works in Servia, and afterwards was, for two years, a foreman in their erecting shop in Leeds. In October 1885 he went to Sheffield to take charge of the erection of a 4,000-ton hydraulic forging press, a pair of hydraulic pumping engines and two 150-ton overhead travelling cranes in connexion with the press. At the completion of this work in October 1887, he entered the employment of John Brown and Co., Ltd., Sheffield, as under-manager of their forge department. He was appointed a director of the Company in 1906 and became managing director in 1919.

Throughout his career Sir William displayed marked ability in technical, commercial and administrative work, and in addition, found time to render valuable public service. Among the many positions he has occupied, it is worth while putting on record here that he had been president of the Institution of Civil Engineers, of the Iron and Steel Institute, of the Sheffield Society of Engineers and Metallurgists, and of Section G (Engineering) of the British Association at the Glasgow meeting in 1928. He was Master Cutler in 1914, 1915, 1916 and 1917. He was a member of the Council of the University of Sheffield, of the Executive Board of the National Physical Laboratory, of the governing body of the Imperial College of Science and Technology and of the Cambridge University Appointments Board. He was also a member of the Committee of Privy Council for the Department of Scientific and Industrial Research, and of the Government committee on drainage in the Doncaster area.

Sir William was a member of the Swiss Alpine Club, a keen and intrepid mountaineer, and did much to assist Swiss guides in their retirement. He climbed the Matterhorn on his seventieth birthday. The Derbyshire moorlands were an open book to him. He looked forward to his week-ends, when walks of 16–20 miles over the wild heather-clad moors and fells of the Pennines were his delight and afforded him mental rest, in invigorating air, and equipped him for the work of the ensuing week.

On the artistic side Sir William was an accomplished organist, and loved to entertain friends in the evenings with selections from famous composers.

Sir William was a man of outstanding ability, tenacious in the pursuit of his object, and prior to his retirement from John Brown and Co., Ltd., was extremely active in the industrial life of Sheffield. He was a warm-hearted friend, and his passing leaves a gap in the ranks of Sheffield's old prominent citizens.

J. F. Bridge.

We regret to announce the following deaths :

Prof. J. Davidson, head of the Department of Entomology, Waite Agricultural Research Institute, and professor of entomology in the University of Adelaide, aged sixty.

Mr. J. S. Highfield, consulting engineer, a past-president and honorary member of the Institution of Electrical Engineers, on August 15, aged seventy-three.

Prof. L. Wertenstein, formerly of the Mirosław Kernbaum Radiological Laboratory of the Warsaw Society of Sciences, during a bombardment of Budapest in January 1945.

Prof. J. T. Wilson, F.R.S., emeritus professor of anatomy in the University of Cambridge, on September 2, aged eighty-four.

NEWS and VIEWS

Dr. H. J. Gough, C.B., M.B.E., F.R.S.

The announcement that Dr. H. J. Gough has relinquished the post of director-general of scientific research and development, Ministry of Supply, to become engineering chief of Messrs. Lever and Unilever Ltd., is of particular interest at the present time, since it means that British industry will have the full benefit of the accumulated experience of an engineer-scientist who has shown outstanding ability, first as an individual scientific investigator and then, during the war years, as one of the most responsible scientific administrators in the Government service. As a young man, Dr. Gough served with distinction in the Royal Engineers in the War of 1914–18 and then returned to the Engineering Department of the National Physical Laboratory to carry out the valuable researches on the causes of deformation and failure of engineering materials with which his name will always be associated. He rapidly became recognized as the leading authority in Great Britain on the important subject of the behaviour of metals under repeated or fatigue loading, and although always interested in the application of his researches to engineering practice, demonstrated very fully in his own work how invaluable it is to utilize fundamental metallurgical and physical science in the solution of engineering problems. Dr. Gough succeeded the late Sir Thomas Stanton as superintendent of the Engineering Department of the National Physical Laboratory in 1930, and in this position not only continued his personal researches, but was also responsible for the initiation of many valuable researches in engineering materials and design, applied fluid mechanics, ballistics and lubrication. His researches and authoritative lectures did much to enhance the high reputation of the National Physical Laboratory in engineering research. In 1938 Dr. Gough was appointed the first director of scientific research at the War Office, and almost immediately had to face the tremendous task of organizing and directing the scientific activities of the newly created Ministry of Supply. This work called for all his abilities and almost inexhaustible energy, and can perhaps be summed up by saying that Dr. Gough, perhaps more than any other individual, was responsible for the many advantages which applied science has been able to give to the British Army in its successful fight.

Chair of Geography at the London School of Economics

Prof. Ll. Rodwell Jones

THE retirement of Prof. Llewellyn Rodwell Jones under the age-limit marks the termination of twenty years tenure of the chair of geography in the University of London at the London School of Economics, where he succeeded Sir Halford Mackinder as head of the Department. After a period as a school-master, he lectured for a year in the University of Leeds, before serving during 1914–19 in the West Yorkshire Regiment, which he left with the rank of major and with an M.C. to take up a lecturership at the London School of Economics. Under Mackinder's guidance, Rodwell Jones and his sister (afterwards Dr. Hilda Ormsby) laid the foundations of one of the strongest schools of geography in Britain, very wisely joining forces with King's College, London. Under this inter-collegiate arrangement, Rodwell Jones secured for his specialist staff the ideal opportunities of combining research and lecturing in their own fields, and avoided what is so often the curse of university departments, namely, too great a burden of lecturing on any one member of the staff. As a result, a constant stream of original work has emanated from the Department.

Rodwell Jones's own interests were particularly in the historical and economic geography of North America, and it was after a period as visiting professor in the University of Chicago that he published in conjunction with a former student of the School, Dr. P. W. Bryan, his standard work on North America, now in its seventh edition. Always constructively critical, his meticulous attention to detail is well shown in his volume on "The Geography of London River" (1931). His influence on the progress of geography in Great Britain cannot be measured by his published works. As an ideal chief, an ever-helpful colleague, and inspiring lecturer, he succeeded in imparting an enthusiasm for his subject to successive generations of students. It is no accident that those students now occupy the headships of geography departments in half a dozen universities in Britain and the Empire.

Dr. L. Dudley Stamp

THE appointment of Dr. L. Dudley Stamp to the chair of geography at the London School of Economics and Political Science, made vacant by the retirement of Prof. Rodwell Jones, does not involve him in any change of location, for he has long held a Cassel readership at the School. No doubt he will re-establish the fruitful connexion with the Geography Department at King's College, which was broken by the War. Prof. Stamp has travelled in most parts of the world, and has spoken and written on many subjects, but his best-known work is that of the Land Utilisation Survey. This series of maps and memoirs on the counties of Britain has been found invaluable, not only in academic regional studies, but also as a guide to planning and reconstruction, particularly in respect of rural land use. As regards the latter, Prof. Stamp is chief adviser to the Ministry of Agriculture. Like his late brother, Lord Stamp, he is a persuasive and lucid speaker and writer, and has done much 'to carry geography into the market-place'; not, of course, without danger to his reputation, since it is almost impossible to be simultaneously simple and precise. But Ministers are impatient of indeterminacy, and of exact answers promised for delivery fifty years hence. They are required to take action here and now, and the scientific worker must take the risk of offering advice based upon a first approximation. It was not very long ago that Prof. Stamp's gift of exposition carried all the lay members of an important committee with him, leaving the only other expert, an economist (who in this instance was probably in the right), to carry his orthodoxy into the dusk of a minority report, and thence to Cambridge. But more than one economist now recognizes that the location of industry (to take but one example) has some relation to locality, and since geography is the minute study of locality and its significance, the association of a Department of Geography with a School of Economics holds possibilities of real usefulness. These possibilities, it is to be hoped, Prof. Stamp will have the opportunity to develop.

Science and Education in India

MR. L. J. F. BRIMBLE, joint editor of *Nature*, has recently returned from a short but intensive tour of India and Burma, where he not only made cultural and educational contacts with British and other troops in South-east Asia Command, but was also able to visit a number of scientific and educational institutions in various parts, mainly Calcutta. It is hoped, in due course, to publish a more extensive account of the contacts made, but men of science in Britain will be glad to know that the Editor has returned inspired by the enthusiastic way in which their Indian colleagues are working for the advancement of science and education in India. The hospitality extended to him by Indian men of science left nothing to be desired; in fact, he found it quite impossible to accept all invitations. Though it is not possible, at present, to discuss details or mention all individuals, it is impossible, even in a short note, to omit mentioning the kindness of Prof. M. Saha, professor of pure physics in the University of Calcutta. Under Prof. Saha's guidance the Editor was able to see most of the departments of the physical sciences in various colleges of the University. He saw the cyclotron which, after three years work on it, is nearing completion. It only remains for a few parts to arrive from the United States before research work with this instrument can begin. Prof. P. N. Ghosh, Prof. S. K. Mitra and Prof. S. N. Basu were also helpful in showing the work going on in the departments of pure and applied physics. The pure and applied chemistry departments were visited under the guidance of Prof. J. N. Mukherji and other professors. Here the Editor had the honour of visiting the room in which Sir P. C. Ray lived and died.

Many biology departments were also visited, mainly at the University College of Science (under the guidance of Profs. S. P. Agharkar, H. K. Mookerjee and their assistants) and at Presidency College (under the guidance of Profs. J. C. Sen Gupta, S. Banerjee and others). The work of other science departments was explained by their various heads and assistants. Mr. Brimble is particularly grateful for the kind hospitality of the statistician, Prof. P. C. Mahalanobis, professor of physics in Presidency College and the founder of the Statistical Laboratory, Calcutta. Mr. Brimble was able to address the students of the University and also certain sections of the staff. He had a fruitful discussion with Dr. R. Pal (vice-chancellor), Dr. B. C. Roy (president of the Post-graduate Department), Dr. S. Mookerjee (former vice-chancellor), the Hon. Justice Mr. C. C.

Biswas, and other members of the University Senate. Under the guidance of Dr. K. Biswas, an interesting visit was paid to the Royal Botanic Garden, Sibpur, of which Dr. Biswas is superintendent. There he was able to meet other botanists, including Prof. S. A. Bose, of the Carmichael Medical College, Prof. J. C. Sen Gupta, of Presidency College, Dr. P. C. Biswas, anthropologist in the University, and others. Some time was also spent in visiting the All India Institute of Hygiene and Public Health, the School of Tropical Medicine and other centres of medical research. Many other men of science were met, both in Calcutta and Allahabad and elsewhere. Of more special interest was the visit paid to the offices of *Science and Culture*, of which Prof. Saha is an Editor. These offices are situated in the University College of Science.

The Editor has been asked to convey greetings to British men of science from their Indian colleagues, and has also brought many private messages for individuals. He hopes to convey these in due course.

Peoples of India

THE condensation of a description of a vast and complex country like India into a booklet of some 85 pages, including illustrations, is no mean feat, especially when the result is so clear and informative. Wm. H. Gilbert, jun., has done this in War Background Studies, No. 18, entitled "Peoples of India", issued by the Smithsonian Institution. Starting with the environment (geographical, climatic and biological), the author passes on to the inhabitants; these are of diverse origins as is well known, and thus lay the foundations for the complicated aggregation that is India. Most of the so-called races of man are represented there. When it is realized, moreover, that there are about 180 different languages, apart from 550 dialects, in the country, there is no denying that the difficulties of administration are great. Although India shows great ethnic diversity, there is at the same time a certain cultural unity. The people as a whole may be described as sharing certain traits such as conservatism, a lack of time sense, a love of social prestige, a highly developed religious sense and a strong devotion to the family. The mental abilities of certain castes are unquestioned, as shown by their metaphysics and by their art, to mention only two examples. Caste coupled with religion is perhaps the outstanding characteristic of India. The caste system, faulty though it may be, at least has the merit of bringing order into what might otherwise be a discordant assemblage of peoples. The book ends with a short account of Indian contribution to the War, and it is illustrated with fine photographs which do much to emphasize the essential contrasts in India of great riches and abject poverty, of fine buildings and squalid huts.

Food Policy in Britain

Discussion Circle, No. 2 (Craig and Wilson, 70 Bath Street, Glasgow), opens with an article by Sir John Boyd Orr, entitled "If I were Minister of Food in Peace-time". The first thing that might be done, says Sir John, is to get out a statement of the findings and recommendations of the United Nations Food and Agricultural Conference, the delegates of which represented 80 per cent of the world's population. They unanimously declared that: (1) the kind of food needed is known; (2) even in the best fed countries, 20–30 per cent of the population do not obtain sufficient of the right kinds of food essential for health; (3) lack of sufficient of the right kind of food is the cause of disease, physical disability and untimely death; (4) the first cause of lack of food is poverty; (5) we have the knowledge and ability to produce all the food needed. The Conference also recommended that every nation should provide a diet adequate for the health of the citizens, and these recommendations have been accepted so far as they affect Great Britain. If, continues Sir John, you were Minister of Food, the first decision which you would have to make would be whether you would carry out these recommendations, and, before you made this decision, you would have to consider what would happen if you did carry them out. Opinions on this will differ. Sir John bases his estimate of what would happen on what did happen when we changed the national diet between the War of 1914–18 and the present time. During this period the average consumption of foods of special value for health increased by about 50 per cent, and there was also a remarkable improvement in national health. Certain deficiency diseases, such as rickets, almost completely disappeared; children were nearly three inches taller, and infant mortality fell by more than 30 per cent, and deaths from tuberculosis by more than 50 per cent. Other factors undoubtedly helped to produce this result; but the improvement in the national diet was, Sir John thinks, the outstanding change. During the recent War, the food policy of Britain has been based upon nutritional needs. The special needs of mothers and children have been provided for, and the diet of the working class is therefore now better than it was before the War.

To maintain this improvement Sir John suggests that the Government should appoint a food and agricultural commission. The commission would need to own, or at least to control, the processing centres such as flour mills, slaughter houses, bacon factories and milk depots if it were to give a guaranteed market. The wholesale food trade would purchase from the commission all its supplies at a wholesale price calculated in such a way that, by the cheapest method of distribution, namely, cash and carry, retail prices would be adjusted to the capacity of the poorest families. The provision for the poor of an adequate diet would go far to abolish poverty itself, and the guarantee that there would be no lack of food adequate for health would do much to abolish one of the worst fears of poverty.

New Zealand Forest Service

THE annual report of the New Zealand State Forest Service for 1944 (Gov. Printer, Wellington, 1944) is fully up to pre-war standard both in make-up and contents. A separate report on post-war forest policy being under preparation, only a brief reference to this subject is made. In one of the reports published during the War, the Department pointed out that the only realistic and economic solution of the problem of erosion control lies in Dominion-wide control of land-burning operations. This contention is now winning wide recognition, and support from the various advisory committees functioning under the Soil-Conservation Council is being received. It is added that a great step forward will be achieved if the newly appointed catchment boards concentrate upon this phase of their operations. During the War, the Department has been immersed, as is the case with most other forest departments, in

war production. The shortage of man-power was still a major problem. Some alleviation resulted from the return of forestry units from Great Britain and of men from the Middle East, together with a number returned from the Armed Forces within New Zealand. The chief problem was to maintain the large number of saw-mills at maximum production; the continued transfer of semi-skilled and inexperienced workers from other industries to forest and saw-milling work making it difficult to maintain a high production. The cessation of construction of defensive works against a Japanese invasion and the recent release of a substantial number of men from the Pacific theatre of war for service in the timber industry has resulted in a material improvement.

