NATURE

No. 3916 SATURDAY, NOVEMBER 18, 1944 Vol. 154

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Editorial and Publishing Offices
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.
Telephone Number: Whitehall 8831
Telegrams: Phusis Lesquare London

The annual subscription rate is £4 10 0, payable in advance, Inland or Abroad.

A COLLEGE OF AERONAUTICS

AN Interdepartmental Committee on the Establishment of a School of Aeronautical Science was set up in October 1943, under the chairmanship of Sir A. H. Roy Fedden, who had just returned from a mission to the United States, where he had studied, among other matters, the system of aeronautical education in that country. The members of the committee dealing with the scheme were Sir A. H. Roy Fedden (chairman); Sir Alan Barlow, Treasury; Commdr. M. S. Slattery, Admiralty; Mr. W. P. Hildred, Air Ministry; Air Marshal Sir Ralph Sorley, Ministry of Aircraft Production; Sir John Stephenson, Dominions Office; Dr. W. Abbott, Ministry of Education; Sir Charles Darwin, Department of Scientific and Industrial Res arch; Sir B. Melvill Jones, Aeronautical Research Committee; and Sir Walter Moberly, University Grants Committee. Detailed memoranda and oral evidence were given by representatives of the various interests concerned, a list of which is added to the report*.

The Committee's report states that the object of the suggested college should be to provide a high-grade engineering, technical and scientific training in aeronautics for selected students to fit them for leadership in the aircraft industry, civil aviation, the Services, and for education and research. Sir Stafford Cripps, Minister of Aircraft Production, has already stated, in the House of Commons, that the Government accepts the report in principle and that the Air Ministry is making temporary accommodation available. It is understood that this is to be at Abingdon Aerodrome, Oxfordshire. The cost of this adaptation is likely to be about £150,000, with an additional £300,000 for equipment. The complete scheme, which it is suggested should be situated at either Aldermaston in Berkshire or Dunsfold in Surrey, will cost £2,610,000, with an annual upkeep of £380,000. About £150,000 would also be needed for removing and adapting apparatus from the temporary to the permanent site, and this must be regarded as an expenditure justified by the urgency of the need for starting the scheme at once.

While the efficient use of any applied science by industry must depend upon a continuous flow of scientifically trained entrants, the aeronautical world makes an even greater demand in that its new men need a more comprehensive training. They must be scientific men first, probably either physicists or engineers, and then be further trained in the technology of the application of their science to aeronautics. This is particularly true of engineering, where many problems arise that are peculiar to aircraft and aero-engine design and construction. Education has its own need as well. Facilities for obtaining the more elementary and technological training need to be much more widely spread over the country than they are at present. Such courses will be able to give the shorter theoretical and more practical training to those needing only this, in their own localities, and

* Ministry of Aircraft Production. A College of Aeronautics: Report of the Interdepartmental Committee on the Establishment of a School of Aeronautical Science. Pp. ii+98. (London: H.M. Stationery Office, 1944.) 2s. net.

will also provide a suitable flow of candidates to the proposed college, as well as to the universities. The Ministry of Education is already preparing plans for such courses in many of the local technical colleges and institutions, under extensions of the National Certificate scheme, and some of the universities are considering the question of undergraduate courses in aeronautics and aeronautical engineering.

Many of the Dominions, India, and the Colonies are moving in this matter, and it would serve a double purpose if they also encouraged their students to attend a central establishment in Britain for the completion of their training. All such schemes will form a reservoir from which the best men can be drawn to proceed to a higher education such as this college will provide.

The report also says: "We believe that progress will now depend less on the genius and resource of individuals and more on the organized investigation and experimentation of trained workers working in teams and using large-scale equipment. If so, then the College is essential to the future of the industry." This postulates a further outlook for such a scheme. It will train research workers and produce results of a kind that will be different from, and will not in any way trespass upon the province of, the accepted type of research establishment.

Another aspect that has never received sufficient attention in the past is the more scientific aspect of flight and flying operations. Such problems have come within the province of the Fighting Forces up to the present, and have presumably been investigated by them within their own organizations. The coming of long-distance transport, with its possibilities of stratosphere operation, bring problems for the physicist, engineer, flying operator and the pilot that can only be properly solved by teams of workers, some of whom are pilots trained in the more scientific aspects of flight, working in an atmosphere of experimentation such as would be found in a college of the kind proposed.

The principal function of this college will be to provide a two-year advanced training in aeronautics for about fifty students. It is suggested that they should be of university graduate standard, with at least one year of works experience, although it is emphasized that the possession of a degree should not be considered to be essential.

Shorter courses of a more specialized nature, either to provide training for administrators who do not require complete technical knowledge, or as refreshers for men already engaged in the profession, are contemplated, up to the numbers of a further two hundred students.

The syllabus will contain five main subjects: aerodynamics; aircraft structures, engineering and design; aircraft equipment; engines and systems of propulsion; production, administration and maintenance. Flight and operations will be included, embracing full-scale experimental work and flight testing.

The teaching and experimental work will be in the hands of a professor with a suitable permanent staff in each of the five branches. Specialist subjects can best be dealt with in short courses by visiting lecturers, who are engaged on that work professionally, possibly with the assistance of some of the permanent staff from the point of view of the technique of teaching. The short courses will obviously be principally of this class of lecture, while the full two-year course will have more of the fu damental science type of teaching, with a judicious mixture of specialist work. It is hoped to combine some appropriate experience in flying and flight conditions with all the courses. The establishment will naturally be in the hands of a principal with the necessary administrative staff; advised by a governing body representing the aircraft industry, the universities, the Government and Service departments, the Dominions and the Royal Aeronautical Society.

The report suggests that the college should be placed under the Ministry of Education for administration purposes, which would be given a special vote for its expenditures. It is also hoped that a Royal Charter would be granted.

The equipment of such a school will be large and expensive, and will need careful thinking out if it is not to lose its usefulness through obsolescence in a comparatively short time. It will need to be chosen to illustrate basic principles rather than to compete in modernity with the latest equipment of a professional research establishment. For example, wind-tunnels, which would inevitably be the principal equipment of the aerodynamics section, always tend towards greater 'Reynolds' number', which is obtained by a combination of increases in size, wind-speed and internal pressure. All these inevitably add to the complication of the apparatus, the rate at which experiments can be carried out and the cost. It is more than likely that all these points would make a high Reynolds' number tunnel unsuitable for demonstrating the principles of aerodynamics to students. The measurement of a force by the simple counterpoising of it by a weight is so much more obvious than, say, balancing it by an electric solenoid where the reading merely becomes a figure on the dial of a measuring instrument. The report suggests a battery of smaller tunnels, and one of higher speed for the more advanced work appropriate to the college.

For aircraft design the equipment will be mostly testing machines and rigs for the investigation of strengths of structural components. It is recommended that one slow-speed general-purpose wind tunnel be provided here, of sufficient size to accommodate full-size aircraft parts. The provision of this will avoid interference with the programme of work in the aerodynamics section. Aircraft equipment will probably need a multitude of small items appropriate to the testing and development of instruments, electrical, and electronic work in general.

Engines and systems of propulsion will demand a good deal of equipment to cover the work. Reciprocating engines will need facilities for tests on both single-cylinder research units and complete engines up to the largest sizes. Gas turbines must also be investigated, although in the present state of knowledge of these it is difficult to foresee just what equipment may ultimately be necessary. Test rigs will be needed for problems in the development of super-charging,

carburation, ducting, propellers, accessories, and for tests on fuels and oils.

'Production and materials' will need typical workshops sufficiently equipped for students to fabricate such parts as they may be investigating, a standards room and an inspection department. The metallurgical outlook, both practical and theoretical, will need special equipment covering chemistry, metallography, crystallography and plastics.

'Flight and operations' will obviously call for an aerodrome with the usual facilities, and a fleet of aircraft of various types. Using aircraft as flying laboratories requires a very well-equipped maintenance workshop with the right type of personnel, and a comparatively large fleet of machines to ensure continuity of demonstration.

In putting forward this scheme, the aeronautical world has given a lead that might well be followed by many industries that make use of applied scientific and technical knowledge. It is becoming increasingly evident to-day that there is a distinct gap between the end of a scientific university type of training, and a correspondingly responsible position in the appropriate profession. Some postgraduate training is necessary, of an advanced technical nature, rather different from the specialized research which is the only work the universities offer at present to postgraduate students. It is obvious that such training can best be given in a school, properly equipped and staffed by teachers who are specialists both in education and the appropriate professional work. Such students need to take the telescopic rather than the microscopic view of their technology. It is not too much to hope that this school will prove to be the forerunner of many others in various industries.

It is a pity that no situation nearer the centre of London could have been found. The technology of aeronautics is so closely related to the various societies which are all established in the heart of London that a situation within say the orbit of 'London Transport' would have seemed almost a necessity. There are still one or two large R.A.F. aerodromes within this range that will surely be made redundant in peace-time by the increasing speed and range of modern service aircraft.

Probably the greatest difficulty that the Ministry of Education will meet in the administration of this college will be to find the necessary teaching staff. It must be realized, as is appreciated by all educationists, that there is something in the art of teaching, and that the man who may be an acknowledged expert on his subject is not necessarily the best to impart that knowledge to a class of students. The reservoir from which such men can be drawn at present must be extremely limited.

The Government has shown considerable courage in embarking upon this scheme at a time when the ending of the War must create a period of uncertainty in the aircraft industry. It is to be hoped that those who control the world of aircraft and aero-engine design and construction will find themselves able to take as long a vision, and provide employment for such students, with both duties and salary in keeping with the training that they have undertaken.

PROGRESS OF PLANT VIRUS RESEARCH

Plant Viruses and Virus Diseases

By F. C. Bawden. (A New Series of Plant Science Books, Vol. 13.) Second entirely revised edition. Pp. xiv+294. (Waltham, Mass.: Chronica Botanica Company; London: Wm. Dawson and Sons, Ltd., 1943.) 4.75 dollars.

IT is just over half a century since the discovery of the first virus, that of tobacco mosaic, and it is perhaps fitting that during the last ten years it is the study of this virus which has yielded such fruitful results. There are, however, some outstanding questions which need to be answered concerning viruses and particularly plant viruses. First and foremost perhaps, as suggested by Mr. Bawden, there is the behaviour of viruses in their natural environment, the cells of the host. In other words, how do viruses multiply? This aspect may, as the author hopes, provide the next great advances in knowledge of the subject. Let us hope so too, but it is such a fundamental study that one cannot see at present just how it is to be tackled.

Then there is the puzzling subject of the relationship between viruses and insects, very clearly and succinctly discussed in this book. Is there really an intimate relationship between the two, and do plant viruses actually multiply inside their insect vectors? Or is the whole question merely one of particular feeding methods whereby the virus is introduced into the right plant tissues, and of particular anatomical conditions in the insect which must be fulfilled to permit of adequate virus storage? All these questions need answering, and although we have a mass of data concerning insects and plant viruses, we really know very little about their relationships.

Then take the question of the origin of viruses dealt with in Chapter 16. The author cites the paracrinkle virus present in all King Edward potatoes, also recently discussed in *Nature*[1], and suggests that it is possible that viruses may have arisen, only to disappear with the death of their host plant. Presumably, however, if such viruses can be transmitted by insects, they would be spread to other plants and a new virus disease would be perpetuated. Unfortunately, or perhaps fortunately, so many of the new viruses which do come to light are not apparently insect-borne.

