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FIELD STUDIES IN BRITAIN

To some, in particular to the young reared more or less exclusively in an urban environment, the rising hum of the machine age is as music in the ear—enticing, exciting, novel. Contemplation of mechanical achievement induces a pleasing impression of man's inventiveness, his sense of finding ways and means, his ability to triumph over all kinds of difficulties in the interest of utility.

Our present purpose, however, is not to discuss the merits or demerits of this trend in human affairs, but to indicate that there are other trends which have a special claim on our attention at the present time. In particular, attention may be directed to the advocacy, on many sides and by people of widely diverse background, of the need for encouraging and fostering a love of the countryside and of all the many interests and delights which it can provide for men of quiet mind. To some, perhaps, contact with country life is no more than an occasional need, the response to a passing nostalgic mood. To others it represents an escape from the grime and grind of city life. But these, on the whole, are negative aspects of the call of the countryside. The positive aspect is seen in the actions of those for whom life in the country, involving a close, personal contact with Nature, is regarded as both necessary and desirable because it provides something not to be found in town or city; something that is felt to be essential to the fullness of life.

No short description will cover the attractions which the English countryside can provide. To each one of us, according to his mind, it has something to offer. As our contact becomes more close and intimate, specific interests begin to take shape. These include what might be described as the general interests of the countryman, a combination of the æsthetic, the scientific and the utilitarian; and, more specifically, those of the field naturalist, the geologist, the geographer, the archæologist and the landscape painter. On each of us the world of Nature, whether represented by the open downs, the moor, the fen, the forest or the shore, lays its spell. Not only do we advance our particular interest and broaden our general sympathies: we also acquire an outlook on life other than that which emerges from the urban daily round. It seems improbable that anyone will seriously dispute the desirability of fostering a knowledge and appreciation of the countryside (and all that this connotes) as part of the educational equipment of a nation that now professes to look forward to a better way of life. Nor will it be denied that it is to young people in particular that this opportunity should be given.

There is nothing new in the pursuit of field studies. No contemporary poem is necessary to extol the joys of the country life or the pleasures of contemplating wild Nature. But two things may perhaps be noted. One is that during the last few decades there has, in fact, been a relative decline in field work. The other is that with the development of large towns and suburbs, young people are of necessity being brought up in an environment which daily becomes

more and more completely removed from the realm of meadow and hedgerow. There is, then, a real need for a renewal of interest in field studies. There is also a very real practical problem, namely, how ways and means can be provided to make good this want. On page 744, we publish a paper by Mr. F. H. C. Butler, honorary secretary of the Council for the Promotion of Field Studies, in which the aims, objects, inception and achievement, of this Council are fully set out.

After a perusal of that article, we feel sure that many readers will desire to support the work of the Council by individual subscription and personal advocacy. Such support will be welcome. But the matter should not be allowed to rest at this level. It is not too much to say that the work of the Council, if it can be carried out on an adequate scale, will contribute both directly and indirectly to the national well-being. In that the field studies envisaged have a definite educational, cultural and practical value, they should be regarded as an integral part of the new movement in education. They should therefore be encouraged and promoted by all who realize the value of this work, while, at the administrative level, they should be supported by a grant from the Treasury commensurate with the proposals indicated in the Council's modest but well-considered plan of action. Further, in view of the fact that the Council's work will turn on the acquisition of appropriate centres spread over the country, it can show a good case for the receipt of capital grants. Here the larger philanthropic bodies might well consider whether the Council's objects do not come within their range of interests, and whether they cannot help in establishing the Council on the secure basis which its significance for the future seems to justify.

UNIVERSITY RECONSTRUCTION

The University and the Modern World

An Essay in the Social Philosophy of University Education. By Arnold S. Nash. Pp. 223. (London: S.C.M. Press, Ltd., 1945.) 12*s*. 6*d*. net.

THIS essay in the social philosophy of university education is in the nature of a tract for the times, and like most such tracts it is something of *un cri du cœur* and is apt to be stronger in criticism and diagnosis than in constructive suggestions. Mr. Nash faces the fundamental questions of the real function of the university in society which must be answered before we can determine finally its place in the organization and endowment of research or in the educational system as a whole. The problems he raises and discusses are more vital and searching than most of those which Mr. Brian Simon asked and, with the impatience of youth, did not stay to answer. Mr. Nash makes his diagnosis and writes a prescription, though whether the prescription can be made up, or whether its ingredients are available or potent, are matters on which opinion may differ widely.

As to the diagnosis, Mr. Nash is in good company. His main thesis, that the modern university has built up its curriculum and elaborated its educational procedures on the basis of an inadequate philosophy, and that some new unifying principle is needed, is reflected in much current criticism of the universities. Dr. Lowe, for example, in "The Universities in Transformation", in a passage quoted by Mr. Nash, commented that our future intellectual leaders would not be able to understand, and still less to plan, more than a small fraction of social life, unless they knew how to link together the various aspects of their experience into a unity of knowledge. They can only carry out this process if they have learnt how to utilize the findings of the specialist sciences, and at the same time have acquired some direct experience of, say, the particular benefits and strains arising from industrial life, of Nature as reshaped by technique, of social responsibility as increased by planning.

The same thesis is to be found in a recent essay of Prof. John MacMurray on "The Functions of a University" in the *Political Quarterly* and in the new edition of Sir Charles Grant Robertson's "The British Universities". It is implicit also in B. Dobrée's essay on arts faculties in modern universities, though not all who recognize as consistently as Rashdall and Mansbridge the unifying influence of a true university would agree that the task of integrating the various branches of learning is specially the function of the arts faculties.

Mr. Nash's argument elaborates at greater length this view that a university is not a university at all unless the various faculties and the subjects they treat gain unity of purpose and aim by some common view of man's nature and destiny. It is the substance of his indictment of the liberal democratic university in the first part of his book that the liberal university failed to supply such a view. By rejecting any real attempt to discover and then to teach a unified conception of life, the liberal university ceases to be a university, and in the second part of the book Mr. Nash argues that students on the continent of Europe embraced Nazism and Communism so readily because the totalitarian philosophies appeared to present the only live option to the confusion and chaos of the liberal world view which regards each academic subject as autonomous.

In these two parts of his book Mr. Nash writes with unmistakable courage and sincerity. His analysis is impartial, but there will be many who, while accepting his view as to the disintegration that is proceeding in the university world and even that the university is facing a profounder crisis than that evoked by the Renaissance or the Reformation, will challenge his conclusions or diagnosis in respect of particular fields. What is at stake, he urges, is not a question of the scientific tradition as opposed to the literary tradition as the basis of university education, but the adequacy of the common premises of any tradition now current in the liberal democratic world on the nature and function of the university in human society. Scientific knowledge of man and the universe does not, he holds, by itself provide an adequate foundation for intellectual reconstruction, though a place must be found for it in the superstructure, and he urges an attempt to discover the limits of reason and the range of validity of scientific method.

Neither that, nor his main thesis, is a new plea, but in his discussion of the liberal university, Mr. Nash is inclined to attribute a larger place to science as a discipline in the universities than it has actually held. It may well be disputed whether the modern university has ever assumed that the scientific method and spirit are an adequate guide in the pursuit of knowledge. Only last January Sir Lawrence

Bragg welcomed the admission from the arts side that the six different, though interconnected, realms of intellectual activity of which an educated man should know something included at least the sciences of physics, biology and astronomy. So far from science having been given, at least in the older universities, the place as a discipline to which it is entitled, it may be held that it has been rather admitted on sufferance.

While accordingly it could be maintained that science should have a larger place as a cultural element in education at all levels than it occupies at present, Mr. Nash's criticism of the inadequate philosophy of science and of the chaos of liberal atomism whereby the subjects of the university curriculum are separated from each other into neat departments of specialized knowledge is much easier to sustain. In the two chapters on the rise and decline of scientific individualism, Mr. Nash scarcely allows himself the space to deal adequately with the issues, and these chapters are suggestive rather than conclusive. Even more challenging is his explanation in the second part of the book of the way in which European students came to embrace the totalitarian philosophies. His linking of Nazism and Marxism together in this respect will not please all his readers. Both Nazi and Communist, he argues, are right in rejecting the assumption that science has no preconceived ideas, in maintaining that knowledge must and does serve some purpose greater than itself, and in contending that all human knowledge is conditioned by non-rational factors.

But while Mr. Nash agrees with the totalitarian attempt to achieve a synthesis of the different specialisms that give a prominent place to political factors and concepts by showing the political implications of different realms of specialized knowledge, he rejects forthright the totalitarian attempt to unify all realms of knowledge by making them subject to political categories and purposes, and by creating a new scholasticism which puts the whole of knowledge into a totalitarian strait-jacket. He does not assume that the university must satisfy only the demands which society can make articulate: a university, he holds, discharges its obligations to the social order also by making society aware of what society ought to want. In other words, the breakdown and inadequacy of the three existing philosophies of the relations between the university and the social order—what he describes as the spectator theory, the ambulance theory, and the participant theory—lead Mr. Nash to advance what may be described as the prophet or interpreter theory, and it is essentially to this that he devotes the third part of his book.

Not even Mr. Nash's sincerity renders this part entirely convincing, but he is himself conscious of its limitations and anxious to inspire a further attempt. Possibly the further volume on "The Reconstruction of the University" which he has in preparation may deal more adequately with some of the questions raised. Meanwhile Mr. Nash is not alone in his plea that the university teacher must accept the responsibility for the creation and teaching of a unified and coherent philosophy, and the task of creating a *Weltanschauung* which steers a middle path between liberal atomism and totalitarian dogmatism. Sir Charles Robertson urged that theology should be restored to the position of queen of the sciences in the original sense of the term 'science', and others like Dr. A. D. Lindsay have urged that the universities must complete the education provided in religion as fully and as essentially as in humanism and science if the spirit of the community itself is to be rescued from disintegration.

Mr. Nash himself urges that Christian scholars must work out an adequate conception of religious education which, although giving meaning to the whole of knowledge, does not confuse the spirit of the age with the spirit of the ages. His main thesis is developed following a rather inadequate treatment of the sociology of knowledge, the chief value of which he finds in the truth of its thesis that there are fashions of thought which cannot be adequately understood so long as their social origins are obscure. He pleads for a fellowship of lay theologians or Christian scholars who would strive to create a Christian world view within which the conclusions of the specialized subjects of the university curriculum could be given their ultimate meaning in terms of a specifically Christian philosophy of man and of his relation to the historical process.

His plea for an intellectual synthesis for the twentieth century and an interpretation of human life and destiny with a moral or specifically Christian basis is sometimes tantalizing but never without dignity. His treatment of the philosophy of science is short—almost brutal—but Mr. Nash is always stimulating. His defence of the freedom of science is sound, and he dispels false ideas in the controversy over science and planning as trenchantly as he does misconceptions of the importance of the university's task of witnessing to the value of the independent and critical pursuit of truth as such and not the buttressing of political or religious doctrines, or as to the entire objectivity or detachment of university thought or teaching.

The relevance of Mr. Nash's present book to the problem of university reconstruction is in fact in just this challenge and stimulus to critical and constructive thinking on the philosophy of the university and the content and interrelation of its curricula. Out of such thought must come the creative proposals on which will be based any re-orientation of the functions of the universities to serve the new age. Mr. Nash would not claim that he has given us the answers to the questions he raises. He claims that university life and teaching must have a moral and spiritual basis and unity, and is content to start us thinking. His book is a modest but useful contribution to that debate, and its value is increased by an annotated bibliography which, in spite of some surprising omissions—why is Bavink ignored, for example?—is a useful starting point for wider reading. The production is scarcely in keeping with the quality of the matter and there are too many bibliographical slips for a book of this calibre. R. BRIGHTMAN.

COSMOLOGICAL THEORIES

The Idea of Nature

By R. G. Collingwood. Pp. viii+184. (Oxford: Clarendon Press; London: Oxford University Press, 1945.) 15*s*. net.

COLLINGWOOD'S illness and early death prevented him from saying fully or as effectively as possible all that he had to say. Prof. Knox, the editor, points out that the work now published was written in 1933–34, after the "Essay on Philosophical Method", and was intended as an application of that method. Since the author did not publish anything at the time, we may infer that he was not satisfied

with it. In spite of some later revision it must be taken as no more than a substantial fragment. It suffers more than most of Collingwood's work from a tendency to rash statements and occasional labouring of small points. Nevertheless, the book is a valuable contribution to philosophy, and supplements what we have already of Collingwood's highly original and distinctive way of thought.

The central thesis is that cosmological theories at all periods are based upon analogy. Some familiar aspect of experience is taken as a clue to the character of the whole realm of Nature. Ancient Greek thinkers, almost without exception, conceived of Nature as a living organism. They drew no sharp distinction between the material, the living and the conscious, and they saw the orderliness of the natural world as an expression of its intelligence. After the Renaissance, when machines became familiar, it was conceived as a machine. "The word 'matter' had acquired a new sense : it was no longer the formless stuff out of which everything is made by the imposition upon it of form, it was the quantitatively organized totality of moving things" (p. 112).

Then comes the most challenging part of Collingwood's argument. Since the eighteenth century a new view of Nature has been displacing the older one, a view that does not stress permanence, but rather process, change, development. This means, according to Collingwood, that the natural world is conceived on the analogy of human history, whence these ideas are derived. There follow interesting comments on Hegel, Bergson, Alexander, Whitehead and others, showing how in their hands old conceptions have given place to others, but the process has not gone to completion.

It is here that one sees most clearly that Collingwood's own thought has not reached its own full development. Not only has he cut out the sketch of his own cosmology at the end, but also he has not co-ordinated the stages of the historical process to make clear the way older views have given place to later, as he should have done according to his theory of philosophical method. Moreover, there is only cursory treatment of one of the chief problems : how far at any stage of thought the natural world could be conceived as self-contained and self-subsistent.

Like all Collingwood's work, this book effectively jolts the reader out of common habitual modes of thought. The pity is that it is really no more than a fragment. A. D. RITCHIE.

SCIENCE AND CRAFT OF BEE CULTURE

A Manual of Bee-Keeping

For English-speaking Bee-keepers. By E. B. Wedmore. Second edition, revised. Pp. xxiv+389+9 plates. (London : Edward Arnold and Co., 1945.) 18*s*. net.

THE honey-bee has been more extensively and deeply studied than any other insect. The craft of bee-keeping has perhaps the most complex technique that has ever been developed for the domestication, or perhaps it is safer to say the exploitation, of any livestock. This is due to the highly developed social life of the bee, with its infinite variety of possible reactions to stimuli not always understood or controllable by man. It is not surprising, therefore, that there is a very extensive literature dealing with the science, art and craft of bee culture.

The author of "A Manual of Bee-Keeping" deals entirely with bee-life, its science, and the technique of bee-keeping, and does not interpolate extracts from the classics or the poets. He deals in facts. After a life-time spent in research work, he has a keen sense of scientific caution, and adroitly avoids giving unproved theories or indulging in flights of fancy. All the time he presents facts in clear and critical form. It is to be hoped that readers will appreciate that when the author of this book gives instructions for an operation involving a sequence of steps at intervals indicated in precise words, no deviation from literal accuracy in taking those steps is allowed for, otherwise trouble will be encountered.

The general arrangement is encyclopædic, and all paragraphs are numbered—some 1,600 of them—with cross-references to all related subjects. There is nothing to tie the book to bee-keepers in one country and render it unsafe to use in another. It gives facts about honey-plants and current practice in both hemispheres, and general management of bees is much the same all over the world, so that it may be described as of international application.

It is significant that among the traditional notions that the author discredits is the persistent belief that each baby bee that emerges from its cell leaves behind its cocoon skin adhering to the walls and base so that the size of the cradle diminishes with each successive generation that uses it until only undersized bees can be reared. Much searching has failed to reveal any comb with cell walls more than six thousandths of an inch in thickness, whatever their age.

Pollen, which was for so long regarded as a nuisance in the combs that writers used to give elaborate instructions for getting rid of it, receives full recognition of its value in no uncertain terms. Some readers will be surprised to learn that well over one hundredweight of pollen is used annually in a normal bee colony, and that in summer the daily gathering of pollen may exceed two pounds. Annual consumption of honey will be about four hundredweights, with some few gallons of water, so that the total food consumed by the bees is considerably in excess of a quarter of a ton per hive.

Bees have normally been cleared from filled super boxes of honey by use of a device called a Porter escape, which causes the bees to walk between two delicate springs through which there is no return—as long as nothing happens to jam the springs. The author illustrates a device of his own designing which has no movable parts to become fixed. It operates on principles similar to those employed in some fly or crab traps.

The important discovery that bees will tolerate a space of about $\frac{1}{4}$ in. between frames of comb and the sides and floor of the hive without filling it with comb was published in 1852 by L. L. Langstroth. It appears, however, from evidence adduced by Mr. Wedmore, that Debeauvoys published in 1851, in his "Guide de L'Apiculture", a description of a space of 6 mm. which could be used in the same way, so that he would appear to have anticipated Langstroth's announcement. There was, however, the difference that in France the discovery passed unnoticed, while in the English-speaking world the American's book made a great stir.

Altogether, Wedmore's "Manual" is a book for the serious student, for the practical man, and for aspirants to both classes. H. J. WADEY.

Diseases of Vegetables

Bulletin No. 123 of the Ministry of Agriculture and Fisheries. By Lawrence Ogilvie. Second edition. Pp. ii+74+8 plates. (London: H.M. Stationery Office, 1944.) 1*s.* 6*d.* net.

THIS is the second edition of the now well-known bulletin on diseases of vegetables written by Mr. L. Ogilvie, advisory mycologist for the Ministry of Agriculture's western province, with headquarters at Long Ashton Research Station, Bristol.

Among the expert mycologists comprising the Ministry's team of advisers, no one is more fitted than Mr. Ogilvie to write this bulletin. His province includes five counties within the boundaries of which are to be found some of the best vegetable-growing areas, cultivated by some of the most progressive growers of market-garden produce. Long years of experience coupled with his considerable number of investigations into many diseases of vegetables have given Mr. Ogilvie such knowledge of the problems which arise in the successful cultivation of vegetables as to render his advice extremely valuable to growers of these crops.

After a brief but lucid introduction explaining the nature of the various kinds of disease, the ones attacking vegetables are described and appropriate measures for preventing or checking them are given. The diseases are referred to by the accepted common name (standardization of which for Great Britain has been attempted in the List of Common British Plant Diseases recently published by the Cambridge University Press); but the full scientific name of the organism causing the disease also appears in brackets after the common name.

Compared with the first edition, there has been some revision and addition in the light of recent discoveries by research workers. There are a score or so of excellent photographs to illustrate some of the important diseases.

Following the main part of the bulletin dealing with vegetable crop diseases, there is a small but useful section giving descriptions of such practices as soil sterilization by steam and chemicals, seed treatment, preparation and use of fungicidal sprays and dusts, disinfecting of glasshouses, etc. There follows a list of the Ministry of Agriculture advisory mycologists with the counties administered by each —this is of great use in indicating where growers can apply for advice on crop troubles.

It is an extremely well set up publication which every grower of vegetable crops ought to have. The information it contains is written by an expert, and the price, as usual with these bulletins, is within reach of everyone's pocket. D. E. G.

Radio Technique

By A. G. Mills. Pp. viii+170. (London: Chapman and Hall, Ltd., 1944.) 12*s.* 6*d.* net.

Radio Receivers and Transmitters

By S. W. Amos and F. W. Kellaway. Pp. x+281. (London: Chapman and Hall, Ltd., 1944.) 21*s.* net.

THE paucity of new text-books concerned with radio transmission makes the above pair particularly welcome. While we cannot subscribe to the claims of the first author that his text covers among other matters a thorough treatment of transmission and reception necessary for the complete understanding of radio, nevertheless what he has attempted for the young student in a restricted field is well done, and gives a very good idea of the theoretical background necessary in every telecommunications engineer whether specializing in radio transmission or not.

The authors of the second book are slightly more ambitious; they link up the theoretical work with practice and bring in topics too numerous to mention here. There are many applications of valves which must wait for general disclosure, but this book will certainly impress the student that there are important applications of radio technique, and that to understand them—and in the future to introduce new ones —it is necessary for him to learn much relevant fundamental work. The authors, while not exhausting the subject, have made a careful selection which can be recommended with confidence. L. E. C. HUGHES.

Organic Reagents for Organic Analysis

By the Staff of the Research Laboratory of Hopkin and Williams, Ltd. Pp. 172. (London: Hopkin and Williams, Ltd., 1944.) 5*s.* 6*d.*

ESSENTIALLY a summary of a good deal of information hitherto available only in a dispersed form in recent chemical literature, this book provides a comprehensive list of organic reagents which may be used in identification work for the preparation of crystalline derivatives of various organic types. To illustrate its scope, we may note that under the alcohol type are given oight 'selected reagents' and eleven 'other reagents', the former being as a rule more satisfactory and easier of access than the latter, for details of which the reader is referred to the original literature. Choosing 3 : 5-dinitrobenzoyl chloride as a typical 'selected reagent', we find a description including its structural formula, molecular weight and significant properties, with experimental details for its use in preparing derivatives of alcohols and phenols, together with notes on other applications, a bibliography, and references to tables of melting-points given at the end of the volume. To name a less familiar example, xanthydrol is described, on a similar plan, as a reagent for amides, urethanes, sulphonamides and substituted barbituric acids. There is a good index.