Ball Lightning

THE *Ayrshire Post* of August 10 contains a description of what is described as a fireball, which caused considerable damage on the night of Sunday, August 5. The so-called fireball was associated with a thunderstorm which reached Ayr from the north shortly before 8.30 and passed quickly away. It caused serious damage to a house at 6 Teviot Street, Ayr. From the descriptions of those who saw the phenomenon, it is clear that, as it accompanied a flash of lightning, it was not the fireball familiar to the astronomer but a case of ball lightning. Mr. John Don, of 1 Gardenroso Path, Maybole, Ayrshire, who directed our attention to the above article and who also saw the ball, says that it fell very quickly. Ball lightning, it may be recalled, was photographed before the War on at least one occasion, and was included by Sir George Simpson, former director of the Meteorological Office, in his studies of atmospheric electricity.

White Dwarf Binaries

THE April issue of *Sky and Telescope* contains a short notice of white dwarfs which form binary systems, the first discovery being made recently by Dr. W. J. Luyten. The twins were found in Antlia and are of magnitude 14, nearly identical in colour, and apparently genuine members of the dwarf species. Originally a wide double star had been announced, but on examining the star with the 36-in. Steward Observatory reflector, Dr. Luyten found that the fainter component of the wide pair was merely an optical companion, but the brighter component appeared elongated. Verification of the double character of the star was obtained from Mount Wilson, where Dr. Walter Baade secured a photograph with the 100-in. telescope which revealed two stars separated by 3″ and differing by 0·3 magnitude. A tentative estimation of their orbit shows a period of the order of 250 years, and it is hoped that in ten years the period will be determinable with a fair precision. It is conjectured that the twins are each intrinsically 1,600 times less luminous than the sun and have diameters smaller than that of the earth. Assuming that their masses are typical—about that of the sun—their densities are about 25 tons per cubic inch, or more than 1½ million times the density of water.

Department of Forestry, University of Oxford

THE following appointments have been made in the Department of Forestry of the University of Oxford: Dr. W. R. Handley has been appointed microbiologist. He graduated in botany at the University of Leeds in 1935 and was awarded the Ph.D. for his studies on the structure, development and physiology of the xylem of trees. He then turned to bacteriology as research assistant to Dr. F. C. Happold, and in 1939 was appointed lecturer in that subject at the University of Birmingham. During the War he has been working at a public health laboratory at Wellington (Salop) and Hereford. Dr. L. Leyton, who has been appointed tree physiologist, also graduated in botany at Leeds (in 1938) and continued his studies as a University research scholar, working on the physiology of the monocotyledonous leaf, obtaining his Ph.D. in 1941; he has been at the Telecommunication Research Establishment during the War. Squad.-Leader G. W. Dimbleby has been appointed ecologist; he graduated in botany at Oxford in 1939, and has worked on oxidation-reduction potentials as measures of soil activity. It is intended that the work associated with these appointments shall be focused on the relations between tree-growth and soil factors.

Announcements

AFTER evacuation for a period of three years to Saratov, the Leningrad Society of Naturalists has resumed its activities at the State University of Leningrad. Several meetings, general and sectional (zoology, botany, physiology and geology), were held during last spring, and publication of the *Travaux* is also being started.

A NEW series of lectures on "How it Works in Photography" has been arranged by the Scientific and Technical Group of the Royal Photographic Society of Great Britain to be held at 16 Prince's Gate, London, S.W.7. The first of the series, entitled "Camera and Optics", will be delivered by Dr. G. B. Harrison on September 25 at 6 p.m.

CATALOGUE 10 recently issued by Schuman's, 20 East 70th Street, New York, contains more than 350 items of old medical and scientific works of the sixteenth and seventeenth centuries. Special mention should be made of works by Boyle, Harvey and Willis, of whom contemporary portraits are inserted. Among many other books deserving attention are: John Banister's "Historie of Man" (1578); Wordsworth's copy of Sir Thomas Browne's "Urn Zurial" and other works; William Clowes' "On the Working Gallilus" (1683); Culpeper's "Physical Directory" (1651); Sir Thomas Elyot's "Castel of Helth" (1541); William Gilbert's "De Magnete" (1600); Peter Levens's "Right Profitable Book for all Diseases. Called the Pathway to Health" (1582); Peter Lowe's "Discourse of the Whole Art of Chyrurgerie" (1634); and Morton's "Phthisiologia or A Treatise of Consumptions" (1694). Frontispieces of many of the works are inserted.

ERRATA. In the article by Dr. Julian Huxley on "Evolutionary Biology and Related Subjects" in the series dealing with Science in the U.S.S.R. (*Nature*, September 1), on p. 255, col. 1, line 41, for "Khostova" read "Khvostova", and on p. 256, col. 1, lines 26–29, it is stated that "The most interesting are in blackcock, where more than 200 million specimens from the markets for some four hundred years had been gone through". For "four hundred years" read "forty years".

LETTERS TO THE EDITORS

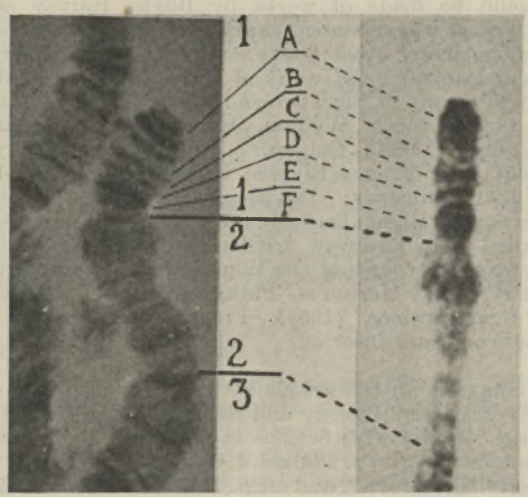
The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

Phosphatase on Chromosomes

When the tissues of Craniata are treated by the technique of Takamatsu[1] and of Gomorri[2], alkaline phosphatase is found to be present in the cell nuclei. Willmer[3] has observed that in mitosis in tissue cultures the nuclear phosphatase is concentrated on the chromosomes. One of us (J. F. D.), in collaboration with Dr. H. B. Fell, has found phosphatase on the chromosomes in tissue culture mitoses, and in the mitoses of healing wounds. That the enzyme is indeed in the cell nuclei may be shown in many ways[4]; for example, on heating dry rat kidney sections phosphatase not in the nuclei is destroyed more rapidly than is nuclear phosphatase, so that, by careful timing, sections may be obtained in which only the nuclei contain active phosphatase.

In view of these observations, we thought it desirable to study the distribution of phosphatase on the giant salivary chromosomes of *Drosophila*. Larval salivary glands were fixed in 1 or 5 per cent acetic acid for a few (1–4) minutes, squashed, and the squashes immersed at once in 95 per cent alcohol. The cover slips were lifted immediately to check destruction of phosphatase, which may be caused by prolonged contact with acetic acid. These squashes were then treated by the technique of Takamatsu and Gomorri: this showed the phosphatase to be distributed apparently in bands.

While the phosphatase appears to be situated at the Feulgen positive bands, the amount of phosphatase at any place as judged by the intensity of blackening is not absolutely related to the amount of nucleic acid at the same place, as judged by the intensity of staining shown by acetocarmine preparations. Thus in the case of the left (distal) end of the long arm of the *X*-chromosome, the photomicrographs reproduced herewith will demonstrate the similarities and differences. Taking the acetocarmine staining of the bands as a standard, it appears that 1 *C* and *D* are relatively stronger, while 1 *B* 1–3 are somewhat weaker. The normally dark bands of 1 *E* and *F* are also somewhat weaker and appear to be surrounded by a diffuse cloud of blackening. These differences in relative staining make the identification of the parts of individual chromosomes by means of the standard maps a somewhat precarious proceeding. Nevertheless, the phosphatase bands do give a general pattern strikingly similar on the whole to the more familiar carmine-stained preparation.



(*a*) (*b*)

Photomicrographs of left end of *X*-chromosome in salivary glands of female *Drosophila melanogaster* larvæ: (*a*) stained in acetocarmine, (*b*) stained by technique of Takamatsu and of Gomorri to show alkaline phosphatase. The parts of the chromosomes are numbered and lettered in accordance with Bridges' (1938) standard *X*-chromosome map.

This apparent coincidence between sites of enzyme activity and of genetic activity suggests that we have here an indication of a process whereby genes influence cellular activity, and is, we believe, the first experimental indication of the nature of such processes.

J. F. Danielli.
Departments of Biochemistry and Zoology,
Cambridge.
D. G. Catcheside.
Department of Botany,
Cambridge.

[1] Takamatsu, *Trans. Soc. Path. Japan*, **29**, 492 (1939).
[2] Gomorri, *Proc. Soc. Exp. Biol. and Med.*, **42**, 23 (1939).
[3] Willmer, *J. Exp. Biol.*, **19**, 11 (1942).
[4] Danielli, *J. Exp. Biol.*, in the press.

Pigments and Chromatophore Reactions of *Polycelis nigra* and *Planaria lugubris*

In 1938, I observed that the chromatophores of *Planaria lugubris* and *Polycelis nigra* expand in light and contract in darkness. My experiments have recently been repeated with similar results; and in addition the effects of adrenaline and ergotine have been noted. In every case the chromatophores showed normal primary responses (as do the chromatophores of less primitive animals, for example, leeches[1] and sea urchins[2]). They had no influence upon the general coloration of the animals.

Variations in colour appear among Triclads of the same species living side by side. For example, two black, five dark brown, four light brown or grey, five pinkish and one almost white specimens of *Polycelis nigra* have been found underneath a single stone. These variations are due to different depositions of melanin in the skin.

Two typical habitats were selected: one under stones in a slow-running stream (Vicar's Brook) from chalk springs to fen; the other in the axils of leaves of *Glyceria aquatica* in a creek of the Cam (by Fen Causeway). Counts were made in each habitat, care being taken to remove every animal from each stone or plant investigated.

	Under stones *P. nigra*		In the axils of leaves *P. lugubris*		*P. nigra*	
	No.	per cent	No.	per cent	No.	per cent
Black	61	15·5	—	—	1	0·7
Dark brown and dark grey	175	44·5	45	67·0	18	12·0
Light brown and light grey	123	31·0	22	33·0	115	78·5
Pink	32	8·0	—	—	11	7·5
White	4	1·0	—	—	2	1·3

From these results it can be seen that the average colour of *Polycelis nigra* and *Planaria lugubris* living in the axils of the leaves of *Glyceria aquatica* (a relatively light habitat) is lighter than that of animals living under stones (a dark habitat) where there is a much greater colour-range. *Planaria lugubris* tends

[None of the vacancies in these columns relates to a Man between the ages of 18 and 50 inclusive or a Woman between the ages of 18 and 40 inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1945, or the vacancy is for employment excepted from the provisions of that Order.]

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Applications are invited from graduates in Science, or Engineering (with some knowledge of Chemistry), for the post of Lecturer in Ceramics. A specially qualified man may be graded immediately as a Senior Lecturer (£600–£750) but others may expect promotion to this grade subject to satisfactory service. Applications giving details of age, training and experience should be sent to the Principal on or before September 22, 1945.

J. F. CARR, B.Sc.,
Clerk to the Governors.

THE UNIVERSITY OF LIVERPOOL

GEORGE HOLT CHAIR OF PATHOLOGY

The Council of the University invites applications for the George Holt Chair of Pathology at a salary of £1,500 per annum, together with superannuation within the Federated Superannuation System for Universities.

The appointment will date from January 1, 1946, or as soon thereafter as may be practicable; leave of absence may be granted to a Professor-elect who is engaged upon National Service.

Further particulars may be obtained from the undersigned, by whom applications (12 copies), should be received not later than October 31, 1945. Candidates who are overseas may make application by cablegram naming three referees.

STANLEY DUMBELL,
Registrar.

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Applications are invited for the post of a further Full-time Lecturer in the Department of Chemistry to commence as soon as possible. Candidates must have a good honours degree in Chemistry of a British University; industrial and/or research experience would be an advantage.

Salary according to Burnham Scale, plus bonus. Application forms and further particulars may be obtained from the undersigned and should be returned not later than Thursday, September 20, 1945.

W. ALFRED RICHARDSON,
Principal.

MIDLAND AGRICULTURAL COLLEGE

(NOTTINGHAM UNIVERSITY COLLEGE)

Applications are invited for the following appointments:

1. ASSISTANT LECTURER IN CHEMISTRY. Candidates must possess an Honours Degree in Chemistry. Salary £300 per annum.
2. ASSISTANT TO THE ADVISORY CHEMIST. Candidates must possess experience of analytical work. Salary £300–£20–£400, plus war bonus.
3. ASSISTANT LECTURER IN DAIRYING. Candidates must possess a degree in Dairying. Salary £300 per annum.

Further particulars may be obtained from the Principal, Midland Agricultural College, Sutton Bonington, Loughborough.

NATAL UNIVERSITY COLLEGE

(IN DURBAN)

Applications are invited for the post of SENIOR LECTURER in CHEMISTRY. Salary will be on the scale: Men, £550 × £25 – £750; Women, £450 × £25 – £650, plus current cost of living allowance. Initial salary to be determined in accordance with the qualifications and experience of the successful applicant. Degree in Chemical Engineering or similar qualification is essential. Membership of the University Teachers' Provident Fund is compulsory. The appointment will be in the first place for a probationary period of one year. Further particulars may be obtained from the Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1. Closing date for applications October 15, 1945.

For Sale: Complete set of Journal of Scientific Instruments, unbound. Highest offer above £25 secures. Box P134, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

NATAL UNIVERSITY COLLEGE

(IN PIETERMARITZBURG)

Applications are invited for the post of LECTURER in CHEMISTRY (with qualifications in Inorganic and Physical Chemistry). Salary will be on the scale: Men £450 × £25 – £600, Women £350 × £25 – £500, plus current cost of living allowance. Initial salary to be determined in accordance with the qualifications and experience of the successful applicant. Membership of the University Teachers' Provident Fund is compulsory. Appointment will be in the first place for a probationary period of one year. Further particulars may be obtained from the Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, W.C.1. Closing date for receipt of applications October 15, 1945.

EDINBURGH AND EAST OF SCOTLAND COLLEGE OF AGRICULTURE

Applications are invited for the post of LECTURER in AGRICULTURAL CHEMISTRY. Salary £400 × £20 × £550, plus appropriate war bonus (£60).

Candidates should be in possession of an Honours Degree in Chemistry and should have had experience in teaching or research.

Applications, together with not more than three testimonials, should be lodged not later than September 29 with the undersigned, from whom further particulars may be obtained.

THOMAS BLACKBURN,
13 George Square, Secretary.
Edinburgh, 8.

University of Capetown invites applications for the following appointment: Professor of Bacteriology in the Department of Pathology, required to assume duty as soon as possible, and in any case not later than February 1, 1946. Will also be Honorary Bacteriologist to the Groote Schuur Hospital, which is the teaching hospital for the Medical School of the University. Salary £1,250 per annum. Write quoting F.4802A to Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, for memorandum on conditions of appointment and application forms, which must be returned completed by October 15, 1945.

Physicists (graduated) required by firm of domestic refrigerator manufacturers in South Midlands to train for position of responsibility in laboratory testing and research work. Salary £400 to £500 according to qualifications. Write quoting A.808XA to Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, for application form which must be returned completed by September 22, 1945.