There is no doubt that previously undescribed viruses do appear in plants, even under controlled conditions, and these would undoubtedly have been lost again if they had not been carefully propagated by artificial means. There is the interesting case of tomato bushy stunt virus, which suddenly appeared in a few tomatoes in the Bristol area and one or two other localities in 1935 and then disappeared again completely until the summer of this year, when it was re-discovered affecting tomatoes near Worcester. No insect vector has ever been discovered for this virus nor has it been found occurring naturally in any other host plant. Incidentally, this virus was first purified as true three-dimensional crystals by the author and N. W. Pirie, and the purification of viruses and the properties of purified virus preparations are well discussed in Chapters 8, 9 and 10.

The author has made a special study of the serological reactions of plant viruses, and he discusses this aspect very thoroughly in Chapter 7. He also advocates in Chapter 14 a classification of plant

viruses based on their serological relationships, in a severely critical review of present systems of nomenclature and arrangement. Undoubtedly a classification of viruses based on some such scientific basis as serological relationships would be ideal. Unfortunately the fact that a very large number of viruses cannot at present be studied by serological methods renders such a classification for the time being purely academic.

Mr. Bawden is to be congratulated on a very good book which presents an authoritative survey of the present status of plant virus research.

KENNETH M. SMITH.

[1] *Nature*, 154, 164, 334 (1944).

INORGANIC NUTRITION OF PLANTS

Lectures on the Inorganic Nutrition of Plants

(Prather Lectures at Harvard University.) By Prof. D. R. Hoagland. (A New Series of Plant Science Books, Vol. 14.) Pp. xii+226 (28 plates). (Waltham, Mass.: Chronica Botanica Company; London: Wm. Dawson and Sons, Ltd., 1944.) 4 dollars.

THE present volume embodies the texts of seven lectures, five of which were originally delivered at Harvard University under the Prather Lectureship. It is fortunate that these lectures have been printed, for this is undoubtedly a valuable contribution to the literature of the subject. It carries, of course, the limitation of the form of presentation. Prof. Hoagland explains in the preface that "this small volume cannot have any of the characteristics of a monograph or a text"—and such it has not. But it does provide a discursive survey of a field of investigation in which cohesion is frequently obscured by the rich variety of topics that the subject is commonly held to embrace, and in which, therefore, such a survey is particularly valuable.

The variety of content probably makes the subject difficult to discuss comprehensively, and to this, no doubt, must be attributed the fragmentary character of the discussion. But the difficulty is not relieved by the particularly generous view that the author takes of the implications of the term 'inorganic nutrition of plants'. The book begins with a discussion of soil conditions in relation to nutrient absorption, deals then with micronutrient elements, the absorption and accumulation of salts by plant cells, the translocation of inorganic solutes, exudation and root pressure, the growth of plants in artificial media, the relation of salt absorption to organic acids, and concludes with a chapter on potassium nutrition. In different connexions extensive reference is made both to the crystalline structure of soil colloids and to the synthesis of amino-acids. Inevitably within a text which is restricted to a hundred and eighty small pages of comparatively large print, the treatment of even the majority of these topics cannot be extensive, and must, in many instances, be unduly cursory. Moreover, in certain connexions the emphasis is unusual. The metabolic significance of potassium, nitrogen and zinc receives considerable attention, but there is little discussion of, for example, phosphate nutrition; and whereas the effects of individual elements are described, the interaction of the several nutrients in metabolism and growth is not treated in any detail.

These criticisms, however, are in any event not important, and may be irrelevant, since Prof. Hoagland writes: "the assumption was made that in lectures of the present type and objective the writer should emphasize the work with which he has had most direct contact". That work represents a distinguished body of contributions, and the prominence that it receives necessarily emphasizes certain recent important developments both in the elucidation of the mechanisms of well-recognized phenomena, and in the elaboration of new techniques. The author and his school have devoted considerable attention to the processes of salt absorption, accumulation and translocation, and in relation to these the importance of the metabolic situation is developed in some detail; the particular implications of absorption from the soil are discussed; and valuable summaries are provided of the results of investigations based on the use of radioactive isotopes as tracers.

The text is adequately illustrated with figures and plates; it is also supplied with a number of tables which are difficult to decipher, the print and numerals being distressingly minute. Otherwise the print and lay-out are admirable.

R. BROWN.

LOCAL GOVERNMENT FINANCE

The Problem of Valuation for Rating

By J. R. Hicks, U. K. Hicks and C. E. V. Leser. (National Institute of Economic and Social Research, Occasional Papers No. 7.) Pp. vii+96. (Cambridge: At the University Press, 1944.) 7*s*. 6*d*. net.

THIS paper is the second part of a study of the incidence and effects of local government taxation, the first part of which, "Standards of Local Expenditure", has already appeared and the third of which will round off and complete a work of great interest and considerable importance for those who are, or shall be, occupied in local planning and reconstruction. It may well be the most significant of the three; for it examines and discusses the key problem of local finance—the variation in the burden of rates from one area to another due to the absence of uniformity in the standards employed for valuing rateable property. It is an old problem, the essentials of which were being studied by a Departmental Committee on Valuation for Rating set up in 1938 which had not completed its task at the outbreak of war. The authors were fortunate in having been permitted access to returns collected for the use of this Committee. They are, in consequence, able to offer reliable evidence confirming conclusions hitherto based on surmise or impression only.

Briefly, the conclusions are that rating valuations are inaccurate, that, therefore, they are not an index of the true wealth of an area, and the anomalies resulting from this stand in the way of effective assistance by means of grants to the poorer areas. As at present administered, rates are a bad tax. On the other hand, their abolition and replacement by an alternative would involve a fundamental alteration in the whole basis of local government. This is not practical; but some measure of reform is imperative, and a beginning might be made with the regularization of the assessment of rateable values. It is generally understood that the Rating and Valuation Act of 1925 had this, among other aims, in view; but the uniformity in valuation practice which was anticipated was not realized. In 1938,

thirteen years later, the condition in this respect could only be described as chaotic. The remedy suggested is the transference of the responsibility for valuation to a central authority which, helped by a court of appeal, would in the course of time evolve a national code of rules. The authors proceed to examine the difficulties that would arise in any attempt at speedy reassessment from the fact that, under the present law, rates vary nearly proportionately with gross values and that, to prevent them from falling on the poor to an extent felt to be intolerable, there is under-assessment of 'poor' houses in comparison with 'wealthy' houses. There is also the problem arising from the prevalent tendency to value new houses at a relatively lower level than old houses. Much time would elapse before the proposed new authority could straighten out imperfections; for a new system must grow slowly.

It was not part of the authors' plan to suggest major innovations or reforms in the finance of English local government. This is to be regretted; for it is no secret that small and poor authorities are viewing with dismay the addition to the commitments threatened or imposed upon them by the new Education Act and similar measures. Rumour has it that only minor alterations in boundaries will be made as the result of government inquiries now proceeding and that the larger and wealthy areas will be left substantially untouched. It is difficult to escape the conclusion that the size and functions of local government units call for drastic revision if the present financial system is to continue.

J. G. SMITH.

FLUORESCENCE AND PHOSPHORESCENCE AND THEIR APPLICATIONS

Luminescence of Liquids and Solids

And its Practical Applications. By Peter Pringsheim and Marcel Vogel. Pp. x+201. (New York: Interscience Publishers, Inc.; London: Imperia Book Co., Ltd., 1943.) 4 dollars.

THE study of luminescence, particularly the luminescence of solids, has undergone profound changes during the last ten years. Before that time, knowledge of energy states and energy transfers in the liquid and solid states was exceedingly meagre; the subject of luminescence as a whole had a very uncertain theoretical basis. The recent advances have perhaps been more striking in the case of solids, and this can be traced in great part to the stimulation which the subject received from A. H. Wilson's papers on semi-conductors. Almost simultaneously, some of the newer discharge lamps began to pass from the laboratory to the manufacturing stage. The new mercury discharge lamps were at once a challenge to those interested in the luminescence of solids; for the emission spectrum of these lamps contained a plentiful proportion of near ultra-violet radiation, coupled with a deficiency of emission at the red end of the spectrum. Lamp manufacturers in many parts of the world successfully met this challenge, and greatly improved techniques for the preparation of luminescent solids were developed, with results that most of us are now familiar with. At the same time the more fundamental aspects of the subject received renewed attention (see, for example, the Faraday Society's Discussion on Luminescence, 1938), and it was clear that the subject was emerging from a period of empirical research previously dominated by the Lenard school, and documented, for example, in vol. 23 of the "Handbuch der Experimental Physik".

Prof. Pringsheim is well known for his original work on the fluorescence of liquids and vapours, and also for his earlier book "Fluorescenz und Phosphorescenz", the third edition of which was published in 1928. This book undoubtedly gave the best available physical approach to the subject, but from the modern point of view it was sadly out of date, and scarcely comprehensive. The present reviewer had hoped that the new work by Pringsheim and Vogel would in effect be a completely revised edition of the earlier German monograph. In this it must be confessed he is disappointed; the new volume is a popular exposition of the subject, and particular emphasis is laid on the applications. Within these self-imposed limits, the authors have produced a useful survey for the general reader; it cannot be said that the book will add much to the knowledge of specialists.

The first part of the book is concerned with the physics of luminescence. After a brief introduction to the historical and theoretical aspects of the subject, experimental technique, materials and their properties are considered at length. A chapter is also devoted to the rapidly growing subject of fluorescence analysis. Fluorescent paints and screens for various purposes are also considered, but some of the later illustrations are more reminiscent of the cheaper type of commercial brochure than would have been anticipated from the hands of the senior author. Figs. 56, 57 and 59 give, respectively, external views of a cathode-ray tube, a television receiver and an electron microscope; they do not appear to serve any particularly useful purpose.

It is to be hoped that Prof. Pringsheim will now write the book we have been waiting for.

J. T. RANDALL.

GERMANO-POLISH PROBLEMS

Teuton and Slav on the Polish Frontier

A Diagnosis of the Racial Basis of the Germano-Polish Borderlands and Suggestions for the Settlement of German and Slav Claims. By Lt.-Col. G. R. Gayre. Pp. 76+18 plates and 41 maps. (London: Eyre and Spottiswoode (Publishers), Ltd., 1944.) 8*s*. 6*d*. net.

LIEUTENANT-COLONEL GAYRE has written a short study of the Germano-Polish problem in terms of physical and social anthropology. He has sought indeed to give as much information, explanation and comment by means of cartography as through the letterpress, since the book has more than forty maps and diagrams.

Some of the cartographical material is interesting in that the work of foreign scholars has been reproduced for the benefit of English readers for the first time. Some maps, however, are spoiled by the form of reproduction, for example, Nos. 4, 5, 16 and 31, in which the type of the place-names and legend has been reduced so much that the result is illegibility.

The descriptions of geographical background, of the physical characteristics of the peoples concerned, and of their culture, are not without interest, nor

are the final comments on possible post-war frontiers. But the reader who has had the opportunity of studying the Germano-Polish question is left at the end with a feeling of disquiet. He has the impression that factual information has been chosen to make yet another theory on the vexed problem of Central Europe, but that even an outline tale has not been told in proportion. Any account of the Germano-Polish settlement areas, for example, should contain much more emphatic comment upon the loess strip between the Hercynian Highlands and the glacial plain than is present in Lieutenant-Colonel Gayre's study. Moreover, the story of Teuton-Slav relations is incomplete from the point of view of the anthropologist without some treatment of the migrations of the Dark Ages. It is misleading to take it up at the stage when the peoples of Central and Western Europe were beginning to achieve some geographical fixity, especially when early history is made the foundation of political opinion on current events. Finally, although one may agree with the author that too great an importance was attached to linguistic divisions in the re-drawing of frontiers after the War of 1914–18, it is difficult to believe that physical anthropology is going to prove a safe guide to demarcation after the present one.