The book is evidently an outcome of much first-hand experience, and will be a valuable adjunct to teachers, students, research workers and others concerned with qualitative organic analysis. J. R.

Bentley and Driver's Textbook of Pharmaceutical Chemistry

Revised by Dr. John Edmund Driver. Fourth edition. Pp. ix+644. (London, New York and Toronto: Oxford University Press, 1945.) 21*s.* net.

THIS book is widely used by those who have passed preliminary scientific examinations and are studying for the qualifying examinations in pharmaceutical chemistry. Its suitability for this useful purpose is attested by the appearance of four editions in twenty years. It is divided into three sections dealing with analytical methods, inorganic chemistry and organic chemistry respectively, and is full of facts clearly and simply set forth. A large proportion of these facts is taken from the "Pharmacopoeia", with suitable explanations and amplifications. A few references are given to original papers, but the book is essentially an elementary text-book for a specialized purpose. The new edition has been brought up to date by the inclusion of data from the first six addenda to the "British Pharmacopoeia" of 1932 and revised throughout in the interests of accuracy and clarity.

THE COUNCIL FOR THE PROMOTION OF FIELD STUDIES

By F. H. C. BUTLER
Honorary Secretary

IN all branches of knowledge which deal with the nature or configuration of the earth, or with its animal or plant population, or with human ecology, past and present, teaching cannot be adequate unless the student can learn in the field as well as in the lecture-room, library and laboratory; this is equally important whether he is to become a teacher, an administrator or a research worker. It is difficult, often impossible, to carry out adequate field excursions from school or university. The time taken in travelling to and from any but the nearest localities leaves little opportunity for serious work; the carriage of apparatus and equipment is also a major problem. Moreover, in research it is often necessary that continuous observations in the field should be carried out over long periods; this is essential where the subject-matter of a problem is so great that its adequate investigation will take many years; for example, the detailed geological or geographical study of selected areas, or the study of fauna and flora. It is equally essential where seasonal changes are all-important, such as the effect of weather on coastal configuration, or the observation of seasonal changes in the fauna and flora of the sea, lakes and rivers, or on the land. A great deal of the biological field-work done at present loses much of its value because of the impossibility of making regular observations in the same area throughout the year.

In order to meet such difficulties on an adequate scale, the Council for the Promotion of Field Studies was founded in 1943; a report of the inaugural meeting was given in *Nature* of December 18 of that year. A leaflet was issued by the Council last June giving a brief description of its aims, membership, proposed constitution and current activities. In February this year the first number of the *C.P.F.S. Bulletin* was published. The aims of the Council are to provide facilities for every aspect of field-work at first-hand, and to set up for this purpose residential field study and research centres, distributed throughout Britain, in localities selected for the richness and variety of their ecological features, geological and geographical interest and archæological and historical importance. The field centres will be available alike to all serious workers in the field, whether amateur or professional, whether as individuals or as members of a class from a school, training college, university, young people's college, youth club, or other corporate body. The Council wishes to co-operate closely with local societies and field clubs, and through the centres —many of which will be situated in or near Nature reserves or national parks—should be able to play an important part in the training of the community in sound knowledge, æsthetic appreciation and proper use of the countryside.

The Council is working in close co-operation with the National Trust, which is fully in sympathy with its proposals. It is hoped to establish the field centres so far as possible by leasing National Trust properties, care being taken in their adaptation and use to ensure their preservation as national monuments, while at the same time putting them to a cultural purpose. For the establishment of the first field centre, the National Trust in 1943 made an offer to the Council of the lease of Flatford Mill and Willy Lott's Cottage in East Suffolk, made famous by Constable, and admirably suited to scientific and artistic studies. Prof. W. A. F. Balfour-Browne made a generous gift to cover the first year's rent, and application was made in June 1944 to the Carnegie United Kingdom Trust for a capital grant towards the considerable cost of adaptation and equipment. The Trustees expressed their interest in the aims of the Council and agreed to contribute up to £2,000 for this purpose. Negotiations with the National Trust for the lease of this property have therefore been concluded, and when labour and materials become available the work is to be carried out under the professional direction of Mr. Marshall Sisson, who has been appointed consulting architect to the Council. The family of the late Miss Alice Hibbert-Ware has generously presented her unique collection of natural history material for the use of students at Flatford. It is hoped to dedicate the library to the memory of James Reid Moir, the well-known Ipswich field archæologist, who did so much of his scientific work in the neighbourhood and who lived in the Mill House for the last five years of his life; he greeted the foundation of the Council for the Promotion of Field Studies with enthusiasm and his help would have been invaluable.

It is the unanimous view of the Executive and General Committees of the Council that the success of its scheme depends on the possibility of establishing a number of field centres in different parts of Great Britain more or less simultaneously as soon as possible after the general conclusion of world hostilities, to be followed by others as occasion and opportunity offer. The general demand for properties suitable for centres is rapidly increasing; for the Council's needs their precise location is of paramount importance on ecological grounds; it is therefore essential that the Council should be in a financial position to take urgent selective action before it is too late, as present opportunities are never likely to recur. Regional sub-committees covering England and Wales have been appointed to advise the Executive Committee on the selection of suitable sites, with the requisite accommodation for centres, in their areas. Mr. Hubert Smith, chief agent of the National Trust and a member of the Council's executive committee, is kindly advising the sub-committees when suitable Trust properties become available.

In addition to the grant from the Carnegie Trust, the University of Cambridge, on the recommendation of three faculty boards (Biology 'A', Geography and Geology, Archæology and Anthropology) and the General Board of Studies, has agreed to put the capital sum of £600 at the disposal of the Council towards initial expenses incurred in establishing field centres. The University of Bristol and the University of Leeds have allocated token annual grants and a donation has been received from University College, Hull. Owing to the unique opportunities for teaching, study and research in the field that will be made available to them as the centres become established, the Council looks to each of the other universities for at least token financial support at the earliest possible moment. As the Council's work will involve the management and ownership of property, with gradually increasing financial responsibilities, the Executive Committee considers it essential that the Council should become incorporated under the Com-

panies Act, 1929, and the necessary application is being made. Under the constitution, the General Committee of the Council will be the statutory body responsible for the formulation of policy, the direction of activities and the election of the executive. It is composed of representatives appointed by the universities, scientific societies and institutions, leading organizations of the teaching profession and the main groups of natural history societies, field and art clubs. The Council's work will embrace very wide and varied interests, and, in order to be fully representative, the General Committee must necessarily be a large and influential body ; it is clear that finality in the election of official representatives cannot be reached until the Council gets into its stride, and it is important that this should be borne in mind. It is proposed that one quarter of the General Committee should be representatives of individual members.

At the first meeting of the General Committee held in the Royal Society's meeting room on April 25 the following resolutions were passed unanimously :

(1) This representative meeting strongly urges the great potential value of the work of the Council and the scientific, educational and cultural importance of taking immediate measures to establish a number of field centres actively in operation in different parts of the country.

(2) That the Executive Committee be instructed to take immediate measures to put this view before appropriate Government Departments, the Carnegie Trust and other bodies, with a view to securing a direct grant from the Treasury, and any other assistance which offers means of realizing the early fulfilment of our programme.

In some respects, the Council for the Promotion of Field Studies will perform for the culture of the countryside what the Council for the Encouragement of Music and the Arts has been doing for the presentation of music and the arts to the community. Not only will it introduce the serious first-hand study of the countryside to a new and to a much wider public, but also "the Council will," in the words of Prof. F. T. Brooks of Cambridge, "fill a very important gap in our system of education, both at the school and university level". Its functions are concerned with the processes and not merely with the products of intellectual achievement. It will play a vital part in many branches of research. Its financial needs are therefore no less great than those of C.E.M.A., and worthy of at least equal consideration for a direct annual Treasury grant.

The field centres will be staffed and equipped to provide adequate board, lodging and working facilities for numbers ranging up to forty or fifty students. They must cater for a wide variety of needs and interests—for every science and art the natural province of which is (or ought to be) the open air. They must be able to provide ample and varied material for study ; attractive and comfortable but not extravagant living accommodation ; the right tools and books and elbow-room during working hours ; congenial and useful occupation in spare time. In function, they may be fairly described as residential university outposts in the field, for they would be field extensions of the departments of botany, zoology, geography, geology and archæology, and of essential use to students of history, dialect, place-names, folk-lore, anthropology, antiquities, art, agriculture, forestry, architecture, town and country planning, rural crafts, economics, sociology, and so forth. As it gradually becomes fully equipped, a field centre must combine adequate facilities for field work with some at least of the social amenities of a residential college. A field centre would, in short, offer its students something far more tangible, more lasting, than the limited experience of the 'day-excursion' or of the 'bench-experiment' kind.

Each centre will be under the direction of a trained warden. Although it is intended that classes of school and university pupils shall be accompanied by their own teachers, it is essential that the wardens of the field centres should be experienced naturalists and trained field-workers with wide cultural sympathies : they must be able to undertake specific instruction in the field in their own subject as well as advise on other activities in which an intimate general knowledge of the district will be necessary. The position of warden will be one of peculiar responsibility—he will have to direct, advise and collaborate in every way possible—and obviously on him will depend to a very large extent the success and efficiency of a centre. It is considered, therefore, that the post should carry with it a status comparable to that of a university reader or professor.

As well as the student and professional research worker, the Council is especially anxious to attract and help the amateur—the 'born' naturalist, artist or archæologist—and hopes that local societies and field clubs will co-operate closely with the work of the centres. At each centre there must be, for the novice, expert help and individual encouragement ; for the advanced student, every facility for research—the standard must be high in personnel and equipment. For professional research workers from institutions like Wray Castle and Rothamsted, there must be facilities for obtaining comparative data in fundamental long-term investigations ; each centre should be an ecological research station and have places reserved for investigators who wish to stay for long periods.

We have mentioned that the centres could be regarded as field outposts of various departments of a university. An important point is the co-operation which could be instituted at a centre between the work of different departments even of the same university. At present these function independently, but all would gain greatly if combined work were done. For example, biologists and archæologists would have the advantage of information about the geological formation of the area, for the maps and surveys of the geographers would be of service to them, while both geologists and geographers would benefit from first-hand information concerning the fauna and flora. Geologists could receive instruction from geographers in the methods of trigonometrical survey and tachyometry. Also, meteorological data and climatic (or micro-climatic) investigations would be fundamental to many studies. Thus students in different subjects would have the great advantage of working together, seeing each other's methods and results and learning, at first-hand, of the unity of knowledge, which is an ideal so difficult to attain within the somewhat water-tight compartments of a university. There would be further and wider advantages both of a social and cultural nature. Members of the staff as well as students of one university would meet those of other universities in their own as well as in other subjects, when staying at the same centre together. Furthermore, the association of art and science, under the informal and fortuitous circumstances in which their practi-

tioners would meet, would at least be interesting and might well be beneficial to both.

For secondary schools, the centres would afford admirable opportunities for individual or group work in many subjects, including natural history, biology, geology, geography, history, art and allied studies. Many school syllabuses in biology—largely dictated by external examinations—are too academic to appeal to the average boy and girl, and are, therefore, not of the real educational value that they should be. Children are interested in studying living plants and animals in their natural environment, and it is coming to be realized among educationists that this aspect of the subject needs to be greatly encouraged; but unfortunately, few teachers—including university graduates in the biological sciences—have the requisite first-hand knowledge and experience of field-work to teach natural history with competence and enthusiasm. In biology (a subject which purports to be the science of living things), it is far easier to teach and examine classes of pupils by anatomizing dead specimens in the laboratory than by observing living organisms in the field, and this may account for the comparative neglect of the study of animals and plants in their natural habitats.

The evacuation scheme, whereby the schools were dispersed from the cities of Britain into the countryside during the War, has shown only too clearly that for many teachers the countryside is a closed book; comparatively few seem to have been able to make use of the excellent opportunities presented to them for first-hand observation and teaching in the field, even when there was no external examination syllabus to tie them down to an unadventurous and monotonous urban class-room routine. Moreover, in schools permanently situated in the country, it is the exception rather than the rule to do any serious work in the field in school hours, in studies (other than gardening) which specially lend themselves to observational work and the testing and illustrating of teaching and text-book authority at first hand. Admittedly, this work requires detailed knowledge and a carefully planned technique, which are at present outside the range of experience of many teachers in the schools, not having been demanded in their university studies or dealt with in their courses of professional training. The centres will be equipped and organized to enable this special knowledge of field-work to be acquired by teachers and pupils in the various subjects; also teachers will be able to learn the technique of handling classes in the field, which undoubtedly requires special training, experience and facilities, if the work is to be efficient and time and energy conserved. In course of time, perhaps, when the centres have become widely established, new influences will be brought to bear on school and university teaching and examining, and then the Council for the Promotion of Field Studies will be "filling the very important gap which exists in our system of education both at the school and university level". It is hoped that the centres will be widely used by teachers and pupils in the schools, and that they will enjoy working out the fresh approach to culture that field-studies will bring them, with new kinds of technique, in places of great natural beauty that should rejoice the hearts of artists and craftsmen, as well as scientific men, geographers and historians.

Finally, the Council for the Promotion of Field Studies is a scientific society, and therefore it is important that the spirit of research should not be confined to field and laboratory, but should be applied to the planning, organization and equipment of the centres, and, indeed, to the general administration of the Council's activities as a whole. What these activities will be in their completeness it is not yet possible to forecast; but from the widespread and eminent support that the Council has already received, it would seem that we are on the fringe of great possibilities of service to those who wish to make a first-hand study of the many branches of knowledge that have their source and inspiration in the field.

THE SEVERN BARRAGE SCHEME

COAL supplies in Great Britain having become deficient in quantity and quality, public attention has been forcibly directed towards alternative sources of power and energy. The most novel and also the largest single source which has attracted public interest is the Severn Barrage. A scheme formulated by Mr. A. G. Vaughan-Lee, Sir William Halcrow and Mr. S. B. Donkin, published by the Ministry of Fuel and Power*, gives a broad outline of a method of utilizing tidal power in the Severn Estuary, provides an estimate of the amount of power and energy which would be made available, and the cost thereof.

The principle of the scheme is simple. A dam across the Severn enables water to be impounded on rising tides. This water flows through turbines on the succeeding falling tides. Its potential energy is converted to kinetic energy by the turbines and then to electrical energy by alternators directly coupled to these turbines.

The proposed dam is located at the English Stones, some two and a half miles downstream from the mouth of the River Wye, a rough locating point on the north bank of the Severn being the village of Snabrook. It is about two miles long, and comprises sections for inlet sluices, navigation locks and turbines. Thirty-two turbines, in two equal groups, would drive thirty-two alternators, each rated 25 MW. at 0·9 power factor. These would be capable of providing a maximum power output of 800 MW. At spring tide, when the power available is greatest, the total output from the alternators would rise to a maximum of 800 MW. in two and a half hours, remain at this value for four hours, and then fall to zero in a further period of about one hour. There would thus be two periods of about seven hours during each twenty-four, in which the plant would be able to generate power and energy. The maximum power and the hour at which it is available changes day by day in accordance with the state of the tide. These daily and seasonal changes of the power and energy output are to be balanced by suitable operation of the barrage power in conjunction with the electricity grid system of Britain.

The gross energy available at the barrage would be 2,365 million kWh. per annum. If the water flow through the turbines were continuous, the energy available per annum would be 7,008 million kWh. The ratio $\frac{2,365}{7,008}$, that is, 0·47, is important when

* Ministry of Fuel and Power. Report of the Severn Barrage Scheme. By A. G. Vaughan-Lee, Sir William Halcrow and S. B. Donkin. Pp. 32. (London: H.M. Stationery Office, 1945.) 2*s.* 6*d.* net.

considering the relative merits of the barrage scheme and of other sources of energy, such as interconnected thermal power stations, where the maximum output can be maintained continuously if some 15 per cent of spare plant is provided. About one million tons of coal per annum would be saved by using the Severn power. To maintain constant electrical frequency and output, the turbines are to be of the Kaplan type, with variable-pitch propeller-type runners.

The magnitude of the project can be gauged by considering the quantity of material to be used and the labour to be expended.

Civil engineering materials, cement, stone, sand and gravel	6,585,000 tons
Steel	89,000 ,,
Copper	5,000 ,,

The labour required for manufacturing plant and constructing the barrage would be 86,840 man-years. The report suggests that the constructional time should be eight years, with an average of 10,355 persons in service over that period. The estimated cost of the barrage (1944 basis) is £40·22 million. This is £50 per kW. of plant installed. Thermal power stations cost about £30 per kW., but they have a power-delivering ability of about 85 per cent as compared with 47 per cent for tidal stations. They can also be sited closer to power-consuming centres, and can be operated to suit the load requirements.

Ordinary hydro-electric stations, such as are scheduled for construction by the North of Scotland Hydro-electric Board, will cost about £53 per kW. Their power availability factor is not precisely known, but should be of the order of 80 per cent, and is certainly far higher than that of a tidal scheme.

Viewed from the conventional economic point of view, the prospects of the Severn Barrage scheme appear to be bleak. It is, nevertheless, possible or even probable that it will become expedient to construct the Severn scheme in the fairly near future. This renders it particularly interesting to consider its prospects from a practical engineering aspect.

No justifiable doubt exists as to the ability of British engineers to construct the barrage, civil engineering works and electrical equipment. Laymen are liable to be apprehensive about possibilities of disaster, or at least crushing expenditure due to erosion downstream, and silting upstream from the barrage. This aspect has, however, been fully clarified by an admirable series of experiments made by Prof. A. H. Gibson on a scale model of the relevant part of the Severn estuary with and without the barrage. A detailed survey of the estuary made by the Admiralty in 1849 had established the contours of the river bed at that time. Prof. Gibson was able to show that he could reproduce on his model the changes which were caused in the undammed Severn by scouring and silting. Similar experiments on the model provided with a barrage enabled Prof. Gibson to indicate, it is believed accurately, what will take place in the Severn over a period of sixty years after the Severn scheme is put into service.

Prof. Gibson's remarkable investigation, in the best tradition of Osborne Reynolds, has made it possible to predict accurately what the total costs of electricity generated at the Severn Barrage will be over a long term of years. The figure for the energy cost given in the report is 0·199d. per kWh. at the barrage.

There is an unfortunate tendency on the part of the public to hamper development of schemes of the Severn Barrage class because they are deemed to be 'huge'; nevertheless the fact remains that its cost is only the equivalent of some three days of the British expenditure during the War.

In this connexion, it may be useful to direct attention to a water-power scheme at Catrine, Ayrshire, which was put into service in 1837, and which continues to function to this day, as perfectly as it did initially. The Catrine scheme uses the power of the River Ayr. Two overshot water wheels, each 50 ft. in diameter, develop 800 h.p. This power is transmitted to a factory by a shaft 200 ft. long. The hydro-power fluctuations are evened out by a 200 h.p. beam, which started work in 1847 and which is still in action.

Although the Severn Barrage is about a thousand times as large as the Catrine scheme, considered as a risk to the community it is trifling compared with that faced and overcome more than a hundred years ago by forgotten Ayrshiremen. Those now responsible for electrical development in Great Britain are not lacking in enterprise, and will doubtless set the Severn to work at its appointed time.

SYMBIOTIC NITROGEN FIXATION

By PROF. ARTTURI I. VIRTANEN
Biochemical Institute, Helsinki

SINCE 1940 I have not had the opportunity of reporting to English readers the results of our investigations on symbiotic nitrogen fixation. As an opportunity now offers itself, I will briefly record in the following the chief points of our research during the War.

Oxaloacetic acid, which according to my conception has a central position in the formation of aspartic acid, has been determined in several leguminous plants at different stages of growth and under different lighting conditions, employing a method previously described[1]. The oxaloacetic acid content of the plant is highest at noon and in the afternoon, lowest after the night. If the plants are kept for two days in the dark, the oxaloacetic acid disappears. The pea contains before flowering usually about 50 γ oxaloacetic acid per 1 gm., determined at noon, and red clover about 100 γ. At the end of flowering and when growth ceases oxaloacetic acid is no longer detected in plants[2].

We have been able to isolate bacterial strains of *Rh. leguminosarum* which causes nodulation on peas but do not fix nitrogen at all (in ten experiments, inoculated pea plants contained on the average 7·5 mgm. N. per plant, uninoculated control plants 7·3 mgm.). By using our sterile culture system, we have been able to show that this is a constant property of this bacterial strain. Although the bacteria were allowed to pass through five plant passages they did not become active nitrogen fixers. The experiments with ineffective and very effective bacterial strains have without exception led to the conclusion that all the reports in the literature on the change of an ineffective strain to an effective one and *vice versa* through successive plant passages are erroneous and due to the fact that the experiments have been carried out in open pots. In such conditions there is always a great danger of contamination by foreign strains. Only in a sterile culture system can reliable results be obtained.

In comparing the root nodules of the pea formed by an entirely ineffective strain (H VIII) with those formed by effective strains, the following differences can be noted :

(1) In a sufficient concentration of oxygen, the root nodules formed by effective bacterial strains always contain a red pigment, the interior of the nodule being bright red in colour. The red nodules are active nitrogen fixers.