South-Eastern Agricultural College, Wye. Applications are invited for the post of Technical Assistant to the Advisory Bacteriologist, South-Eastern Province, in connection with the National Milk Testing and Advisory Scheme. Applicants will be required to work in London and should possess a University degree. Experience of the bacteriological control of dairy plant is essential. Salary, excluding war bonus: Men £300–£400 p.a.; Women £240–£320 p.a. Applications to Advisory Dairy Bacteriologist, 39–41 Sackville Road, Hove, 3, Sussex.

Bio-Assay—Applications are invited for position of head of the Bio-Assay Department at laboratories situated near London. Suitable qualifications and previous experience in large-scale routine biological testing are essential. The position is permanent and pensionable (contributory). Salary paid will be commensurate with experience and qualifications. Applications should be addressed to the Production Director, The Wellcome Foundation, Ltd., 183, Euston Road, London, N.W.1.

Analyst required by Genatosan Ltd. Candidate should be of Honours graduate or A.R.I.C. qualification and should have had several years industrial experience in the analysis of medical preparations and fine chemicals. Commencing contract at £350–£450 per annum, plus 12½ per cent war bonus. Apply Chief Chemist, Genatosan, Ltd., Loughborough.

Experienced Works Chemist required to take charge of small scale organic chemicals production. Must have administrative ability, and a knowledge of chemical engineering would be considered an advantage. Write giving details of age, qualifications and past experience, to British Schering Manufacturing Laboratories, Ltd., c/o P.O. Box 407, Manchester.

Applications are invited for a post of Technical Indexer on the staff of the Plant and Animal Products Department of the Imperial Institute. Applicants should be women with a scientific training to Inter.B.Sc. standard, and a good knowledge of French and German is essential. Applicants must be British born of British parents. Commencing salary £200 plus war bonus, which at present is £48 p.a. Further particulars on application to the Establishment Officer, Imperial Institute, London, S.W.7.

Applications are invited for Graduate Physical Chemists with experience in the Printing Ink or Paint Industry to assist in the investigation of problems connected with the drying of printing inks from the physico-chemical aspect. Initial salary £275–£450 according to qualifications. Superannuation under the F.S.S.U. The Printing and Allied Trades Research Association, Charterhouse Chambers, Charterhouse Square, London, E.C.1.

Editorial Assistant required immediately to deal with the editing, printing and distribution of the publications of the Institution of Gas Engineers and of the Gas Research Board. Commencing salary £500 p.a. Applications giving age, experience and other relevant information, to be sent to the Secretary, The Institution of Gas Engineers, 1 Grosvenor Place, London, S.W.1, not later than September 12, 1945.

Library of the Printing and Allied Trades Research Association requires assistant with experience in scientific and technical abstracting to assist in preparation of Abstracts covering (*a*) Packaging Industries, (*b*) Printing and Allied Industries. Initial salary £300–£400 per annum according to experience and qualification. Superannuation under the F.S.S.U. Applications to the Director of Research, P.A.T.R.A., Charterhouse Chambers, Charterhouse Square, London, E.C.1.

Midland Agricultural College (in conjunction with Nottingham University College). Applications are invited for the post of Lecturer in Agricultural Botany. Candidates must possess an honours degree in Botany, with at least two years post-graduate research. Teaching experience essential. Salary, £500–£550. Applications, with names of two references, to be sent to the Principal, Midland Agricultural College, Sutton Bonington, Loughborough, not later than September 15.

Chemist with honours degree or previous experience required as assistant for work on design development and testing of gas heating appliances. Laboratory London district. Salary according to qualifications. Write Box A8182, Samson Clark, 57/61 Mortimer Street, W.1.

Wanted: Research Assistant in Department of Pathology. Should have University Degree in Zoology or Physiology. Knowledge of Biochemical technique desirable but not essential. Minimum salary £250 p.a. Pension Scheme. Hosa Research Laboratories, Sunbury-on-Thames.

Woman Abstractor and Librarian, experienced in technical translation, seeks more responsible post. Box P135, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

International Organization requires services of a fully qualified Chemist or Engineer to organize and take charge of research laboratories which they contemplate establishing in the U.K. Good salary and excellent prospects. Box 398, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

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to be darker than *Polycelis nigra* living in the same habitat. The temperature of the water was taken on a number of occasions and varied between 7° C. and 17·5° C. but was consistently the same in the two habitats.

By means of controlled habitat experiments I have shown that colour depends neither upon light nor temperature. No breeding experiments have yet been made to determine whether coloration is hereditary.

I am indebted to Dr. J. E. Smith and Dr. F. G. W. Knowles for much helpful advice.

J. L. Cloudsley-Thompson.

63 Lensfield Road,
Cambridge.
June 6.

[1] Wells, G. P., *Nature*, 129, 686 (1932).
[2] Kleinholz, L. H., *Pub. Staz. Zool. Napoli*, 17, 53 (1938).

Production of Extracellular Starch in Cultures of Capsulated Yeasts

In the course of a study of the growth requirements of different yeasts, it was unexpectedly found that cultures of *Torulopsis rotundata* gave a steel-blue colour reaction with iodine. The cells of this yeast were grown in a simple inorganic salt medium with glucose as source of carbon, ammonium sulphate as the source of nitrogen and a supplement of thiamine as a growth factor.

The substance responsible for the colour reaction was found to be present in the medium as well as in the large capsules by which cells of this species are usually surrounded, but could not be detected within the cells. It was precipitated from the cell-freed medium by alcohol in the form of white thread-like masses. Several grams were prepared in this way, and after purification the following properties could be demonstrated: the substance dissolves slightly in cold water giving a colloidal and opalescent solution. Molisch test was positive, protein test negative. Treatment with hot 60 per cent potassium hydroxide did not impair the iodine colour reaction. A spectrophotometric analysis of the iodine complex revealed an extinction curve identical with an iodine preparation of pure potato amylose. Acid hydrolysis produced reducing sugar. The solution was practically free from nitrogen. Reactions for ketoses, uronic acids and methyl pentoses were all negative. The fermentation test of the hydrolysed material with bakers' yeast showed that only about 50 per cent of the reducing sugar, calculated as glucose, is fermentable. The unfermented residue gave a strong reaction for pentose. Amylases of plant and animal origin caused complete disappearance of the iodine colour reaction with simultaneous liberation of reducing sugar which, calculated as maltose, corresponded to about 30 per cent of the total weight. The fraction precipitated with alcohol after the action of amylase gave strongly positive reactions for pentose.

These results seem to justify the assumption that the material contains at least two different polysaccharides one of which corresponds to the amylose fraction of the starch of green plants, the other being a pentosan.

A great variety of carbon compounds other than glucose including aldo- and keto-hexoses, disaccharides, pentoses, methyl-pentose (rhamnose), polyalcohols and organic acids permitted growth of the yeast in the synthetic medium with simultaneous production of the amylose fraction. Cori ester and polysaccharides (inulin, starch, glycogen) were unsuitable sources of carbon for growth and failed to maintain amylose production even when a heavy inoculum of cells was used. On the other hand, not all sources of nitrogen used by the yeast enabled the formation of amylose. If, for example, the yeast is grown in a medium with either peptone, urea or potassium nitrate instead of ammonium sulphate, an extracellular polysaccharide is produced which gives a positive test for pentose but is entirely free from amylose. It can be demonstrated, however, that the production of the amylose does not depend in principle on the nature of the nitrogen compound but on the *p*H which is established during the utilization of nitrogen by the micro-organism. Amylose formation was observed only if the reaction was below *p*H 5. If the yeast is grown with ammonium sulphate or chloride as sole source of nitrogen, a steady lowering of the *p*H occurs as the sulphate or chloride ion is set free, whereas with potassium nitrate, urea and peptone an alkalinization results. Correspondingly, when calcium carbonate is added to the ammonium sulphate medium, the formation of amylose is suppressed; whereas the buffering of the reaction at a *p*H below 5 leads to a production of amylose even in a medium containing peptone as sole nitrogen source. In conclusion, it may be said that production of amylose by *T. rotundata* only takes place if the medium is favourable to good growth and maintains during growth a reaction below *p*H 5.

Twenty-five different yeast strains belonging to various taxonomic groups, *Saccharomyces*, *Schizosaccharomyces*, *Hansenia*, *Willia*, *Monilia*, *Rhodotorula*, *Torulopsis* (uncapsulated), produced no amylose when tested in the conditions defined above. Among the capsulated *Torulopsis* yeasts, the only species other than *T. rotundata* available to us was the pathogenic *T. neoformans*, also known in the medical literature under the synonyms of *T. histolytica* or *Cryptococcus hominis*. This strain produced amylose in exactly the same conditions as *T. rotundata*.

The serological properties of the extracellular polysaccharides described above are at present under investigation.

M. Aschner.
J. Mager.
Department of Hygiene and Bacteriology,
Hebrew University, Jerusalem.
J. Leibowitz.
Chemical Department of the
Cancer Research Laboratories,
Hebrew University, Jerusalem.
May 21.

Antibiotics from Moulds

The antibiotic for which the structure anhydro-3-hydroxymethylene-tetrahydro-γ-pyrone-2-carboxylic acid has been proposed[1] was detected in the metabolism solution of *Aspergillus clavatus*[2] (clavacin)[3], was isolated in crystalline form from *Penicillium claviforme* (claviformin)[4], *P. patulum* (patulin)[1] and *A. clavatus* (clavatin)[5]. The chemical nature of the product was investigated[1,5] and the structure given above was proposed[1]. The product has also been isolated from the metabolism solution of *P. expansum*[6], *A. giganteus*[7], *P. melinii*[8] and *Gymnoascus* sp.[8].

We have now shown that the same substance is

responsible for at least part of the antibiotic activity reported[9,10,11] as being produced by the following moulds: *Penicillium urticæ* Bain. (N.C.T.C. No. 1215); *Aspergillus terreus* Thom (N.C.T.C. No. 981); *Penicillium expansum* (Link) Thom (N.C.T.C. No. 5612). (The production of this inhibitor by a number of unspecified strains of *P. expansum* was reported[6] two years ago.)

In each case the substance was isolated from the crude culture fluid by adsorption on charcoal, elution with 80 per cent acetone, and extraction of the concentrated acetone-free eluate with ether in a liquid-liquid extractor for several hours. Crude crystalline inhibitor separated from the concentrated ether after 1–2 days in the refrigerator and was recrystallized from hot chloroform. Identity with the authentic substance was established by mixed melting point, analytical figures, *p*H stability, antibacterial properties and chemical tests.

All three moulds were grown on liquid media in layers 1–2 cm. deep, at 24° C. for 6–10 days; antibiotic action was shown on a number of media by each mould, but the particular media from which the inhibitor was actually isolated were: *P. urticæ*, Czapek-Dox; *A. terreus*, Czapek-Dox, also 2 per cent malt extract; *P. expansum*, potato-dextrose. In the case of *A. terreus* some other inhibitor is produced under certain conditions. This is being studied.

J. Kent.
N. G. Heatley.
Sir William Dunn School of Pathology,
University of Oxford.
June 8.

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[2] Wiesner, B. P., *Nature*, **149**, 356 (1942).
[3] Waksman, S. A., Horning, E. S., and Spencer, E. L., *Science*, **96**, 202 (1942). *J. Bacteriol.*, **45**, 233 (1943).
[4] Chain, E., Florey, H. W., and Jennings, M. A., *Brit. J. Exp. Path.*, **23**, 202 (1942).
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[9] Wilkins, W. H., and Harris, G. C. M., *Brit. J. Exp. Path.*, **25**, 135 (1944).
[10] Wilkins, W. H., and Harris, G. C. M., *Brit. J. Exp. Path.*, **23**, 166 (1942).
[11] Wilkins, W. H., and Harris, G. C. M., *Brit. J. Exp. Path.*, **24**, 141 (1943).

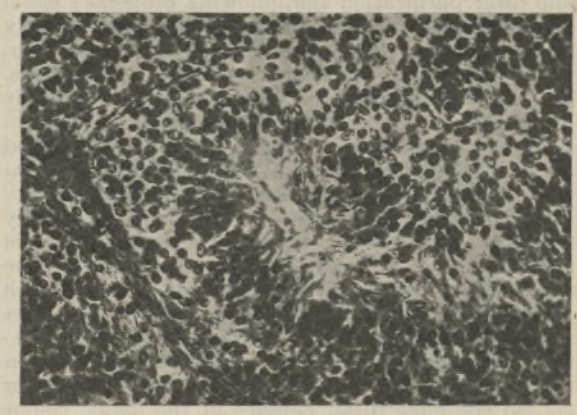
Glioma in a Rat Fed with 2-Acetyl-amino-fluorene

Malignant tumours of nerve tissue have been produced experimentally in mice of pure strains by several authors. In rats, repeated unsuccessful attempts have been reported; but Russell[1] has recently given convincing evidence of positive results. All successful results have been achieved by direct action of the carcinogenic hydrocarbons (mainly methyl-cholanthrene) upon the nerve tissue, by way of crystals or pellets implanted in the brain substance. The result reported below refers to glioma-induction in a rat by the oral administration of a new carcinogenic agent, 2-acetyl-amino-fluorene.

The carcinogenic activity of 2-acetyl-amino-fluorene was discovered by Wilson *et al.*[2] and has been investigated in Great Britain by Bielchowsky[3], to whom we are indebted for a generous supply of the substance. The interesting feature of its action is the variety and multiplicity of the neoplasms provoked by oral administration.

The rat which developed a glioma was one of twelve which were fed from the age of two months for twenty-four weeks on a standard diet in which was incorporated 0·5 gm. of the substance in 1 kilo of food. Of the twelve rats, seven are still alive and well. Four have developed tumours; study of the fifth is not yet complete. Of the four which had tumours, one had a malignant hepatoma; another a mammary cancer and an auricular epithelioma; a third, a mammary cancer, two epitheliomas of the ductus acusticus and a hepatoma; the fourth, the subject of this note, a glioma.

The rat with the glioma first gave signs of a brain tumour by inco-ordination of movement and by a slight paresis. Two weeks after these signs were noticed, the animal died. At the post-mortem examination the only abnormality present was the asymmetry of the cerebral hemispheres, with the left obviously and regularly enlarged in its frontal part. The enlargement was accompanied by a loss of the normal aspect and vascularity of the cerebral surface. Sectioned after fixation, the left hemisphere showed the existence of a voluminous infiltrating tumour mass extending throughout the olfactory bulbs, which were later found to be totally invaded by the new growth, and the white matter of the frontal and temporal lobes, gradually diminishing backwards and leaving the cortex almost intact. The anterior and main parts of the lateral ventricle were filled with tumour tissue but the posterior horn was patent. At the level of the olfactory bulb and part of the frontal lobe the tumour invaded the leptomeninges, spreading along the subarachnoidal spaces to the cortex of the left and right sides by way of the perivascular spaces.



Microscopically, the tumour shows an almost uniform mass of small cells, mostly with round nuclei and short elongated cytoplasm. In some parts the cells are arranged in 'rosette' or palisade fashion with converging processes as shown in the accompanying illustration. Some mitoses are present. There are few blood vessels but no necrotic zones. These characteristics lead to the diagnosis of the tumour as a glioma belonging to the type 'glioblastoma isomorphe' according to the Rio-Hortega[4] classification. Further structural details will be published later.

The extraordinary rarity of spontaneous gliomas in the rat and the time of the appearance of the

tumour, simultaneously with the other tumours in the series, justifies the opinion that this is a chemically induced neoplasm. The small number of animals used does not permit of any conclusion about the relative incidence of this type of tumour among the many produced by the same agent. With regard to previous experiments on glioma formation, it seems evident that when the carcinogenic substance is administered, as in our case, by a systemic route, the pathogenesis of the tumour must be nearer the natural glioma development than if a massive amount of the agent is artificially brought into direct contact with normal cerebral tissues.