Lieutenant-Colonel Gayre makes a point at the end of his study which is worth close attention. Before the first World War the disparity between the German and Polish birth-rates was noticeable, and the greater increase of the Slavs has continued between the two Wars. The Germans may have needed *Lebensraum* in the sense of greater economic opportunity, but they wanted living space in the literal sense much less urgently than the Poles. The eager concentration of the Germans on penetration into Eastern Europe came rather from demographic unease, an instinctive dread of the multiplying Slavs, than from territorial need. The immense loss of German man-power in the present War suggests that pressure on living space in Germany will be still less, once the actual devastation of war is repaired. It remains to be seen whether the terrible destruction of life and material well-being in Poland will affect the demography of that country only temporarily or permanently.

It is scarcely the fault of the author if the development of the 'art' of war in the fifth year of this struggle makes arguments on frontier demarcation from the strategic point of view seem a little irrelevant.

H. G. STEERS.

ELEMENTARY ZOOLOGY

Animal Biology

By Dr. A. J. Grove and Dr. G. E. Newell. Second edition. Pp. viii+678. (London: University Tutorial Press, Ltd., 1944.) 16*s*.

THIS book is already well known, and young people coming to the study of zoology for the first time will find in this second edition an account of animal structure which is welded with the elementary facts about the animal's physiology and relation to the environment. The whole fascinating story is told in words which create enthusiasm and stimulate further study and reflection. Older readers who were students when morphology was the main preoccupation of zoology will appreciate this book no less. It is easy to neglect or even to deprecate the beauty and significance of animal architecture, but this book avoids this error and also the older one of emphasizing it too much. By it the beginner will be prepared for the wider conceptions of modern biology.

The changes in this new edition are mainly amplifications of certain sections and additions wherever these are necessary to bring the book up to date. An outstanding feature of the book is its excellent diagrams, which are much better than those usually found in books of this kind. Some of these diagrams have been re-drawn; others are new. Eight new photographic illustrations of the earthworm and crayfish have been added; but some readers will wish that the space occupied by these had been given to really good and characteristic photographs or drawings of the animals dealt with in the chapter on the animal's background or to a better illustration than the one of the rabbit on p. 234. These would have helped other illustrations to remind the student that a diagram is only an interpretation of living structure and not a representation of it. Captious critics may detect one grammatical error, evidently missed in the proofs, namely, "The life-histories" . . . of nematodes . . . "is frequently complicated" on p. 628. Nematoda are classified as a phylum and not as a class of the Nemathelminthes. Although their uniformity of structure in spite of their success in a wide variety of habitats is noted, their great influence on the health of man and on his food supplies entitles them, some consider, to a more adequate treatment, even in a book for the beginner, than they receive here. Nor are the paragraphs on the pathology and control of the flatworm parasites adequate.

But these are, perhaps, minor criticisms. The beginner will not go far wrong if he selects this book, especially if he adds to it, for the sake of its philosophical and physiological outlook and the illustrations designed to resemble what is actually seen under the microscope, Woodger's "Elementary Morphology and Physiology for Medical Students". But, whatever books he uses, the student should never forget the advice given in the preface to the first edition of this book, namely, that the study of the animal is the essential thing, that a living animal is better than a dead one and that a dead animal is better than no animal at all. If this book is intelligently used, the student will not come excitedly to his teacher, as he has been known to come, with the information: "There's something wrong with my rabbit; it isn't like the book".

G. LAPAGE.

ORGANIC CHEMISTRY

Principles of Organic Chemistry

By Sylvanus J. Smith. Pp. viii+570. (London: Macmillan and Co., Ltd., 1944.) 15*s*.

THE author states in the preface that the object of this book is to provide a course in organic chemistry which a student may be expected to cover in about three years from starting the subject, and hence, quite rightly, the book does not follow rigidly the syllabus of any particular examining board.

The first two chapters give a brief survey of the determination of formulæ and physical properties, together with a discussion of isomerism and the electronic theory of valency. In view of the scope of the book it is a pity that no mention is made at this stage of the phenomenon of resonance; and it is unfortunate that a misleading structural formula has

been given to the ammonium ion, which has been repeated later on (pp. 176–177) for the substituted ammonium salts.

The paraffins and their aliphatic derivatives, such as alcohols, ethers, aldehydes, ketones, fatty acids and amines, are described in the following chapters; a pleasing feature of which is the number of graphs that have been given to show the relation between the molecular weights of homologues and their melting and boiling points.

After a short description of the olefines and acetylenes and their derivatives, a fairly detailed account is given of the dibasic acids, together with derivatives such as urea, ureides and diureides. The amino-acids and proteins are discussed in the same chapter as the hydroxy and keto acids, which is not a very suitable arrangement. The ultracentrifuge method of measuring the molecular weights of proteins is described, and the theory of the method is given in an appendix at the end of the book. A detailed account of the structure of the chief carbohydrates and of the reactions of the cyanogen derivatives and organo-metallic compounds is given.

Benzene and its more important derivatives are described adequately on the whole, although the account of the resonance effect on substitution in the benzene ring is too brief to be clear.

The heterocyclic compounds are illustrated in the main by a discussion of furane, furfural, pyrrole, indole, pyridene and quinoline. The terpenes and alkaloids are described in the closing chapters of the book, which also contains logarithm tables and a good index, as well as a wide selection of questions at the end of each chapter.

One of the outstanding features of the book is the large number of structural formulæ which have been given; but it is very unfortunate that apart from a few obvious misprints, several of these formulæ are based on obsolete structures; for example, ethylene ozonide, the Grignard reagent, and penta-covalent nitrogen in alanine, glycine, betaine, sulphanilic acid, etc. In this connexion it is surprising to find that although the modern formula for the nitro-derivatives has been given, the nitro-compounds are represented for the most part by the classical penta-covalent nitrogen structure.

Another criticism is that too much space has been devoted to obsolete or semi-obsolete processes, and many reactions which are now of far-reaching importance are omitted or given scanty treatment. Thus, the manufacture of methyl alcohol from wood spirit is described prior to, and in more detail than, the carbon monoxide – hydrogen method; while it is implied that the only technical preparation of acetone is from pyroligneous acid. No mention is made of the chlorination of acetylene and the subsequent preparation of useful solvents; and the polymerization of the olefines, now of supreme industrial importance, is dismissed in three lines.

The statement (with the accompanying equations) that the formation of an alkyl halide from an alcohol and hydrogen hydracid "structurally resembles the formation of a metallic halide from an alkali:

$$C_2H_5OH + HCl = C_2H_5Cl + H_2O,$$
$$NaOH + HCl = NaCl + H_2O."$$

will make the reader rub his eyes and wonder whether the theory of the complete ionization of strong acids and bases has been discarded.

On the whole, I do not consider that this book is suitable for use as a school text-book; but portions of it may be useful to university students, provided that due regard is paid to the criticisms made above. The book is printed in clear type on paper of good quality, and the binding is excellent for a war-time publication.

A. C. CAVELL.

PSYCHIATRY FOR EVERYMAN

A Handbook of Psychiatry

By Dr. P. M. Lichtenstein and Dr. S. M. Small. Pp. 330. (London: Kegan Paul, Trench, Trubner and Co., Ltd., 1944.) 16*s*. net.

DURING the past three years, a number of books dealing with psychiatry have been published. They have all been condensed and mostly very well done. The present book by Lichtenstein and Small of New York presents the subject from a rather different aspect. It is described as "having been prepared not only for students of psychiatry, but for all those whose work brings them into contact with mentally disturbed persons". It is very well done, and will serve the purpose for which it was prepared extremely well. It will probably appeal most to the social worker and those whose work is almost entirely concerned with the mentally abnormal, but there are many relatives of those mentally disordered who might with great advantage read, mark and learn. Their attitude towards both patient, nurses and medical men might change greatly.

It is difficult to select any one chapter of the book as better done than any other. Naturally in a work so condensed and simplified it is difficult to deal adequately with subjects like psychotherapy and general principles of psychiatric therapy, but the reader will be able to realize how much progress has been made and is still being made in treatment in what is admittedly the most difficult branch of medicine.

It is a pity that in discussing the etiology of schizophrenia the authors do not mention the work of Hemphill and Reiss at Bristol on biopsy of the testicle. This work is confirming the general direction taken by the views of Mott put forward in 1922, which were afterwards rather discredited. The results of biopsy show very definite changes in the testicle. The modern view of paranoia does not accept the presence of hallucinations as part of the clinical entity. Both pellagra and beriberi are surely vitamin deficiency diseases and *not* infectious in origin.

We would like to see included under the senile disorders, Pick's disease. Alzheimer's disease is included as a pre-senile condition, and Pick's disease should be mentioned with it. It is a mistake to say that with electric shock treatment the patient has a complete amnesia after the experience. Some patients remember everything prior to the unconscious phase, and quite a few have a very decided objection to the treatment, often amounting to a definite fear.

Having regard to the amount of space devoted by the popular Press to the subject of psychosurgery, the section dealing with this most fascinating development in modern treatment might well have been considerably expanded. The mortality-rate in Great Britain is distinctly less than the 4–5 per cent quoted by these authors.

The book is well produced, very easy to read, and we recommend it heartily as an introduction to that most fascinating study—human abnormality.

G. W. T. H. FLEMING.

INTERNATIONAL STATUS OF CRYSTALLOGRAPHY, PAST AND FUTURE*

By PROF. P. P. EWALD

IN the period between the War of 1914–18 and the beginning of the present War, crystallography experienced a rejuvenation, and in its new form of X-ray crystallography it has once more attained a central position bordering on many fields of promising development. While in its early days crystallography had contacts mainly with mineralogy, geology and crystal optics, at present its most intimate links are with atomic physics, chemistry, metallography and increasingly with engineering and industrial production. In fact, crystallography is forming the background for most problems concerning the solid state of matter. Compared to its advances on the newly won ground, its recent interactions with mineralogy and geology have been rather limited, but this may change in the future. It is recognized that crystallography stands in respect to its methods nearest to physics, for it originated as a part of physics; but the most urgent present demand for its methods and data comes from chemistry.

The early spread of research on crystals from the physical to the mineralogical and chemical laboratories in the first half of the last century prevented a consolidation of crystallography as such. It became, as it were, suspended between the three dominant disciplines. Even to-day, few universities have chairs of crystallography; crystallographic instruction is mostly given in the departments of mineralogy, but the departments of physics and of chemistry usually also give the bare minimum of crystallography which is needed for applications. In no country does there exist a learned society solely for the promotion of interest in, and knowledge of, crystallography. The results of crystallographic research have to be collected from physical, chemical, physico-chemical and mineralogical journals, besides being dispersed in the publications of learned societies. This was so before the days of structural crystallography; since then, biological, engineering and industrial journals have been added to the dispersal area of crystallographic work.

Nevertheless, there is a close connexion between the various sides, pure and applied, of crystallography. The underlying laws and the methods of observation and interpretation are the same, and progress made in one field may immediately benefit problems which seem altogether remote. The determination of unknown crystalline material from geometrical, optical or X-ray observations (to be mentioned again later on) shows the application of different methods to the same end; while the application of the same method in entirely different fields of research is exemplified by the X-ray determination of particle size and shape of clays, of metals and of catalysts.

The development of other subjects has led to their segregation from their original context. Astronomy and engineering have broken away from physics; physical chemistry, bio- and colloid chemistry from chemistry; there are societies devoted to the promotion of optics and acoustics, with the corresponding journals. This process of specialization, inevitable as it seems, is sometimes deplored as a disintegration of science. Should it not rather be looked upon as the formation of a new branch on the tree of science, which conveys the sap to a region hitherto not well provided for, a branch necessary for rounding off the shape of the tree as a whole? Crystallographic research might gain much by being clearly outlined as such and by being provided for by a Crystallographic Society with its own journal.