(2) The nodules formed by the ineffective strain H VIII never contain red pigment and do not fix nitrogen.

(3) In oxygen-free conditions even the nodules of effective strains have no red pigment. These nodules do not fix nitrogen.

(4) If the plants are removed for two or three days into the dark the red pigment turns green. The green nodules are no longer able to fix nitrogen, even when the plants are again brought into light.

All the observations show undoubtedly that the red pigment is essentially associated with the nitrogen fixation and is necessary to this phenomenon. Similar evidence has not previously been furnished of the significance of the red pigment in the leguminous root nodules.

The red pigment of the effective root nodules is not a derivative of dioxyphenylalanine, as assumed by Mothes and Pietz[3], but a hæmoprotein as Kubo[4] has shown with the red pigment he isolated from the nodules of soya bean. We have noted with the hæmoprotein extracted from the effective root nodules of pea the absorption band at 556 mμ. If the solution is vigorously shaken, the oxyhæmoprotein is formed with absorption bands at 575 and 540 mμ. Also the absorption bands of other hæmoprotein compounds correspond approximately to the bands given by Kubo. Thus we have been able to confirm his results. Accordingly, the hæmoprotein is a hæmoglobin which functions as a store and as a carrier of oxygen. Whether this pigment has also other functions specifically connected with the nitrogen fixation is unknown. The combination of hæmin-iron with nitrogen or nitrogen compounds is also a possibility.

[Prof. Virtanen was, of course, unaware of the article "Hæmoglobin in the Root Nodules of Leguminous Plants" by Prof. D. Keilin and Dr. Y. L. Wang, published in *Nature* of February 24, 1945, p. 227. Editors.]

The change in the colour of pigment from red to green—demonstrated also in the sterile culture system after the plants have ceased to grow—shows that the red pigment undergoes a change as the activity of the nodules comes to an end. It can be assumed that the ring system is thereby broken and possibly products of pseudo-hæmoglobin-type of H. Fischer are formed. The properties of the green pigment are being examined more closely. Likewise we are just doing some experiments to find out whether the nitrogen fixation can be accomplished in cultures of free-living legume bacteria to which has been added hæmoglobin of root nodules and oxaloacetic acid. As the bacteria apart from the host plant are not able to synthesize hæmoglobin, one reason for the inability of the free-living legume bacteria to fix atmospheric nitrogen must lie in the lack of hæmoglobin.

In examining the effectiveness of different strains of nodule bacteria, we have given attention also to the immunity which is brought about by the bacteria first invading the nodule. For this purpose we have also used the sterile culture system. The results have been as follows :

(1) If the seed of the pea is at first infected with the ineffective strain H VIII and, after the appearance of the first nodules, the culture medium is inoculated with an effective strain, this is no longer able to form nodules. The pea ceases therefore to grow when the nitrogen reserve of the seed has been exhausted, and the plant turns yellow. If the experiment is interrupted at this stage, no increase of nitrogen can be noted in the plant. If the withered plant is, however, left unremoved, in many cases—though not always—a few nodules are formed by the effective strain here and there in the roots, and the pea pushes out new shoots which begin to grow. According to this experiment, the immunity seems to weaken as the plant withers.

(2) If the seed of the pea is simultaneously inoculated with an effective and an ineffective strain, nodules are formed almost regularly by both strains in the roots. The growth of the plant varies accordingly. The pea may grow as well as after inoculation with an effective strain only, but it may also grow very poorly, depending on which one of the strains becomes dominant. Results between these two extremes are perhaps the most common ones.

The immunity is a somewhat local phenomenon. The pea can be grown in a sterile culture system where the roots by means of a branched tube have entered two separate culture flasks ; if then the roots in one flask are infected with an ineffective strain and, after the first nodules have appeared there, the uninoculated roots in the other flask are inoculated with an effective strain, the latter is often, though not always, able to form nodules and the pea begins to grow. If the roots are in the same flask, the effective strain used for later inoculation is never able to form nodules before the withering of the plant, as was already mentioned above.

In microscopic examination of the effective and ineffective nodules the following can be noted. In the effective red nodules, round cell formations—but no rods—are to be seen. The nodules formed by the ineffective strain H VIII contain, on the contrary, rod-shaped bacteria which seem to be surrounded by a slimy layer. In water, under anærobic conditions, the root nodules formed by effective strains contain rods and branched bacteroid forms. On the basis of these observations and with regard to the peculiar fact that a given strain which forms ineffective colourless nodules on one legume may, in another, form effective red nodules (cf. our observations on the effectiveness of a bacterial strain on *Trifolium Alexandrinum* and on its ineffectiveness on *Trifolium pratense*[5]) I have formulated the hypothesis that the cause of the inability of an ineffective strain to fix nitrogen in root nodules is perhaps primarily the slimy layer surrounding the bacteria. This prevents the uptake of oxygen, and at the same time the formation of hæmoglobin is inhibited. To what extent this hypothesis agrees with the results to be gained will be seen later.

I am indebted to the Rockefeller Foundation for a grant made at the beginning of the War.

[1] Virtanen and Arhimo, *Nature*, 144, 36 (1939).
[2] Virtanen, Arhimo, Sundman and Jännes, *J. prakt. Chem.*, 162, 7 (1945).
[3] *Naturwiss.*, 25, 201 (1937).
[4] *Acta Phytochim.*, 11, 195 (1939).
[5] Virtanen, "Cattle Fodder and Human Nutrition" (Cambridge, 1938).

OBITUARIES

Mr. James Young

MR. JAMES YOUNG, lecturer in physics at the University of Birmingham, who died on May 28, 1945, aged forty-seven, was born at Dalferf, Lanarkshire. He was educated at Allan Glen's School, Glasgow, and in 1916 proceeded to the Royal College of Science, South Kensington. After a brilliant academic career, Young joined the physics staff at Birmingham in 1920 and worked with one of his former teachers, Prof. S. W. J. Smith.

At South Kensington, under the influence of the late Prof. A. Fowler, Young's interest in astronomy—an interest dating from early boyhood—was enhanced to such a degree that finally it exercised a dominating influence on his professional life. At Birmingham, he was given charge of the University observatory and the teaching of astronomy. Between the two Wars he devoted himself untiringly to the study of the moon, observing a great many occultations and also examining the lunar craters in great detail. These craters specially attracted him, and from his own observations and from results obtained from other sources, he compiled an exhaustive catalogue of positions and diameters. These data he analysed statistically in order to determine the relation between the diameter and frequency of occurrence. This examination convinced him that the meteoric hypothesis of crater formation was untenable.

In addition to his contributions to astronomy, Young did a great deal of work in collaboration with Prof. Smith on the crystallographic analysis of the meteoric irons. Because of their well-developed structure, these natural iron-nickel alloys lend themselves well to X-ray and microscopic examination and are peculiarly adapted to the study of one of the most fundamental questions of ferrous metallurgy, namely, the precise crystallographic mechanism of the $\gamma \rightarrow \alpha$ transformation and its relation to the Widmanstätten structure. The matter is one of some complexity but Young's geometrical insight enabled him to solve the problem almost completely. He also played a part in proving that the Neumann bands, so characteristic of many meteoric irons, are mechanical twins in the kamacite. Young left much unpublished work in this field. In particular, he examined in detail the crystallographic relations between the kamacite and the imbedded rods of rhabdite.

Despite all these activities, Young never lost sight of the fact that he was a teacher. His simple, direct style was much appreciated by elementary students although, perhaps, he himself preferred more advanced work, especially in subjects with a mathematical bias, such as relativity.

As a man, Young was somewhat aloof and silent; but to those who knew him sufficiently well, he was both charming and helpful. Whenever he intervened in any scientific discussion, his accurate knowledge usually gave him the final word. His last illness was borne with the greatest fortitude, and he continued working in his quiet way until very near the end. We admired him above all for his lasting devotion to astronomy, and those of us who knew him well will often think of him as we pass the Observatory on our way up the hill to the University. He leaves a widow and two daughters. A. A. DEE.

WE regret to announce the following deaths:

Mr. C. S. Middlemiss, C.I.E., F.R.S., superintendent of the Geological Survey of India during 1895–1917, on June 11, aged eighty-five.

The Right Hon. Lord Onslow, G.B.E., president during 1936–44 of the Zoological Society of London, on June 9, aged sixty-eight.

Major Charles E. S. Phillips, O.B.E., from 1929 until this year secretary of the Royal Institution, on June 17.

Mr. A. E. Rambaut, formerly of the Colonial Forest Service, Malaya, on June 2.

Miss E. R. Saunders, formerly fellow of Newnham College, Cambridge, on June 6, aged eighty.

Brigadier-General Sir Percy Sykes, K.C.I.E., C.B., C.M.G., well known for his contributions to the geography and knowledge of Persia, on June 11, aged seventy-eight.

NEWS and VIEWS

The King's Birthday Honours List

THE following names of scientific men and others associated with scientific work appear in the King's Birthday Honours List:

G.C.M.G.: Sir Frank Stockdale, development adviser to the Secretary of State for the Colonies, late comptroller of development and welfare, West Indies.

K.B.E.: The Hon. Sir Herbert Angas Parsons, senior puisne judge, Supreme Court, and vice-chancellor of the University of Adelaide.

Knights: Mr. R. G. Allan, commissioner of agriculture, Baroda State; Dr. H. H. E. Craster, Bodley's librarian; Prof. C. E. Inglis, lately professor of mechanical sciences in the University of Cambridge; Mr. W. J. Jenkins, director of agriculture, Bombay.

C.M.G.: Prof. A. V. Bernard, late chief Government medical officer, Malta; Mr. L. Nicholls, director of the Bacteriological Institute, Ceylon; Dr. B. S. Platt, director of the Human Nutrition Research Unit, Medical Research Council.

C.I.E.: Mr. J. C. M. Gardner, forest entomologist, Forest Research Institute, Dehra Dun; Lieut.-Colonel Kombar Ramaswami Krishnaswami Iyengar, director, Pasteur Institute of Southern India, Coonoor; Capt. (E) W. J. Lifton, chief surveyor, India.

C.B.E.: Mr. F. M. Birks, chief engineer, Gas Light and Coke Co.; Capt. F. Burnett, commissioner of lands, Jamaica; Colonel H. W. R. Chandler, director of supplies, Gold Coast; Mr. S. O. Chivers, honorary technical adviser to the Ministry of Food on fruit and vegetable products; Mr. B. Hart, consultant adviser in psychiatry, Ministry of Health; Dr. J. W. McDavid, managing delegate director, Explosives Division, I.C.I. (Explosives), Ltd.; Mr. W. D. MacGregor, conservator of forests, Sierra Leone; Mr. D. M. Matheson, secretary of the National Trust; Mr. H. C. Smith, chief conservator of forests, Burma; Mr. B. R. Wood, conservator of forests, British Guiana.

Prof. Szent-Györgyi

PROF. SZENT-GYÖRGYI, the well-known Hungarian biochemist and Nobel prize-winner, has recently visited Moscow at the invitation of the Soviet Government. On May 17, he lectured to the Physiological Society at the University of Moscow on his new work on the chemical composition of striated muscle (*Acta Physiol. Skan.*, 9, Suppl. 25; 1945). From muscle material Szent-Györgyi has succeeded in preparing myosin in a crystalline form, and a new protein, isolated by his collaborator, F. B. Straub, called actin. Both myosin and actin have striking properties. Myosin is completely discharged by minimal quantities of potassium. Actin can exist in both globular and fibrous forms, and in the cycle of contraction both forms are involved. The contractile system consists of a combination of these two proteins: actomyosin. In relaxed muscle actomyosin is dissociated into actin and myosin. Actomyosin passes into the contracted form in the presence of potassium, magnesium and adenosin triphosphate. Szent-Györgyi has demonstrated the contractile properties of this system *in vitro*, and his work provides a mechanical picture which is consistent with all the phenomena of muscle contraction. It is only necessary to assume that in striated muscle there are double rods of actin and myosin, to account for the contraction of living muscle. If the molecules of myosin are spirally arranged around a chain of actin molecules, then contraction, when myosin is discharged by ions, will result in a sudden decrease in the pitch of the spiral. This theory is consistent with microscopic evidence. The familiar cross-striation can be explained by the optical properties of the spiral: for, by rotating muscle fibre under the microscope, Szent-Györgyi has observed the apparent travelling of the spiral along the length of the muscle. This work was done by Szent-Györgyi in Szeged between 1939 and 1944. When the Germans occupied Hungary in 1944, Szent-Györgyi had to go into hiding, and he took a lead in anti-Fascist activities and preparations for the liberation of Hungary. In February 1945 he was liberated by the Red Army. He has now transferred his laboratory to Budapest, and he has accepted chairmanship of the Hungarian Board of Education. Outside his field of research, Szent-Györgyi's main interests are the re-education of his nation for peace, and the re-establishment of international scientific relations.

Prof. Ragnar Granit

ON June 29, Prof. Ragnar Granit is to deliver at the Royal Institution the fourteenth Thomas Young Oration of the Physical Society, and his subject will be "The Electro-physiological Analysis of the Fundamental Problem of Colour Reception". The occasion will provide an opportunity for a first-hand account of Prof. Granit's recent studies of the electrical response of the retina, summaries of which appeared in *Nature* of January 2, 1943, p. 11, and June 16, 1945, p. 711. Some fifteen years ago, Prof. Granit was working at the Johnson Foundation of Medical Physics, University of Pennsylvania, on the general problem of the retina as a nervous centre; in these experiments he relied mainly on the subjective observations of flicker phenomena. Later, he worked in Sir Charles Sherrington's laboratory at Oxford, where he investigated and analysed the retinal action potentials which develop on stimulation of the retina by light; in this work his tests were carried out on the retinæ of decerebrated cats. Since then he has held the chair of physiology at the University of Helskinki and is now at the Nobel Institute of Neurophysiology, Karolinska Institutet, Stockholm. The continued refinement of his experimental technique has enabled him to record the responses from individual receptors in the retina and to investigate their variation with wave-length. This work is of fundamental importance to the understanding of the processes of colour perception. The account of Granit's methods is of interest not only in connexion with vision but also in the much wider field of nerve physiology; indeed his studies of the retina now form only a part of his research activities.

Manchester Joint Research Council

THE Manchester Joint Research Council, which is representative of the University of Manchester and the Manchester Chamber of Commerce, has appointed Mr. A. D. Butchart to be executive officer. Mr. Butchart will commence his duties immediately and will be known as Executive Liaison Officer. As the permanent official of the Council, his duties will cover a wide field; in particular, he will be accessible for discussion and will deal with correspondence having specific reference to any problems facing industrialists where scientific information would prove valuable. It will be recalled that one of the objects of the Council is "the encouragement of activities designed to bring science and industry into closer relationship". As a practical move to give effect to this, the Council is creating an Information Service, and Mr. Butchart will be in charge of it. The service will not aim at furnishing scientific answers to problems submitted, but at placing the inquirer in touch with that scientific institution or authority best able to deal with each particular subject. In short, the essence of the service will be to introduce the industrial inquirer to the relevant scientific worker. Mr. Butchart has had a long experience in the oil industry. As a research chemist and in other capacities he has served in Burma, Iran and Iraq. From the outbreak of war to the present time, he has been employed on important Government work. Until a permanent office can be established, contact can be made with the Executive Liaison Officer, c/o The Manchester Joint Research Council, at the Manchester Chamber of Commerce, Ship Canal House, King Street, Manchester, 2.

Scholarships and Research Fellowships in the Textile Industries

TEXTILE MACHINERY MAKERS, LTD., the constituent firms of which are Platt Brothers and Co., Ltd., Howard and Bullough, Ltd., and other textile machinery manufacturers, have established a scheme for the furtherance of higher education and research in relation to the textile industries. It provides in the first instance for the expenditure of £35,000 over a period of seven years, the administration of the funds being vested in a Board of Trustees for the award of scholarships and research fellowships to be known as "The Sir Walter Preston Scholarships and Research Fellowships" and tenable in the Faculty of Technology of the University of Manchester, or in such other university institution as may be from time to time determined.

The scholarship awards will be as follows: Group I, for works apprentices who have obtained the Higher National Certificate in Mechanical Engineering (£250–

300 a year for three years); Group II, for works apprentices who have obtained the Ordinary National Certificate in a textile or equivalent subject (£225–300 a year for four years); and Group III for secondary school leavers possessing the Higher School Certificate or equivalent qualification (£200–250 a year for three years). The courses to be followed will be in textile engineering, or mechanical engineering, or textile technology, or economics. A small number of scholarships (Group IV, £300–350 a year for three years) will also be offered to honours graduates in science or engineering in order to attract suitable workers into the textile machinery industry or the textile industry. The Trustees are also empowered to award one or more research fellowships which will enable a selected candidate from any of the groups I to IV to continue in advanced study and research for a further period of two, three or four years, with grants of £400–550 a year.

During the first year of the scheme the following awards will be offered: five in Group I; three in Group II; two in Group III; one in Group IV. In succeeding years further awards will be offered of which due notice will be given. In deciding on the scale of assistance to be given under the scheme, the directors of Textile Machinery Makers, Ltd., have been guided by two main considerations: (1) compensation for the sacrifice of freedom to engage in remunerative occupation; and (2) the desirability of enabling all scholars to play a full part in the social, athletic and other extra-curricular activities of university life. All undergraduate scholars will be required to live in one of the university halls of residence, provided there is accommodation available. The award of scholarships in Groups I and II is restricted to candidates nominated by the constituent companies of Textile Machinery Makers, Ltd. The scheme will come into operation for the university session commencing October 1945, and applications addressed to S. H. L. Greaves, Textile Machinery Makers, Ltd., 60 Huddersfield Road, Oldham, were to be submitted not later than June 23, 1945.

National Certificates in Applied Physics

THE announcement by the Ministry of Education of a scheme for the award of Ordinary and Higher National Certificates in Applied Physics brings to fruition one of the recommendations made in the Institute of Physics report on Education and Training issued in 1943. Students may obtain further particulars of the courses from their local technical colleges or local director of education. With a rapid growth of physics in industry and in the different Government services, it has been found that the existing courses in branches of engineering, in chemistry and so on do not singly provide the combination of knowledge required by juniors in some branches of work which depend on the advances of science, such as, for example, the physical testing of materials and the maintenance and use of instruments for the measurement and control of different processes.

The three-year part-time course for the Ordinary National Certificate in Applied Physics must include mathematics, physics and chemistry, and in the first year a special course (not the orthodox engineering one) in workshop practice and drawing. The physics in the course is to be treated realistically and the principles are whenever possible to be illustrated by practical examples drawn from the industries in which the students are working. The course in applied physics in the final year is to be related to the local industries. Although English is not included formally as a subject in the course, it is a part of the scheme that at all stages and in all classes attention is to be paid to its correct use. It is hoped in this way to help to train students to present written statements which are clear and concise, when in the course of their employment they are required to report on their work. The course for the Higher National Certificate must be a two-year part-time one, and must aim at reaching a standard in the several branches of physics corresponding to that required for a degree in the subject at pass standard. It will include mathematics and a special subject related to the student's daily work in local industry.

Royal Asiatic Society of Bengal

AT the annual meeting of the Royal Asiatic Society of Bengal, the following medals and prize were awarded: Joy Gobind Law Memorial Medal, to Rai Bahadur Dr. S. L. Hora, director of fisheries, Bengal, in recognition of his conspicuously important contributions to our knowledge of the ichthyology of Asia; Paul Johannes Bruhl Memorial Medal, to Dr. N. L. Bor, formerly forest botanist, Imperial Forest Research Institute, Dehra Dun, for his important original research in the Gramineæ and the ecology of Indian plants; Dr. Bimala Churn Law Gold Medal, to Dr. D. R. Bhandarkar, formerly Carmichael professor of ancient Indian history and culture, University of Calcutta, for his important contributions to ancient Indian history and archæology; Sarat Chandra Roy Memorial Medal, to Dr. Verrier Elwin, of the Bhumijan Seva Mandel, Patangarh, C.P., for his meritorious and many-sided contributions to the study of cultural anthropology of India; Elliott Prize for Scientific Research for 1944, to Dr. S. K. Chakrabarty, of the University College of Science and Technology, Calcutta (the Prize for 1944 was for mathematics).

The following officers were elected: *President*, Dr. Meghnad Saha; *General Secretary*, Dr. Kalidas Nag; *Treasurer*, K. P. Khaitan; *Philological Secretary*, Dr. Nalinaksha Dutt; *Joint Philological Secretary*, Dr. Mohammad Ishaque; *Natural History Secretaries*, Dr. S. L. Hora (Biology), Dr. K. N. Bagchi (Physical Science); *Anthropological Secretary*, Rev. W. G. Griffiths; *Historical and Archæological Secretary*, Dr. B. C. Law; *Medical Secretary*, Dr. Indubhusan Basu; *Library Secretary*, Dr. Nalinaksha Dutt.