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Penicillin in Kala Azar

In the available literature to date there appears to be no record of the effect of penicillin in leishmaniasis, and as a supply of the drug has recently become available it was decided to try its action on two cases of kala azar. Both cases were regarded as clinically typical and fairly severe, and neither had previously received any kind of treatment. The following short notes illustrate the patients' conditions before and after treatment.

Case (1). Male, twenty-two years, admitted to Gedaref Hospital on 2.5.45 seriously ill with a history of seven days fever (his condition suggested he had been ill for a much longer period), and clinical dysentery.

Clinical Notes: Spleen 1 F.B. (finger's breadth below costal margin). Liver 3 F.B. Spleen and lymphatic gland smears positive for *Leishmania donovani*.
Blood Count: R.B.C., 3,000,000; W.B.C., 3,000. Diff. count, P 57, L 31, L.M. 12 E.O. Repeated blood films negative for malaria and other parasites.
Fæces contained blood and mucus; no *Entamœbæ histolytica* were found. Urine normal.

After some days rest and treatment for bacillary dysentery his condition improved considerably. Penicillin treatment commenced on 21.5.45 and continued until 29.5.45. During treatment he developed an attack of malaria, and M.T. parasites were present in blood (23.5.45). The malaria was controlled by quinine. The temperature chart was complicated by the malaria, but when this was treated the temperature still continued swinging with no sign of diminution (ranging from subnormal to 104° F.). Liver and spleen were unaltered and there was no sign of clinical improvement. On 31.5.45, spleen and gland smears still positive.

Case (2). Female, aged forty, admitted on 14.5.45 complaining of fever for one month.

Clinical Notes: General condition, fair. Spleen, 3 F.B. Liver, 1 F.B. Spleen and gland smears, positive for *Leishmania donovani*.
Blood Count: R.B.C., 3,400,000; W.B.C., 4,000. Diff. count, P 65. Lymph 29. L.M. 6 E.O.
Repeated blood films negative for malaria or other parasites.
Fæces and urine normal.

Treatment commenced on 21.5.45 and continued until 29.5.45. During treatment the temperature showed no signs of diminution, ranging between normal and 104° F., and the general condition appeared to be deteriorating. There was no appreciable change in the blood counts and no diminution in size of the spleen and liver. On 31.5.45 spleen and gland smears still positive.

Treatment: 20,000 units of penicillin in normal saline (4 c.c.) were given intramuscularly three-hourly until a total of 1,500,000 units was reached. There were no complaints of pain or reaction. To avoid any mistake in times of administration or dosage, all injections were given personally by one of us (M. H. S.), the course of treatment, dosage and times of administration being identical for both patients.

Comments: The results were a complete failure, and there was no evidence that the course of the disease in either patient was influenced in any way. On the contrary, the condition of the second patient deteriorated, while the first patient developed malaria during the course.

It is of course well known that Sudan kala azar, as compared to the Indian disease, is far more resistant to any kind of drug, and the possibility must be admitted that much larger doses with continuous administration might have had some influence on the course of the disease. At the moment, it can only be said thay there is no evidence in favour of such a suggestion, and either repeated or continuous administration has serious disadvantages when treatment has to be carried out in a small hospital without a specially trained staff.

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A Medium for Mounting Parasitic Helminths

This medium is an aqueous one, and gum arabic forms its basal element. It is clear and of a suitable refractive index for mounting stained helminthic parasites. Carmine-stained specimens mounted in this medium show no deterioration or discoloration. Above all, the medium has great tolerance of water; in fact, no dehydration and clearing is required before mounting specimens in it.

Chemicals: Hung's Solution I*		
	Gum arabic	8 gm.
	Distilled water	20 c.c.
	Chloral hydrate	80 gm.
	Glycerine	12 c.c.
Hung's Solution II*		
	Gum arabic	20 gm.
	Distilled water	20 c.c.
	Chloral hydrate	17 gm.
	Glycerine	3 c.c.

* Dedicated to Dr. See-lu Hung, under whose guidance this medium was worked out.

In preparing the solutions, the gum arabic is first dissolved in the distilled water, then the other chemicals are added in the order given.

Procedure: The helminth is fixed and stained in the usual way. Having been destained, the material is washed in 70 per cent alcohol or in distilled water. Then it is transferred directly into solution I for one to two hours according to the size of the specimen; material remaining in the solution I is not injured. Finally it is mounted in solution II. Within two

days, the mounting medium surrounding the margin of cover glass becomes solidified, and in two weeks it becomes quite hardened.

Some worms, such as *Fasciola hepatica*, *Fasciolopsis buski*, *Echinostoma revolutum*, *Clonorchis sinensis*, *Metagonimus yokogawai*, *Echinococcus granulosus*, *Dipylidium caninum*, *Diphyllobothrium mansoni*, *Taenia crassicollis*, *Taenia solium*, *Ancylostoma duodenale*, *Necator americanus*, *Enterobius vermicularis* have been mounted satisfactorily in this medium.

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This interesting communication directs attention to the great difficulty experienced by most workers in making really satisfactory and permanent preparations of nematodes. The Hung's solution described above resembles in composition Berlese's well-known medium for mounting small insects and small arachnids. The formula of this is given by Bolles Lee[1], as follows: Water 20 c.c., chloral hydrate up to 160 gm., gum arabic 15 gm., glucose syrup 10 c.c., acetic acid 5 c.c. On the same page Bolles Lee gives the following formula which is, it is stated, used in British and other museums (its origin is unknown): distilled water 50 c.c., gum arabic 40 gm., glycerin 20 c.c., chloral hydrate 50 gm. Dr. P. Tate of the Molteno Institute, Cambridge, reminds me that formulæ for other gum-chloral media exist, some of which contain cocaine hydrochloride, presumably put in to narcotize living small insects and arachnids. An example of these is the medium of G. Faure[2] mentioned by M. Langeron[3], who gives the following formula for it: distilled water 50 c.c., gum arabic 30 gm., chloral hydrate 50 gm., glycerin 20 c.c., 0·5 gm. cocaine hydrochloride being added when living animals are being mounted. References to methods used for the mounting of nematodes parasitic in plants will be found in "Plant Parasitic Nematodes", by T. Goodey (Methuen, London).

A gum-chloral medium is used by H. L. Ratcliffe[4] for the mounting of adult nematodes (hookworms and small nematodes) and the eggs of *Enterobius vermicularis*. A concentrated suspension of the eggs of this species in neutral formalin is passed through a series of bottles containing dilutions of gum-chloral in 10 per cent formalin, beginning with a 10 per cent dilution and rising by 2 per cent increases in strength until the eggs are suspended in pure gum-chloral. The process takes two months. Ratcliffe recommends it also for insects (including their larvæ and pupæ) and small arachnids.

D. Minckler[5] gives a method for clearing, in less than three days, adult *Enterobius vermicularis* for class study. The nematodes are fixed in 10 per cent formalin and the formalin is washed out for several hours in running water. The nematodes are then put in three changes of dioxane, each change lasting one hour. They are then put in carboxylene (phenol 25 c.c., xylene 75 c.c.) for twenty-four hours and then three changes of neutral xylene lasting a few minutes each, and mounted in damar dissolved in xylene. The nematodes are handled in a small bottle, the fluids being decanted. They adhere to the sides of the bottle, so that this is drained after each change by setting it mouth downwards upon filter paper. The nematodes are removed for final mounting by a large-calibre medicine dropper. The nematodes acquire a tan or yellow colour in various parts, but the nerve ring is not shown.

T. N. Tahmisian[6] gives a method for mounting hookworms without the opacity which is usually experienced when they are put into balsam. This has been attributed, he says, to imperfect dehydration and to exposure to air between clearing and mounting, but shows that this is not so. When he dehydrated carefully and cleared in xylene or toluene and then floated balsam over the clearing oil to prevent the access of air, 90 per cent of the nematodes were still opaque. He noted that those which cleared were always ruptured ones. He therefore partially dehydrated them in 70 per cent alcohol and then pierced the cuticle with a fine needle under the dissecting microscope. The nematodes were then further dehydrated, cleared and mounted without difficulty. He says that, when the cuticles of opaque nematodes were pierced, gas could always be expressed from them and that then they would clear. He believes that the balsam causes a rapid exosmosis of the clearing oil, so that gas forms under the cuticle and causes opacity.

There are, of course, other methods of mounting nematodes, such as treatment of them with lactophenol (see Bolles Lee, "Microtomist's Vademecum"). This is very useful for diagnosis, but preparations cleared with it are not suitable for permanent use. It seems probable that work now being done in Cambridge by Dr. Trim and at Newcastle by Prof. A. T. Hobson on the permeability of the nematode cuticle may eventually indicate methods of preliminary treatment of the nematode cuticle which will make permanent preparations of them much more satisfactory. Meanwhile it would be valuable to know of other methods which individual workers may have found satisfactory for making permanent preparations of either trematodes, cestodes or nematodes.

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Production of Skin Burns by Hot Gases

The chief factor determining the time taken to produce a burn of given severity will be the rate of heat transfer from the hot gases to the skin. Other factors such as individual variation in the skin and its condition at the time, for example, sweating, will also play their part. Thermal conduction from the skin surface into the deeper tissues is a complex phenomenon, but a simplified model leads to interesting conclusions.

If we treat the corium as a single region of reasonably uniform temperature from which heat is conducted away into the deeper tissues, that is, across or through the fatty layer when present, at a rate proportional to the elevation of its own temperature, then

$$d\theta/dt = Q/\rho ls - A\theta,$$

where Q is the rate at which heat is transferred across the epidermis into the corium from the hot gases, θ is the rise of temperature (above normal) in the corium the thickness of which is l, density ρ and specific heat s; t is the time and A a constant.

Integrating and putting $\theta = 0$ when $t = 0$,

$$t = -\frac{2 \cdot 30}{A} \log_{10} (1 - A\theta\rho ls/Q),$$

treating Q as a constant independent of θ, which will be justifiable while θ and the temperature difference across the epidermis are small compared with the difference between the temperature of the hot gases and skin temperature.

If a temperature rise of θ' in the corium is necessary to produce a burn of given severity, then Q must exceed $A\theta'\rho ls$ or no such burn can be produced. The total absorbed heat, H, required to produce the burn is Qt', which has a minimum value of $\theta'\rho ls$ when Q is very large.

According to recent work[1], a temperature of about 50° C. must be reached in the corium if irreversible effects leading to œdema and scabbing, that is, second-degree burns, are to occur. This corresponds to a value of θ' for such burns of about 15° C. The thickness of the corium is variable, but 1–2 mm. is average, the ventral surfaces being the thinner. Both the density and specific heat may be taken as approximately unity. Hence for burns of the ventral surface of the forearm, the value of the factor $\theta'\rho ls$ should be about 1·5.

Gas temperature (° C.)	Velocity of flow (ft.p.m.)	Q* (Cal./sec./cm.²)	Efficiency of thermal transfer (per cent)	H (cal./cm.²) obs.	H (cal./cm.²) calc.	t' (sec.) obs.	t' (sec.) calc.
150†	25	0·10	35	>6	–	>60	–
200†	25	0·133	35	2·5	2·7	15–20	20
1100‡	1000	3·6	9	1·4	1·5	0·4	0·44

* Measured by the rate of temperature rise of a copper block when in similar position as the forearm. This assumes the surface coefficient to be similar for skin and metal at similar temperatures. That the epidermis is a poor conductor does not significantly affect this assumption, since its thermal capacity is negligible, and the temperature differences across it necessary to produce these rates of heat transfer are small compared with the differences of temperature between the hot gases and the skin. Under other conditions, for example, burning by contact with relatively low-temperature objects, the conductivity of the epidermis may become of major importance.

† From 1 cm. diam. jet.

‡ Large flame.

The data in the accompanying table represent a small group of nine second-degree burns of the ventral surface of the forearm of three subjects; the burnt area was about 2 cm. in diameter in each case. No burns were produced when Q was less than 0·10 cal./sec./cm.²:

that is, $A\theta'\rho ls \simeq 0 \cdot 10$ and $A \simeq 0 \cdot 067$.

Hence the time taken under these conditions to produce a second-degree burn,

$$t' = 34 \log_{10} \left(\frac{Q}{Q - 0 \cdot 10} \right).$$

The calculated values of H and t' in the table are derived from this equation and are in good agreement with the experimental figures.

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Absolute and Differential Light Sensitivity of the Dark-adapting Eye

The lack of correlation between the absolute light threshold of the dark-adapted eye and the 'ability to see in the dark' has been currently attributed to psychological factors; but little attention has been given to the behaviour of contrast sensitivity, despite the fact that vision at low illumination depends largely on the perception of differences in brightness. In particular, the possibility of variations in contrast sensitivity independent of variations in the absolute threshold does not seem to have been investigated, although the occurrence of such variations seems likely from the observations of Edmund and others[1,2].

Comparison also of the generally disappointing data on variations in the absolute light threshold of the dark-adapted eye in supposedly vitamin A deficient and non-deficient (or treated) subjects with the data on variations in contrast sensitivity as observed by the Scandinavian workers[1,2], suggests that the latter yield more significant differences. However, no reference directly relating the two functions, or adequate data allowing of direct comparison, could be found in the literature.

We have carried out a comparative study of the absolute and differential threshold of the dark-adapting eye in selected subjects with 'good' and 'poor' night vision respectively, and our observations indicate first, that, in observers with identical light-threshold recovery curves, marked differences in contrast sensitivity occur, and appear to be related to their 'ability to see in the dark'; secondly, treatment of the 'poor' observer with vitamin A together with brewers' yeast produced a striking improvement in contrast sensitivity with little effect on the light threshold.

The instrument used was the new Crookes's standard adaptometer[3], the only modification being that the test object was replaced by black or grey arrows on a fully transparent background. The curves shown here were obtained, after initial light adaptation to 750 ml. for five minutes, by recording the time required in the dark to recognize the position of a rotatable grey or black arrow on a bright ground, the brightness of which was reduced in steps. The following contrasts were used: C_1, 7 per cent; C_2, 20 per cent; C_3, 34 per cent; and C_4, 100 per cent. A curve thus obtained with a 'black' figure on a bright ground is practically identical with one obtained using a bright figure on a black ground and, with a relatively large and simple figure, is closely approximate to the recovery of the absolute light threshold. A simple figure was chosen as it objectivates the response and appears to control the part of the retina used. A remarkable reproductibility was obtained without a fixation spot[3,4]. There was thus freedom for using the most suitable part of the retina, which was parafoveal for the lower rod range; the observer was advised to facilitate perception of contrast by continuous small movements of the eye. Observation was binocular with natural pupils, the distance between eye and test object being 60 cm., the test field and the smallest detail of the arrow having a visual angle of 7° and 1° respectively. The curves representing the visibility of the lower contrasts are averaged from repeated tests, their number being indicated in brackets. (These curves describe the outer envelope of adaptation curves which are not smooth, but actually fluctuate.)

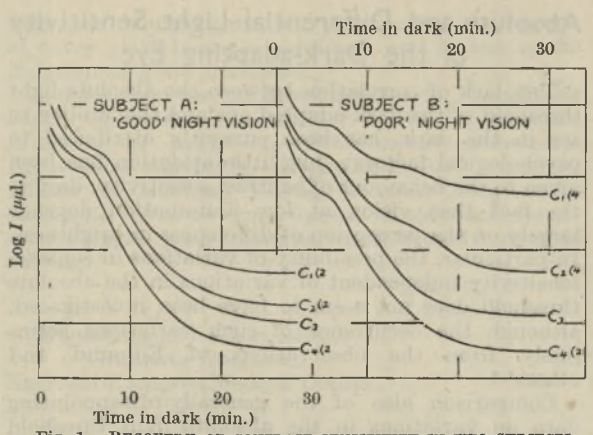

Fig. 1. Recovery of contrast sensitivity in two subjects with 'good' and 'poor' vision respectively.