This idea is not new, as the history of the *Zeitschrift für Kristallographie* shows. It was a hundred years of development from Romé Delisle's first correct description of crystals to the foundation of this journal. Even then, in 1877, P. Groth could not venture to devote his journal to crystallography alone, but for financial and other reasons he had to make it a *Zeitschrift für Kristallographie und Mineralogie*. Fortunately, this foundation coincided with a time of rapid development, especially of chemical crystallography, and the editor, together with the great number of his students from all countries, contributed many important crystallographic papers, thus giving the *Zeitschrift* a bias towards crystallography. Groth's interest and experience ranged wide and were full of detail. This made his abstracts of crystallographic papers from other publications critical and stimulating, and he aimed at making them detailed enough to render the study of the original papers unnecessary to most readers of the *Zeitschrift*. From these reviews and from the hundreds of checks and corrections on the reported results which he got his untiring collaborators to carry out, there arose the five volumes of "Chemische Kristallographie", a monumental summary of the first great period of crystallography.

Groth edited fifty-five volumes of his *Zeitschrift*; then, in 1921, he handed it over to P. Niggli, of Zurich. At the same time a new publisher, the Akademische Verlagsgesellschaft, acquired the *Zeitschrift*. Niggli remained chief editor until 1940; owing to his not being subjected to the Nazi *Reichsschrifttumskammer*, and owing to the international connexions of the *Zeitschrift*, it was possible to maintain for it a freedom in editing which most scientific journals in Germany had to sacrifice in order to survive.

When Niggli took over, the time had at last come when mineralogy could be dropped from the title, which now read *Zeitschrift für Kristallographie* (*Kristallgeometrie*, *Kristallphysik*, *Kristallchemie*). Many of the papers offered to the *Zeitschrift* for publication, especially crystal structure determinations, came from abroad, and often after it had been found impracticable to obtain their full publication in the overcrowded physical and chemical journals, the bulk of the readers of which were not interested in the details of the work, or even competent to judge them. The absence of journals devoted to crystallography gave rise to great inconvenience, especially in the English-speaking countries. It was therefore decided to facilitate the publication of structural work in the *Zeitschrift* by 'internationalizing' it; that is, by accepting papers in French and English as well as in German. At the same time, prominent crystallographers all over the world were asked to act as patrons by allowing their names to figure on the title page and by entrusting the *Zeitschrift* with the publication of suitable parts of their research. The liberal answer to this request, and the use to which this mode of publication was put, fully justified the action taken. It was somewhat unfortunate that the steady but slow increase in number of subscriptions

* Part of an evening lecture delivered at the meeting of the X-ray Group of the Institute of Physics at Oxford on March 31, 1944.

could not balance the rapid increase in volume of production without imposing a heavy burden on the subscribers.

The *Zeitschrift für Kristallographie* never held, nor attempted to hold, a monopoly in the publication of structural work. Much of this went to the proceedings of learned societies, and much to chemical, physical and technical journals. This will always be so, as it is not easy even to define the class of work which from a rational point of view should go to a journal of crystallography rather than to any related journal. The same difficulty, however, arises between general and physical chemistry or radio engineering and physics. The decision to publish a particular piece of research in one journal rather than in another depends, apart from more personal grounds, on the nature of the research and on the public which the journal can be expected to reach. The aim of any scientific publication must be to reach those who are most interested in the paper and most competent to judge its merits. The fluidity of the boundaries between subjects is no argument against devoting a journal to any one of them.

The countermeasure to this inevitable centrifugal tendency of scientific publication lies in a reliable abstracting service. Owing to the fact that crystallography is suspended, as it were, between many acknowledged and firmly organized sciences, abstracts of crystallographic papers are to be found in some twenty abstracting journals in English, French and German. But with few exceptions no clear outline of the method and results of these papers can be gained from any one of the abstracts. Groth's ideal of fully summarizing the results quoted in the paper abstracted has been abandoned, and abstracts in most cases merely indicate the type of work presented in the paper.

Various ways were tried in the *Zeitschrift* of returning to the Groth type of abstract. For the limited field of structure determinations it could be attempted in the 'Strukturbericht', thanks to liberal financial aid given by the Notgemeinschaft der Deutschen Wissenschaft. As regards the entire field of crystallography, however, the attempts failed. Not only was the number of papers so great that the abstractors were unable to keep up with them, but also the variety of the work contained often in a single paper demanded abstracting under different headings and from widely diverging points of view; finally, the range that had to be covered to satisfy all those interested proved prohibitive from the point of view of cost to the reader. After trying out other systems, a classified collection of titles was all that could be produced. This, however, is very nearly contained in *Science Abstracts*, *Chemical Abstracts*, *Physikalische Berichte*, *Zentralblatt*, etc.; even if their classification is not quite so convenient as one drawn up for the purposes of crystallography, the gain is not worth paying the price of re-collecting and re-publishing the catalogue of titles.

A similar situation arises in other semi-independent parts of physics and chemistry, such as geophysics or colloid chemistry. It leads to a great amount of duplication of abstracting work. The problem of handling research work from the many points of view, such as methods, results, substances and properties, is so important, and at the same time so difficult, as to require a concerted effort on the part of all those interested; the methods of approach might well form the subject of further regional and international discussions.

Pending a better solution of this general problem, crystallographic research may best be reviewed and collected by an extension of the method adopted in the *Annual Reports of the Chemical Society* or in *Reviews of Modern Physics*. Here no completeness is aimed at, but selected topics are reviewed by particularly competent workers. By changing the subjects of the reports, a fair survey of the whole field is obtained in due course.

Apart from the tasks of publication and abstracting, the development of crystallography after the War of 1914–18 brought some other problems to the fore which required international settlement. The simpler crystal structures had been more or less explored by 1924, and the use of the theory of Schoenflies-Fedorow became imperative. Niggli, Astbury and Yardley, and Wyckoff had adapted this theory to practical requirements, each in their own way, with different origins and axes of the space groups, different symbols in the drawings and different items listed. Text-books which appeared had to choose between two evils: either to repeat all the results, if not the derivation of space groups, or to be quite incomplete for practical work. The preparation of standard tables of space groups was an obvious desideratum. The occasion to discuss it formally arose when, after a conference on crystal structure arranged by the Faraday Society in 1929, Sir William Bragg convened a meeting of the many crystallographers then present in London. Three committees were set up at this meeting to report (*a*) on the abstracting scheme, (*b*) the preparation of tables, (*c*) nomenclature. Their reports, delivered in the course of the next year, were published in the *Zeitschrift für Kristallographie*. The Tables Committee, after substantial preparation by correspondence, met in Zurich in 1930 and decided the details of the tables and the distribution of work among the British, American, French, German, Dutch and Swiss authors volunteering for it. These "International Tables for the Determination of Crystal Structures", edited by C. Hermann and published by G. Bornträger in conjunction with firms in the various countries, appeared in 1935, and were subsidized by the International Union of Physics and by many learned societies in the contributing countries. They have since found wide application for structure determinations.

One of the successful innovations in these Tables was the replacement of the conventional Schoenflies notation of space groups by a more rational one, developed by C. Hermann and Ch. Mauguin, which has a direct bearing on the symmetry, and therefore on the actual determination of space groups from X-ray data. Thus the recommendation of the Nomenclature Committee was incorporated in these Tables.

A further occasion for an international discussion was afforded by the International Congress of Physics, held under the auspices of the Union of Physics in London in 1934, one half of which was devoted to problems of the solid state.

No description of international relations in crystallography could overrate the influence of the two great British schools and centres of research, at the Royal Institution, and at the University in Manchester, both associated with the name of Bragg. Here students and scholars from all over the world received training and inspiration for crystallographic work; they made contacts among each other which wove them into a friendly international guild.

The present War has temporarily disrupted most of this texture, but it is certain that the desire for even closer international co-operation will return after the War in a subject so wide in extent and developing so quickly. A prelude to this is the regional consolidation of those interested in X-ray crystallography. In the United States, a Society for X-ray and Electron Diffraction was founded in 1940; its present membership is 350. In Britain, an X-ray Analysis Group of the Institute of Physics was formed in 1943, based on the success of several conferences on the subject which had been arranged by the Institute of Physics in the preceding years and which had shown attendances up to two hundred. In Germany the Deutsche Gesellschaft für technische Röntgenkunde arranged yearly conferences from 1929 onwards which dealt largely with the analysis and testing of materials by means of X-rays. Further regional or national organizations may be in existence or planned in other countries. They are to be welcomed, as they promote the interest taken in the subject, raise the standard of application and form a necessary stepping-stone for an international organization.

The desirability of forming, besides regional crystallographic societies, an International Union of Crystallography, should be clear, I believe, from past experience. Co-operation of all authorities is necessary to develop a subject with so many ramifications and applications to its optimum efficiency. In particular, the following topics seem to demand general agreement:

(1) *Publication*. It is undesirable that structural and other crystallographic work should be scattered in many journals, each of which only grudgingly concedes adequate space to it. A fair amount of concentration of this work in a single journal offers the obvious advantage of knowing where to look for it.

A journal like Groth's *Zeitschrift*, privately owned by a publisher, and therefore out of the control of the editors in important respects, is not ideal. It would be preferable to have a journal of crystallography owned by, and edited on behalf of, an International Union of Crystallography.

(2) *Archives*. The lengthy details of some structural work are of immediate interest only to the very few working on the same or closely related substances. It is unfair to make all the others pay for their publication. On the other hand, it is a generally accepted principle that only public tion of the details allows the necessary check on the author's work. As a way out of this quandary, it has been proposed to establish an archives for crystallography in which the full details submitted to the journal of crystallography would be kept in a form suitable for publication; anyone interested could obtain them at low cost on microfilm or in other photographic form. The manuscripts, as submitted to the editors of the journal, would have to give the complete argument, but on the proposal of the editors or the author certain parts of the details, mainly routine measurements, would be either relegated to the archives and replaced by a summary in the paper, or included in the paper at the author's cost.

These archives would also be used for depositing unfinished work of which only a summary description would appear in the journal.

(3) *Abstracts and Summaries of Crystallographic Work*. The collection of structural work and of phase diagrams could be carried on in conjunction with the archives and the journal. Summaries of experimental and theoretical work as proposed above could be arranged to appear. An important function of the Union would consist in representing the interest of crystallographers once the general problem of rationalizing the abstracting schemes in science comes to be discussed.

(4) *International Tables*. The first edition of these Tables is exhausted and a second edition should be prepared by pooling the experiences gained in the various laboratories where they have been in use. It is therefore desirable that the second edition should again be prepared by an international committee. Here also the question of property rights arises; it would be preferable to make the Tables the property of the Union, and to commission a publishing firm with the printing and distribution.

(5) *Analytical Tables of Crystals*. Various systems have been or are being worked out for determining unknown crystalline substances from geometrical, optical, or X-ray data (cf. J. M. Robertson, *Nature*, 154, 350; 1944). These systems are still on a tentative scale, but it seems likely that a method of wide applicability will emerge, and with it the necessity for a systematic survey of all known substances. The detailed planning and the distribution of this work would best be done under the auspices of the Union.

(6) *General Tasks*. Lastly, a Union of Crystallography, represented regionally by its member societies, would act—to use an appropriate metaphor—as a nucleus of crystallization for the whole system of research on the structure and properties of matter in the solid and in related states. The Union and its members would be called upon to co-operate on particular problems with the Unions of Physics and Chemistry, with mineralogical and biological societies, and with those for testing materials. In matters of scientific instruction and of planning of research, the Union might arrive at well-considered recommendations in its field. Finally, the Union might act as a juridical person in matters requiring the handling of money.

A word should be said about the use of the term 'crystallography'. American and British societies referred to earlier have avoided this term in their names and have stressed instead the method of observation they wish to promote. The main reason for this may have been the fact that X-ray and electron diffraction methods are being applied also to substances which are not crystals, such as fibres, proteins, colloids, even liquids and the molecules in gases.