International Commission on Zoological Nomenclature

THE International Commission on Zoological Nomenclature announces its intention of publishing at an early date a revised and up-to-date edition (1) of the "International Code of Zoological Nomenclature" and (2) of the "Official List of Generic Names in Zoology". The last edition of the English text of "The International Code of Zoological Nomenclature" was published some years before the War and is now out of date for various reasons, including the adoption by the International Congress of Zoology of changes in some of the Articles in the International Code. The revised edition will consist of the substantive French text (on left-hand pages) and the English translation (on right-hand pages). The volume, which will be fully indexed, will also

contain a detailed analysis of all the "Opinions" so far rendered by the International Commission in regard to the interpretation of the provisions of the Code. "The Official List of Generic Names in Zoology" was established by the International Congress of Zoology at its meeting at Monaco in 1913 for the purpose of recording full particulars relating to the names of the 5,000–10,000 best-known and most important genera in the animal kingdom with their type species. So far, however, only about seven hundred names have been placed on the "Official List", due largely to the fact that the decisions taken by the International Commission have never hitherto been brought together in a single volume and with a full index. It is hoped that the "Official List" will now develop into a powerful instrument for stabilizing zoological nomenclature. It is hoped that its publication in book form will stimulate specialists to make proposals for the addition of other generic names important not only in systematic zoology but also in the applied sciences and in the teaching of zoology at the universities.

The International Commission is anxious to issue each of the above works at the lowest possible price, for it desires that both shall be within the financial means of every zoologist. This will only be possible if, before publication, the Commission is assured of a sufficient volume of immediate sales. Zoologists are accordingly invited at once to register themselves as prospective subscribers. As soon as the publication price has been fixed, a notification will be sent to all such subscribers, who will be granted a discount of 20 per cent on the publication price, provided that payment at the reduced rate is made to the Commission before the date of publication. All inquiries should be addressed to the International Commission on Zoological Nomenclature at its Publications Office, 41 Queen's Gate, London, S.W.7.

Globe Lightning

WHAT appears to have been a clear example of globe lightning has been described by Mr. B. E. Waye, "Larch Gates", Altwood Bailey, Maidenhead, Berks. He writes, "At about 2.20 a.m. on May 8, during the height of an intense thunderstorm, I observed a roughly circular orange glow, about the same apparent diameter as the sun, on the horizon, in a southerly direction. The glow was moving towards the west and was followed by a horizontal column of white vapour. It took about ten seconds to reach a point in the south-west, when it disappeared with a flash; the succeeding noise could not be distinguished with certainty from other claps of thunder."

Lady Tata Memorial Trust

THE trustees of the Lady Tata Memorial Fund announce that, on the recommendation of their Scientific Advisory Committee, they have made the following awards for research in blood diseases, with special reference to leukæmia, for the academic year beginning on October 1, 1945. *Grants for research expenses:* Dr. P. A. Gorer (London) and Dr. A. H. T. Robb-Smith (Oxford). *Personal grant:* Dr. Penelope K. Hammick (Oxford). *Part-time personal grant and grant for research expenses:* Dr. W. Jacobson (Cambridge). Since these awards do not fully use the margin of funds available, it is hoped to issue a public advertisement for new candidates from the continent of Europe and elsewhere, as soon as conditions permit.

Summer Schools in Health Education

THE Central Council for Health Education will conduct two summer schools in England this year. One will be residential, during August 4–13, at Kingsmoor School, Glossop, Derbyshire; the other will be non-residential, during August 15–29, at Chelsea Polytechnic, Manresa Road, Chelsea, London, S.W.3. The Glossop school will be directed by Mrs. F. A. Ogden, and the London school by Mr. L. J. F. Brimble. The schools are intended primarily for those who have to do with the training and care of children and young people—teachers, youth leaders, health visitors, school nurses, educational and medical administrators—but would also be of interest to general practitioners. The object of the schools is to review the principles of mental and physical health and development, to discuss the main health problems confronting the individual and the community, and to consider the methods of health education, including sex education. Those wishing to book accommodation or to be supplied with further details about the schools should write to the Medical Adviser and Secretary, Central Council for Health Education, Tavistock House, Tavistock Square, London, W.C.1. The Scottish Council for Health Education is holding a residential summer school at the University of St. Andrews during August 18–September 1. The directors of the school are Prof. Andrew F. Skinner, of the University of St. Andrews, and Prof. A. D. Peacock, of University College, Dundee. Courses and lectures will be given under the headings of physiology, psychology and social medicine. Further information concerning the Scottish school can be obtained from the Secretary and Treasurer, Scottish Council for Health Education, 3 Castle Street, Edinburgh. 2.

Announcements

UNDER the statute of the Royal Society which provides for the election of persons who either have rendered conspicuous service to the cause of science or are such that their election would be of signal benefit to the Society, the Right Hon. Sir John Anderson, Chancellor of the Exchequer, has been elected a fellow of the Society.

DURING his recent tour in Sweden to lecture on penicillin, under the auspices of the British Council and at the invitation of the Swedish Medical Society, Sir Howard Florey, professor of pathology in the University of Oxford, was presented with the Berzelius Medal in silver. This Medal was given to members of the Swedish royal family and certain other distinguished persons when it was instituted in 1850 but has not been awarded since that time.

SIR D'ARCY THOMPSON, professor of natural history in the University of St. Andrews, has been awarded the Daniel Giraud Elliot Medal for 1942 by the U.S. National Academy of Sciences. The Medal is awarded for distinguished work in some branch of zoology or palæontology.

A CONFERENCE on "School and Society" will be held under the auspices of the Institute of Sociology at St. Hilda's College, Oxford, during July 26–August 3. The president of the conference will be Sir David Ross, whose presidential address is "The Challenge: the Present Crisis and the Needed Revolution". Further information concerning the conference can be obtained from the Hon. Organizer, Institute of Sociology, Le Play House, Albert Road South, Great Malvern, Worcestershire.

The vacancies advertised in these columns are available only to applicants to whom the Employment of Women (Control of Engagement) Orders, 1942–3, do not apply.

COMMONWEALTH OF AUSTRALIA

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

DIVISION OF INDUSTRIAL CHEMISTRY

APPOINTMENT OF RESEARCH OFFICER FOR SPECTROSCOPIC INVESTIGATIONS

Applications are invited for one position of RESEARCH OFFICER, DIVISION OF INDUSTRIAL CHEMISTRY, MELBOURNE.

Duties : To undertake spectroscopic investigations within the Division's Chemical Physics Section; to supervise spectro-chemical analysis and carry out investigations in the field of infra-red spectroscopy.

Qualifications : University degree in science preferably with chemistry and physics as major subjects; also research experience in spectroscopy.

Salary : Dependent on qualifications and experience, commencing salary will be within the range of Research Officer (male: £A560 to £A640 p.a., actual; female: £A485 to £A565 p.a., actual; four equal increments, first automatic, remainder discretionary).

Subject to a satisfactory medical examination, the successful applicant will be appointed initially on probation for a period of twelve months, and thereafter, if confirmed in his or her appointment as an officer of the Council, will be eligible to contribute to, and receive benefits from, either the Commonwealth Superannuation Fund or the Commonwealth Provident Fund.

Applications, stating date of birth, nationality, present employment, particulars of qualifications and experience, accompanied by copies of not more than four testimonials, should reach the Secretary, Australian Scientific Research Liaison Office, Australia House, Strand, London, W.C.2, not later than July 16, 1945.

(Signed) G. A. COOK,
Secretary.

Council for Scientific and Industrial Research,
314 Albert Street,
East Melbourne, C.2, Victoria,
Australia.

Manchester Municipal COLLEGE OF TECHNOLOGY

(Faculty of Technology in the University of Manchester)

Appointment of

HEAD OF THE DEPARTMENT OF PHYSICS

The Governing Body invites applications for the position of Head of the Department of Physics and Director of the Laboratories in the College of Technology, with the title and status of Head of the Department of Physics and Director of the Laboratories in the Faculty of Technology of the University of Manchester.

Present Salary Scale: £700 per annum, rising by annual increments of £25 to £900 per annum, plus war bonus (which at the present time is £52 per annum). Commencing salary according to qualifications. Revised salary scales are at present under consideration.

Conditions of appointment and form of application may be obtained from the Registrar, College of Technology, Manchester, 1. The last date for the receipt of applications is MONDAY, JULY 9, 1945.

Canvassing, either directly or indirectly, will disqualify a candidate for appointment.

J. E. MYERS,
Principal of the College.

UNIVERSITY OF ABERDEEN

LECTURESHIPS IN THE DEPARTMENT OF PHYSIOLOGY

The University Court will shortly proceed to the appointment of two Lecturers in the Department of Physiology, to commence duty on October 1, 1945, or a date to be arranged.

One Lecturer will require to have special knowledge of Experimental and Human Physiology, the other to have training and experience in Biochemistry.

Salary according to qualifications and experience. Scales of salaries are: Grade I, £650 to £800; Grade II, £500 to £650.

Persons desirous of being considered for either office are requested to lodge their names with the Secretary to the University on or before July 7.

The conditions of appointment and Form of Application may be obtained from the undersigned.

H. J. BUTCHART,
Secretary.

The University,
Aberdeen.

UNIVERSITY OF ABERDEEN

STRATHCONA-FORDYCE CHAIR OF AGRICULTURE

The Strathcona-Fordyce Chair of Agriculture which is under the patronage of the Curators of the Chair is vacant through the resignation of Professor Sir John Orr, D.S.O., M.C., LL.D., F.R.S. Persons who desire to be considered for the post are requested to lodge their names with the Secretary of the University by August 31, 1945.

Conditions of appointment may be obtained from the undersigned.

H. J. BUTCHART,
Secretary.

The University,
Aberdeen.

THE UNIVERSITY OF SHEFFIELD

Applications are invited for the post of WARDEN OF CREWE HALL (the University Hall of Residence for Men) which accommodates 99 students. The Warden must be a graduate and will be required to take some part in University teaching. The University would prefer to appoint a married Warden. Salary £1,000 a year, with Superannuation under the Federated Superannuation Scheme for Universities. The Warden's House is provided free of rent and rates. The appointment is expected to be made early in October and the duties should begin as soon thereafter as may be arranged. Applications (six copies), with the names of at least three referees, should be sent to the undersigned from whom further particulars may be obtained. In order to allow time for candidates now in H.M. Forces to apply, the last date for the receipt of applications has been fixed at August 31, 1945.

A. W. CHAPMAN,
Registrar.

BRADFORD EDUCATION COMMITTEE

TECHNICAL COLLEGE, BRADFORD

APPLICATIONS are invited for APPOINTMENT as ASSISTANT LECTURER in CHEMISTRY in the College.

Salary at present according to the old Burnham Scale, which is £180–£480 per annum. Commencing salary according to qualifications and experience. A war bonus of £52 per annum is also paid. The salary scale is at present under review.

Further particulars of the appointment and forms of application may be obtained from the Director of Education, Town Hall, Bradford, and completed forms should be returned to the Principal of the College not later than July 14, 1945.

THOS. BOYCE,
Director of Education.

UNIVERSITY OF BIRMINGHAM

Applications are invited for the post of Grade II(b) LECTURER IN MECHANICAL ENGINEERING. Candidates should have an Honours degree in Engineering with some practical experience, and a keen interest in research.

Commencing salary £500. Applications would be considered from candidates who are unable for a period to secure release from work of national importance.

Applications should be sent before July 31 to the undersigned, from whom further particulars may be obtained.

C. G. BURTON,
Secretary.

The University,
Birmingham, 3.

LONDON (ROYAL FREE HOSPITAL) SCHOOL OF MEDICINE FOR WOMEN

(UNIVERSITY OF LONDON)

8, Hunter Street, Brunswick Square, W.C.1.

LABORATORY ASSISTANT (man or woman) for the BIOLOGY DEPARTMENT of this School required in July 1945.

Experience essential. Salary according to qualifications, but not less than £3 per week.

Applications, giving particulars of age, qualifications, experience, etc., should be sent to the undersigned as soon as possible.

NANCIE MOLLER,
Warden and Secretary.

UNIVERSITY COLLEGE, EXETER

Lecturer in Chemistry with qualifications in Organic Chemistry required. Particulars on application to the Registrar.

THE UNIVERSITY OF LIVERPOOL

Applications are invited for the post of Assistant Lecturer, Grade III, in the Department of Metallurgy, at a salary of £350 per annum, rising by annual increments of £25 to £400, with child allowance.

The appointment will date from September 20, 1945, or as soon after as release from National Service can be obtained, and will be made for one year in the first instance.

The selected candidate must be prepared to undertake research, and will be required to give instruction (lectures and laboratory classes) under the direction of the Head of the Department. Further particulars may be obtained on application.

Applications, stating age, academic qualifications and practical experience, together with the names and addresses of three referees, should be made to the undersigned, not later than July 5, 1945.

STANLEY DUMBELL,
Registrar.

UNIVERSITY OF OXFORD

DEPARTMENT OF FORESTRY

Applications are invited for the following appointments:

1. PLANT PHYSIOLOGIST to undertake research on trees, particularly on tree roots.
2. PLANT ECOLOGIST with some knowledge of physical science as one of a team to study forest soils in relation to tree growth.
3. MICROBIOLOGIST for research work on forest soil problems.
4. FOREST ECONOMIST to teach and undertake research in the subject. Applicants who have qualifications in forestry only or in economics only would be required to study the second subject after appointment.

Initial salaries will be at a point on the standard scale for University Demonstrators (£350–£750) appropriate to age and qualifications. A War Bonus of £25–50 is also paid at present. Applications should be sent by June 30 at latest to the Professor of Forestry, Imperial Forestry Institute, Oxford, from whom fuller particulars may be obtained.

IMPERIAL BUREAU OF DAIRY SCIENCE

SHINFIELD, NEAR READING

Applications for the post of Scientific Assistant are invited from University Graduates. Training or experience in dairy science is desirable; alternatively qualifications in scientific subjects which are applied in dairy science are necessary. Knowledge of foreign languages is required. Duties include abstracting, indexing and other work involved in a scientific information service. Salary scale—£300—£15—£390, with superannuation in the F.S.S.U. after probationary period, if not already a member, and, at present, war bonus. Applications should be sent by July 21 to the Deputy Director, The Imperial Bureau of Dairy Science, Shinfield, near Reading.

UNIVERSITY OF OXFORD

DIRECTORSHIP OF THE INSTITUTE FOR RESEARCH IN AGRICULTURAL ECONOMICS

Applications are invited for the above Directorship, tenable for seven years in the first instance, and should reach the Registrar of the University not later than August 4, 1945. Stipend £1,400 per annum (plus children's allowances and subject to general reconsideration of stipends). The duties will include responsibility for teaching in agricultural economics at both the undergraduate and post-graduate level. Retiring age 65. Further particulars may be obtained from the Registrar, University Registry, Oxford.

PORTSMOUTH MUNICIPAL COLLEGE

Principal: L. B. BENNY, M.A.

HEAD OF ENGINEERING DEPARTMENT

Applications are invited from suitably qualified persons, with good experience, for the post of HEAD OF THE ENGINEERING DEPARTMENT, which is becoming vacant, owing to important promotion obtained by the present Head. The salary offered is on the scale £900 by annual increments of £25 to a maximum of £1,000. Particulars, and forms of application, may be obtained from the Registrar, the Municipal College, Portsmouth.

E. G. BARNARD, M.A.,
Chief Education Officer.

PORTSMOUTH MUNICIPAL COLLEGE

PRINCIPAL: L. B. BENNY, M.A.

DEPARTMENT OF PHARMACY

Applications are invited for the position of LECTURER IN PHYSIOLOGY, qualified to teach the subject to the standard of the Ph.C. and B.Pharm. Examinations. The Lecturer should also be able to assist with Pharmaceutical Chemistry, or any other subject of the Pharmacy Course. Salary according to the Burnham Technical Scale.

Particulars and forms of application may be obtained from the Registrar, the Municipal College, Portsmouth, to whom they should be returned not later than June 27.

E. G. BARNARD, M.A.,
Chief Education Officer.

ROYAL HOLLOWAY COLLEGE

(UNIVERSITY OF LONDON)

Principal: Miss C. E. Batho, M.A., D.Litt.

The Michaelmas Term commences on Thursday, October 4, 1945. The College prepares women students for the London degrees in Arts and Science. Entrance Scholarships, from £40 to £80 a year, and several Exhibitions of not more than £35, tenable for three years, will be offered for competition in February 1946. The last date for the receipt of entry forms is December 8, 1945. For further particulars apply to the Registrar, Royal Holloway College, Englefield Green, Surrey.

UNIVERSITY COLLEGE OF NORTH WALES, BANGOR

SCHOOL OF AGRICULTURE

Applications are invited for the post of Assistant Adviser in Plant Pathology. The commencing salary, depending on the qualifications and experience of the selected candidate, will not be less than £240 or more than £400 per annum plus war bonus at the Civil Service rate. Conditions of appointment may be obtained from Professor R. G. White, to whom applications should be sent not later than Saturday, July 14, 1945.

UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Applications are invited for a Lectureship in Chemistry. Candidates must possess a University degree with first-class Honours and have some experience of research in physical or inorganic chemistry. The successful candidate will be expected to take up duty in October, 1945, but a later date may be fixed if he is not available then. Further particulars may be obtained from the Registrar, Trinity College, Dublin. Applications should reach him not later than August 20.

BEDFORD COLLEGE FOR WOMEN

(UNIVERSITY OF LONDON)

Regent's Park, N.W.1.

WANTED IMMEDIATELY Laboratory Apprentices (Boys or Girls) in the Departments of Botany, Physics, Physiology and Zoology. Salary 30s. to £2 10s. per week. Initial salary according to qualifications and experience. Applications The Secretary.

UNIVERSITY OF READING

The Council invites applications for a Lectureship in Geography. Candidates should possess special qualifications in Cartography. Initial salary from £425 to £500 per annum according to qualifications and experience. Further particulars may be obtained from the Registrar to whom applications should be sent not later than July 16.

NORTH STAFFORDSHIRE ROYAL INFIRMARY

STOKE-ON-TRENT

Applications are invited for the post of Physicist to the Stoke-on-Trent Regional Radium Centre. Some experience in hospital physics is desirable. Applications stating age, qualifications, experience and salary required, together with copy testimonials to be forwarded, as soon as possible, to the House Governor.

For Sale, the following Biological material and apparatus: Preserved zoological preparations, dissections and material for dissection; osteological specimens; microscopical preparations; lantern slides; microscopical glassware, glass bottles and tanks; slide boxes, etc. Can be inspected. Particulars and detailed list from Mrs. L. Hunter, 11 Carisbrooke Avenue, Leicester.

NORTHAMPTON POLYTECHNIC

St. John Street, London, E.C.1

Applications are invited for the post of full-time LECTURER in the PHYSICS DEPARTMENT.

Salary in accordance with London Burnham Scale for teachers in Technical Institutions.

Conditions of appointment and form of application on request to the Secretary.

S. C. LAWS, O.B.E., M.A., M.Sc.,
Principal.

CANTERBURY UNIVERSITY COLLEGE

CHRISTCHURCH, NEW ZEALAND

Applications are invited for the CHAIR OF CIVIL ENGINEERING. Salary £1,075 per annum (N.Z. currency); allowance for travelling expenses. Appointment is for three years in the first instance. Further particulars may be obtained from the Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1.

CANTERBURY UNIVERSITY COLLEGE

CHRISTCHURCH, NEW ZEALAND

Applications are invited for the CHAIR OF MECHANICAL ENGINEERING. Salary £1,075 per annum (N.Z. currency); allowance for travelling expenses. Appointment is for three years in the first instance. Further particulars may be obtained from the Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1.

Applications are invited for the following four Superintendent posts in a Government Research Establishment. The salary will be a fixed rate within the range of £1,050 to £1,200 per annum according to qualifications and experience (a higher salary would be considered in the case of an applicant with exceptional qualifications). The successful candidates will be required to organize and direct the branches to which they are appointed.

Post 1. Candidates should be well qualified in physics with a knowledge of mechanical and electrical engineering and a wide experience in research work. The branch will be devoted to Applied Research on fuses, detonators and caps. Reference No. C.2656.A.

Post 2. Candidates should be well qualified in the chemistry and physics of explosives and should have experience in the handling and filling of explosive stores. A knowledge of mechanical engineering would be an advantage. The branch will be devoted to Applied Research on high explosives and pyrotechnic stores and to the development of new munitions and the measurement of their performance. Reference No. F.4376.A.

Post 3. Candidates should have a wide knowledge of physics and physical chemistry with considerable experience in research in one of these subjects. The branch will be concerned with the theoretical and experimental research on the detonative properties and efficiency of high explosives and on the burning properties of pyrotechnics and incendiary compositions with a view to developing existing and new types of ammunition. Reference No. F.4377.A.

Post 4. Candidates should possess high academic qualifications in applied mathematics or mathematical physics, considerable experience of theoretical research, powers of leadership and ability to organize scientific work. The branch will be concerned with the theoretical research on ballistics explosives, etc. Reference No. A.943.A.

Write, quoting the appropriate Reference No., to the Ministry of Labour and National Service, Appointments Department, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, for application form which must be returned completed by July 10, 1945.

Applications are invited for the post of CHIEF ENGINEER in a Government Establishment dealing with the design of armaments. The salary will be at a rate up to £2,000 a year. Applicants must possess first-class qualifications which should preferably include an honours degree and practical experience in mechanical engineering or other applied science, knowledge of fundamental design and of the practical problems involved in applied research and development work; ability to administer a large technical organization is essential. The post will involve contacts at a high level with officials of the Service and Supply Ministries. Vision, keenness and tact are essential personal qualities for the position. Knowledge of some branches of armaments and of Civil Service procedure would be useful, but not essential qualifications. Write, quoting C.2657.A, to the Ministry of Labour and National Service, Appointments Department, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, for application form, which must be returned completed by July 11, 1945.