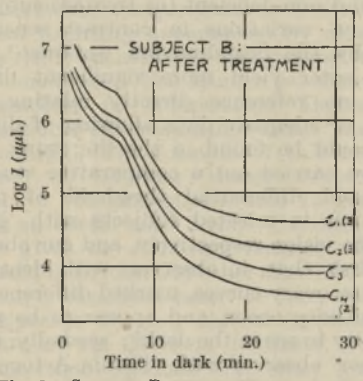

Fig. 2. Subject B. following treatment.

Fig. 1 shows a typical set of observations. Fig. 2 shows the changes in the 'poor' observer following treatment for 10–14 days, consisting of daily administration of 33,000 I.U. of vitamin A (Crookes's vitamin A concentrate) and about 10 grams of dried brewers' yeast ('Aluzyme') kindly supplied by Messrs. Phillips Yeast Products, Ltd. A second dose of vitamin A was given on the day of the tests 3–7 hours before the test.

Psychological factors undoubtedly play a part in night visual capacity[5,6]; however, complaints about poor night vision in subjects having a normal absolute light threshold should not be tacitly attributed to such factors without information concerning contrast sensitivity. It also seems likely that the latter may reflect more sensitively the influence of nutritional, metabolic and presumably also nervous factors than variations in the light threshold. It may, in fact, under the experimental conditions herein described, represent the only demonstrable change in visual sensitivity.

Our thanks are due to Messrs. Crookes Laboratories for the loan of the adaptometer, to Mr. R. B. Morris from Kodak Research Laboratory for help and advice, and to Mr. A. Rugg-Gunn for his stimulating interest.

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Parthenocarpic Production of Tomato Fruits

Recent work at Long Ashton has shown that a number of chemical compounds, when suitably applied, will induce the parthenocarpic production of tomato fruits[1]. Their effectiveness has varied between 2-4 dichlorophenoxy acetic acid which can be used at 1 p.p.m., to that of *beta* naphthoxyacetic acid which is used at 60 p.p.m. The use of the latter substance on a commercial basis is now possible, and I have used it in commercial greenhouses in 1945 to 'set' bottom trusses which had failed owing to unusual weather conditions. In one instance a natural set of 25 per cent was raised to 97 per cent by a single application.

Many of these substances, however, have marked 'formative effects' when used at relatively high concentrations[1], and a number of symptoms suggestive of virus diseases have been induced in this way[1,2]. This property is now being used in extreme measure in the so-called selective weed killers[3,4,5].

Two completely new lines of investigation have recently been opened up in experiments at Long Ashton to induce parthenocarpy in tomatoes. The first is in the use of synthetic animal hormones of the œstrogen type, the second in the use of crude extracts of tomato flowers.

Recent developments in animal hormone physiology have shown that certain substituted stilbene compounds are more effective œstrogens then the naturally occurring substance. Preliminary trials on tomato have shown that 4-4′ dihydroxydiethyl stilbene (stilbœstrol) will cause parthenocarpic development of tomato fruits within the concentration range 50–100 p.p.m. Hexœstrol, which is the hydrogenated stilbœstrol, has also been shown to be active in this direction. These observations are of considerable theoretical interest since the latter substance is a fully saturated compound and does not contain a carboxyl group. By further substitutions within this molecule, it may be possible to provide a chemical theory for some of the work now in progress.

The second line of development is no less important. During this work large numbers of tomato flowers were removed just prior to anthesis. These were stored in the laboratory in a litre beaker until it was nearly full. These flowers were then extracted with ether under a reflux condenser. The dried ether extract was taken up with 5 ml. of absolute alcohol and diluted to 100 ml. with water, when a dense cloudy suspension of unknown concentration was obtained. Portions of this suspension were further diluted to $\frac{1}{4}$ and $\frac{1}{2}$ strengths respectively, thus giving three concentrations. All these proved active when applied to the tomato. 5 ml. of 11 per cent ester salts per litre of water was added to all sprays in order to provide adequate wetting properties. The most concentrated solution induced 100 per cent set when applied to flowers which had been deflorated fourteen days earlier. Appreciable development of the fruits was noticeable three days after application and in this respect the extract of tomato flowers compared favourably with beta naphthoxyacetic acid. A second batch of flowers similarly extracted yielded an extract which was equally active. It is hoped in due course to obtain sufficient material to provide for biochemical investigations of the active substances in the flower extract.

These observations suggest an important field for investigation into problems of fruit setting and de-

velopment of tree fruits, and may have important applications in orchard practice in relation to problems of pollination and sterility.

In similar experiments with apples and pears, only limited success has so far been achieved. A severe frost occurred on April 30–May 1, 1945, by which time apple and pear fruits had set and commenced to swell. The frost killed the embryos and blackened the centres of the fruits. A number of trees of apple and pear bearing crops of these frosted fruits were sprayed on May 8 with a mixture of growth-promoting substances known to be effective on tomato. Conference pear and Miller's Seedling apple responded to the spray, and at the time of writing all treated fruits are still on the trees and some show appreciable swelling. Cox trees sprayed at the same time with the same mixture did not respond and all the fruits fell off, as was also the case with the untreated trees of Miller's Seedling. It is still doubtful whether the treated fruits of Miller's Seedling will develop to full size or maturity, but it is of interest that such severely damaged fruits have been prevented from falling, and it seems reasonable to expect that in further experiments suitable materials will be found which will be as effective on apples and pears in inducing parthenocarpy as *beta* naphthoxyacetic acid is on tomato.

Grateful acknowledgment is made to Dr. S. J. Folley, of the National Institute for Research in Dairying, and to Messrs. Boots, Ltd., for the synthetic œstrogens used in these experiments.

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Neutron-Proton Scattering at 8·8 and 13 MeV.

THE experimental work of Champion and Powell[1] on neutron-proton scattering at 8·8 and 13 MeV. gives, essentially, two new results: (1) the angular distribution, as given by the best smooth curve, is not exactly isotropic as is generally expected for particles of wave-lengths long compared with the dimensions of the system; (2) there is some evidence for a high-order fluctuation in the intensity.

Champion and Powell suggest (*op. cit.*, p. 84) that the general trend of the distribution can be due to a small p-component in the scattered wave. However, the intervention of forces deriving from potentials of the type

$$S_{12} = (\overrightarrow{{}^1\sigma r_{12}})\,(\overrightarrow{{}^2\sigma r_{12}})\,.f(r_{12}), \quad . \quad . \quad (1)$$

suggested by the existence of the quadrupole electric moment of the ground-state of the deuteron[2], gives rise, already in the lowest-order scattering wave, to a mixture of S and D states, therefore leading—even in the first approximation—to an anisotropic scattering.

Rodrigues Martins[3] has investigated the influence of the coupling (1) on the angular distribution of the triplet ($^3S + {}^3D$) scattering. Following the general lines of his paper, it can be shown that the angular distribution of the lowest scattering is given by

$$I(\theta) = 1 - 1{\cdot}19\,|C_2|\cos\delta\,.\tfrac{1}{2}(3\cos^2\theta - 1) + f(\theta).|C_2|^2 + , \quad . \quad . \quad (2)$$

where C_2 is the scattering coefficient of the d-wave (taking $C_0 = 1$), and δ is its phase-shift.

Neglecting the quadratic terms, we obtain the general trend of the distribution (referred to the centre of mass of the system); determining the factor $|C_2|\cos\delta$ so that the mean quadratic error with respect to the curves of Champion and Powell be a minimum, we obtain the values $-0{\cdot}11$ for the 8·8 MeV. neutrons group, and $+0{\cdot}14$ for the 13 MeV. group. Drawing the curve, it is seen that the intervention of potentials of the type (1) produces a remarkable anisotropy in the angular distribution. According to the formulæ given by Rodrigues Martins (due to eventual resonance with compound levels), the values of $|C_2|$ are of the order of 1/10 and are thus sufficiently in agreement with the values of $|C_2|\cos\delta$ as obtained above.

On the other hand, the fluctuations suggested by Champion and Powell cannot be explained by the intervention of forces of the type (1). As a matter of fact, the amplitude of these fluctuations exceeds considerably the value of the quadratic terms of (2); and their frequency would require the inclusion of spherical waves of very high order. Therefore, if these fluctuations should be found to be real, it would be hard to explain them by any physical picture.

Supposing, further, that all the forces acting are of the exchange type, the potential (1) would have to be replaced by[4]

$$R_{12} = \tfrac{1}{2}(1 - {}^1\beta^2\beta)\,(\overrightarrow{{}^1\alpha r_{12}})\,(\overrightarrow{{}^2\alpha r_{12}})\,.f(r_{12}) \quad (3)$$

The amplitudes of the scattered waves remain, then, essentially the same as in the foregoing case, at least in Born's approximation.

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Time Dependence of Interfacial Tension and Density in Solutions

Dr. A. F. H. Ward and L. Tordai[1] have described experiments showing changes of interfacial tension with time in solutions. There is no mention made whether in these experiments density changes also could be observed.

I have investigated a number of systems in which the interfacial tension changes in time. The most remarkable feature of these experiments was the time dependence of some other properties, and densities in particular. Densities can be easily measured to six decimal places. I observed changes in the third decimal as a rule. Changes in densities were observed irrespective of whether the experiments were con-

ducted uninterruptedly, or portions taken out for individual measurements.

Before equilibrium is reached, the physical properties and densities in particular fluctuate all the time, and eventually they become stabilized and acquire definite values. Similarly, F. F. Nord[2] with collaborators has described volume changes in sodium oleate as a function of time.

These facts cannot be interpreted as surface phenomena, but must be attributed to changes in the bulk of solutions[3].

GEORGE ANTONOFF.

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New York, N.Y.
May 2.

[1] *Nature*, **154**, 146 (1944).
[2] Nord, F. F., and others. *Ber.*, **65**, 1148 (1932); *Koll. Z.*, **58**, 205 (1932).
[3] Antonoff, G., *Arch. Biochem.*, **6**, 199 (1945).

Occurrence of Boron Phosphate in Fireside Deposit from an Economizer

IN a recent communication in *Nature*, Rafter[1] has directed attention to the presence of appreciable proportions of boron in samples of New Zealand coal ashes.

In this connexion it may be of interest to note the presence of a comparatively large proportion of boron phosphate in a deposit recently examined here. This deposit was one of several typical deposits from the fireside of economizers and boiler tubes of certain high-pressure boiler plants which were examined in 1942 and 1943; the work was carried out at the request of the British Coal Utilisation Research Association acting on behalf of the Boiler Availability Committee sponsored by the Central Electricity Board.

The method of separating deposits taken from the fireside of economizers and boiler tubes into convenient fractions has been suggested by B.C.U.R.A. It is as follows: the sample is powdered, extracted by boiling water, then by 10 per cent aqueous nitric acid and finally the insoluble residue is analysed. The insoluble residue prepared in this way from the deposit removed from an economizer of a high-pressure boiler had the following composition:

SiO_2	50·93%	$K_2O + Na_2O$	1·92%
Fe_2O_3	8·7	$CaO + MgO$	0·82
Al_2O_3	4·16	P_2O_5	17·7
B_2O_3	7·6	SO_3	1·78

Loss on ignition, 8·04 per cent.

There was negligible loss of phosphoric acid when the material was boiled with water or with 10 per cent nitric acid. It was therefore probable that the phosphoric acid was not combined with the metallic oxides. A search was next made into the possibility of its being combined with silica or with boric oxide.

Comparatively stable silicyl phosphates have been prepared[2] and their X-ray powder patterns described[3]; the X-ray powder pattern of the insoluble residue from the economizer deposit did not correspond with that in ref. 3 or with that of the silicyl phosphate which we synthesized by the method given by Hautefeuille and Margottet.

On the other hand, boron phosphate made as described by Vogel[4] gave a pattern corresponding exactly with that produced from the insoluble residue. This pattern agrees with that determined by Schultze[5] and with that set out in the Index of X-Ray Diffraction Patterns published by the American Society for Testing Materials (Card 1301). Boron phosphate is therefore a major constituent of the insoluble residue from the economizer deposit; it amounted to about 4½ per cent of the particular sample of deposit which we examined. Unfortunately, it is not possible to relate this occurrence of boron phosphate to the fuel from which it was derived, because during the time the deposit was being formed, the fuel burned in the grate was drawn from a wide variety of sources.

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J. HASLAM.

Imperial Chemical Industries, Ltd.,
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Alkali Division,
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June 6.

[1] *Nature*, **155**, 332 (1945).
[2] Hautefeuille and Margottet, *C.R. Acad. Sci.*, **96**, 1052 (1883); **99**, 789 (1884); **102**, 1017 (1886); **104**, 56 (1887).
[3] Levy and Peyronel, *Z. Kryst.*, **92**, 190 (1935).
[4] Vogel, *Z. Chem.*, (2) **6**, 125 (1870). See also Skey, *Chem. News*, **16**, 187 (1867), for the first description of this compound; and Mylius and Meusser, *Ber*, **37**, 397 (1904) for a detailed account.
[5] Schultze, *Z. phys. Chem.*, B, **24**, 215 (1934).

The Hazel Period in the Post-Glacial Development of Forests

POLLEN analysis shows the well-known hazel-maximum, especially in Central and Western Europe. In certain horizons hazel pollen is so frequent that there must have existed real hazel-scrub forests. This hazel period has been assigned to the beginning of the post-glacial warm period, and coincides with the mesolithic culture period (see, for example, Firbas[1]).

The reason for this high frequency of hazel pollen is, according to Firbas, difficult to understand to-day. This is shown too by the interesting attempt of Erdtman[2] to explain the apparent pollen frequency by modalities of sedimentation and preservation of hazel pollen.

Climatic changes, such as those in humidity, should not have been very important, according to Salisbury and Jane's[3] determinations of widths of annual rings.

I would not attempt to suggest a possible explanation for the problem, if I had not observed, during residence in Brazil, the great transformations in vegetation caused by natural or artificial fires. Modern ecology agrees that fires made by primitive man, to free land for the hunter and the cultivator, have swept over very large areas. It is probable that prehistoric man acted in the same way. Fire has a selective action among the plants, according to their capacity to survive it. *Corylus* seems to be fire-resistant. This is emphasized in the very interesting description that E. Chavannes[4] gives for Wisconsin: ". . . Names of a Richwood, Glenwood, Woodland type appear frequently, as do several forest townships in the north and east. Scrub vegetation characteristic of areas undergoing encroachment is described in Hazel Green, a village name referring not to a pioneer's sweetheart, but to a condition commonly found in burned-over woodland. After ground cover and trees were destroyed by recurrent prairie fires, hazel brush sprang up thickly, persisting through the fires by virtue of a sturdy root system, flourishing as a scrub between destructions."

If during the Mesolithic period the same methods of using fire were practised, the existence of such prevalent hazel vegetation would not be unexpected; in any event there is a certain concordance in the maps of the distribution of the hazel maximum in the boreal period, for example, that given by Erdtman for Europe, and the distribution of the Campignien culture period, as generally indicated by prehistorians.