While the titles chosen give a clear indication of the main present activity of the respective societies, I would suggest that they imply a restriction which will ultimately be either abandoned, or prove undesirable. For any particular method, after having been applied for some time, tends either to become a routine method of observation, and as such of minor interest, or continually to be merged with other methods supplementing it from fresh sides. In the case of the X-ray method, this latter happened first when W. L. Bragg drew up a list of atomic radii. Later optical and magnetic observations, and the principles of atomic physics and of crystal chemistry which were being established, were added to the armoury supplementing the diffraction method. For how long will it be true that the main interest of the two societies lies in the diffraction and not in the supplementary methods? Are not many of their members interested mainly in applying the results gained by diffraction methods to the elucidation of

chemical, mechanical and physical properties ? Is it not one of the main aims of these societies to link up X-ray diffraction with whatever chemical or physical methods seem promising to supplement it ? The present circumscription of the societies' activities is decidedly too narrow.

'Crystallography', in its original meaning, does not, it is true, include the entire field of application of diffraction methods. But it covers the main field even then. 'Leptology', which Rinne coined for fine structure (λεπτός, fine), would be preferable to 'crystallography', but the word has not been generally introduced, and this might not be a good occasion to plead for it. Unless something new is adopted, however, 'crystallography' will have to be used in a wider sense than originally intended, so as to cover substances which for some purposes may be regarded as inferior forms of crystals ; in them the arrangement of the atoms or molecules, while showing some kind of regularity, departs further from perfect three-dimensional symmetry, homogeneity and periodicity than in the actual piece of quartz to which the name of crystal was originally applied. The remaining regularity may, however, suffice to make profitable a close connexion of substances regarded from this aspect and of the old-time crystals, and it is this enlarged field which the term 'crystallography' should be understood to cover.

'PHENOXETOL' AND OTHER ANTIBACTERIAL SUBSTANCES

THE offensive against pathogenic micro-organisms continues to succeed, and a number of recent articles upon antibacterial substances indicate the widespread interest in them among non-medical workers and also the value of co-operation between scientific men—and especially biochemists—and the medical man. In a leading article last year the *Lancet* (781, June 19, 1943) discussed the evaluation of wound antiseptics and directed attention to Prof. Garrod's review of the recent advances that have been made (*Brit. Med. Bull.*, **1**, 48 ; 1943). W. A. Altemeier (*Surgery, Gynaec., and Obstetr.*, **75**, No. 6 ; 1942) has published a collective review of the bacteriology of war wounds (see *Bull. War Med.*, **4**, 60 ; 1943). Numerous articles in the *British Medical Journal* and the *Lancet* keep us continually informed of progress of research on this subject. Referring to the work in Sydney, Australia, of A. Albert, J. E. Falk and S. D. Rubbo (*Nature*, **153**, 712, June 10, 1944), the *Lancet* (148, July 29, 1944) discusses the antibacterial action of organic arsenicals such as arsphenamine and neoarsphenamine. Interesting also is the work on sulphasuxidine (succinyl sulphathiazole), some of which is hydrolysed in the lower bowel with the release of free sulphathiazole, which is effective in intestinal infections. It is stated in the *Lancet* (544, April 22, 1944) that E. J. Poth and C. A. Ross (*Proc. Amer. Soc. Pharmacol. Fed.*, Baltimore, **2**, 89 ; 1943) claim that sulphathalidine (phthalyl sulphathiazole) is two to four times more bacteriostatic than sulphasuxidine because it is more completely hydrolysed in the bowel. Combinations of sulphathiazole and proflavine in powder form have been recently successfully used by Prof. J. Macintosh and his colleagues (*Lancet*, 591, May 6, 1944) and by Major G. Y. Feggetter (*ibid.*, 593). Lieut.-Colonel J. W. Bigger (*Lancet*, 142, July 29, 1944) records his work on the synergic action of penicillin and the sulphonamides.

Penicillin is, of course, always in the picture. Sir H. W. Florey (*Brit. Med. J.*, 169, Aug. 5, 1944) gives yet another survey of progress of work on its action, and the same issue of that journal contains articles on the use of penicillin in ophthalmology and in acute empyema and on its combination with sulphonamides for the treatment of infantile gastro-enteritis. J. S. Jeffrey and Scott Thomson (*Brit. Med. J.*, 1, July 1, 1944) give their experience of the treatment of battle casualties in Italy with penicillin, and in the same issue (p. 15) a leading article discusses an American symposium on the uses of penicillin. In the *Lancet* (44, July 8, 1944) W. D. Jeans, J. S. Jeffrey and K. Gunders record their treatment in Italy of four cases of smallpox with penicillin. The pustules in these cases contained *Staphylococcus aureus*, and secondary infection must, these authors think, be responsible for much of the toxæmia in the later stages of the disease. The penicillin treatment was followed by marked improvement, and three of the patients survived, including one who had not been vaccinated. Most of the penicillin used in the Mediterranean theatre of war and for research purposes in Great Britain has been supplied by British manufacturers (*Brit. Med. J.*, 186, Aug. 5, 1944), who are now increasing their production of it : but we owe to the United States the solution of its large-scale production and the consequent saving of the lives of many British and American wounded.

Penicillin is, of course, active only against certain species of bacteria. As Prof. Garrod states (*Brit. Med. Bull.*, ii, 2, 1944), most of the species susceptible to it are Gram-positive, and these include the pyogenic cocci Staphylococcus, Pneumococcus and *Streptococcus pyogenes*, the gas gangrene group of organisms and those of anthrax and diphtheria. The tubercle bacillus and almost all the Gram-negative bacilli, including the typhoid-dysentery group and *Brucella*, *Hæmophilus* and those common invaders of wounds *Proteus* and *Pseudomonas pyocanea*, which produces blue pus, are resistant to penicillin ; but the Gram-negative *Gonococcus* and *Meningococcus* are susceptible to it. There is great need, therefore (*Lancet*, 185, Aug. 5, 1944), for a substance which will control Gram-negative organisms. In the same issue of the *Lancet* (p. 175) is an article by H. Berry on the antibacterial action of ethylene glycol monophenyl ether, to which the name 'Phenoxetol' has been given. Prof. A. A. Miles, in his interesting Sydney Ringer lecture at University College Hospital Medical School on the epidemiology of wound infections (*Lancet*, 809, June 24, 1944), points out that Sir Alexander Fleming's work on the bacteriological history of an infected war wound has been abundantly confirmed. Spore-bearing and intestinal coliform bacilli predominate in the first phase ; they are replaced by pyogenic cocci in the second phase ; and in the third phase these cocci persist and flourish. To them may then be added *Pseudomonas pyocyanea* and *Proteus*. Sulphonamides or penicillin will control the cocci, and this is a great advance ; but the control of them may enable *Ps. pyocyanea* and *Proteus* to become more active, so that healing may be delayed. Berry claims that *Ps. pyocyanea* is particularly susceptible to 'Phenoxetol'. The addition of 10–20 per cent of serum in his *in vitro* experiments with it did not depress its action on this organism, and Berry claims that his *in vitro* tests suggest that 'Phenoxetol' might perhaps be used with penicillin, the acridine

compounds (for a discussion of some recent work on these and on some other wound antiseptics see the *Lancet*, 90, Jan. 15, 1944), the sulphonamides and the quaternary ammonium compounds. 'Phemeride' ('Phemerol') is one of these and its action on bacteria is discussed by C. N. Iland (*Lancet*, 49, Jan. 8, 1944). It resembles the related substance 'Cetavlon' (CTAB) (see J. M. Barnes, *Lancet*, 531, i, 1942, and R. Williams *et al.*, *Lancet*, 522, i, 1943). Further work on the antibacterial action of organic detergents such as these should be interesting. The toxic action of 'Phemeride' and another detergent called 'Zephiran' on the tissues, and methods of studying their toxic action are discussed in an annotation in the *Lancet* (188, Feb. 5, 1944), together with work on the effect of antiseptics on the metabolism of bacteria.

J. Gough, H. Berry and B. M. Still (*Lancet*, 176, Aug. 5, 1944) have tried 'Phenoxetol' on wounds, some of which were war wounds, and on burns, tuberculous cavities and cases of infected dermatitis. Most of the injuries treated were granulating areas associated with loss of skin and the need of skin-grafting; and these authors are studying combinations of 'Phenoxetol' with penicillin, the sulphonamides and the flavines. They conclude that a daily application of 2·2 per cent solution of 'Phenoxetol' in water reduced the infection with *Ps. pyocyanea* or eliminated it and resulted in clinical improvement. The addition of 5 per cent 'Phenoxetol' to the sulphonamide cream, which contains 'Cetavlon', devised by the Burns Unit of the Glasgow Royal Infirmary (see *Med. Res. Council War. Memo.*, No. 10) was tried *in vitro* and the results were encouraging. But the toxicity of 'Phenoxetol' and its absorption need further study. It would seem that the blue pus of *Ps. pyocyanea*, which was so common during the War of 1914–18 and did not then give rise to much anxiety, will shortly be controlled. It is proving, Gough and his colleagues state, an increasing nuisance in plastic surgery and skin-grafting. If future work discovers an opposite number to penicillin which will act with an equal efficiency on the Gram-negative organisms, then the labours of all those who are conducting the offensive against pathogenic micro-organisms will be well rewarded. Their problem will then be the reduction of the considerable laboratory work which is necessary before a choice of antibacterial substance suitable for each case can be made.

Regulations governing the manufacture of penicillin have been issued by the Government. The manufacture and use of crude penicillium filtrate was discussed by J. M. Alston in the *British Medical Journal* (654, May 13, 1944). A further note in the same journal (314, Sept. 2, 1944) reviews two articles in American chemical engineering journals which describe the great effort which has been made to produce penicillin in quantity; it required the expenditure of millions of dollars at a time (1940 and 1941) when the sceptic might have doubted whether the effort was justified. More than twenty factories have been erected at a cost of some 20 million dollars. The *British Medical Journal* (250, Aug. 19, 1944, and 317, Sept. 2, 1944) publishes notes on the use of penicillin for civilian cases, and the Ministry of Health has issued two memoranda on the use of penicillin now being issued to medical schools free of charge for the treatment of civilians. Next year there may be enough of it for all requirements. R. J. McNeill Love (340, Sept. 9, 1944) records one of a number of air-raid casualties to whom penicillin was given as a prophylactic with very gratifying results. In a leading article the *Lancet* (348, Sept. 9, 1944) further discusses the manufacture and use of penicillin and gives further references. A. Dolphin (*Brit. Med. J.*, 317, Sept. 2, 1944) has described the treatment of ten civilian cases at a meeting of the Fever Group of the Society of Medical Officers of Health, which was opened by Sir Alexander Fleming.

LA SOCIÉTÉ FRANÇAISE DE PHYSIQUE

AT the meeting of the Physical Society on November 9, the president, Prof. E. N. da C. Andrade, welcomed some French physicists, members of the sister society, la Société française de Physique. He said: "We have here Prof. P. Auger, Prof. G. A. Boutry and Dr. S. Rosenblum. Through the kind offices of M. Boutry, professeur au Conservatoire national des Arts et Métiers and a fellow of our Society, I have received a brief account of the history of the Société since the outbreak of war. In it the president, Prof. J. Cabannes, records the lamentable fate of many members whose names are known to, and honoured by, all of us." Prof. Andrade then read out the following names of those who had died, the assembly standing:

"G. Dechêne, J. Farineau, H. du Mesnil du Buisson and J. Rossignol fell on the field of honour in the early battles.

"F. Holweck, who made his name famous by his pump and by other ingenious instruments, by his work on soft X-rays and by other notable researches, was murdered by the Gestapo; and J. Solomon, one of the most promising of the younger theoretical physicists, was shot by the German military authorities.