Applications are invited for the post of DIRECTOR OF SIGNALS AND RADAR DEVELOPMENT in a Government Department. The salary will be at the rate of £1,400 per annum but a higher rate would be considered in the case of an applicant with exceptional qualifications. The successful applicant will be responsible for technical policy and the general direction and progress of research and development connected with the design of signals and radar equipment, special fuses, and certain other electrical equipments including searchlights. Candidates should have good educational qualifications with a University degree and practical experience in the planning and management of research and development, and knowledge of the electrical and radio industries. Write, quoting D.1281.A, to Ministry of Labour and National Service, Appointments Department, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, for application form which must be returned completed by July 10, 1945.

The Paint Research Association (embracing a wide range of related industrial activities of great scientific interest) is planning to extend its work, and applications are invited for posts on the research staff to be taken up at once or as soon as war circumstances permit. Applicants who are not immediately available should make their position clear.

The posts will be remunerated according to qualifications, experience and suitability; personality and ability to lead research teams are regarded as more important than previous experience with oils, resins, paints and related materials; such experience would be of advantage in some of the vacant posts but not in others.

The following posts are vacant:

Research Manager, age 35–40, commencing salary not less than £900.

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Two or three Chemists and Physicists, with some years research experience, capable of acting as leaders of research teams—particularly a Physical Chemist to conduct an extensive programme of pigment research with the main conception of the study of pigments as powders. Age about 28 or 30, commencing salary not less than £500.

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All the senior appointments will carry superannuation under the F.S.S.U. scheme, and the junior appointments after a probationary period.

Applications, with a statement of previous experience and qualifications, should be made to the Director, Paint Research Station, Waldegrave Road, Teddington, Middlesex.

Qualified personnel required for part-time abstracting and preparation of subject surveys in physics, chemistry and engineering for circulation to production managements. Present contact with literature and industry desirable. Send an example of work with your application. Preference given to part-time workers in selecting home and overseas library personnel. Reply to Technical Information Service, Bank Chambers, Brentwood, Essex.

Physicist required for position as Research Scientist in Laboratory on work connected with magnetic properties of alloys. Applicants should have a good degree and some research experience. Salary according to experience and qualifications. Reply stating full particulars to: Research Scientist, Permanent Magnet Association, Physics Department, University of Sheffield.

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LETTERS TO THE EDITORS

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

Cancelled Visit of British Men of Science to the Academy of Sciences of the U.S.S.R.

MANY readers of *Nature* will have been astonished and repelled by the studied discourtesy with which eight of the intending guests of the Soviet Academy of Sciences were prevented by His Majesty's Government last week from going to Moscow. Not only were they put to gross inconvenience and annoyance by the refusal, without warning and at the last moment, of permission to travel, but also the explanation given was as incredible as the real reason was insulting.

In this prohibited group were those whose talents and devotion have rendered priceless service to the nation during the War. But let us remember the words of the "Preacher":

"There was a little city and few men within it; and there came a great king against it and besieged it and built great bulwarks against it:

"Now there was found in it a poor wise man and he by his wisdom delivered the city: yet no man remembered that same poor man.

"Then said I, Wisdom is better than strength: nevertheless the poor man's wisdom is despised, and his words are not heard".

The offensive treatment of our scientific colleagues, inconceivable towards members of most other professions, is a sufficient comment on the patronizing Ministerial praise with which science and scientific men are occasionally favoured. When they, and others, are offered reparation later on in 'awards' or 'honours', let them recall the words of T. H. Huxley:

"The sole order of nobility which, in my judgment, becomes a philosopher, is the rank which he holds in the estimation of his fellow-workers, who are the only competent judges in such matters".

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Distribution of Vanadium, Chromium, Cobalt and Nickel in Eruptive Rocks

WHEN analysing the rock differentiation suite of the Skaergaard intrusion, Greenland, L. R. Wager and R. L. Mitchell[1] found a most interesting distribution of the above trace elements, which are comparatively immobile.

TABLE 1. THE SKAERGAARD INTRUSION (EARLY ROCKS MENTIONED FIRST; THE CONCENTRATIONS CALCULATED AS WEIGHT PER CENT; SPECTRUM ANALYSIS).

	Gabbro-picrite	Olivine-gabbro	Middle gabbro	Hortonolite-ferro-gabbro	Late basites, $M(n=3)$*	Acid granophyre
V	0·010	0·020	0·026	0·004	0—tr.	0·0010
Cr	0·115	0·023	0—tr.	0—tr.	0—tr.	0·0003
Co	0·008	0·007	0·004	0·006	0·0020	0·0003
Ni	0·06	0·020	0·0025	0—tr.	0·0001†	0·0005

* Includes a basic granophyre. † Two members have given 0—tr.

Independently, I determined the content of several trace elements on intrusive rocks from Eastern Upland, Sweden. The following concentrations were obtained (for explanations, see Table 1).

TABLE 2. NORMAL DIFFERENTIATION SUITE, EASTERN UPLAND.

	Pyroxenite-hornblendite	Basic quartz-gabbro	Diorite	Late Diorite	Granite, $M(n=2)$
V	0·033	0·05	0·025	0·0025	0·0040
Cr	0·015	0·0085	0·0005	0	0·00040
Co	0·0040	0·0040	0·0048	0·0025	0·0011
Ni	0·012	0·009	0·0075	0	0·0010

TABLE 3. LATE, ABNORMAL DIFFERENTIATION SUITE, EASTERN UPLAND.

	Peridotite	Allivalite	Ultra-basic norite	Amphibole-gabbro	Microcline-granite
V	0·006	0·0015	0·10	0·035	(tr.)
Cr	0·0005	0·00013	0·00020	0	0·00010
Co	0·020	0·006	0·0065	0·0023	0·00005
Ni	0·045	0·012	0·0020	<0·00002	0·00005

Comparing Tables 1–3, it might be assumed that the amounts of Fe + Mg are to be regarded as similar in each member, according to the analyses. We may here point out the striking resemblance between Table 1 and Table 2, whereas the rocks of Table 3 in part display a different behaviour of the actual elements. The problem will be dealt with more fully in a later paper.

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[1] *Min. Mag.*, 26, 286 (1944).

Intensities of Light Absorption

IT is an interesting and well-known fact that the order of magnitude of the highest extinction coefficients recorded for the absorption of light rarely exceeds $\varepsilon \sim 10^5$, where ε is the molecular extinction coefficient.

The problem of absorption intensity can be approached in a simple way, as follows. Consider light of intensity I falling on a slice of thickness dl of a cell of unit area filled with the vapour or a dilute solution in a transparent solvent of the absorbent at a concentration of c gm.-mol. per litre. Let the *average effective absorbing area* (*'chromophore area'*) of the absorbing molecules in the plane perpendicular to the incident light be a. Then

$$\text{Illumination falling on absorbing molecules} = \frac{\text{Area of absorbing molecules}}{\text{Total area}} \times \text{Total illumination}$$

$$= \frac{cNadl}{1000} I;$$

and

$$\text{Illumination absorbed} = -dI = F\frac{cNadl}{1000} I;$$

where F will be termed the *light extinction factor* and represents the fraction of the light falling on the absorbing molecules which is absorbed, and N is the Avogadro number. Integrating between the limits $l = 0$ and $l = l$

$$\varepsilon = \frac{1}{cl}\log_{10}\frac{I_0}{I} = \frac{FNa}{2{\cdot}3\times 1000} = 2{\cdot}64\times 10^{20}Fa \quad (1)$$

If a is taken as the largest cross-sectional area ($[a]$) of the molecule and F put equal to unity, (1) yields the maximum possible value ($[\varepsilon]$) of ε for that molecule. For a simple molecule, $[a]$ is of the order of 10 A.^{2}, hence $[\varepsilon] \sim 10^5$.

Both classical electromagnetic theory and quantum-mechanics lead to the expression

$$f = \frac{2{\cdot}3 \times 10^3 \times mc^2}{N\pi e^2} \int \varepsilon_\nu d\nu \quad . \quad . \quad . \quad . \quad (2)$$

for f, the effective number of oscillating electrons or 'mean oscillator strength', where m and e are the mass and charge of the electron, c the velocity of light, N the Avogadro number, ε the molecular extinction coefficient and ν the wave number. For an absorption band of normal half-width (*c.* 2,000 cm.$^{-1}$) in the visible and ultra-violet region, $f = 1$ requires[1,2,3] $\varepsilon \sim 10^5$.

The simple treatment outlined above thus yields the same result for the maximum possible value of ε as the classical one, but F, unlike f, is an absolute quantity which depends only on molecular size and configuration and involves no assumption as to the mechanism of absorption. The observed values of $\varepsilon_{max.}$ are always smaller than $[\varepsilon]$; this can be due to :

(1) a being smaller than $[a]$ if, as will generally be the case, the system responsible for absorption in the wave-length region considered does not comprise all the atoms of the molecule, or if, in an optically anisotropic molecule, absorption depends on the spatial orientation of the molecule with respect to the incident light.

(2) F being smaller than unity, if the transition does not always occur when a photon of the right magnitude falls on the molecule in the optimum spatial orientation. In classical and in quantum theory, the interaction probability depends on the dipole moment ('transition moment') associated with the transition, but F will also be reduced if only certain electronic, vibrational or rotational states of the molecule represent absorbing entities, or, in a different terminology, if the transition only occurs in certain resonance forms of the molecule. The magnitude of F may be regarded as a measure of the contribution which the resonance form responsible for absorption in the wave-length region considered makes to the 'hybrid' ground state.

On the other hand, if F is assumed to be unity or can be otherwise estimated, the effective chromophore area (a) can be calculated from the observed value of $\varepsilon_{max.}$. In a spherically non-symmetrical molecule the calculated value of a will be smaller than the true chromophore area by a statistical factor due to random orientation.

In linear polyene systems[4] of type $-(C{=}C)_n{-}X$, $\varepsilon_{max.} \propto n$. If F is independent of n, $a \propto \varepsilon_{max.}$, hence $a \propto n$. This requires the most effective incident direction for absorption to be perpendicular to the molecular axis and substantiates the view[5,6] that the electrons responsible for absorption in the visible and ultra-violet regions of the spectrum are directed in a plane perpendicular to that of the covalent bond.

I am indebted to Dr. M. Blackman for valuable discussion.

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March 27.

[1] Förster, *Z. Electrochem.*, **45**, 548 (1939).
[2] Mulliken, *J. Chem. Phys.*, **7**, 14 *et seq.* (1939).
[3] Sponer and Teller, *Rev. Mod. Phys.*, **13**, 75 (1941).
[4] Hausser, Kuhn, Smakula and Hoffer, *Z. Phys. Chem.*, B **29**, 371 (1935).
[5] Pauling, "The Nature of the Chemical Bond" (Cornell, 1940).
[6] Lennard-Jones, *Proc. Roy. Soc.*, A, **158**, 280 (1937).

The Two-body Gravitational Problem in Kinematical Relativity

THE equations of motion of two gravitating particles have been given by Milne[1]; they are second-order differential equations in $(t_1, \mathbf{P}_1)$, $(t_2, \mathbf{P}_2)$, the epochs and vector positions of the two particles as measured by a fundamental observer, O. From their derivation, the equations are invariant for Lorentz transformations from one fundamental observer to another. There are eight variables, four for each particle, but only six differential equations—since Milne's equations (45′) and (46′) may be deduced from (45) and (46). Thus a further relation is needed in order to integrate the equations.

Milne has proposed for this relation the equation $t_1 = t_2$, so that the event $(t_1, \mathbf{P}_1)$ in the history of the particle m_1, and the event $(t_2, \mathbf{P}_2)$ in the history of m_2 are simultaneous in the experience of O; this relation, as he points out, is not invariant for Lorentz transformations. Schild[2] has recently suggested that this invalidates the whole treatment, since if the equations are solved with the additional relation $t_1 = t_2$, the orbits obtained will not be invariant.

However, there is no difficulty in finding an invariant relation to replace $t_1 = t_2$, and contrary to Schild's expressed view, there is little or no choice. Since only one relation is needed, it will be symmetric in the suffixes 1 and 2, and it will also be a scalar relation. Only three invariant scalars can be constructed from the two four-vectors, $(t_1, \mathbf{P}_1)$ $(t_2, \mathbf{P}_2)$, namely, $t_1^2 - \mathbf{P}_1^2/c^2$, $t_2^2 - \mathbf{P}_2^2/c^2$, $t_1 t_2 - \mathbf{P}_1.\mathbf{P}_2/c^2$. There is a further condition that $t_2 \to t_1$ as $\mathbf{P}_2 \to \mathbf{P}_1$. The relation suggested by Schild may be written.

$$(t_1^2 - \mathbf{P}_1^2/c^2) + (t_2^2 - \mathbf{P}_2^2/c^2) = 2(t_1 t_2 - \mathbf{P}_1.\mathbf{P}_2/c^2).$$

This is more simply expressed in the form,

$$t_2 - t_1 = \pm\, |\, \mathbf{P}_2 - \mathbf{P}_1 \,|/c.$$

Taking the upper sign, we see that the effect of m_1 on m_2 is associated with a retarded time, whereas the effect of m_2 on m_1 occurs at an advanced time, so that the relation is not truly symmetrical.

The only relation which seems entirely acceptable is

$$t_1^2 - \mathbf{P}_1^2/c^2 = t_2^2 - \mathbf{P}_2^2/c^2.$$

Putting each side of this equation equal to T^2, we obtain a simple physical interpretation. The event $(t_1, \mathbf{P}_1)$ is the passing of the particle m_1 and a fundamental observer A_1, who records the epoch of that event as T; similarly, the event $(t_2, \mathbf{P}_2)$ occurs at a fundamental observer, A_2, in whose experience this epoch is also T. This gives a definition of simultaneity which is invariant; two events are simultaneous in this sense if the epochs assigned to them by the fundamental observers at which they occur are equal.

The actual equations of motion have a remarkable property in that, no matter what relation is assumed between t_1 and t_2 to make the problem determinate, they possess an energy integral. Denoting by χ, E_1, E_2, the gravitational potential and the kinetic energies of the two particles, Milne has shown that

$$\frac{dE_1}{dt_1} + \frac{\partial \chi}{\partial t_1} + \frac{d\mathbf{P}_1}{dt_1}\,\frac{\partial \chi}{\partial \mathbf{P}_1} = 0,$$

with a similar equation for E_2 and t_2. If t_1 and t_2 are unspecified functions of a single parameter s, the rate of change of total energy with the parameter is

$$\frac{dE_1}{dt_1}\frac{dt_1}{ds} + \left(\frac{\partial\chi}{\partial t_1} + \frac{d\mathbf{P}_1}{dt_1}\frac{\partial\chi}{\partial\mathbf{P}_1}\right)\frac{dt_1}{ds} + \left(\frac{\partial\chi}{\partial t_2} + \frac{d\mathbf{P}_2}{dt_2}\frac{\partial\chi}{\partial\mathbf{P}_2}\right)\frac{dt_2}{ds} + \frac{dE_2}{dt_2}\frac{dt_2}{ds}.$$

This is zero, independently of the relations between t_1, t_2 and s. Thus $(E_1 + \chi + E_2)$ is constant for any fundamental observer, no matter what definition of simultaneity he adopts.

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March 29.

[1] Milne, *Proc. Roy. Soc.*, A, **160**, 12 (1937).
[2] Schild, *Phys. Rev.*, **66**, 340 (1944).

I AM in general agreement with the content of Dr. Camm's letter. The fact which he independently arrives at, that the energy integral in the problem of two bodies (or indeed, of any number of particles) is independent of the simultaneity convention adopted, I had already encountered in my own work. I may point out here that until *some* simultaneity convention is adopted, a conservation law applying to a number of different particles has no meaning; for the essence of a conservation law is that we pick out some attribute of the motion of each particle, and add them all together. If these attributes are varying in time, as in gravitational problems, it is essential to decide at what epoch to evaluate each attribute, and so to adopt a standard of simultaneity. It is therefore very satisfactory that the conservation of energy comes out independently of the standard of simultaneity adopted. Similar considerations apply to the conservation of linear and angular momentum, to which I hope to return on a future occasion.

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Thermal Stability of D.D.T.

IT appears that on certain information obtained from America the belief has become current that D.D.T. decomposes and loses hydrogen chloride at relatively low temperatures, for example, of the order of 107–130° C.

Recently, Fleck and Haller[1] have shown that iron and aluminium compounds catalyse this decomposition very readily at 110–120° C., in 15 minutes to the extent of 99 per cent with the formation of the corresponding dichloroethylene (m.p. 88–89° C.). We have now examined the thermal stability of D.D.T., and find that this substance, whether it be pure or the commercial quality, is only decomposed at relatively high temperatures.

We have confirmed Fleck and Haller's observations that metal salts, even in very small amounts, enhance the onset of this decomposition.

Our experiments were carried out by placing samples of D.D.T. in a tube fitted with a thermometer and an air-bubbler, and heating in a glycerine bath. The air was drawn through a short air condenser and passed into 1 per cent silver nitrate solution, acidulated with nitric acid. The sample (*c.* 40 gm.) was melted at 110–115° C., and the temperature raised at the rate of 1·2–1·4° C./minute. The decomposition point was noted as the temperature at which a definite turbidity appeared in the silver nitrate solution.

In sample No. 2, rapid evolution of hydrogen chloride set in with consequent precipitation of silver chloride.

No.	D.D.T. sample taken: m.p. in ° C.	Decomposition point (° C.)	m.p. of recovered material (° C.).
1	Batch 50; 80% *p*:*p*′; m.p. 96–102; setting pt. 96	200	98–100
2	As above + 0·1% $FeCl_3$	120	81–91
3	As above + 0·005% $FeCl_3$	150	94–100
4	MBL/204/2; 71% *p*:*p*′; m.p. 89–100	188	—
5	Batch 203; 75% *p*:*p*′; m.p. 82–94	170	82–92
6	D.D.T. m.p. 108·5–109·5 (corr.); setting pt. 107·5	195	106–107·5 (corr.)

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[1] Fleck and Haller, *J. Amer. Chem. Soc.*, **66**, 2095 (1944).

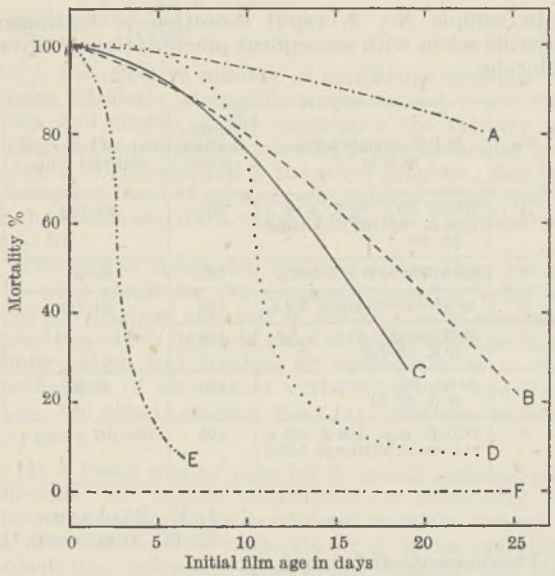
Effect of Pretreatment on the Toxicity of Insecticidal Films on Building Surfaces

INSECTICIDAL films, formed by the deposition of a solution of pyrethrins in a heavy refined mineral oil of very low volatility, for example, Shell Oil P.31, have been used in warehouses for the control of *Ephestia* and *Plodia* moths and caterpillars[1]. These films were formed on wooden boxes. There has more recently been a considerable increase in scope for the use of such films for controlling other pests of stored foodstuffs, especially beetles, which are more resistant than the moths and their caterpillars to most insecticides, including the pyrethrins. We have found, however, that, other things being equal, the toxicity of films of pyrethrins in a heavy oil differs widely according to the material upon which the insecticide is deposited.

In laboratory experiments at 25° C. and 70 per cent relative humidity, samples of different building materials were sprayed with 1·6 per cent w./v. pyrethrins in P.31 oil at a rate of 4 mgm./sq. cm.; this deposit is much greater than that applied in practice. Twenty-four hours after spraying, batches of flour beetles, *Tribolium castaneum* Herbst., were confined on the samples. The percentages of insects knocked down and dead after six days exposure to the insecticide are shown in the accompanying table.

Surface	Knock-down (%)	Dead (%)
Rough deal	100	59–77
Brick	100	15–31
Limewashed brick	0–12	0– 8
Concrete	0–16	0–16
Cement	0–10	0–10

Thus, oil films incorporating pyrethrins as the toxic agents were of moderate toxicity when deposited on deal, of low toxicity on brick, and virtually non-toxic on limewash, concrete and cement. A trial under practical conditions has confirmed the differ-



THE TOXICITY TO *T. castaneum* OF FILMS FORMED ON PRETREATED CEMENT BY 1·5 MGM./SQ. CM. OF 1·6 PER CENT PYRETHRINS IN P.31. INSECTS CONFINED ON FILMS FOR 6 DAYS. PRETREATMENTS: *A*, SIZE (10 PER CENT); *B*, GELATIN (5 PER CENT); *C*, STARCH PASTE; *D*, POLYVINYL ACETAL EMULSION; *E*, BRICKWORK SEALING PAINT; *F*, NO PRETREATMENT.

ence in toxicity between insecticidal films on wood and on limewash.