In this connexion it is interesting that hazel in North America is seldom if ever mentioned by authors from that country (for literature see Sears[5]). Detailed studies on the connexion of the hazel period with the prehistoric cultures would probably be interesting.

FELIX RAWITSCHER.

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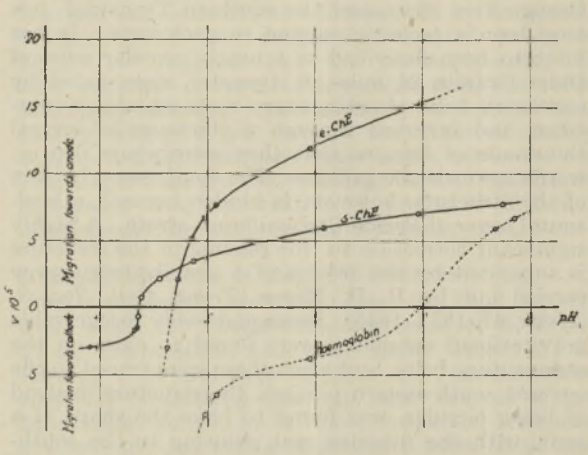
University of São Paulo.
March 13.

[1] Firbas, F., *Naturwiss.*, **27**, H.6 (1939).
[2] Erdtman, G., *J. Ecol.*, **19**, No. 1 (1931).
[3] Salisbury, E. J., and Jane, F. W., *J. Ecol.*, **28**, 310 (1940).
[4] Chavannes, E., *Sci. Monthly* (July 1941).
[5] Sears, P. B., *Amer. J. Bot.*, **29**, 684 (1942).

Choline Esterases

A DEFINITE proof that two distinct choline esterases really exist has been sought by Bader *et al.*[1], who call for an "electrophoretic or closer elementary analysis". I have reported such an analysis in a recent paper[2], which has obviously not reached these authors.

I have shown that a true chemically established difference exists between the acetylcholine-hydrolysing enzymes in horse blood serum and red blood cells. Cataphoretic investigations show that a large difference exists between the rates of migration of the two enzymes in the electric field. This is shown in the accompanying figure (for details, see the original paper). Furthermore, erythrocyte choline esterase seems considerably more sensitive to *p*H than serum choline esterase.



It may thus be definitely stated that the choline esterases from blood serum and erythrocytes are not identical.

The next question to be decided is whether choline esterase from blood cells is identical with the enzyme in brain. Work by Canadian and Swiss schools have shown that this is in fact the case. I am at present engaged in an attempt to prove this chemically. Preliminary examinations have shown the permanence towards *p*H-changes of the brain choline esterase (ox) is much the same as that of erythrocyte choline esterase. Thus the brain choline esterase is wholly destroyed at *p*H $\approx$ 4·7 and has lost 40 per cent of its activity at *p*H $\approx$ 6. The corresponding figures for the erythrocyte choline esterase are *p*H $\approx$ 4·5 and 50 per cent at *p*H $\approx$ 5, for serum choline esterase *p*H $\approx$ 2 and no loss of activity at *p*H $\approx$ 6.

In a letter addressed to Dr. Zeller in Basel in October 1943, I expressed the opinion that it is highly probable that we must henceforth take into consideration even more types of choline esterase. Many facts suggest this. Thus the enzyme in mollusc hepatopancreas and choline esterase in the venom of *Cobra* have not the same properties as either of the two types mentioned above. Indeed we know very little about the specificity of choline esterase in invertebrates. An investigation in this sphere is being planned.

I largely agree with Richter and Croft[3] in their statement that "it would appear more accurate to describe the choline esterases as a group of enzymes showing considerably divergent properties rather than to regard choline esterase as a single entity".

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and Chemical Institute of the Veterinary College,
Stockholm.
May 25.

[1] Bader, R., Schütz, F., and Stacey, M., *Nature*, **155**, 239 (1945).
[2] Augustinsson, K.-B., *Ark. Kem., Mineral. Geol.*, **18** A, No. 24 (1944).
[3] Richter, D., and Croft, P. G., *Biochem. J.*, **36**, 746 (1942).

A Theory of Telepathy

IN his recent review[1], Dr. E. J. Dingwall includes a quotation which refers to an alleged disintegration of memory in trance personalities.

This should not be considered without reference to the natural disintegration of memory throughout life. If any personality is observed through life from the time of his graduating or passing professional examinations, there is a gradual dispersal of the knowledge gained, in spite of the fact that his environment is such that the knowledge would be of considerable value. If we assume a continuation of this process after the death of the body, then, in view of the fact that the new environment no longer demands retention of earth-memories, it is surely remarkable that they persist as long as they do.

A. T. ORAM.

Belle Vue House,
Devizes.

[1] *Nature*, **155**, 619 (1945).

Custody of Uranium

MANY of us have used specimens of pitchblende as demonstration pieces, perhaps to take autophotographs during the course of a lecture. The newly disclosed potential menace of a pound weight of such material brings with it a warning that those entrusted with the custody of any uranium-bearing minerals should take their obligations seriously; from careless hands uranium might pass to unscrupulous ones.

SIDNEY RUSS.

Barnato Joel Laboratories,
The Middlesex Hospital,
W.1.

RESEARCH ITEMS

Low-Temperature Limits of Life

THE temperature of water inhabited by living organisms is assumed not to fall below − 3·3° C. In the salt lakes of Kazakhstan, however, water becomes cooled well below that limit while still remaining liquid, and plankton investigations by S. A. Zernov and O. I. Schmalhausen (*C.R. Acad. Sci. URSS.*, **44**; 1944) have shown that motile algæ, *Pyramimonas* sp. and *Dunaliella* sp., are able to survive winter in salt water cooled down to − 5° C. and even − 7·75° C., remaining fully active. Various other algæ of the genera *Oscillatoria*, *Nodularia*, *Glœotila* and *Botryococcus* also appear to be able to survive such temperatures. Under experimental conditions, both *Pyramimonas* and *Dunaliella* were found to survive and swim in a drop of salt water from the lake cooled down to − 15° C. The upper temperature limit for *Pyramimonas* was experimentally found to be + 29° C., and for *Dunaliella* + 42° C.

American Clingfishes

L. P. SCHULTZ has subjected the American species of Gobiesocidæ to a thorough revision and described new genera and species (*Proc. U.S. Nat. Mus.*, **96**, No. 3187; 1944). The clingfishes are mostly marine, but a few species occur in freshwater streams, a short distance above brackish water, clinging to the stones. *Gobiesox cephalus* Lacepède is one of these and occurs in freshwater streams of northern South America and Central America on the Atlantic side, and there are four other American species. A key to the genera and species of the American Gobiesocidæ is given, including nine genera and twenty-four species, and a table of counts made on the dorsal fin rays, anal fin rays, pectoral fin rays above attachment of gill membrane, and pectoral fin rays.

Mutations in Bacterial Virus

S. E. LURIA (*Genetics*, **30**, 84; 1945) shows that α and γ, the two viruses of *Escherichia coli*, produce by mutation new strains which are able to attack strains of the bacterial host which were resistant to the original virus strains. Mutation in bacteria and in these viruses in respect of resistance is specific and is generally independent; in one exceptional case a bacterial strain resistant to α and α^1 reverted to susceptibility as a result of a mutation to resistance to virus γ and γ^1. The changes in resistance are considered by the author not to be due to adaptation.

Biennial Bearing of Apple Trees

BIENNIAL bearing, to which many apple varieties are prone, is one of the important causes of gluts. Attempts to modify this character and at the same time to provide a satisfactory thinning of the crop by the use of caustic sprays at blossom time have been made in the United States. The sprays used generally have a basis of sodium dinitrocresylate or other similar dinitro compound; but the difficulties in their use are numerous. F. S. Howlett (*Proc. Amer. Soc. Hort. Sci.*, **42**, 151; 1943) has described how the thinning effect differs with the variety and with the season, while A. B. Burrell (pp. 159–162) points out that even a single spray may result in an excessive thinning of the crop. Nevertheless the early fruit thinning (supplemented when necessary by hand thinning in June) is advantageous in that it reduces competition between fruits early in the season, and this may be one reason why sprayed trees give larger fruits than hand-thinned trees, as reported by A. V. Doren and M. B. Hoffman (pp. 182–184). A further effect of the reduction of crop in an 'on' (that is, bearing) year brought about by this treatment may be an increased initiation of fruit buds, so that blossom and fruit production in the following 'off' year (M. B. Hoffman and J. D. Van Geluwe, pp. 185–186) are both increased and the biennial bearing habit thus somewhat, although not markedly, modified. This effect of the caustic spray may be intensified by branch ringing in the 'on' year (A. E. Murneek, pp. 163–166); but sometimes the complete removal of the crop by spraying the bloom with a caustic spray fails to induce flowering in the following 'off' year (A. E. Murneek, pp. 177–181).

Chalk-washing of Sugar-Beet in Dry Climates

SUGAR-BEET plants cultivated in hot, dry climates are liable to wilting. The problem has serious economic importance in some regions of the Soviet Union, such as the Northern Caucasus and Middle Asia, but ingenious experiments in chalk-washing the plants, with the view of reducing the absorption of radiant heat, carried out during 1932–41 (Kolossov, *C.R. Acad. Sci. URSS.*, **42**; 1944), have proved that this process reduces wilting. When leaves were covered with a 10 per cent suspension of chalk in water, their transpiration decreased by 14–23 per cent; the osmotic pressure of the sap fell from 17·8 to 14·2 atmospheres; the temperature of chalk-washed leaves was reduced by 4·5° C. The yields were increased by the treatment, in the case of roots by 13–14 per cent, and in the case of seed plants by 19·7 per cent. Germinating capacity of seeds from treated plants was not affected; but their energy of growth was considerably higher and the number of shoots per seed was greater than in the controls.

Structure of the Vredefort 'Dome'

THE Vredefort 'dome', situated in the northern Orange Free State and the southern Transvaal, has long been a tectonic enigma to geologists. It has hitherto been described as a nearly circular mass of Older Granite 26 miles in diameter, surrounded by concentric belts of sedimentary rocks which are overtilted and inverted through a thickness of several thousands of feet, so that they everywhere dip inwards towards the granite. The south-easterly part of the structure, however, is hidden beneath a horizontal cover of Permo-Carboniferous strata. A highly significant correction to this reading of the structure is suggested by the results of a gravimetric survey carried out by B. D. Maree (*Trans. Geol. Soc. S. Africa*, **47**, 183; 1945). Large and easily recognizable gravitational anomalies were found to exist on the sedimentary belts, and when these were traced to the covered south-eastern portion, the structure, instead of being circular, was found to have the shape of a pear, with the tapering end pointing to the south-east. The anomalies are arranged symmetrically about an axis striking 32° west of north, through the middle of the exposed mass of granite. There is no longer any necessity to postulate vertical, centripetal and evenly distributed forces to account for a supposedly circular structure symmetrical about a point. The observed overtilting of the sediments in the north-west can now be ascribed to a tectonic deformation directed superficially from the south-east, the

core of Older Granite being infolded with the sediments. This interpretation is consistent with the existence of a big thrust fault at Potchefstroom. The gabbro sheets and bosses of alkali rocks of the region represent post-tectonic phases of magmatic activity. The aureole of metamorphism and a marked area of positive anomalies found over the Older Granite indicate that the great bulk of these later igneous rocks is still concealed. The survey has disclosed the high probability that a large area is underlain by the Witwatersrand System with dips that would favour mining activities. It remains for the drill to prove the possible presence of gold-bearing banket in these formations.

Nuclear Energy Generation in the Sun

THE only source of energy generation in main-sequence stars which has as yet been found to satisfy even remotely the astrophysical requirements is the Bethe carbon cycle. In this process, a helium nucleus is formed from four protons, with the emission of energy in the form of γ-radiation, the process being catalytically assisted by a carbon nucleus. Attempts at determining the internal distribution of temperature and density in the sun, on the basis of a model in which all the energy is generated by this means in a convective core surrounded by a radiative envelope, have met only with qualitative success, however. Although the hydrogen content needed to fit such a model agrees with Eddington's value of 35 per cent, and the central temperature and density are not unreasonable, use of the carbon cycle to predict the luminosity gives a result nearly 150 times the observed value. This discrepancy, however small compared with those resulting when other nuclear reactions are assumed, has undoubtedly delayed general acceptance of the carbon cycle. Now, however (*Astrophys. J.*, **100**, 347 ; 1944), N. R. Sen and U. R. Burman have developed a solar model based on Bethe's law which is much more satisfactory. With a given composition and central temperature, a series of cores is studied, each corresponding to a particular central density. Only one of these satisfies Bethe's law and the boundary conditions ; in it the central temperature is the commonly accepted value of $20{\cdot}2 \times 10^6$ degrees, but the central density of $45{\cdot}5$ gm./cm.^{3} is very much smaller than the value ordinarily assumed. This model gives a total luminosity within 2 per cent of the observed energy output, a mass 7 per cent larger and a radius $1{\cdot}5$ per cent larger than the observational values. Still better agreement with observation is predicted if minor adjustments are made in the constants used.

Surge Characteristics in Electric Transmission

IN a paper (*J. Inst. Elec. Eng.*, **92**, Pt. 2, No. 25, Feb. 1945) on "Surge Characteristics of a Three-Phase Transmission Line with Earth Wire", W. G. Hawley deals first with the data and formulæ necessary for evaluating the self and mutual surge-impedance values of a three-conductor overhead system equipped with a single earth wire. It is then indicated how these impedances may be used for obtaining the theoretical attenuation and distortion, below corona, of standard unidirectional surges. Good agreement is shown to exist between theory and experiment. Above corona, loss factors for the short surges employed are deduced from experimental results, and formulæ are given to enable the corresponding factors for any single-circuit line conductor to be found. Formulæ for determining the visual critical corona voltages of one, two or all three conductors of a system are also given, in terms of the relevant surge impedance values. Finally, several values for a typical line are included.

Over-Current Relays on Medium-Voltage Circuits

A PAPER read by A. G. Shreeve and P. J. Shipton before the Institution of Electrical Engineers reviews existing methods of protection from excess load current in medium-voltage circuits, and outlines some of the problems encountered with the wide variation of industrial applications. British Standard Specifications dealing with excess current are considered, suggestions are made to correlate them, and the main factors which determine the protection required are reviewed. Motor starting-loads, starting times, and various duty cycles are mentioned, and reference is made to faults which can be caused by the inherent characteristics of some electrical equipment. Existing basic designs of overload relays and some of the difficulties experienced with them are dealt with, and an outline is given of the effect of temperature variation on thermal- and oil-type devices, and of excess current due to lost-phase faults, together with suggestions for the type of protection required to meet various circuit conditions. The relation of equipment to both excess load – current capacity and short-circuit rupturing capacity is considered, and attention is paid to the correlation of fuses and overload relay design with the thermal rating of electrical gear in the protected circuit.

Tensile Load on Steel-Cored Aluminium Conductors

A PAPER read by E. W. W. Double in London on April 11 before the Institution of Electrical Engineers dealt with the distribution of tensile load on steel-cored aluminium conductors in relation to their temperature and sag. The main objects of the investigation were : (1) to determine the effects of temperature and tension upon the sharing of the tensile load between the steel and aluminium components of such a conductor ; (2) to ascertain whether variations in the load distribution seriously affect the normal sag and safety of the conductor ; and (3) to propose measures for ensuring that the normal sag remains unaffected after the stringing of the conductor. Tensions in the steel and aluminium at various points along typical conductors were measured by a magnetic method. The effects of load-distribution changes were also estimated by noting the corresponding variation in the elastic modulus of the conductor. Adhesion between the steel and aluminium was also examined. The results indicated that the final load distribution is determined by the rate of creep in the aluminium wires, and is independent of the stringing temperature. Although more data concerning creep are required, the tests suggested that it will be some years before creep has any marked effect. It was found that the inelastic stretch of a conductor can cause large increases in sag which far outweigh those that might result from creep. Most of the inelastic stretch was removed when the conductor was tensioned up to the maximum design load, and stressing the conductors before final stringing is therefore strongly recommended. The steel core appears to carry slightly more than its share of the total load, but since its safety and that of the conductor are not threatened thereby, no change in the British Standards Specification governing the strength of steel-cored aluminium conductors is advocated.