"Deaths that we have to deplore, some no doubt accelerated by the traditional brutalities of the Germans, are those of H. Buisson, H. Chipart, A. Dufour, A. Guillet, Victor Henri, J. Lemoine, Jean Perrin, Émile Picard and Pierre Weiss.

"Besides those who are known definitely to have lost their lives, there are others whose ultimate fate is unknown. H. Abraham, Eugene Bloch, G. Bruhat, L. Cartan, C. Sadron and J. Yvon have been deported to Germany, and we dare scarcely hope that they have received humane treatment there. Of Paul Langevin, who received in 1940 the highest honour the Royal Society has to give, the Copley Medal, we have no news, unless M. Boutry has something to tell us.

"Let me assure our French friends that although, as Mr. Eden said yesterday, 'People in Britain do not yet fully understand how complete, how merciless, how dastardly has been the devastation inflicted by the German armies in Allied lands as they withdraw', some of us here have some comprehension of German brutality. . . ."

Prof. Andrade added that, in spite of obvious difficulties, "all through the troublous days of the German occupation, zealous and courageous French colleagues have kept alive the science of physics in France. In June 1941 appeared a new publication, the *Cahiers de Physique*; and the first number of another new publication, the *Annales de Géophysique*, is at this moment in the press. We congratulate our French brethren on the success of their strenuous efforts."

Turning then to M. Boutry, Prof. Andrade said: "Au nom de la Physical Society je vous prie de bien vouloir saluer de notre part nos camarades de la Société française de Physique et de leur dire combien nous regrettons le lamentable sort de nos confrères, victimes du maudit système Nazi, ou plutôt allemand, combien nous espérons voir renaître dans toute sa gloire traditionelle et la France et la physique française. Nous avons remarqué avec la plus vive émotion comment, au milieu de tant de dangers et de difficultés, les physiciens français ont continué leurs travaux désinteressés. Tout ce que la Physical Society peut faire pour encourager et appuyer nos collègues, nos amis français, soyez assuré que ce sera fait. C'est pour nous un très grand bonheur de pouvoir désormais renouveler nos cordiales et traditionelles relations avec la Société française de Physique. Cher collègue, soyez le bienvenu."

In the course of his reply, Prof. Boutry said that Langevin is alive and well.

OBITUARIES

Sir John Ledingham, C.M.G., F.R.S.

SIR JOHN LEDINGHAM, emeritus professor of bacteriology in the University of London and a former director of the Lister Institute of Preventive Medicine, died in London on October 4 after a brief illness. John Charles Grant Ledingham—'a son of the manse'—was born in 1875, his father, the Rev. John Ledingham, being the minister of Boyndie, Banffshire. He was educated at Boyndie Public School, Banff Academy, and the University of Aberdeen, where he achieved many successes including the Simpson and Arnott Prizes and the Anderson Scholarship. He graduated with first-class honours in mathematics and physics, obtaining the B.Sc. degree with distinction. After a brilliant career in the Faculty of Medicine he obtained the M.B. degree with honours in 1902. Postgraduate study at the University of Leipzig and at the London Hospital followed, and in 1905 he joined the staff of the Lister Institute, being appointed assistant bacteriologist at Elstree and afterwards to the main institute at Chelsea. In 1909 he succeeded George Dean as chief bacteriologist, and on the retirement of Sir Charles Martin in 1930 he was appointed director of the Lister Institute.

During his tenure of the directorship of the Lister Institute, one of the most responsible posts in preventive medicine, Ledingham proved himself to be an able administrator and supervisor of research, while finding time to pursue his own researches on experimental studies of viruses and virus diseases. His investigations regarding the elementary bodies from vaccinial and smallpox material were a notable contribution to this subject. Later he studied the morphology and conditions of growth of the organisms of pleuro-pneumonia and allied conditions. Earlier in his career he carried out studies on the causation of purpura hæmorrhagica in man, on the mechanism of phagocytosis and on the epidemiology of the typhoid carrier state. He retired from the directorship of the Lister Institute in 1943. The University of London in 1920 had granted him the title of professor of bacteriology and, after his retirement, the title of emeritus professor was conferred on him in the present year.

During the War of 1914–18, Ledingham was in charge of the Bacteriological Department of King George Hospital and served afterwards in the Royal Army Medical Corps, with the rank of lieutenant-colonel, as member of the Medical Advisory Committee in the Mediterranean area and as consulting bacteriologist to the Forces in Mesopotamia. For these services he received the C.M.G. in 1918. He was elected to a fellowship of the Royal Society in 1921 and was knighted in 1937. He received the honorary degree of LL.D. from his own University of Aberdeen and also the honorary degree of doctor of science from the Universities of Dublin and Leeds. He was appointed a member of the Medical Research Council in 1934 and served on many expert scientific committees, being chairman of the Tropical Diseases Research Committee of the Medical Research Council and the Royal Society and a member of the War Wounds Committee in the present War. He was chairman of the British National Committee of the International Association of Microbiologists, president of the Second International Congress for Microbiology which was held in London in 1936 and was an honorary president of the Third (New York) Congress in 1939. He was largely instrumental in the formation of the National Collection of Type Cultures, sponsored by the Medical Research Council and domiciled at the Lister Institute, and was its director from its inception in 1920 until his appointment as director of the Lister Institute.

Some thirty papers were published under Ledingham's name or in collaboration with others during the period 1920–43; one of his outstanding achievements being a book written jointly with Sir Joseph Arkwright entitled "The Carrier Problem in Infectious Diseases", which was published in 1912. He was a noteworthy contributor to, and an associate editor of, the "System of Bacteriology" in nine volumes published by the Medical Research Council in 1930–31, as well as to the Council's "Treatise on Diphtheria". In 1924 he delivered the Harben Lectures in London and in 1934 the Herter Lectures at Johns Hopkins University, Baltimore.

Sir John Ledingham married in 1913 Barbara, daughter of David Fowler. They had two children, a son and a daughter, both of whom are following the discipline of medicine. His scientific attainments were of a high order; his life was dedicated to scientific research, and by precept and example he stimulated enthusiasm in others. His kindly and unassuming nature endeared him to colleagues and associates, and above all to those who were honoured by his personal friendship. R. ST. JOHN-BROOKS.

WE regret to announce the following deaths:

Prof. G. D. Birkhoff, Perkins professor of mathematics in Harvard University, on November 12, aged sixty.

Prof. D. M. Blair, regius professor of anatomy in the University of Glasgow, on November 10, aged forty-eight.

Prof. R. J. Rowlette, King's professor of materia medica and pharmacy in the School of Physic, Trinity College, Dublin, and president during 1940–43 of the Royal College of Physicians of Ireland, on October 13, aged seventy-one.

Prof. F. J. Wilson, Freeland professor of chemistry, Royal Technical College, Glasgow, on October 18, aged sixty-four.

NEWS and VIEWS

Royal Society: Royal Medals

H.M. THE KING has approved of the following awards of the Royal Society:

Royal Medal to Prof. D. Brunt, professor of meteorology at the Imperial College of Science and Technology, London, in recognition of his fundamental contributions to meteorology.

Royal Medal to Dr. C. R. Harington, director of the National Institute for Medical Research, in recognition of his work in the analysis and synthesis of thyroxine, and in immunological chemistry.

Nobel Prizes for Physics for 1943 and 1944

THE Nobel Prizes for Physics for 1943 and 1944 have been awarded to Prof. Otto Stern, research professor in the Department of Physics at the Carnegie Institute of Technology, Pittsburgh, and Prof. I. I. Rabi, professor of physics in Columbia University, New York, respectively.

Prof. Otto Stern

Stern has developed the method of molecular rays into a powerful tool for the investigation of the properties of ultimate particles. His first application was the experimental verification of Maxwell's law of velocity distribution in gases. Then followed his famous work, in collaboration with Gerlach, on the deflexion of atoms by the action of an inhomogeneous magnetic field on the atom's magnetic moment; this provided direct evidence for one of the strangest statements of quantum mechanics, the so-called quantization of direction. By an almost incredible refinement of this method, Stern succeeded in detecting and measuring the (about 2,000 times smaller) magnetic moments of some nuclei, the proton and the deuteron. It is this work for which he has now been awarded a Nobel Prize. But he used his method also for other purposes. He gave the most striking proof for the wave nature of ordinary matter, as formulated by de Broglie, in producing interferences by rays of ordinary matter, hydrogen and helium, reflected by crystal surfaces. Stern has also published important theoretical papers on thermodynamics and quantum theory. He was professor of physical chemistry at Hamburg, and when he was compelled to leave Germany in 1933 he became a member of the staff of the Carnegie Institute of Technology, Pittsburgh, Pennsylvania.

Prof. I. I. Rabi

Rabi is an American who worked for some time with Stern in Hamburg and is now professor at Columbia University, New York. He developed the same ray method to a considerable precision for the measurement of the magnetic properties of atomic nuclei. His apparatus is based on the fact that one can produce ordinary electromagnetic oscillations of the same frequency as that of the Larmor precession of atomic systems in a magnetic field. By an ingenious application of the resonance principle he succeeded in detecting and measuring single states of rotation of atoms and molecules, and in determining the mechanical and magnetic moments of the nuclei. A Nobel Prize has been awarded to him for his great contribution to our knowledge of nuclear magnetism.

Nobel Prize for Chemistry for 1943: Prof. G. C. von Hevesy, For.Mem.R.S.

PROF. G. VON HEVESY, of the University Institute for Theoretical Physics, Copenhagen, has been awarded the Nobel Prize for Chemistry for 1943. Prof. von Hevesy's earlier work was mainly in the field of radioactivity and radioactive isotopes. He determined the valency and electromotive series of the radio-elements, and established the identity of radium D with lead. Investigations on the 'self-diffusion' in liquids and solids introduced the use of radio-elements as indicators in following the movements of common elements with which they are isotopic, and this technique he has developed in chemistry, physics and biology, where the use of 'tracer elements', which now include artificial radio-elements, has become very important in the elucidation of reaction mechanisms, and in following the processes of metabolism. Prof. von Hevesy's most recent work is in this field. His work with Brönsted on the separation of isotopes of mercury and chlorine by diffusion has become classical.

In 1923 Coster and von Hevesy announced the discovery of a new element, which they named hafnium (after Copenhagen), in zirconium minerals (*Nature*, **111**, 79; 1923). The discovery was made by the X-ray spectrum method, and in later publications the use of this method in quantitative chemical analysis was developed. The search for hafnium in various minerals led to a broader interest in the distribution of the elements in the inorganic and organic worlds, and in problems of geochemistry.

Radioactivity was enriched in some later work on the activity of potassium and samarium, and the detailed study of the radioactivity of the rare earths. Apart from the discovery of hafnium, Prof. von Hevesy is perhaps best known for his work in the field of general radioactivity (in which chemical methods and interests have predominated), and on radioactive indicators, but his researches have spread into many fields, all of which have been enriched by his discoveries.

The Nobel Prize for Chemistry for 1944 has been reserved.

Vladimir Komarov, President of the U.S.S.R. Academy of Sciences

VLADIMIR KOMAROV, president of the Academy of Sciences of the U.S.S.R., celebrated his seventy-fifth birthday on October 14. It also marked the fiftieth anniversary of his scientific work. Komarov holds many posts; thus in addition to being president of the Academy of Sciences of the U.S.S.R., he is chairman of the Council for Studying the Production Potentialities of the U.S.S.R., chairman of the All-Union Botanical Society and the All-Russian Society for the Conservation of National Resources, head of the Department of Geography in the Botanical Institute of the Academy of Sciences, and head of the Botanical Department of the University of Leningrad. In addition, he is editor of leading Soviet periodicals on biology and author of more than two hundred published works, including a number of monographs, text-books and papers of botanical interest. Komarov has taken part in, organized and directed nine large research expeditions in Central Asia, the Far East and Kamchatka, and has become the leading authority on the flora of Asia and particularly of the Far East. More than sixty plant species have been named after him.