Ways have been sought to increase the toxicity and persistence of these films. The most striking results were obtained by pretreating the surfaces, before application of the insecticide, with substances which might be expected to reduce greatly the rate of sorption into the substrate, and so to render the insecticide more available to insects walking over the surface. Many substances, including water, hygroscopic materials, sodium silicate preparations, paints, varnishes and colloidal gels were put through preliminary tests to assess their value as pretreatments. The relation between film toxicity and film age was determined for some of the most promising of these when applied to cement. The accompanying graph shows the results. Insecticidal films formed by deposits of 1·5 mgm./sq. cm. of 1·6 per cent pyrethrins remained highly toxic under laboratory conditions for more than three weeks on some coatings.

After further investigation, size and gelatin, applied in aqueous colloidal solution, have been selected as the most useful of the materials at present available; gelatin was better than size at equal concentration. A solution of pyrethrins was used in most of the laboratory work, but coatings of size or gelatin also supported solutions of other insecticides, including D.D.T., in an oil base.

A trial of size under practical conditions indicated that it was effective, provided that a continuous coating was formed.

This work forms part of the programme of work of the Pest Infestation Laboratory, and this note is published by permission of the Department of Scientific and Industrial Research.

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April 9.

[1] Potter, *Ann. Appl. Biol.*, **22**, 769 (1935); **25**, 836 (1938).

Preliminary Report on the Purification and the Molecular Weight of Hypertensin

DURING an investigation on the chemistry of hypertensin some facts have emerged worth a brief report. Hypertensin has been purified to a very high degree, its effect in raising the blood pressure of a cat in chloralose anæsthesia equalling that of adrenaline. The smallest dose eliciting an appreciable effect on the blood pressure lies in the vicinity of 0·5 γ. Important steps in the ultimate purification are chromatography[1] and electrodialysis.

The former rests upon the fact that hypertensin is adsorbed on aluminium oxide from a methyl alcoholic solution and eluted with appropriate mixtures of methyl alcohol and water.

For the electrodialysis an apparatus constructed by Hammarsten[2] was employed. Parchment paper was used as cathodic membrane, and goatskin, which is impermeable to hypertensin, as anodic membrane. It was found that if the reaction in the centre compartment was held more alkaline than *p*H 7·5 with barium hydroxide, no hypertensin passed into the cathodic compartment. Thanks to this fact, inorganic salts and other impurities could be removed without loss of activity. When thereafter the reaction in the centre compartment was made acid to *p*H 3 with sulphuric acid, hypertensin rapidly passed out into the cathodic compartment. 1 mgm. of this preparation obtained in good yield (70–80 per cent) had an activity corresponding to 35 mgm. tyramine phosphate. The nitrogen content (Kjeldahl) was 13·6 per cent.

From the last experiment together with earlier electrophoresis experiments[3] it was concluded that hypertensin must be neutral or nearly neutral in character. Hence a determination of the diffusion constant at neutral reaction would give information —though approximate—on the molecular weight of hypertensin. The apparatus and technique of Theorell[4] were used, and the diffusion was followed by activity measurements. To prevent inactivation of hypertensin the experiments were performed at 0° C. In two different determinations the diffusion constant was found to be $1{\cdot}20 \times 10^{-6}$ cm.²/sec. resp. $1{\cdot}18 \times 10^{-6}$ cm.²/sec. Assuming for hypertensin a specific volume of 0·75, the diffusion constant obtained corresponds to a molecular weight of 2,750.

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[1] Edman, P., *Ark. Kemi, Mineral., Geol.*, B, **18**, No. 2 (1944).
[2] Ågren, G., *Diss., Skand. Arch. Physiol.*, **69** (1934).
[3] Edman, P., v. Euler, U., Jorpes, E., and Sjöstrand, T. O., *J. Physiol.*, **101**, 284 (1942).
[4] Theorell, H., *Biochem. Z.*, **275**, 19 (1934–35).

British and Continental Races of the Starling, *Sturnus vulgaris* L., in Canada

AN account of the differences in timing of the reproductive cycles of the British and Continental races of the European starling has been given by Bullough[1], and the consequent differences in external morphology and in behaviour have been emphasized. It was suggested that these differences, particularly in behaviour, may prevent cross-breeding, and that in any event the two races must be considered as subspecifically distinct.

It was further suggested that a critical test of the separate nature of these races might be obtained from a study of the starling in North America. The species was introduced there on numerous separate occasions before the United States Lacy Act of 1900 prohibited further importations of alien species. It is generally considered, although not proved, that the successful introductions were those of 1890 and 1891 in the Central Park, New York City, and that it was the descendants of these few birds which spread half-way across the continent and north into Canada[2,3]. From the many descriptions of the habits of these birds in their new home, it was already evident that the Continental race of starling was present in enormous numbers, living a flock life throughout the summer, autumn and winter, and developing the migration habit as in Europe. On the other hand, there was also evidence that the British race was present too. Bissonnette[4], in Connecticut, discovered starlings with unusually large gonads in winter, and associated with this was the observation of Hicks and Dambach[5], in Ohio, that there are present in winter many pairs of mated birds which roost, feed and live independently "near cavities where they will nest in the spring". Enlarged gonads in autumn and winter, and a consequent interest in nesting sites, are distinguishing features of the British race of starling.

A study of the starlings present in Ville St. Laurent (near Montreal, Quebec), made during the autumn and winter of 1944–45, has confirmed the presence of both races. In October and November the Continental starling was especially common, ranging the countryside in flocks. These birds had dark beaks, indicating the absence of gonad activity, and associated with this, they were unpaired, uninterested in their old nesting sites, and they roosted communally. In sharp contrast, there were also present smaller numbers of British starlings. These birds had beaks turning yellow at the base, indicating gonad activity, and associated with this they were already paired, and spent much time singing by their old nesting sites. Although they remained all day in the close vicinity of these nesting places, in the evening they joined the Continental starlings in the communal roosts.

Towards the end of autumn, just before the onset of severe weather, the southward migration of the Continental starlings was complete. Consequently, in December and January, relatively few of these birds remained in Ville St. Laurent, and it seemed possible that the few which did so came from even farther north. The majority of the starlings remaining in the neighbourhood were of the British type. By the middle of January, these individuals had beaks almost fully yellow, and their attachment to their nesting sites was further strengthened by the fact that nest-hole roosting in pairs then took the place of communal roosting. The few Continental birds which remained had uniformly dark beaks until the end of January when, in some individuals, the first signs of yellow colour appeared. The birds, however, remained unpaired and continued to roost communally.

When, about the middle of March, the huge flocks of Continental starlings returned to the Montreal district, these birds still had beaks which were partially, or even in a few cases wholly, dark, they were unpaired, and being as yet unattached to nesting sites, they still roosted communally. At this same time, the adult British starlings had fully yellow beaks, nest-building had begun and copulation was frequently observed.

It is therefore evident that the difference in the reproductive rhythm, which distinguishes these two races of the starling in Europe, has proved sufficiently powerful to preserve their separate identities on the American continent for a period of fifty-five years of the most considerable increase in numbers and the most active spread of the species. All this time the breeding ranges of the two forms have been either identical or have overlapped, a state of affairs which is not apparently found in Europe. However, unless there exists some more positive bar to interbreeding than is provided by the fact that the British starlings pair in early autumn while the Continental starlings do not do so before the late winter and early spring, it seems inconceivable that some mixing of the two races has not occurred. To determine the precise amount would obviously require a large-scale statistical study; but it is already abundantly clear, at least in the neighbourhood of Montreal, that such mixing as may have taken place is inconsiderable.

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April 6.

[1] Bullough, W. S., *Phil. Trans. Roy. Soc.*, B, 231, 165 (1942).
[2] Kalmbach, E. R., and Gabrielson, I. N., United States Department of Agriculture, Bulletin No. 868 (1921).
[3] Lewis, F. L., University of Toronto Studies, Biological Series, No. 30 (1927).
[4] Bissonnette, T. H., personal communication (1940).
[5] Hicks, L. E., and Dambach, C. A., *Cardinal*, 4, 25 (1935).

X-Ray Induced Mutations in the Physiology of *Ophiostoma*

Tatum's and Beadle's[1] investigations on *Neurospora* inspired me to attempt to induce physiological mutations in *Ophiostoma multiannulatum* (Hedgc. and Davids.) by means of X-ray treatment. Normal strains of this fungus grew optimally on a synthetic medium containing glucose, ammonium tartrate, inorganic salts, aneurin (= vitamin B_1) and pyridoxin (= vitamin B_6)[2]. Out of 775 monosporous mycelia which were obtained from X-ray treated ascospores by means of a special procedure[3], 12 (that is, 1·6 per cent) differed physiologically. The manner in which they differed is shown in the accompanying table.

Strain No.	Physiological properties
225	Biotin-heterotrophic.
358	Parathiotrophic: able to reduce 4-valent sulphur.
446	" : unable to reduce 4-valent sulphur.
460	Requires uracil; also growing with uridine, cytidine or cytosylic acid
513	Requires adenine; also growing with adenosine or adenylic acid
617	Requires *p*-aminobenzoic acid.
620	Requires adenine as No. 513
636	" " " "
692	Parathiotrophic as No. 446
829	" " " "
834	" " " "
848	Requires guanine; also growing with guanosine.

The ability of No. 358 to reduce 4-valent sulphur (sodium sulphite) was not transmitted to the following generations. All the other physiological properties, however, shown in the accompanying table were heritable. These strains should, therefore, be considered as physiological mutants. *O. multiannulatum*

being heterothallic and rapidly giving rise to perithecia, it was possible to produce by means of adequate combinations monosporous mycelia possessing two or more of the reported divergent properties in the next or later generations.

Parathiotrophy which was induced in five strains in the present study has so far been observed in Nature solely in Saprolegniaceæ[4] and in certain bacteria[5]. The parathiotrophic strains investigated which were not able to reduce 6-valent sulphur (as sulphate or sulphone) assimilated two-valent sulphur as, for example, sodium sulphide, cystine, cysteine and $CH(SCH_3)_3$.

The three strains which required adenine required rather considerable quantities of this purine. These quantities were at least a thousand times larger than the required amounts of aneurin and pyridoxin. The mycelium/adenine-quotient seemed to be equivalent to approximately 100. The action of guanine (on strain No. 848) has quantitatively not yet been extensively investigated. This applies, too, to the action of uracil on strain No. 460, in which also cytidine and cytosylic acid—though not cytosine—are active. In all these cases the indispensability of a certain nuclein compound to a certain strain seemed to be due to the fact that this strain lost the ability to synthesize the substance in question, which is necessary for the formation of essential nucleoproteids, co-ferments, etc.

The two auxo-heterotrophic mutants which were induced, that is, the biotin-heterotrophic mutant No. 225 and the *p*-amino-benzoic-acid-heterotrophic mutant No. 617, required only exceedingly small quantities of the growth-substances mentioned. Biotin was even active in a dilution of 10^{-12}, and *p*-aminobenzoic acid in a dilution of 10^{-10}.

More detailed reports of these investigations will be published in Swedish journals of botany.

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March 14.

[1] Beadle, G. W., and Tatum, E. L., *Nat. Acad. Sci. Proc.*, **27**, 499 (1941). Tatum, E. L., and Beadle, G. W., ibid., **28**, 234 (1942). (only available in abstracts.)
[2] Fries, N., *Symb. Bot. Upsal.*, **7**, 2 (1943).
[3] Fries, N., *Ark. Bot.*, **32**, 4 (1945).
[4] Volkonsky, M., *C.R. Soc. Biol. Paris*, **109**, 528 (1932).
[5] Fildes, P., and Richardson, G. M., *Brit. J. Exp. Pathol.*, **18**, 292 (1937).

Serodiagnosis of Trichinosis by Microscopical Testing with Living *Trichina* Larvæ

DURING the last ten to fifteen years, diagnosis of *Trichina* infection in man (and partly also in swine) has been made easier by the adoption of different methods, based on the immunological response of the organism to the parasite. Particularly, the intradermal and the precipitin test with *Trichina* antigen, both first described by Bachman[1,2], have been used in many modifications. Thus, I am employing for this purpose a clear Seitz filtrate prepared from *Trichina* larvæ that had been freed from their cysts by artificial digestion, dried, pulverized and then extracted in physiological saline in the ratio 1 : 100. Though both these tests are a great help in the diagnosis of trichinosis, they may also fail in very mild cases of this disease, and, on the other hand, unspecific reactions may be obtained in persons not suffering from it.

In January 1941[3], I proposed a more delicate and more specific microscopical test depending on the peculiarity of living trichina larvæ at 37° C. of evoking typical precipitates in immune serum. Since then, this new method has been tried with good results in some hundred cases of suspected human or animal trichinosis by Hauge[4] in Norway as well as by me in Denmark and Sweden (*cf.* Bergwall[5] and Norup[6]). In this connexion it might be mentioned that during recent years several outbreaks of trichinosis have occurred both in Norway and in Sweden, while no cases at all have been reported in Denmark and in Finland.

BUBBLE-LIKE PRECIPITIN REACTION OF IMMUNE SERUM AGAINST LARVÆ OF *Trichinella spiralis*, AFTER 24 HOURS INCUBATION AT 37° C. SERUM SAMPLE FROM PATIENT *D.A.*, 23 DAYS AFTER HIS FALLING ILL. × 80.

For the microscopical test, well-coiled *Trichina* larvæ are needed, which, after having been freed from their cysts by artificial digestion, are very carefully washed with sterile saline. For each test about a hundred larvæ are placed in the depression (diameter 20 mm.) of a sterile, 3·5 mm. thick hollow-ground slide and then covered with 0·5 c.c. of the twice centrifugalized serum. A large sterile cover-slip (24 mm. × 32 mm.) is laid over the serum, care being taken that no air bubbles pass in. The slides are collected on a wire-netting lying in a large rectangular glass dish. Below the wire-netting, wet filter-paper is spread on the bottom of the dish to prevent desiccation of the preparations. The dish is then covered with a glass lid and kept in an incubator at 37° C. The samples are examined under the microscope after five as well as after twenty-four hours.

After five hours the larvæ are very motile. In case the serum is positive, bubble-like or finely granular precipitates are seen primarily around the anterior ends of a greater or smaller portion of the worms. After twenty-four hours the larvæ are often shrunken, an observation made both in normal and in immune serum. Most precipitates are now lying free in the serum. The quantity and form of the precipitates are very variable and highly dependent on the age and size of the infection. As a rule, the reaction becomes positive between the tenth and twentieth day after the appearance of the first symptoms of the disease, which most frequently are œdema of the lids and fever. In a few cases, however, a faint reaction was obtained before the tenth day. In mild cases the antibodies seem to disappear again about a year after the patient's recovery.

Altogether, I was, by aid of the microscopical test, able to ascertain the clinical diagnosis of trichinosis in eighty patients from five different outbreaks, while in thirty other patients, clinically suspected to suffer from trichinosis, this possibility could be excluded. The test proved often to be more sensitive and more specific than the usual intradermal and precipitin tests with trichina antigen. Similar reliable results were obtained in trichinized animals, as pigs (positive already seventeen days after infection), dogs, cats, silver foxes, rabbits and guinea pigs. Necessary conditions for obtaining a clear result even in cases of very light infections are cleanness and sterility of the serum examined.

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April 3.

[1] Bachman, G. W., *J. Prev. Med.*, **2**, 35 (1928).
[2] Bachman, G. W., *J. Prev. Med.*, **2**, 513 (1928).
[3] Roth, H., *Acta Path. et Microbiol. Scand.*, **18**, 160 (1941).
[4] Hauge, St., *Norsk. Vet. Tidsskr.*, **56**, 364 (1944).
[5] Bergwall, Å., *Svenska Läkartidn.*, **40**, 72 (1943).
[6] Norup, E. B., *Svenska Läkartidn.*, **41**, 2420 (1944).

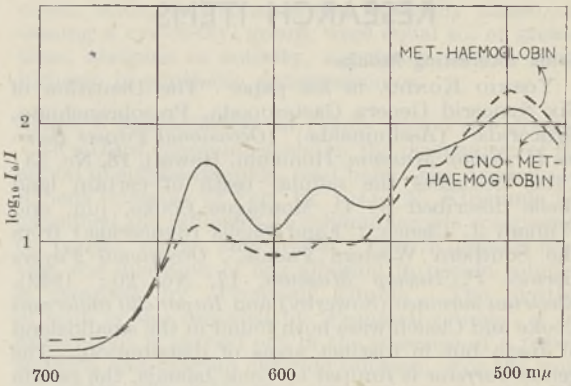
Pharmacological Action of Cyanic Acid

IN the course of a study designed to investigate whether some substances known, or believed to be present, in the body, had any hypnotic action, or could contribute to bring about the internal milieu (for example, water-shift) known to prevail during normal sleep[1], a marked pharmacological action of cyanic acid was found.

K. M. Birch and I found that sodium cyanate was well tolerated by rats, guinea pigs and rabbits in doses which produced marked drowsiness and prolonged sleep. Part of the cyanate used in this investigation we prepared from urea; we are also indebted to Glaxo Laboratories, Ltd., for a gift of pure sodium cyanate. The sleep effect produced is most evident in rats. Though the action is definitely a hypnotic one, no full anæsthesia could be produced. The L.D. 50 (albino rats of 80–120 gm.) is of the order of 30 mgm./100 gm. Rats survived, though with increasing drowsiness, daily injections of 10 mgm./100 gm. for three weeks. When the injections were stopped, the rats' behaviour soon returned to normal. No gross pathological sign could be detected in the animals. The blood sugar was normal in rabbits after two weeks of daily injections (10 mgm./100 gm.), though higher doses given intravenously were followed by a small and transient rise. The body temperature showed a significant and transient fall of as much as 2°.

The hypnotic action of the drug is diminished by thyroxin and insulin. For adrenalectomized rats the drug was of greatly increased toxicity. Posterior pituitary extracts markedly increased the length and depth of sleep caused by the drug. This, however, seems to be a general effect of posterior pituitary extracts and is also evident with other narcotics (barbiturates, etc.).

In more than fifty human volunteers doses of 2–400 mgm., taken orally, were well tolerated. The only feeling reported by the great majority was tiredness and drowsiness, which was often followed by a short and deep sleep. In many subjects we observed a distinct miosis shortly before the tiredness was mentioned.



R. Bader and I tried to investigate whether cyanic acid is a normal constituent of the body. This was claimed by Montgomery[2], whose findings, however, we are unable to confirm. Concerning the fate of injected cyanate in the body, a reduction of cyanate to cyanide seems extremely unlikely, because of the low toxicity of cyanate. Moreover, we could not detect, even with the most sensitive reactions (one[3] with an identification limit of 0·25 γ), any trace of cyanide in the blood and tissues of animals receiving large doses of cyanate over different periods of time.

The cobalt-acetate colour test for cyanate was negative in brain, liver and muscle, but often positive in kidney extracts of animals receiving cyanate injections.

Cyanate was found not to react with either oxy- or reduced hæmoglobin, but it forms a new compound with methæmoglobin. I am greatly indebted to Prof. R. A. Morton, Department of Biochemistry, University of Liverpool, for allowing me to make use of his spectroscopic equipment, and for his invaluable help in constructing the absorption spectrum of cyanate-methæmoglobin, shown in the accompanying figure.

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March 30.

[1] Schütz, F., *Nature*, **153**, 432 (1944).
[2] Montgomery, E. G., *Biochem. J.*, **19**, 71 (1925).
[3] Feigl, F., "Laboratory Manual of Spot Tests" (New York: Academic Press, 1943).

"High Frequency Transmission Lines"

IN the review of my recently published book of this title, the reviewer[1] remarks: "He [the author] gives only cryptic indication of what is actually achieved by the use of high-frequency transmission lines, and evidently expects that his readers should be satisfied to plunge into abstract study without being tempted by a recital of practical achievements."

I do not disagree with this remark, but must state in reply that considerations of national security made a fuller statement on recent practical achievements impossible, and inevitably my treatment of the subject suffered.

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[1] *Nature*, **155**, 681 (1945).

RESEARCH ITEMS

Some Interesting Radulæ

YOSHIO KONDO, in his paper "The Dentition of Six Syncerid Genera Gasteropoda, Prosobranchiata, Syncerida: (Assimineidæ)" (*Occasional Papers Bernice P. Bishop Museum*, Honolulu, Hawaii, **18**, No. 23; 1944) describes the radular teeth of certain land shells described by C. Montague Cooke, jun. and William J. Clench ("Land Shells (Syncerida) from the Southern Western Pacific", *Occasional Papers Bernice P. Bishop Museum*, **17**, No. 20; 1943). *Electrina succinea* (Sowerby) and *Rapanella andersoni* Cooke and Clench were both found in the small island of Rapa but in distinct areas of distribution. The genus *Garretia* is limited to Cook Islands, the radula of *G. biangulata* (Pease) being dealt with here, *Fijianella calciphila* Cooke and Clench comes from Lau Islands, *Quadrasiella mucronata* Moellendorff from Guam, Marianne Islands. All these have a very peculiar operculum characteristic of each species and differ much in form of shell. The type of radula is found to be remarkably uniform for all six. There are no lateral processes, and the teeth themselves are peculiar and distinctive in form.