ASPECTS OF THE DETERMINATION OF THE STRENGTH OF MATERIALS

A MEETING of the British Rheologists' Club was held on June 16 at the Royal Aircraft Establishment, Farnborough, Hants, in the Assembly Hall, through the courtesy of the director, Mr. W. S. Farren, the subject chosen being the "Strength of Materials". Dr. W. Douglas, head of the Materials Department of the Establishment, took the chair in the absence in the U.S.S.R. of the president, Prof. E. N. da C. Andrade. For those unfamiliar with the Establishment, it may be added that it is a directorate under the Controller of Research and Development of the Ministry of Aircraft Production. It is the chief research and experimental station under the Ministry, and it is concerned in all those fields of fundamental and applied science which influence the design, construction and performance of aircraft, military and civil, and in the equipment of aircraft.

Dr. M. C. Pryor, in a paper entitled "Wood and Glue", spoke during the morning session on the molecular and micro structure of timbers used in aircraft construction, and of the micro methods employed

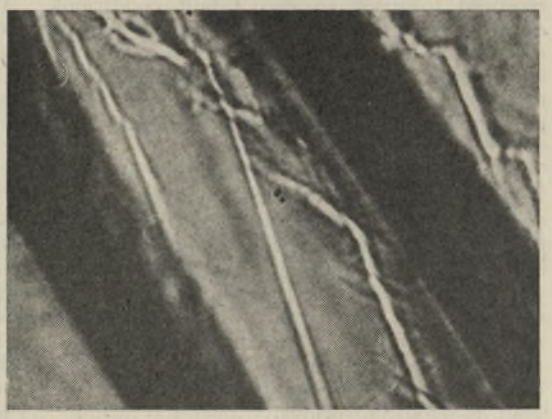


Fig. 1. TENSION FAILURE OF SITKA SPRUCE, FROM AN AIRCRAFT SPAR; LONGITUDINAL RADIAL SECTION, SHOWING PLANES OF FRACTURE. × 1,000.

after an accident to establish the cause of mechanical failure. The movement of micelle aggregates during deformation is accompanied by rupture with the formation of fresh surfaces between the lignin and cellulose portions in the strained and damaged areas, and these fresh surfaces can be selectively stained. Failures by compression or tension are easily distinguishable microscopically, as originally shown by W. Robinson (*Phil. Trans.*, B, **210**, 49; 1920). Under compression, the tracheids in the zone of failure are considerably buckled. The zones of failure, which usually are well defined, run in planes at an angle of about 45° to the compression stress. Under tension, failure develops along slip planes in the substance of the cell walls, and these local shear failures occur in isolated points where the tube wall is weak, so that the failures are scattered up and down the members over quite a wide distance, perhaps for several inches. Some of the microphotographs shown at the meeting illustrating the general behaviour are reproduced herewith.

Mr. C. Gurney read a paper on the "Effect of Duration of Loading on the Strength of Brittle Materials". Some brittle materials, particularly mineral glasses, are known to be subject to static

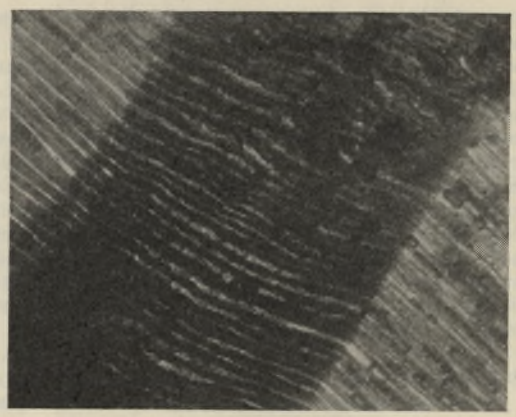


Fig. 2. ZONE OF FAILURE IN DOUGLAS FIR, STAINED WITH ZINC CHLOR IODIDE. × 60.

fatigue, the breaking load decreasing with duration of loading; for example, experiments on an annealed soda-lime glass showed that the strength decreased in the ratio 3 : 1 when the duration of loading was increased from 10^{-2} to 10^{4} sec. It is generally accepted that the weakness of brittle materials is due to cracks, as suggested by Griffith. A likely explanation of the time dependence of strength might be the gradual spread of cracks; Griffith, after considering the energy conditions necessary for the spread of cracks, concluded that crack-spreading could not occur until a critical load was reached; at this load the crack spread catastrophically, and failure was immediate. In these circumstances, the only previous explanation of failure after prolonged loading which is consistent with general principles is damage to the surface material by atmospheric attack. If glass is rapidly broken, there may be no time for atmospheric attack of the growing surfaces of the crack, so that a relatively high strength corresponding to the uncontaminated surfaces is obtained. A number of processes by which cracks may spread, consistent with the laws of thermodynamics, were described, and a new estimate of the strength of flawless materials was given. Stress reduces the height of atomic energy barriers, and immediate failure of a uniformly stressed material will occur when the average thermal motion is just sufficient to overcome the average energy barrier. This condition is approximately that at which the latent heat of isothermal evaporation is zero.

Fig. 3. COMPRESSION FAILURE IN DOUGLAS FIR, SHOWING EARLY STAGE OF BUCKLING OF TRACHEIDS. × 400.

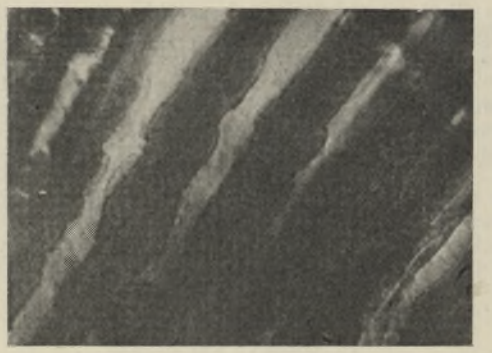


Fig. 4. COMPRESSION FAILURE IN DOUGLAS FIR, SHOWING SLIP PLANES WITHIN THE CELL WALLS. × 650.

At lower stresses, failure is still possible, but it takes time. The stress-free vapour pressure of strong solids is extremely small, but it has been shown that the logarithm of the vapour pressure is approximately proportional to the square of the stress, so that the vapour pressure becomes appreciable at high stresses such as can occur at the end of cracks. The rate at which cracks spread by evaporation of the material has been estimated and found to be insufficient to account for the whole of the time effect with mineral glasses, tested under atmospheric conditions. In a material the atomic arrangement of which is in thermal equilibrium, increase in crack-length by splitting without atomic migrations can only occur at loads in excess of that given by the Griffith criterion. It has hitherto been thought that failure was immediate at the Griffith load, but it has been shown that, for materials having atomic constitution, the Griffith load is the lowest at which the crack may start to spread by splitting, the rate of spread being a function of the stress difference between that at the end of the crack and the maximum the material can withstand. For materials not in thermal equilibrium, the application of stress by reducing the height of energy barriers enables the approach to equilibrium to continue; and if this involves heterogeneous volume changes, internal stresses are set up which cause cracks to spread. Atmospheric attack, involving weakening of the surface material and possible solution of material at the ends of cracks—solubility increases very rapidly with stress—is likely to be an important factor in causing fracture under prolonged loading, when tests are made under ordinary atmospheric conditions.

In the discussion which followed, Dr. E. Orowan spoke on the mechanism of crack spreading and emphasized the importance of atmospheric attack. Dr. Maunder Foster mentioned the high stresses produced during grinding and their effect on reduction of molecular weight.

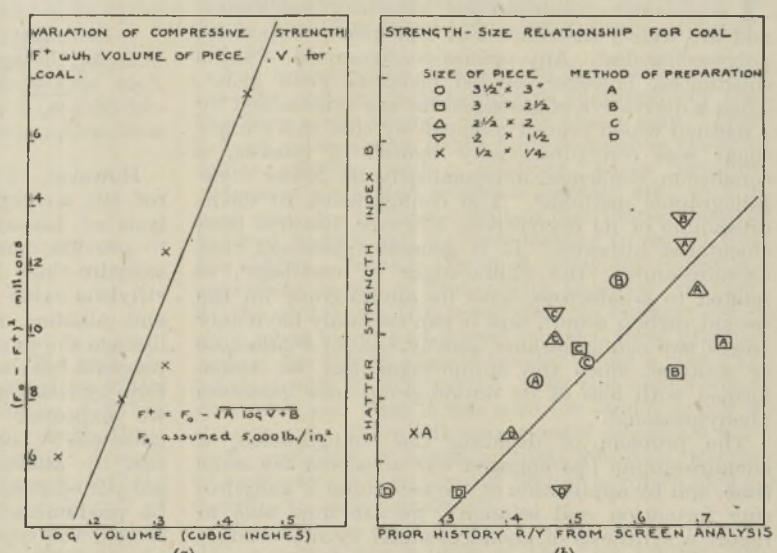
During the afternoon session, Dr. B. Chalmers, in a paper with Mr. E. R. W. Jones, on the "Application of Statistical Methods to Mechanical Test Results", gave a brief account of reasons for adopting a statistical approach to the interpretation of mechanical test results; and examples were given of significance testing, assessment of correlation and curve-fitting in relation to experimental results.

Strength tests are in general destructive, so that it is impossible to apply them to the component to be used. When they are non-destructive, the measurement is not of the property under consideration but of another property in some way related to it. In either case one requires a basis for inferring mechanical properties of the component from the known properties of the specimen tested. It was pointed out that the three reasons for doing mechanical tests are: (*a*) to provide design data; (*b*) to determine whether two or more batches of material are significantly the same in the mechanical property examined; and (*c*) to provide the basis for establishing the rheological laws for the material.

It was emphasized that, in all statements of the numerical value of a quantity, it is desirable to quote both the mean and an estimate of the scatter, based on the standard deviation.

The importance of using impersonal methods for fitting curves was demonstrated by an example in which significantly different results were obtained by various observers interpolating on the same experimental points. In conclusion, a method of presenting results of fatigue tests was shown giving the stresses below which only a stated percentage of specimens would be expected to fail. The view was expressed that this is the logical method of expressing such information in cases where the data are to be used quantitatively for design purposes.

In a written contribution, Mr. R. L. Brown, of the Coal Utilisation Research Association, continued the discussion by referring to the statistical approach and the application of the Griffith crack theory to the strength of coal. In compression tests on cubical cylinders where the load is increased slowly until failure occurs, the worst crack determines the strength. Applying Frenkel and Kontorova's work on the 'worst' crack theory to the effect of size of specimen, it is found that data for coal are well represented (Fig. 5*a*).



For size x in., R = per cent greater than size (x) and Y = yield of size x, per cent per inch, in consignment from which samples for test are taken.

Fig. 5.

In shatter tests, strength can be assessed by the amount of breakage when a sample of a hundred or so pieces of coal is dropped 6 ft. on to an iron plate. Here the extent of cracks rather than the worst crack determines the strength. If it be assumed that the deformation caused by a sudden blow is elastic and that failure occurs when the strain energy exceeds a certain average value E (the value of E depends on the extent of pre-cracking and a hypothetical strain energy), then a formula can be derived for the shatter strength in terms of two factors; first, the amount of breakage, and secondly the size distribution of the dust produced.

The size of the specimen now affects its strength in a rather different way. In Fig. 5*b* the linear relationship between shatter strength and the size distribution of the consignment from which the coal for test is taken (R = per cent oversize, Y = yield in per cent per inch) indicates that the shatter strength is proportional to the difference of the size subjected to test from the biggest material present (which is approximately R/Y) the departure being in the sense that the strength increases with decreasing size. This linear relation has been derived theoretically and will be published shortly.

The linear relationship shown in Fig. 5*b* is interesting in that it enables the strength of the coal to be predicted from its previous history, so far as this is shown by the size distribution of the consignment. In other words, the handling of coal results in invisible breakage (or cracks and loss of strength) and visible breakage, and these two forms of breakage are balanced as shown.

A CONSTITUTIONAL SYNTHESIS OF CHONDROSAMINE

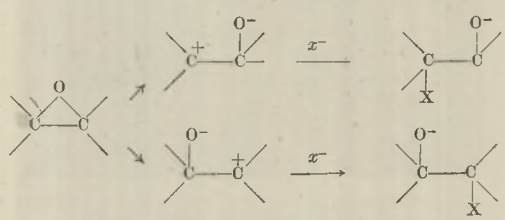
By Drs. SYBIL P. JAMES, F. SMITH, M. STACEY and L. F. WIGGINS

Chemistry Department, University of Birmingham

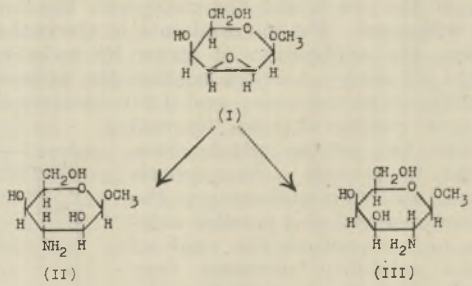
THE naturally occurring *d*-aminohexoses, glucosamine and chondrosamine, have long been known and are widely distributed in biologically important polysaccharides[1]. Any precise configuration of these substances, however, eluded chemists until 1939[2], when a derivative of glucosamine was synthesized by a method which proved conclusively that this amino-sugar was configurationally related to glucose, a conclusion confirmed independently by X-ray crystallographic methods[3]. The configuration of chondrosamine or its derivatives, however, has not been elucidated hitherto. It is generally believed that chondrosamine, the amino-sugar of cartilage[4], is related to *d*-galactose, with its amino-group on the second carbon atom[5], and it can certainly have only one of two configurations, namely, that of *d*-galactose or *d*-talose, since the amino-sugar can be transformed with loss of its amino-group into galactose phenylosazone[6,7].

The problem of deciding the configuration of chondrosamine has engaged our attention for some time, and by application of the technique of anhydro-ring formation and scission[2], we are now able to report a synthesis of chondrosamine by a procedure which determines its constitution.

The method is dependent upon the discovery[8] that anhydro-rings of the ethylene oxide type formed by the alkyl-oxygen fission of suitable esters (*p*-toluene sulphonates) undergo ring-scission in both the possible directions, that is, by rupture of the bonds on either side of the oxygen atom of the three-membered ring, and in each case Walden inversion occurs when an entering anion attaches itself to the carbonium cation in the manner shown below.