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.

The Royal Institute of Chemistry of Great Britain & Ireland

(Founded 1877)
(Incorporated by Royal Charter, 1885)

APPOINTMENTS REGISTER

A Register of Chemists (Fellows, Associates and Senior Registered Students), who are available for appointments or who are seeking to improve their positions, is kept at the office of the Institute. The facilities afforded by this Register are available (free) to Companies and Firms requiring the services of chemists, and to Universities, Colleges and Technical Schools requiring Teachers of Chemistry and Technology.

Particulars of the Regulations and Examinations of the Institute can be obtained (free), on application to The Registrar, the Royal Institute of Chemistry, 30 Russell Square, London, W.C.1.

MANCHESTER MUNICIPAL COLLEGE OF TECHNOLOGY

(Faculty of Technology in the University of Manchester)

Appointment of
ASSISTANT LECTURER IN ELECTRICAL ENGINEERING

The Governing Body invites applications for an Assistant Lectureship in Electrical Engineering in the College of Technology, with the title and status of Assistant Lecturer in the University of Manchester.

Candidates should hold a degree in Engineering and should have had practical experience in Communication Engineering.

Salary, £300 per annum, rising by annual increments of £25 to £400 per annum, plus war bonus (which at the present time is £52 per annum). Commencing salary according to qualifications.

Conditions of appointment and form of application may be obtained from the Registrar, College of Technology, Manchester, 1. The last day for the receipt of applications is Thursday, Nov. 30, 1944.

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

J. E. MYERS,
Principal of the College.

CITY OF LEICESTER EDUCATION COMMITTEE

COLLEGE OF TECHNOLOGY AND COMMERCE

Principal:
L. W. Kershaw, O.B.E., B.Sc., A.M.I.C.E.

Required, a full-time Lecturer in Mechanical Engineering.

Applicants should possess an Honours Degree in Engineering and have had recent industrial experience; ability to take part in research and testing will be an added qualification.

The duties will include both day and evening teaching, together with supervisory duties.

Salary will be in accordance with the Burnham Scale for Technical Teachers, plus current war bonus (£52), together with a responsibility allowance of £50 per annum.

Applications (no printed form issued), together with copies of not more than three recent testimonials and the names of two persons to whom reference may be made, should be sent to the Principal, College of Technology and Commerce, The Newarke, Leicester, not later than Nov. 27, 1944.

H. S. MAGNAY,
Director of Education.
Education Department,
Newarke Street, Leicester.

COIMISIÚN NA STÁT-SHEIRBHÍSE

Positions vacant: (a) GEOPHYSICIST (temporary), (b) GEOLOGIST (established); and (c) GEOLOGIST (temporary) on the staff of the Geological Survey, Department of Industry and Commerce.

Application forms for and full particulars of the above-named posts may be obtained from the Secretary of the Commission, 45, Upper O'Connell Street, Dublin. Salary scale for all three posts: Man, £150—£10—£300—£15—£400 a year, plus bonus; Woman, £150—£7 10s.—£230—£10—£300 a year, plus bonus. A higher initial salary may in certain circumstances be allowed. Maximum Age Limit: Post (a) 40 years on March 1, 1945. Age Limits: Post (b) 28 to 45 years; and Post (c) 25 to 40 years on March 1, 1945, except in the case of persons with certain specified service in the Defence Forces or such Auxiliary Defence Services as may be determined. Essential Qualifications: Post (a), each candidate must (i) hold a recognized University Degree obtained with Honours, in the final examination for which Experimental Physics or Mathematical Physics was taken as a major subject and honours obtained in that subject, or (ii) possess an equivalent academic qualification; Posts (b) and (c), each candidate must hold a recognized University Degree in Geology, which he/she obtained with honours, or possess equivalent academic qualifications. For Post (b) candidates must also have had adequate experience in various branches of petrological research, and have a satisfactory knowledge of modern petrographic methods, optical petrology, the use of polished sections, analysis of ore minerals and assaying, preparation of thin sections, rock and silicate analysis and crystallography. For post (c) candidates must have had adequate postgraduate experience in geology and palaeontology.

Latest time for accepting completed application forms 5.15 p.m. on Dec. 20, 1944.

THE UNIVERSITY OF LIVERPOOL

DEPARTMENT OF ZOOLOGY.

Applications are invited for the post of LECTURER in EXPERIMENTAL ZOOLOGY. The lecturer will be required to develop experimental research and assist in the teaching of General Zoology.

Salary £400 to £450 per annum, according to qualifications and experience.

The appointment will be for one year in the first instance, the successful candidate to begin duties upon appointment, or, if engaged on work of national importance, from date to be arranged.

Applications, together with three testimonials, should be forwarded to the undersigned not later than Jan. 5, 1945.

STANLEY DUMBELL,
Registrar.

KENT EDUCATION COMMITTEE

MEDWAY TECHNICAL COLLEGE
Senior Departments, Gillingham

Full-time LECTURER IN MATHEMATICS is required to take up duties as soon as possible, in any case not later than January. Work will include classes up to the standard required by the Degrees in Science and Engineering of the University of London. Applicants must be graduates of British University. Ability to assist in organizing games and sports among senior students (as part of full-time duties) would be an additional recommendation, but is not essential to this appointment. Salary in accordance with Burnham Scale for Technical Teachers, plus war bonus.

Forms of application should be obtained from the District Education Officer, Fort Pitt House, Rochester, and should be completed and returned to the Principal, Senior Departments, Medway Technical College, Gillingham, Kent, by Dec. 9.

THE UNIVERSITY OF SHEFFIELD

Applications are invited for a post as RESEARCH BIOCHEMIST in the Department of Pathology in association with the Sheffield Radium Centre.

The post is open to Organic Chemists with Biological interests.

Salary £500 per annum.

The appointment will be for one year in the first instance.

Applications (4 copies) should reach the undersigned (from whom further particulars may be obtained) by Dec. 8.

A. W. CHAPMAN,
Registrar.

SOCIETY OF ANTIQUARIES

Applications are invited from University Graduates for the post of LIBRARIAN. Candidates must have experience of the work of Library Administration, but the qualification of Fellowship of the Library Association, although desirable, is not essential. The person appointed will be required to sustain the wide interests of the Society in British, Continental, and foreign antiquities, to develop its manuscript and artistic collections, and to work under the general direction of the Assistant Secretary. The salary will be £400 per annum, with cost of living bonus, the appointment being regarded as initially for the duration of the war.

Applications, stating age, experience, and qualifications, and accompanied by copies of three recent testimonials, should reach the Secretary, The Society of Antiquaries of London, Burlington House, W.1, not later than Jan. 31, 1945.

THE UNIVERSITY OF MANCHESTER

MANCHESTER MUSEUM

Applications are invited for the post of ASSISTANT KEEPER to be responsible for the Zoological Collections in the Manchester Museum. Duties to commence Dec. 25, 1944, or as soon as possible thereafter. Salary £350 to £400 per annum, according to qualifications.—Applications should be sent, not later than Dec. 1, to the Registrar, The University, Manchester 13, from whom further particulars may be obtained.

BEDFORD COLLEGE FOR WOMEN

(University of London)
REGENT'S PARK, LONDON, N.W.1

The Council of Bedford College invites applications for the post of Senior Laboratory Assistant in the Department of Zoology. Salary £3 15s.—£5 15s. p.w. Initial salary according to qualifications.—Applications, as soon as possible, to the Secretary.

The British Leather Manufacturers' Research Association

invites applications for the following posts: (1) RESEARCH CHEMIST. Candidates must have a good degree or equivalent qualification. Knowledge of leather, proteins, or fats would be an advantage. (2) RESEARCH ASSISTANT FOR MICROSCOPICAL DEPARTMENT. Candidates must have a good degree or equivalent qualification. Training in a biological subject is essential, and chemistry desirable. (3) LIAISON DEPARTMENT. One or more senior appointments and one junior appointment are to be made to this Department. Candidates for the senior posts must have experience of the manufacture of leather and qualifications which would enable them to interpret results of research work and assist in bridging the gap between laboratory and production. Candidates for the junior post should have not less than Intermediate B.Sc. or equivalent qualifications, and would be trained under a senior officer to take up liaison duties. The initial salary will in each case be commensurate with qualifications and experience, and the posts will be permanent and progressive, and at the appropriate level will carry benefits under the Federated Superannuation Scheme for Universities.—Applications, with details of qualifications and experience, should be addressed to the Director, 1-6 Nelson Square, London, S.E.1.

Electro-plating Chemist (age 25-35).

Applications are invited for appointment with an established West London manufacturing concern which is scheduled under the Essential Works Order. The work, which is of national importance, will entail factory control and both works and laboratory investigations into problems concerned with metal surface treatment on munition components. Practical experience of works control of electro-plating production is essential, and candidates should have a good knowledge of industrial metal cleaning methods. A degree in chemistry, or its equivalent, would be an advantage but is not essential. Salary £350 to £450, according to qualifications. The post would be of a permanent nature for the right man—i.e., it carries post war prospects.—Applicants should write, quoting F.2409XA, to the Ministry of Labour and National Service, Room 432, Alexandra House, Kingsway, London, W.C.2, for the necessary application forms, which should be returned on or before Dec. 20, 1944.

Applications are invited for a post of (Temporary) Scientific Officer to take charge of the mathematical and computational work of the Admiralty Computing Service. In addition to appropriate qualifications and experience in the fields of applied mathematics and numerical computation, applicants should have administrative capacity and experience of organizing scientific staffs and work. The range of salary, according to age, qualifications, and experience, is £600 to £800 (exclusive of war bonus, at present £49 11s. for men).—Applicants should write, quoting A.702A, to the Ministry of Labour and National Service, Room 432, Alexandra House, Kingsway, London, W.C.2, for the necessary forms, which should be returned completed on or before Nov. 28, 1944.

University Graduate (Lady) in Chemistry and/or Biology required in the research organization of a company manufacturing medical products to undertake the abstracting of scientific literature. Candidates must have good knowledge of German and must be thoroughly acquainted with modern methods of filing and recording. A diploma, or experience, in librarianship would be an advantage.—Apply, with full particulars of qualifications and experience, stating salary expected, to Box 261, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

University of London. The Senate invite applications for the University Chair of Concrete Technology tenable at Imperial College of Science and Technology. Salary £1,250 a year.—Applications must be received not later than first post on Feb. 26, 1945, by the Academic Registrar, University of London, Richmond College, Richmond, Surrey, from whom further particulars should be obtained.

Physicists with first-class research qualifications and in the age group 20 to 35 are invited to send inquiries regarding immediate and post-war vacancies to the Staff Secretary, Imperial Tobacco Co., Ltd., Bristol 3.

Young qualified Chemist (Male or Female) required by Genatosan Ltd. for organic micro-analytical laboratory. It is preferable that candidates should have had some experience in standard micro determinations, or in precise macro-analysis. They should be definitely interested in micro-analysis. Salary according to experience.—Apply, Chief Chemist, Genatosan Ltd., Loughborough.

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

The following full-time posts are available for experienced organic and physical chemists at the Courtauld Institute of Biochemistry, Middlesex Hospital, London, W.1. Salary £400 to £600, according to experience. (1) Research worker on the nature and composition of the anti-anaemic principle in liver. (2) Research worker to prepare and employ purified or crystalline digestive ferments.

Laboratory Assistant (Male) required to start work in January. New Science Block in Boys' Public School. Duration appointment. Salary up to £5 per week, according to qualifications.—Headmaster, St. Albans School, Abbey Gateway, St. Albans.