Manganese Content of Fruit Tree Foliage

DIFFERENT crops vary greatly in their susceptibility to manganese deficiency, and although manganese deficiency symptoms have been recognized in the leaves of apple, apricot, cherry, peach, plum (prune) and walnut (as well as in other crops), prunes remain healthy in locations where peaches develop severe manganese-deficiency chlorosis. These differences may be due to differing manganese requirements or to variations in the ability to absorb manganese or to a combination of these factors. Of interest in this connexion are data presented by E. Epstein and O. Lilleland (*Proc. Amer. Soc. Hort. Sci.*, **41**, 11; 1942). They report that different fruit trees, when grown under identical conditions, with manganese supplies adequate, have widely different contents of manganese in the leaves. Expressed as parts per million of dry matter of leaves the manganese contents found were for: filbert, 494; walnut, 246; almond, 96; apple, 81; prune, 73; peach, 66; pear, 63; and cherry, 62·7. Clearly, susceptibility of the peach to manganese deficiency is not due to an inability to absorb manganese as the peach leaves contain almost as much manganese as those of the 'resistant' prune.

Ascorbic Acid Content of Tomato Fruits

G. B. Reynard and M. S. Kanapaux (*Proc. Amer. Soc. Hort. Sci.*, **41**, 298; 1942) find that two small-fruited tomato species (*Lycopersicon peruvianum* (L.) Mill. and *L. pimpinellifolium* (Jusl) Mill.) have a much higher content of ascorbic acid than the various types of *L. esculentum*. The ascorbic acid content of the fruits of *L. peruvianum* varied between 58·9 and 63·0 mgm. per 100 gm. and of *L. pimpinellifolium* between 35·9 and 47·0 mgm. per 100 gm. Intermediate sized types, for example, *L. esculentum* var. *cerasiforme* (Dun.) A. Gray (cherry tomato) and *L. esculentum* var. *pyriforme* (Dun.) C. H. Mull (pear tomato) gave fairly high values, but large-fruited commercial types of *L. esculentum* gave low values (11·2–21·5 mgm. per 100 gm.), while within each type fruit-size and ascorbic acid content showed a negative correlation. Possibly connected with this inverse relation between fruit size and ascorbic acid content are the high ascorbic acid values which have been reported for the fruits of tetraploid tomatoes, as these often have characteristically small fruits (E. C. Stair and R. K. Showalter, *Proc. Amer. Soc. Hort. Sci.*, **40**, 383; 1942).

Tertiary Igneous Rocks of Eastern Otago

FOR many years W. N. Benson has been making a detailed study of the Tertiary igneous rocks of eastern Otago and their tectonic environment. Five papers, embodying the results to date, have recently appeared (I, *Trans. Roy. Soc. N.Z.*, **71**, 208 (1941); II, **72**, 85 (1942); III, **72**, 160 (1942); IVA, **73**, 116 (1943); IVB, **74**, 71 (1944)). These make a very notable contribution to the geological history, petrology and geochemistry of an extensive area centred on Dunedin. In I and II Prof. Benson recognizes: (*a*) a relatively stable region in the west, almost devoid of late Tertiary igneous rocks, though containing in the extreme north-east a great development of pillow lavas and minor intrusions of early Tertiary age; (*b*) a moderately deformed belt between (*a*) and the coast, which contains most of the rocks so far described in these papers; and (*c*) a strongly deformed Central or Dunedin area with Pliocene volcanic rocks belonging mainly to the basalt-trachyte and basanite-phonolite suites; these are to be described comprehensively later. II includes a summary of all the known outlying representatives of the Pliocene petrographic province from regions (*a*) and (*b*). A conspicuously differentiated sill of olivine-theralite in this group is described in detail in III. The distribution and geological setting of the Mid-Tertiary basalts, tholeiites and dolerites is dealt with in IVA, while IVB is concerned with their petrology. A special study of siliceous xenoliths and their reactions is promised in a forthcoming paper, IVC. In IVB special attention is given to the pyroxenes and the conditions governing their crystallization. The term 'subcalcic augite' is suggested for pyroxenes between pigeonite ($2V$ up to 30°) and augite ($2V <$ 45°). A wealth of optical detail has been provided by F. J. Turner and C. O. Hutton. The average Otago Mid-Tertiary magma corresponds closely with that of the quartz-dolerites of Scotland and the north of England, but the average Pliocene magma is considerably more alkaline and resembles that of the Lower Carboniferous province of the Midland Valley of Scotland.

The Gulf Stream and the Weather in Europe

J. W. SANDSTRÖM (*Ark. Math. Astron. Fys.*, 30. No. 18; 1944) discusses the influence of the Gulf Stream on weather in Europe. It has been generally assumed that heat from the Gulf Stream is disseminated to the surrounding land by winds that have blown over it and are warmed. Sandström points out, however, that as the winds are mainly directed *towards* the Gulf Stream, the warmed ascending air over it being replaced by cooler air blowing from both sides of it, they cannot disseminate heat from it. The winds directed towards the Gulf Stream are deflected about 60° to the right by the rotation of the earth, their direction being from the south or south-south-west over Europe, and from the north or north-north-east over Greenland, and hence the heat produced in Europe and the cold produced in Greenland by the Gulf Stream are greater the warmer the Gulf Stream is. On the way from the tropics to the Arctic, the Gulf Stream loses a considerable amount of heat to the air and colder waters, and in order to transport any heat to the Arctic it must

convey a certain mass of water per second. The speed of the Gulf Stream was probably reduced in 1939, and hence it lost its power to produce low air pressures in the North Atlantic and southerly winds over Europe; hence the winter of 1939–40 was just as cold in Europe as in Siberia, Alaska and Greenland. The cooling of water in the Arctic, increasing its specific gravity, would cause it to sink and the surface water to set in from warmer regions, thus re-establishing the propelling force of the Gulf Stream and increasing its speed. Its waters advance rather slowly; thus in the winter of 1941–42 its warm front may not have reached farther than the south-west coast of Norway. This winter was, therefore, cold; but by the winter of 1942–43 the warm front had passed Scandinavia on its way to the Arctic, the direction of the winds over Europe became more southerly, and the winter was warm over Europe and cold over Greenland. It is suggested that a study of the Gulf Stream properties should make it a suitable medium for long-term weather forecasts.

Economics of Transformer Losses

In a paper recently read before the Institution of Electrical Engineers in London, W. Szwander discusses the valuation and capitalization of transformer losses, outlining a simple and comprehensive procedure for the practical application of the principles of economic selection of transformers. Two aspects are considered: one relating to purchase and the other to the designing of transformers to satisfy specific economic requirements in individual cases. Formulæ are developed and supplemented by practical information on the selection of the correct values for the requisite coefficients. A statistical survey is made of methods used by different buyers for the capitalization of the transformer losses. Finally, approximate values of the coefficients in the formulæ for the capitalization of losses are suggested; these may be used in the absence of more precise information. Of the two equivalent methods available for making an economic selection of transformers, namely, the comparison of the total annual operating costs and that of the total investment cost including the capitalized value of the losses, the first is the more popular and comprehensive. The more complicated problem of finding the most economic design of transformer to meet given operating conditions is analysed in detail. It is concluded that the economic choice of the loss ratio must be such as to ensure the annual costs of the iron and copper losses being equal, the total losses being fixed so that their total annual cost shall be about 2·5 times the total annual capital cost.

Antispasmodics

Twenty-eight basic-alkyl esters of substituted α-thienylhydroxyacetic, $C_4H_3S.CR(OH)COOR'$, and substituted α-thienylacetic acids, $C_4H_3S.CRHCOOR'$, prepared by F. F. Blicke and M. U. Tsao (*J. Amer. Chem. Soc.*, 66, 1645; 1944), in which the substituents R were such groups as methyl, cyclohexyl, benzyl, phenyl, *p*-xenyl, α-naphthyl and α-thienyl, and the basic-alkyl groups R' were β-diethylaminoethyl, β-morpholinoethyl, β-piperidinoethyl, γ-diethylaminopropyl and γ-dibutylaminopropyl, were examined for antispasmodic activity. In general, the activity of the esters of hydroxyacetic acids on the isolated intestinal strip which had been stimulated by acetylcholine was much greater than that of the esters of acetic acids, and some esters, especially those containing a cyclohexyl group, were equal to, or greater than, atropine in activity, a potency seldom found hitherto in synthetic antispasmodics.

Action of Sulphanilamide on Pepsin, Rennet and Urease

In a third communication on the mechanism of the action of sulphanilamide, read before the Academy of Athens (meeting of Feb. 10, 1944), N. Klissiunis has examined the influence of sulphanilamide compounds on pepsin, rennet and urease. Prof. Klissiunis finds that the digestion of egg albumin in pepsin solution is retarded by 'Prontosil soluble'. The clotting of milk is also retarded by 'Prontosil soluble', if the experiment is carried out in the presence of a pepsin solution and calcium chloride solution. For the work on urease, the latter was prepared according to the Van Slyke and Cullen method. The *p*H of the solution was stabilized with a mixture of phosphates at 7·0. The decomposition of urea was measured by the amount of ammonia developed by the reaction. This reaction was retarded in presence of sulphanilamide ('Prontalbine'). Sulphanilamide ('Prontalbine') was also effective in retarding ammoniacal decomposition of urine; the *p*H of this urine was very little changed.

Data on Meteors

Under the title, "An Analysis of British Meteor Data: Part 2. Analysis" (*Mon. Not. Roy. Astro. Soc.*, 104, 257; 1945), J. G. Porter concludes his investigations on the subject (see *Nature*, 152, 420; 1943). After a brief description of the method of classifying and grouping the material for analysis, Porter discusses the errors and their correlation and shows that errors of different kinds—sliding errors, magnitude errors and timing errors—tend to increase with the length of the path of the meteor and also with its brightness. It is not easy to explain this correlation, though in the case of magnitude errors it is suggested that the brighter the meteor the further the observer has to go for standards of reference, and for meteors of planetary brightness or more, these are usually recollected standards only. Adhering to the rules of statistical analysis, it is shown that no essential difference exists between the data for shower and non-shower meteors. In addition, the heights of comparable groups are the same and the 'seasonal effect' is merely of a statistical character. Hoffmeister's assumption of a uniform distribution of meteor paths in space is shown to be without any justification, and the non-distribution of meteor directions is responsible for the apparent seasonal variations on heights. An interesting point appears in Table viii. There it is shown that the average shower meteor appears and disappears at greater heights than does the average sporadic meteor, a fact which Öpik noticed; but the groups are drawn from very different ranges of elongation of the radiant from the apex of the earth's way, and here previous investigators have been misled. Further conclusions are that the low speeds derived from double or triple observations are real, meteors suffering some retardation by atmospheric resistance before they become visible, and that hyperbolic velocities seldom or never exist. The analysis has given the *coup de grâce* to many of the conclusions of the Arizona Meteor Expedition, and, it is hoped, has finally settled the question regarding so-called 'hyperbolic velocities', establishing beyond dispute that meteors are members of the solar system.

SIGNIFICANCE OF HYDROCARBON OILS IN CHEMICAL INDUSTRY

THE Cantor Lectures on "Organic Chemicals from Petroleum", which Sir Frank Smith delivered before the Royal Society of Arts during April, were happily timed to provide the background for wide appreciation of the importance of the recommendations of the Report of the Hydrocarbon Oil Duties Committee*, which Sir John Anderson stated in his Budget speech on April 24 he proposed to accept. The Committee, over which Sir Amos Ayre presided, was appointed by the Chancellor of the Exchequer and the Minister of Fuel and Power, as indicated in last year's Budget speech, and Sir John Anderson has now included in the Finance Bill a provision freeing from Customs duty imported hydrocarbon oils used as raw materials for chemical synthesis. Provision is also to be made for an allowance of an amount equal to the Customs duty in respect of indigenous oils used in these processes, in order that the competitive position in respect of home-produced materials should not be worsened by this change.

The Ayre Committee was appointed at the end of July 1944 "to consider and report upon: (*a*) the effect of the hydrocarbon oil duties on the supply of raw materials to, and the development of, the chemical industry in this country so far as the use of hydrocarbons and their derivatives is concerned; and (*b*) the extent to which any change in those duties would affect industries engaged in the production of similar products from coal". "Chemical industry" in these terms of reference includes the producers of transformation products, such as dyes, pharmaceuticals and plastics, but excludes the industries using hydrocarbon oils as solvents only, though reference is made to the solvent-user position. Similarly, it excludes the industries concerned with the production of synthetic motor fuels and lubricants, although the Committee considered the influence of developments in this field on other modern synthetic chemical processes.

Reviewing first the effect of the duties on the chemical industry in this sense and its development, the Committee points out that while the visible direct effect of the hydrocarbon oil duties has not hitherto been large, apart from the use of petroleum oils for the manufacture of such products as wetting-agents and detergents, and of turpentine for the manufacture of so-called 'synthetic' camphor, the indirect effect has been considerable. This repercussive effect is due to the protection of indigenous oils and to the fact that benzole, one of the main hydrocarbon raw materials of the existing chemical industry, is in demand as a blending constituent, owing to its high anti-knock value, in the motor-fuel industry, where its value is regulated by that of imported duty-paid spirit. The annual cost to the chemical industry, on its pre-war consumption of 10 million gallons, which may well be exceeded after the War, is thus about £375,000 or about 1*d.* per lb. on benzole.

The consequent effect on the cost of chemicals derived from benzole depends on the yield and on the number of steps in the chemical synthesis, and may be more or less than 1*d.* per lb. on the primary intermediates. Even where the effect is less on products further removed from benzole, for example, 0·2*d.* on some finished dyes, the increase is significant and often serious in the export market. The Committee received evidence of the curtailment of the output of certain dye intermediates owing to the almost complete loss of the export trade resulting from this position.

Moreover, as the report notes, the organic chemical industry stands at the opening of a period of great expansion. Chemicals are increasingly providing the basic raw materials of major industries such as synthetic textiles, synthetic rubber and plastics. Since Britain possesses neither the large supplies of hydrocarbons which exist, for example, in America, in the form of natural petroleum, nor the large numbers of scientific and technical personnel trained and experienced in development work, a great effort will be called for to enable her to play a considerable part in the new industry. It is accordingly imperative that the basic and intermediate raw materials should be made abundantly available and that the industry should be free to choose the best material for each particular process or synthesis, guided only by scientific and technical considerations. Since many of the new processes utilize materials derived in part from oil and in part from coal, the growth of the chemical industry based on petroleum may also increase the demand for raw materials derived from coal, and effect of the duties may be far greater in the future, as they will tend to stifle the large-scale production of the primary and basic intermediates.

For these reasons the Committee unhesitatingly accepts the claim that the chemical industry should be able to choose its hydrocarbon raw materials free from the direct and repercussive effects of the present hydrocarbon oil duties, and the industry takes the view that it is urgently necessary that it should be relieved of this encumbrance. The Committee was also impressed by evidence of the extensive use made of the solvent properties of hydrocarbon oils in extraction processes in the industry, while its conclusion is reinforced by its survey of petroleum as a source of chemical raw materials. While the duty on heavy oil has not had any clearly recognizable effect on such developments, the duty at 9*d.* a gallon on light oil has, and there is real danger that if the present position is maintained certain lines of development may be entirely suppressed. For example, the development of 'specialty' refining to provide the gaseous hydrocarbons, particularly the olefins containing one to four atoms of carbon in the molecule, which are the most important raw materials of the new industry, by cracking selected fractions of petroleum oils, and, by the use of aromatization processes, benzene and other aromatic hydrocarbons, will depend largely on the fiscal position. All witnesses from the oil industry urged that hydrocarbons used in the production of chemicals should be freed from duty in order that development should follow the soundest lines without being subject to artificial diversion.

A further consideration which greatly impressed the Committee was that the free growth of new industries producing and using the hydrocarbon raw materials would result in the development of new alloys, apparatus, equipment and technique which will benefit industry generally. Equally, a field would thus be provided for training chemical engineers and metallurgists, the benefit of whose experience is likely to be widely felt in many industries. The question of home refining involves considerations which lie far outside the Committee's terms of reference; but since the quantity of oil required by the chemical industry

* Cmd. 6615. H.M. Stationery Office. April 1945. 3*d.* net.

is very small in proportion to total oil requirements, there is, as the Committee points out, no reason why home-produced oil should not play its due part in the new developments, provided the manufacturer is free to use, unaffected by duties or their repercussions, the material most suitable for his purpose.

It is, of course, to this section of the report that Sir Frank Smith's lectures are most relevant, and the importance of the matter is well shown by some of the figures quoted by Sir Frank Smith. To-day, he said, some two hundred chemicals are made on the commercial scale from petroleum raw materials, the annual value of which he estimated at about £200 millions, and in the plastics industry the ratio of petroleum derivatives to non-petroleum derivatives as raw materials is steadily increasing. By cracking processes there are already produced 60,000 tons of ethylene for the plastics industry and 120,000 tons for ethyl alcohol. The actual volume of refinery gases in the world is about 300,000 million cubic feet per annum or 15 million tons, and acetylene is already being made from petroleum and production may be on a very large scale in the future.

Sir Frank Smith contended that there is no antagonism between the coal-chemical industry and a petroleum-chemical industry, and this contention is borne out by the third section of the Ayre Committee report, dealing with coal as a source of chemical raw materials. Surveying first the low-temperature and high-temperature carbonization processes, the Committee concludes that the producer of indigenous hydrocarbons cannot and should not be called upon to bear the cost of reduction in price of his products to the chemical industry, notwithstanding that the protection afforded in 1938 to encourage the production from indigenous materials of fuels for the internal combustion engine had raised the price of certain raw materials to the chemical industry. Considering next the three chief processes for treating coal which yield raw materials for the organic chemical industry—hydrogenation, the Fischer Tropsch process for hydrocarbon synthesis (which has not yet been operated in Britain), and the production of calcium carbide—the Committee finds it difficult to forecast the part which these processes will play in the development of the chemical industry, but believes that it will not be large in the immediate future, and that its recommendations will not impede their development.

The Committee recommends accordingly that chemical manufacturers be allowed to receive without payment of duty (or upon drawback), as raw material for chemical synthesis, any imported hydrocarbon oil, and the Chancellor of the Exchequer, as already noted, indicated his intention of amending appropriately Section 2 of the Finance Act, 1934. In respect of hydrocarbon oils produced from indigenous material and received by a chemical manufacturer as raw material for chemical synthesis, the Committee recommends payment to the manufacturer of an allowance equal to the duty payable on the importation of like oils. Similarly, any producer or refiner of indigenous oils who uses such oils for the production of hydrocarbons for use in the refinery as raw materials in chemical synthesis should also receive an allowance equal to the duty payable in the importation of like oils. On the basis of the pre-war consumption of indigenous hydrocarbon oils by the chemical industry, the total cost of implementing the Committee's recommendations is estimated at something less than £400,000 a year.

In announcing his acceptance of these recommendations, the Chancellor said that many believe that synthetic chemical processes will be of rapidly growing importance in manufacture, and will affect industries outside the field of synthetic chemistry. Research on these problems has been active in several countries during the last five years, and he said he hoped that the gift he was able to make towards the cost of research by this concession will help Britain to establish itself quickly in a worthy position in relation to these new developments. While the Ayre Report does not cover the whole field—and it may well be desirable to examine the wider question of home refining in relation to national economic policy—when read with the Cantor Lectures of Sir Frank Smith, it shows conclusively that we can no longer be content to treat oil questions only as matters of Imperial defence. Equally it endorses the argument of the Parliamentary and Scientific Committee for an adequate examination of our whole policy of the utilization of our coal resources. The prompt acceptance of the Committee's recommendations is a further indication of official recognition of the importance of scientific and industrial research, and a disposition to accord scientific and technical factors their due weight in the determination of policy.

RUSSIAN PHYSICS JOURNALS

FOR a time, when transport between the U.S.S.R. and Great Britain was very difficult, the flow of scientific journals almost stopped. Recently a fairly regular exchange has been re-established. The following notes on physics journals may help those readers to whom the facilities of the London libraries are not readily accessible, but who nevertheless wish to know how physics has fared in the U.S.S.R. in recent years. On first thoughts, a knowledge of the Russian language may seem essential; but realizing the severe difficulties of their language the Russians for more than ten years have been publishing foreign editions, in German, French or English, of some of their journals. Attention will be confined almost entirely to such journals.