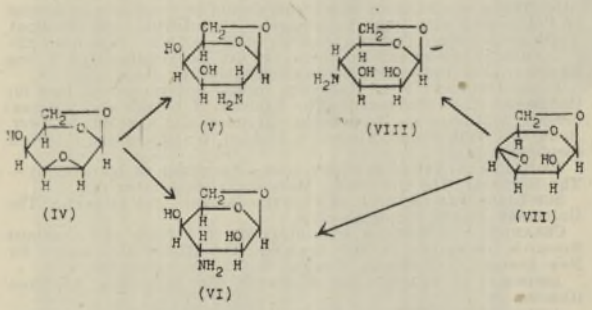


Thus the ring-opening of a derivative of 2 : 3-anhydro-allose with sodium methoxide gives rise to 2-methyl altrose and 3-methyl glucose, and if the ring opening is effected through the agency of ammonia, then the corresponding amino-sugars are obtained. Applying this reaction to a derivative of 2 : 3-anhydro mannose, Haworth, Lake and Peat[2] obtained a 3-amino-altrose (epiglucosamine) derivative and a 2-amino-glucose derivative, the latter being identical with that obtained from natural glucosamine. It was clear, therefore, that with a derivative of 2 : 3-anhydro-talose, ring fission with ammonia should lead to the formation of 3-amino-idose and 2-amino-galactose, which could then be compared with the corresponding derivatives of chondrosamine. Such a derivative of talose, 2 : 3-anhydro-β-methyltaloside (I), was made by one of us[9] and subjected to ring-fission with ammonia. One compound only, namely, 3-amino-β-methylidoside (II), could be isolated in crystalline form, presumably owing to the proportion of the second compound, 2-amino-β-methylgalactoside (III), being small.



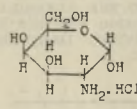
However, 1 : 6-2 : 3-dianhydro-β-talose (IV) (cf. ref. 10), a compound obtained by the alkaline hydrolysis of 2-mesyl-1 : 6-anhydro-β-galactose, appeared to provide more suitable initial material. Its two anhydro-rings have widely different stabilities, the ethylene oxide ring being easily broken by both acid and alkaline reagents, whereas the 1 : 6-anhydro-linkage shows considerable stability towards alkaline reagents but can be broken by acid reagents. Therefore, by treatment of this dianhydride with ammonia, we expected to obtain 1 : 6-anhydro-2-amino-β-galactose (V) and 1 : 6-anhydro-3-amino-β-idose (VI), and by analogy with the investigations on 2 : 3-anhydro-β-methyltaloside, (VI) would be expected to be predominant. There would then remain to be settled the question as to which of the compounds was the idose derivative. This problem could be approached from a consideration of the products obtained by scission of 1 : 6-3 : 4-dianhydro-β-talose[11]

(VII) with ammonia. Theoretically this treatment should give rise to 3-amino-1 : 6-anhydro-β-idose (VI) and 4-amino-1 : 6-anhydro-β-mannose (VIII). Thus the common substance isolated from the ammonolysis of both dianhydro compounds would be 3-amino-1 : 6-anhydro-β-idose. As a natural corollary the second product from the ring opening of 1 : 6-2 : 3-dianhydro β-talose would be the 1 : 6-anhydride of 2-amino-β-galactose (V), and the second product from the ring-scission of 1 : 6-3 : 4-dianhydro-β-talose would be 4-amino-1 : 6-anhydro-β-mannose (VIII).



The practical verification of these predictions has been clearly achieved in the following way: Treatment of 1 : 6-2 : 3-dianhydro-β-talose with ammonia under pressure gave, after subsequent treatment with hydrochloric acid, a crystalline hydrochloride (*A*) in 56 per cent yield together with a residue which, after acetylation, yielded a crystalline triacetyl amino-anhydrohexose (*B*). Similarly, 1 : 6-3 : 4-dianhydro-β-talose gave a crystalline hydrochloride (*C*) in 65 per cent yield, and a triacetyl amino-anhydrohexose which was identical with (*B*) above. The common product (*B*) must therefore be 3-acetamido-2 : 4-diacetyl-1 : 6-anhydro-β-idose, (*A*) must be 2-amino-1 : 6-anhydro-β-galactose hydrochloride and (*C*) must be 4-amino-1:6-anhydro-β-mannose hydrochloride. It is interesting to observe that, whereas in the ammonolysis of 2 : 3-anhydro-β-methyltaloside the idose derivative predominated, in that of 1 : 6-2 : 3-dianhydro-β-talose, the idose derivative was obtained in extremely small amount and was only isolated by virtue of its remarkable readiness to crystallize.

The 2-amino-1 : 6-anhydro-β-galactose hydrochloride was heated with strong hydrochloric acid, that is, under conditions in which the 1 : 6-anhydro-ring opens and no configurational change other than that on C_1 can occur.



2-Amino-α-galactose hydrochloride (IX) was obtained in well crystalline form and showed an initial specific rotation of $[\alpha]_D$ + 125° changing to + 98° in one hour. These figures agree closely with those recorded for chondrosamine hydrochloride. A comparison of the X-ray powder photograph of the synthetic 2-amino-α-galactose hydrochloride and of chondrosamine hydrochloride[7] proved their complete identity. Furthermore, it was possible from (V) to synthesize 2-acetamido-tetra-acetyl-β-galactose, which was identical in all respects with β-penta-acetyl chondrosamine[7].

It is therefore clearly proved that chondrosamine is 2-amino-galactose. Moreover, this synthetic route provides a better means for the preparation of pure chondrosamine hydrochloride than the method of isolation from cartilage.

Full details will be published elsewhere.

[1] Stacey, *J. Soc. Chem. Ind.*, **62**, 110 (1943).
[2] Haworth, Lake and Peat, *J. Chem. Soc.*, **271** (1939).
[3] Cox and Jeffrey, *Nature*, **143**, 984 (1939).
[4] Bray, Gregory and Stacey, *Biochem. J.*, **38**, 142 (1944).
[5] Levene, "Hexosamines and Mucoproteins" (London: Longmans, Green and Co., 1925).
[6] Levene and La Forge, *J. Biol. Chem.*, **18**, 123 (1914).
[7] Stacey, *J. Chem. Soc.*, 272 (1944).
[8] Peat and Wiggins, *J. Chem. Soc.*, 1810 (1938).
[9] Wiggins, *J. Chem. Soc.*, 522 (1944).
[10] Hann and Hudson, *J. Amer. Chem. Soc.*, **64**, 2435 (1942).
[11] Hann and Hudson, *J. Amer. Chem. Soc.*, **64**, 925 (1942).

IRON AGE FINDS FROM ANGLESEY

NEWSPAPER publicity has already been given to some extremely interesting Iron Age finds recently unearthed in the parish of Llanfihangel-yn-Nhowyn, near the west coast of Anglesey, some five miles to the south-east of Holyhead. The discoveries were made as a result of peat dredging work. It had become necessary to excavate certain bogs in the parish, and one day the attention of the clerk of works was directed to a chain which had been caught up in the teeth of a harrow used for spreading the peat. The chain itself had "come in handy" for dragging bogged lorries on to firm ground! Very wisely it was decided to ask Sir Cyril Fox to visit the site, and as a result of further investigations a large number of very important relics were rescued. Unfortunately, of course, no stratigraphical details could be obtained as excavation by bulldozer or grab does not lend itself to this kind of study; but the amazing fact is that a great many well-preserved objects were recovered which have enabled Sir Cyril to come to certain important conclusions. These appear, together with a detailed study of the finds, in a beautifully illustrated publication by the National Museum of Wales entitled "A Find of the Early Iron Age from Llyn Cerrig Bach, Anglesey" (7*s*. 6*d*.).

The report opens with a more detailed account of the site and the facts leading to the discovery than has been given above. There is also a map. There follows a description of the finds themselves classified under various heads: weapons, horse furniture, objects of social and economic interest, etc., with, in each case, one of those excellent distribution maps of kindred finds which we have learned to expect from the author. Perhaps the most intriguing object is a crescentic plaque of bronze with repoussé ornament. In the centre is a triquetra based on trumpet scrolls with lobed stems and domed mouths, three of which end on one side in a tendril curled round a boss. The whole design is asymmetric. Why this object was so decorated and what it was used for cannot as yet be determined. There follows a general discussion when such problems as dates, cultural affinities, whether the objects are a settlement find or a votive offering hoard, etc., are considered.

The objects can be dated to a period between 150 B.C. and the middle of the first century A.D. Indeed, the upper limit can probably be said to be the destruction of the British culture of the district by the Romans. The finds themselves show clearly

that they are not all of local origin, that Anglesey was not a creative centre of art or craftsmanship. This is best seen in a study of the ten bridle bits. It seems clear that Llyn Cerrig was a focal point whither came objects from lowland Britain and from Ireland. This fact reinforces the suggestion that we are dealing with votive offerings—Anglesey, of course, was at this epoch a religious centre—and it would be difficult to postulate there a great market. If the finds do represent a hoard of votive offerings, we may well have to consider that for once we are really concerned with Druid activities, for in Mona who but Druids would supervise such rites at this period ?

Sir Cyril Fox is to be congratulated on having produced a very masterly interim report on these exceptionally important Anglesey finds.

M. C. Burkitt.

FORTHCOMING EVENTS

Tuesday, September 11

Quekett Microscopical Club (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 7 p.m.—Conversation and the Exhibition of Specimens.

Wednesday, September 12

Institute of Metals (at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1), at 10 a.m. and 2.15 p.m.—Thirty-seventh Annual Autumn Meeting.

Friday, September 14

Institute of Physics (Electronics Group) (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 5.15 p.m.—Annual General Meeting. Dr. D. S. Evans: "Electronic Conditions in the Sun and Stars".

Saturday, September 15

Conference on "Friedel-Crafts Catalysts and Polymerisation" (in the large Chemistry Theatre, The University, Manchester), at 10.30 a.m. and 2 p.m.

Saturday, September 15—Sunday, September 16

Association of Special Libraries and Information Bureaux (at Portland Hall, Little Titchfield Street, London, W.C.1).—1945 ASLIB Conference.

Saturday, September 15

At 11.45 a.m.—Prof. J. D. Bernal, F.R.S.: "Information Service as an Essential Factor in the Progress of Science"; at 2.30 p.m.—Symposium on "Links with the U.S.A.".

Sunday, September 16

At 3.30 p.m.—Discussion on "The Great Book Shortage—its Effect on Education, Research, Empire Intercommunication and the Re-establishment of Cultural Relations in Europe".

APPOINTMENTS VACANT

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

Assistant Technologist Engineer (with University Degree) for investigation of manufacturing and laboratory processes in connexion with Machinery and Plant Design, London area—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting C.2694.XA (September 14).

Research Engineers (with University Degree and good workshop training) for development of Industrial Process Plant, London area—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting C.2408.XA (September 14).

Agricultural Chemist—The Acting Director of Agriculture, School of Agriculture, Houghall, Durham (September 15).

Lecturer in Agricultural Botany—The Principal, Midland Agricultural College, Sutton Bonington, Loughborough (September 15).

Laboratory Assistant in the Division of Histology—The Bursar, Royal Veterinary College, Camden Town, London, N.W.1 (September 15).

Lecturer (full-time) in the Department of Chemistry—The Principal, Derby Technical College, Normanton Road, Derby (September 20).

Chair of Philosophy, and the Chair of History, at the University of Otago, Dunedin—The High Commissioner for New Zealand, 415 Strand, London, W.C.2 (September 21).

Electrical and Mechanical Engineers (temporary staff) for the Public Works Department of the Nigerian Government, (*a*) Electrical and Mechanical Engineer in charge of Construction, and (*b*) Electrical and Mechanical Engineers—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting D.1420.A (September 21).

Managerial Technical Executive to a leading firm of manufacturers of Electrical Rotating Machinery in South-east England—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting C.U. 26.XA (September 21).

Topographic Surveyor by Iraq Petroleum Co., Ltd., in the Middle East—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting E.1878.XA (September 21).

Lecturer in Ceramics (applicants should be Graduates in Science or Engineering with some knowledge of Chemistry)—The Principal, North Staffordshire Technical College, Stoke-on-Trent (September 22).

Technical Assistant in Agricultural Economics—The Acting Registrar, The University, Leeds (September 24).

First Assistant Port Engineer by the Government of Iraq for the Basrah Port Directorate—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting E.1895.A (September 26).

Lecturer in Neuro-Surgery, and a Lecturer in Neurology—The Registrar, The University, Manchester (September 28).

Sub-Librarian (Keeper of Printed Books)—The Librarian, The University, Oxford (September 29).

Ceramics Scientist on scientific staff of Pottery and Ceramics Research Association in New Zealand—The High Commissioner for New Zealand, 415 Strand, London, W.C.2 (September 30).

Assistant in Botany—The Secretary, The University, Aberdeen (October 1).

Assistant Lecturers (2, Grade III) in Applied Mathematics—The Registrar, The University, Liverpool (October 1).

Chair of Chemical Engineering tenable at the Imperial College of Science and Technology—The Academic Registrar, University of London, Richmond College, Richmond, Surrey (October 3).

Senior Lecturer in Chemistry at the Natal University College, Durban—The Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1 (October 15).

Lecturer in Chemistry (with qualifications in Inorganic and Physical Chemistry) at the Natal University College, Pietermaritzburg—The Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1 (October 15).

General Manager of the Croydon Gas Company—The Chairman, Croydon Gas Co., Katharine Street, Croydon (October 15).

Assistant Lecturer in Geology—The Registrar, The University, Sheffield (October 31).

Assistant to the County Lighting Engineer—The County Clerk, Lanarkshire House, 191 Ingram Street, Glasgow, C.1 (November 3).

Lecturer in Veterinary Science, and an Assistant Lecturer in Dairy Technology, at Massey Agricultural College (University of New Zealand), Palmerston North, New Zealand—The High Commissioner for New Zealand, 415 Strand, London, W.C.2.

Technician (Grade B) in the Physiology Department—The Vice-Dean, St. Bartholomew's Hospital Medical College, at Queen's College, Cambridge.

Technical Indexer (woman) on the staff of the Plant and Animal Products Department—The Establishment Officer, Imperial Institute, South Kensington, London, S.W.7.

Assistant Lecturer in Chemistry (must possess an Honours Degree in Chemistry), an Assistant to the Advisory Chemist (must possess experience of analytical work), and an Assistant Lecturer in Dairying (must possess a Degree in Dairying)—The Principal, Midland Agricultural College, Sutton Bonington, Loughborough.

Psychologist (part-time) at the Child Guidance Clinic—The School Medical Officer, Public Health Department, Stour Street, Canterbury.

Psychiatrist (temporary, whole-time) or Psychiatrist or Psychiatrists (temporary, part-time) in connexion with the Joint Child Guidance Service—The County Medical Officer of Health, County Hall, Lewes, Sussex.

Laboratory Technician (male, Grade B), and a Laboratory Junior Technician (male, Grade C)—The Secretary-Superintendent, Royal Surrey County Hospital, Guildford.

Technical Assistant to the Advisory Bacteriologist, South-Eastern Province, in connexion with the National Milk Testing and Advisory Scheme—The Advisory Dairy Bacteriologist, 39–41 Sackville Road, Hove 3, Sussex.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Scientific Proceedings of the Royal Dublin Society. Vol. 24 (N.S.), No. 4: The Angular Distribution of Submarine Daylight in Deep Water. By H. H. Poole. Pp. 29–42. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd., 1945.) 1*s.* 6*d.* [28

National Institute of Agricultural Engineering. Publication 505/45: Research on Pneumatic Tyres for Farm Tractors. Report of Work carried out in 1939–40 by the Institute for Research in Agricultural Engineering, University of Oxford, for the British Rubber Producers' Research Association. Pp. 32. (York: National Institute of Agricultural Engineering, 1945.) 2*s.* [38

Society for Freedom in Science. Occasional Pamphlet No. 2: Rights and Duties of Science. By Prof. Michael Polanyi. Pp. 18. (Oxford: Society for Freedom in Science, 1945.) 1*s.* 9*d.* [98

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