The earliest journal of special interest to physicists appears to be the *Physikalische Zeitschrift der Sowjetunion*, published at the rate of two volumes each year starting in 1932. Although most of the papers are in German, some papers are in English. Next to be started was *Technical Physics of the U.S.S.R.*, founded in 1934, having papers in English, German or French. By 1939 the fifth volume had been reached with a publication rate of about twelve parts a year. The centre of publication was Leningrad. In the first volume the editor, A. Joffe, explains that before the Revolution there was practically no technical physics in Russia. By 1934 a number of institutes giving their attention to immediate problems in technical physics had been established. Joffe lists them in seven groups: (1) a group of physical-technical institutes including four Leningrad institutes, Kharkov, Ural, Siberia, Dniepropetrovsk and the Physical Agronomical Institute—with one thousand workers; (2) the Optical Institute—with four hundred workers; (3) the All-Union Electro-Technical Institute with one thousand workers; (4) the Power and Thermal Institutes; (5) the Central Radio Laboratory; (6) the Metallurg-

ical Institutes; and (7) the Institute of Applied Mineralogy and others. At that time there were about three hundred technical scientific publications in Russian. The scope of the journal can be seen from the editor's list comprising (1) electron physics, dielectrics, high-voltage technique, high-frequency physics and gaseous discharge, (2) mechanical testing of materials and structure analysis, (3) thermal technology, (4) applied optics, including illumination, photography and electro-physics, (5) technical acoustics, and (6) high-vacuum physics. Scientific workers of all countries are invited to contribute papers and the editor concludes: "We hope that our journal will help to eliminate the language difficulty which prevents foreigners from becoming acquainted with our work and will form yet another link in the chain drawing science and scientists of all countries together". Under the heading 'Bibliography', detailed summaries in English are sometimes given of papers appearing in Russian in other Russian journals.

In 1939, on the basis of the experience gained in publishing these two journals, the Physical and Mathematical Department of the Academy of Sciences decided to replace them by a single journal, the *Journal of Physics*, published from Moscow with S. I. Vavilov as editor. The papers were to be in English, French and German and to include all branches of physics whether theoretical, experimental or technical. The cover bears the portrait of the first Russian physicist, M. V. Lomonosov (1711–65), who was also the first to combine scientific research work with the solution of practical and economic problems. Outside contributions are invited. "We gladly offer the pages of our journal to foreign scientists who would be willing to publish their works through the medium of the Journal of Physics." Parts are issued monthly at the rate of two volumes each year. Fittingly the first two papers to appear are by Prof. P. Kapitza on an "Expansion Turbine Producing Low Temperatures Applied to Air Liquefaction" and "Influence of Frictional Forces on the Stability of High-Speed Rotors". The other two papers completing the first part are by A. Filippov and co-workers on "Disintegration of Atomic Nuclei of Cosmic Rays" and "Fluorescence of Aqueous Solutions of Rare Earth Salts". The last two parts of the first volume were issued together, dealing chiefly with work of L. I. Mandelstam and his collaborators and pupils, with a special article in celebration of his sixtieth anniversary. A language analysis of the first volume shows forty papers in English and five in French. The second volume has thirty-six papers in English, two in French and three in German.

At one time statements were made giving the impression that Russian physicists had to devote the whole of their attention to subjects of immediate practical use. There is no justification to be found in this journal for such statements of short-sighted policy. For example, in the analytical index to volume 4, it was necessary to provide entries for the following subjects representative of all the main branches of physics: acoustics, cosmic radiation, crystalline state, dielectrics, discharge of electricity in gases, electrical conductivity, electrolytes, electromagnetic theory, electronics, Hall effect, ionization, ionosphere, liquids, luminescence, low temperatures, magnetic properties, quantum mechanics, methods, machines and instruments, nuclear structure, optical constants and properties, optical theory, photoelectric effect, radiation, radio, scattering of light, scattering of particles, spectra (molecular), superconductive state, thermal conductivity, vibration theory. From volume 6 onwards, the editor has been P. L. Kapitza, with E. V. Schpolsky as vice-editor. In volume 5 a new feature was started in giving a list of contents of Russian physics journals, including the titles in Russian and English, but "only those articles whose translations are not published in the *Journal of Physics*". All bibliographical details of the original Russian journals from which the full translations are made are unfortunately omitted. In format, style and content, the *Journal*, which is now being received regularly in Great Britain, is very similar to the *Physical Review*. The majority of papers are in English, with a few in French or German.

The remaining physics journals are published entirely in Russian. Recently the practice of giving also a title index and summary in some other European language has unfortunately stopped. Copies are, however, being received in Britain of several other journals of special interest to physicists. *Acta Physiochimica U.R.S.S.* is similar in content to the *Transactions of the Faraday Society*, and is published almost entirely in English with occasionally a paper in French. Each volume consists of six issues and by 1944 the nineteenth volume had been reached. The chief editor is Prof. A. Frumkin, Bolshaya Kalwzhskaya 31, Institute of Colloid- and Electrochemistry, Academy of Sciences of the U.S.S.R., Moscow. Although the *Comptes Rendus (Doklady) de l'Académie des Sciences de l'URSS.* covers all the sciences, almost every issue contains work by physicists. The journal is published about once in ten days. Articles are seldom longer than three or four pages, and they deal in either English or French with the very latest results of work in progress or just completed. The editorial address is Kazan, rue Baumann, 19. To science students of the Russian language this journal is of special interest, as it is a direct translation of the Russian edition. Both editions are received by the Science Section of the S.C.R., 98 Gower Street, London, W.C.1. Although the *Bulletin de l'Académie des Sciences de l'URSS., Série Physique* is published in Russian, a short abstract in English of each paper is given in the earlier volumes. By 1943, this practice had stopped, presumably owing to war difficulties.

The most complete sets of journals are to be found in the national libraries of the Patent Office, the British Museum and the Science Museum, and in the private library of the Royal Society. The British Museum has a list, which can be seen in the Reading Room, of scientific and technical periodicals received from the U.S.S.R. during 1933–42. A similar ASLIB list is out of print, but can be seen at 31 Museum Street, London, W.C.1. Perhaps the fullest abstracting service from Russian journals is that of the *Chemical Abstracts* of the United States. The fullest card-index of the present whereabouts of any particular number of a journal is that of ASLIB. This card-index is of great value to the research worker as it covers all the main libraries of the country. At present, no one library has a complete run of any current Russian journal. An index of each separate *number* is therefore essential, and the ASLIB index is kept up to date in step with the information supplied by the separate libraries.

A note may be added on transliteration. At least four different systems are in use in the London libraries, and even the Academy of Sciences has not yet reached uniformity, for Prof. Kapitza's name is spelt

differently in two different journals. When the controversial symbols occur in the middle of a word no harm is done. A state of affairs in which an author's name may occur under *c* in one index and *t* in another is, however, very confusing. Research workers who do not read Russian would find it well worth the small effort needed to learn the Russian alphabet and system of transliteration for, in physics at least, many of the technical terms can be recognized as soon as they are transliterated even without the use of a dictionary. Mathematics, tables of results, graphs, diagrams and photographs can therefore be recognized from the captions, which usually involve little grammatical construction. A technical English-Russian dictionary is available (by A. E. Chernukhin, State Theo. Tech. Pub. House, Moscow, 1934), but no Russian-English technical dictionary has been published. There is at present no technical Russian grammar. The writer wishes to thank the authorities named for help in collecting the above data, and would be grateful to receive additional information or corrections of errors for which he is alone responsible. W. H. GEORGE.

POST-WAR UNIVERSITY PROBLEMS IN THE UNITED STATES

THE report of the president of Harvard to the Board of Overseers is always an important document. On this occasion[1] it is perhaps more so than usual, because Dr. J. B. Conant reviews the part that ought to be played by universities in the demobilization period, and he gives an account of the Harvard proposals. British universities have been facing similar problems, and no doubt much can be gained by a consideration of what universities in the United States are proposing to do. There will always, of course, be some differences that originate from differences of outlook and position.

During the past year, Harvard has evolved the general outline of its programme, and though designed for the period of large-scale demobilization, it is equally applicable to the earlier intervening period when the number of 'veterans' is not likely to be large. Two considerations directed the planning. The first was to provide several opportunities each year for returning soldiers to enter the university without having to wait for the commencement of the next academic year; and the second was to shorten the total time necessary to complete the educational rehabilitation. Both of these are worthy considerations, though they should be regarded as essentially post-war measures and not ones that would normally be desirable under peace-time conditions. In order to achieve these ends the College and the Graduate School of Arts and Sciences will have two terms of sixteen weeks and one of twelve, and a returning soldier will be able to enter at the beginning of any one term.

Dr. Conant remarks that there is little or no enthusiasm for such a programme as a permanent basis, but he does express the opinion that it is an improvement on the old pre-war 32–34-week two-term academic year.

Harvard's present 48-week academic year has produced signs of strain in the student body, and no doubt similar strains have been evident in student bodies of British universities, especially during the last four years. It would appear that Dr. Conant considers that a 38–40 week academic year is about the most suitable, because instruction is not too long nor too intensive, and there is time for reading (especially since a reading period of two weeks prior to the examinations is probably included). This contrasts with the Oxford and Cambridge year of about 24 weeks, where instruction has perforce to be intensive and the student lives in a whirl from the moment he comes up to the time he goes down. In other universities in Britain the academic year is somewhat longer and the pressure is probably not so great. The length of the academic year would seem to be a problem that should have some reconsideration in the light of present-day conditions of living.

Turning to problems of admission, Dr. Conant rightly issues a warning lest academic formalities and institutional rigidity drive away men with ambition and imagination. This is probably one of the greatest post-war problems facing the universities, and it will require all the tact and understanding of those who are called upon to deal with the ex-servicemen.

There are two other items in this report that merit attention. The first concerns the appointment to life positions on the various faculties. Naturally a university tries to secure the very best qualified men; but this is by no means easy as one may see from a study of the staff roll of any university. How far a proper solution has been found can be gauged by Dr. Conant's comment, "that nine times out of ten the normal forces working within any special segment of the University make for a good appointment, but against an excellent appointment. And it was President Lowell who said, 'the surest way to ruin a University faculty is to fill it with good men' ". This is an important truth which universities would do well to bear in mind, and it may be that new systems for making permanent appointments need to be evolved.

The second item, which should be heartily endorsed in Britain, is a suggestion that not too long after the War a comprehensive picture should be placed before the American public of the part played by the respective universities in the war effort, "For such a picture would go far towards fortifying the faith of the nation in its institutions of advanced learning". Britain has really only begun to appreciate the value of the universities during the War, and a justification of their immediate enlarged monetary demands could perhaps be better appreciated by the general public if some similar picture of their war effort were to be presented. Beautifully illustrated brochures have been produced showing what the Navy, Army and Air Force have achieved during certain phases of the War. Could not a statement be issued showing the work of the universities? Here, however, a word of warning is necessary, and one cannot do better than conclude with Dr. Conant's own words: "if the story is told piecemeal and the approach is in a spirit of aggrandizement of a particular University and the claiming of a large measure of credit for this or that discovery or participation in this or that military operation, the public will soon sicken of the tale . . . the less glorification of the activities of the home front the better. What is said must be couched in terms of humility if it is to harmonize with the spirit of sacrifice and valour of those who bore the burden of actual combat".

V. J. CHAPMAN.

[1] Harvard College. Report of the President, 1943–44.

FORTHCOMING EVENTS

Monday, June 25

FARMERS' CLUB (at Kingsway Hall, Kingsway, London, W.C.2), at 2.45 p.m.—Mr. J. Turner: "International Co-operation in Agriculture".

ROYAL GEOGRAPHICAL SOCIETY (at Kensington Gore, London, S.W.7), at 3.0 p.m.—Annual General Meeting.

Tuesday, June 26

ROYAL ANTHROPOLOGICAL INSTITUTE (at 21 Bedford Square, London, W.C.1), at 2 p.m.—Annual General Meeting. Prof. J. H. Hutton: "Problems of Reconstruction in the Assam Hills".

QUEKETT MICROSCOPICAL CLUB (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 7.30 p.m.—Mr. F. E. J. Ockenden: "Polarized Light".

Wednesday, June 27

ASSOCIATION OF AUSTRIAN ENGINEERS, CHEMISTS AND SCIENTIFIC WORKERS (NORTHERN BRANCH) (at Austria House, 260 Oxford Road, Manchester), at 7 p.m.—Dr. M. Ruhemann: "Low Temperature Physics".

Thursday, June 28

LONDON MATHEMATICAL SOCIETY (at the Royal Astronomical Society, Burlington House, London, W.1), at 3 p.m.—Mr. A. S. Besicovitch, F.R.S.: "The Problem of the Area of a Surface".

Friday, June 29

PHYSICAL SOCIETY (at the Royal Institution, Albemarle Street, London, W.1), at 5 p.m.—Prof. Ragnar Granit: "The Electrophysiological Analysis of the Fundamental Problem of Colour Reception" (Thomas Young Oration). Members of the Colour Group of the Society, and members of the Physiological Society are invited.

INSTITUTION OF CIVIL ENGINEERS (Great George Street, Westminster, London, S.W.1), at 5.30 p.m.—M. Demaret, president of the Société des Ingénieurs Civils de France, on the general activities of French engineers under the German occupation.

Saturday, June 30

ASSOCIATION FOR SCIENTIFIC PHOTOGRAPHY (at the Alliance Hall, Westminster, London, S.W.1), at 2.30 p.m.—Mr. H. White: "Make the Photograph tell a Story".

APPOINTMENTS VACANT

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

LECTURER IN PHYSIOLOGY to standard of Ph.C. and B.Pharm., and a LECTURER IN GEOGRAPHY able to take work to the standard of the B.A. Honours and B.Sc. Special Examinations of London University—The Registrar, Portsmouth Municipal College, Portsmouth (June 27).

INSTRUCTOR (full-time) qualified to teach ELEMENTARY ENGINEERING, WORKSHOP PRACTICE, and the Care of Agricultural Machinery to members of Young Farmers' Clubs—The Chief Education Officer, County Offices, Chelmsford (June 30).

ASSISTANT LECTURER IN AGRICULTURAL ECONOMICS—The Registrar, University College of Wales, Aberystwyth (June 30).

ASSISTANT LECTURER IN PHYSICAL AND INORGANIC CHEMISTRY—The Acting Registrar, Queen Mary College, c/o King's College, Cambridge (June 30).

ASSISTANT LECTURER IN BOTANY—The Registrar, The University, Manchester, 13 (June 30).

SUPERVISOR AND MANAGER OF THE EXPERIMENTAL FARM, East Malling Research Station, near Maidstone, Kent—The Secretary (June 30).

INSPECTOR OF MACHINERY IN MINES AND FACTORIES, Government of Northern Rhodesia—Ministry of Labour and National Service, Central (T. and S.) Register, Room 5/17, Sardinia Street, London, W.C.2, quoting C.2612.A (June 30).

AGRICULTURAL TRAINING OFFICER to the Cheshire War Agricultural Executive Committee—The Executive Officer, Reaseheath, Nantwich, Cheshire (June 30).

UNIVERSITY DEMONSTRATOR IN ENGINEERING—Dr. R. D. Davies, Secretary of the Appointments Committee, Engineering Laboratory, Cambridge (July 2).

LECTURER IN GENERAL ENGINEERING SUBJECTS, and a LECTURER mainly for ENGINEERING MATHEMATICS at all stages—The Registrar, Merchant Venturers' Technical College, Bristol, 1 (July 4).

ASSISTANT ENGINEERS for the Iraqi State Railways—The Ministry of Labour and National Service, Appointments Department A.9, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, quoting C.2520.A (July 6).

LECTURERS (2) IN THE DEPARTMENT OF PHYSIOLOGY—The Secretary, The University, Aberdeen (July 7).

ENGINEER AND SURVEYOR to the Isle of Wight Rivers Catchment Board—The Clerk to the Board, County Hall, Newport, I.O.W. (July 7).

HEAD OF THE DEPARTMENT OF PHYSICS AND DIRECTOR OF THE LABORATORIES in the College of Technology—The Director, College of Technology, Manchester 1 (July 9).

DIRECTOR OF SIGNALS AND RADAR DEVELOPMENT in a Government Department—The Ministry of Labour and National Service, Appointments Department, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, quoting D.1281.A (July 10).

SUPERINTENDENT POSTS (4) in a Government Research Establishment—Post 1 (Reference No. C.2656.A) candidates should be well qualified in PHYSICS with a knowledge of Mechanical and Electrical Engineering and a wide experience in research work; Post 2 (Reference No. F.4376.A) candidates should be well qualified in the CHEMISTRY AND PHYSICS OF EXPLOSIVES and should have experience in the handling and filling of explosive stores: Post 3 (Reference No. F.4377.A) candidates should have a wide knowledge of PHYSICS and PHYSICAL CHEMISTRY with considerable experience in research in one of these subjects; Post 4 (Reference No. A.943.A) candidates should possess high academic qualifications in APPLIED MATHEMATICS or MATHEMATICAL PHYSICS and considerable experience of theoretical research—The Ministry of Labour and National Service, Appointments Department, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, quoting the appropriate Reference No. (July 10).

CHIEF ENGINEER in a Government Establishment dealing with the design of Armaments—The Ministry of Labour and National Service, Appointments Department, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, quoting C.2657.A (July 11).

Grade II(b) LECTURER IN MECHANICAL ENGINEERING—The Secretary, The University, Birmingham, 3 (July 31).

DIRECTOR OF THE INSTITUTE FOR RESEARCH IN AGRICULTURAL ECONOMICS, University of Oxford—The Registrar, University Registry, Oxford (August 4).

SECRETARY TO THE INSTITUTION OF NAVAL ARCHITECTS—Council of the Institution, 10 Upper Belgrave Street, London, S.W.1 (August 31).

ASSISTANT IN THE DEPARTMENT OF CHEMISTRY, with special knowledge of Physical or Inorganic Chemistry—The Secretary, The University, Aberdeen (October 1).

TOBACCO EXPERT as head of the Agricultural Section of the Director ate General of Tobacco Monopoly of the Government of Iraq, to improve varieties grown and study picking, drying and packing, and able to carry out experimental work on the selection of seed and soil—The Ministry of Labour and National Service, Appointments Department, Sardinia Street, London, W.C.2, quoting O.S.873.

WARDEN AND ASSISTANT LECTURER IN AGRICULTURE at the Kent Farm Institute, Sittingbourne, Kent—The Principal.

CIVIL, MECHANICAL AND ELECTRICAL ENGINEERS in the Colonial Engineering Service—The Director of Recruitment (Colonial Service), 15 Victoria Street, London, S.W.1. or the Ministry of Labour and National Service, Room 5/17, Sardinia Street, London, W.C.2, Appointments Dept. A.9.

GENERAL AGRICULTURAL OFFICERS and also SPECIALISTS IN PLANT PATHOLOGY, GENETICS, etc., for service overseas in the Colonial Agricultural Service—Director of Recruitment (Colonial Service), 15 Victoria Street, London, S.W.1, or Ministry of Labour and National Service, Room 5/17, Sardinia Street, London, W.C.2, Appointments Dept. A.9.

A PROFESSOR OF CIVIL ENGINEERING, and a PROFESSOR OF MECHANICAL ENGINEERING at Canterbury University College, Christchurch, New Zealand—The Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1.

TEACHER OF MECHANICAL ENGINEERING SUBJECTS, and a TEACHER OF ELECTRICAL ENGINEERING SUBJECTS qualified to teach both A.C. and D.C. to National Certificate standard—The Principal, Technical College, Talbot Road, Stretford, Lancs.

GRADUATE TEACHER FOR CHEMISTRY, and a GRADUATE TEACHER FOR MECHANICAL ENGINEERING SUBJECTS—The Principal, Cumberland Technical College, Workington.

PHYSICIST to the Stoke-on-Trent Regional Radium Centre—The House Governor, North Staffordshire Royal Infirmary, Stoke-on-Trent.

GRADUATE MISTRESS FOR BIOLOGY—The Principal, County Secondary School, Workington, Cumberland.

LECTURER IN GEOGRAPHY, and a LECTURER IN SOCIOLOGY, at the Portsmouth Training College—The Registrar, Municipal College, Portsmouth.

ASSISTANT MASTER IN THE JUNIOR TECHNICAL SCHOOL, qualified to teach Science and Mathematics—The Principal, Royal Technical College, Salford.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Conference of Nature Preservation in Post-War Reconstruction. Memorandum No. 3: Report by the Nature Reserves Investigation Committee—Nature Conservation in Great Britain. Second edition. Pp. vi+25. (London: Society for the Promotion of Nature Reserves, British Museum (Natural History), 1945.) 6*d*. [26

Programme of Leave Course on the British Police System for Members of the Allied Forces. Arranged by Chief Constable of Southampton and the British Council, at Southampton Police Headquarters. Pp. 12. (London: British Council, 1945.) [26

Careers for Men and Women: a Brief Summary of Professional Opportunities Open to Service Personnel and War Workers. Pp. iv+28. (London: Ministry of Labour and National Service, 1945.) [56

Other Countries

Smithsonian Institution. War Background Studies No. 21: The Aleutian Islands; their People and Natural History, with Keys for the Identification of Birds and Plants. By Henry B. Collins, Jr., Austin H. Clark and Egbert H. Walker. (Publication 3775.) Pp. iv+128+21 plates. Miscellaneous Collections, Vol. 104, No. 9: On the 27·0074-day Cycle in Washington Precipitation. By C. G. Abbot. (Publication 3800.) Pp. 2. Miscellaneous Collections, Vol. 104, No. 10: Influence of Various Substances on Sugar Determination by Copper and Ferricyanide Reagents. By Robert L. Weintraub and Leonard Price. (Publication 3801.) Pp. 20. (Washington, D.C.: Smithsonian Institution, 1945.) [195

Reports of the Biochemical Research Foundation of the Franklin Institute. Vol. 7, 1942–1943. Pp. 294. (Newark, Del.: Biochemical Research Foundation, 1945.) [195