Married Woman Science Graduate requires short period employments as research assistant. Will keep records and search literature. Preferably physiological, medical, or social welfare. Manchester or Leeds.—Write, Box 263, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Designs, development work, workshop details, and illustrations undertaken. Speciality: optical, photographic, and scientific instruments; light machinery.—"D.O. Service," Julian, Wood End Close, Farnham Common, Bucks.

Microscope: Leitz H.P. Binocular equal to new, large selection of sundry microscopical apparatus and slides, by Clark & Page.—Write for list and prices: J. T. Orme, 51 Rawcliffe Lane, Clifton, York.

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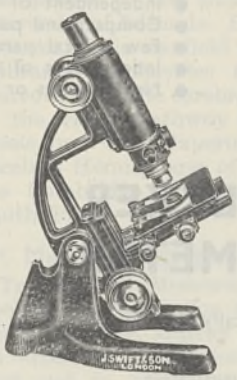

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Komarov's first major work was a "Flora of Manchuria", published in three volumes during 1901–7. His second big work was "An Introduction to the Flora of China and of Mongolia", published in 1908; and his third great contribution to science is his "Flora of the Kamchatka Peninsula", which appeared in three volumes during 1927–30. Apart from these works, Komarov has published a description of his travels through Kamchatka, and a number of essays on the botany and geography of the Far East. The publication of the "Flora of the U.S.S.R." was begun in 1934 under Komarov's direct supervision. It runs into twenty or so volumes and contains a description of all plants known to exist on the territory of the U.S.S.R.

Komarov adds public activities to his scientific work. He is a deputy of the Supreme Soviet of the U.S.S.R. and a member of the Far East Territorial Executive Committee. During the German invasion, Komarov went to Sverdlovsk, where he organized the Commission for Mobilising the Resources of the Urals, Western Siberia and Kazakhstan for war needs. For its work the Commission was awarded the Stalin Prize in 1942. Komarov has been awarded the title of Hero of Socialist Labour, the Order of Lenin, and the Hammer and Sickle Gold Medal, for outstanding scientific work and his service in the organization of Soviet scientific institutions. The Academy of Sciences is to publish a biography and selected works of Komarov; it is also establishing in the Academy of Sciences an annual Komarov Prize of 20,000 roubles for the best work in botany, and eight Komarov fellowships in botany at the Universities of Leningrad and Moscow and the Botanical Institute of the Academy of Sciences. A children's home named after Komarov is to be opened in Moscow for children of scientific workers who perished at the front during the present War.

Chair of Zoology at University College, Cardiff: Prof. James Brough

At the opening of the present session, Prof. James Brough entered upon his new duties as professor of zoology and comparative anatomy in University College, Cardiff, a post upon which distinction had been conferred by the personality and prosperous tenure of the late Prof. W. M. Tattersall. The appointment is an interesting one, because Brough's honours degree, taken at Armstrong College, Newcastle upon Tyne, was in geology, and his published researches are almost entirely palæontological. But he has used his geological knowledge with the avowed and persistent aim of interpreting the evolutionary history of the bony fishes, and his researches have already thrown new light on that difficult problem and have proved to be of fundamental importance for the study of the Palæoniscids. To further these studies he has travelled far and wide, adding to his material by collecting in South Africa and Rhodesia, in the Austrian Alps, in northern Italy and in Spitsbergen, studying in London and Edinburgh, in Stockholm, Paris, Frankfort and Milan. His zoological knowledge, reinforced by his palæontology and his own vivid personality, gave verve and imagination to his teaching in the Department of Zoology in the University of Edinburgh, from which he proceeded to Cardiff, and in his earlier post in the University of Manchester. During the War, he has assisted the Ministry of Food by acting as insect infestation inspector for the south-east district of Scotland. Dr. Brough's interest in educational methods and his researches, with which must be linked the studies in the early history of the Amphibia so successfully followed by his wife (Dr. Margaret Steen), promise well for the continued prosperity of the Department of Zoology at Cardiff.

Prof. Frank Goldby

Prof. Frank Goldby, Elder professor of anatomy in the University of Adelaide, has been appointed to the chair of anatomy at St. Mary's Hospital Medical School, London. Goldby entered Caius College, Cambridge, as Tancred Student and Scholar in 1920 and obtained first-class honours in Part I and Part II (Anatomy) of the Natural Sciences Tripos. In 1923 he was awarded the Frank Smart Research Studentship and spent a further year in Cambridge working under the direction of Prof. J. T. Wilson. His clinical studies were pursued at King's College Hospital, London, where he came under the influence of Kinnier Wilson. He qualified M.R.C.S., L.R.C.P. in 1925, M.B., B.Ch. in 1927 and M.R.C.P. in 1928. During these years he held various residential appointments at his hospital, including the post of assistant pathologist.

In 1931, largely on the advice of Elliot Smith, Goldby became demonstrator of anatomy at University College, London, and in 1932 he went to Hong Kong as lecturer in charge of the Anatomy Department during the absence on leave of Prof. Shellshear. In 1933 he returned to Cambridge as demonstrator of anatomy, and, when Prof. H. A. Harris, of University College, London, succeeded Prof. J. T. Wilson in 1934, Goldby was promoted to a University lectureship in anatomy and was elected fellow and afterwards steward of Queens' College. In 1937, on the return of Prof. Wood Jones to Manchester, Goldby was elected to the Elder chair of anatomy in the University of Adelaide. Prof. Goldby's researches have been mainly in the field of neurology, and range from epibranchial placodes in the head region of the sparrow, over the cerebral hemispheres of the reptile to the visual pathway in mammals. In 1936 his thesis on "The Experimental Investigation of the Cerebral Hemispheres of Lacerta viridis" gained him the Cambridge M.D. and the Raymond Horton Smith Prize.

Dr. Murray Macgregor

The Clough Memorial Medal of the Edinburgh Geological Society for the years 1943–44 has been awarded to Dr. Murray Macgregor in recognition of his outstanding contributions to the geology of Scotland and in particular of the Scottish coalfields. During Dr. Macgregor's long service on the Geological Survey in Scotland, where he has been in charge since 1925, his main task as a worker and administrator has been connected with the geology of the Scottish coalfield area. In his extensive series of original contributions in this sphere, his presidential address to the Geological Society of Glasgow in 1927, entitled "Scottish Carboniferous Stratigraphy", was an outstanding work. Dr. Macgregor has achieved conspicuous success in organizing increasingly detailed work on Scottish mineral deposits and in promoting close collaboration with the mining and industrial community. He has thus been in a position to give authoritative advice to the Scottish Coalfield Committee, appointed by the Secretary of State for Scotland in 1942, and to make important contributions to this Committee's report, now in course of publication. Dr. Macgregor has also made valuable

contributions to the geology of the rocks of the Highlands and of the glacial deposits of central Scotland, and he played a big part in the preparation of the Scottish exhibits for the opening of the new Geological Museum in London in 1935.

British Empire Cancer Campaign

AT a recent meeting, the British Empire Cancer Campaign allocated a sum of £39,000 for the continuation of cancer research during the calendar year 1945. This sum compares with grants totalling nearly £36,000 for the present year. The principal grants are as follows: £10,613 to the Royal Cancer Hospital (Free), including the Chester Beatty Research Institute; £8,000 to the Middlesex Hospital; £3,500 to St. Bartholomew's Hospital; £1,800 to the London Hospital; £2,743 to Mount Vernon Hospital and the Radium Institute; £850 to St. Mark's Hospital, City Road; £1,100 to the Marie Curie Hospital; £120 to the Bristol University Cancer Research Committee; £2,300 to the Cambridge University Cancer Research Centre; £1,740 to the Oxford University Cancer Research Centre; £1,125 to Westminster Hospital; and £5,165 for the expenses of cancer research at the Glasgow Royal Cancer Hospital, University of Glasgow, Institute of Animal Genetics of the University of Edinburgh, University College, Nottingham and St. Thomas's Hospital. These grants are additional to independent expenditure on cancer research by the autonomous branches of the British Empire Cancer Campaign in Birmingham, Yorkshire, Lancashire, Cheshire, North Wales, Northumberland, Cumberland and Durham.

Pest Control in French North Africa

A RECENT publication ("Les Nouvelles Méthodes Insecticides et Les Épidémies." By Dr. A. L. Lepigre. Centre Nationale de la Recherche Scientifique, Algiers) describes what is being done to reduce losses at the ports, in the marshalling yards and in the agricultural depots in French North Africa, resulting from infestation by insects and rats. The loss of potatoes caused by the tuber moth is stated to exceed 50 per cent within three months of harvesting, most of which loss is preventable by fumigation. Dr. A. L. Lepigre, whose pioneer work on the fumigants ethylene oxide and methyl bromide is well known, describes the fumigants and methods now in use in the eight large official stations for *désinsectisation* in Algiers, and the possibility of using vacuum and mobile chambers. Ethylene oxide, hydrogen cyanide and methyl bromide are recommended; but it seems that ethylene oxide is not available in Algiers at present. Chlorpicrin, once highly favoured by the French authorities, is described as being too unpleasant. A brief account of these fumigants is given, and special interest is attached to the statement that ethylene oxide is bactericidal as well as insecticidal, and as such is probably more effective than formalin or sulphur dioxide.

The need for specialists trained in fumigation practice is specially stressed. Loss of lives by typhus, and loss of foodstuffs and other commodities, still occur on a large scale, losses which can on Dr. Lepigre's showing be prevented if the organization of trained staff and equipment, which he describes, can be provided. That is true of many military and civilian bases and depots apart from the North African—in India for example—but there is little prospect of effective action until trained practitioners are available.

British Rheologists' Club

THE fourth annual general meeting of the British Rheologists' Club was held at the University, Reading, on Saturday, October 21. The retiring president, Commander C. F. Goodeve, took the chair at the business meeting. The following were elected officers for the ensuing year: *President*, Prof. E. N. da C. Andrade; *Hon. Secretary*, Dr. G. W. Scott-Blair; *Hon. Treasurer*, Dr. V. G. W. Harrison. The following were also elected to the Committee: Mr. R. L. Brown, Dr. C. A. Maunder Foster, Dr. E. W. J. Mardles, Dr. L. R. G. Treloar. Dr. Scott-Blair reported an increase of more than ninety in the membership figures during the past year. There had been three general meetings, of which one had taken the form of a week-end conference. This had led to closer co-operation between rheologists working in numerous fields. The Committee especially welcomed the newly established contacts with metallurgists. Very cordial relations existed with the (American) Society of Rheology, and it was hoped in the near future to make contact with Soviet rheologists through the courtesy of the Embassy of the U.S.S.R. The business meeting was followed by a discussion on "Tack" introduced by Dr. N. A. de Bruyne and Mr. R. F. Bowles.

Dust Precipitation from Boiler Flue Gases

A PAPER on this subject was read in London on November 2 before the Institution of Electrical Engineers, by John Bruce. In it the author deals particularly with the electrostatic precipitation of dust entrained by flue gases produced from the combustion of anthracite in pulverized form. The paper describes field experiments and results on a pilot-scale electrostatic precipitator operating on such flue gases, as well as the salient features of a large-scale commercial installation. Some of the operating results obtained therefrom are also discussed.

Announcements

PROF. M. N. SAHA, of the University College of Science and Technology, Calcutta, will deliver a lecture before the Physical Society on "A Physical Theory of the Solar Corona" on November 23, at 5.0 p.m. The lecture will be given in the rooms of the Royal Society, Burlington House, Piccadilly, London, W.1, and members of the Royal Astronomical Society are also invited.

THE Melbourne correspondent of *The Times* announces that Mr. W. Russell Grimwade, a member of the Council of the University of Melbourne, has given the University £A50,000 for the foundation of a school of biochemistry devoted both to teaching and research. Mr. Grimwade, who is chairman of the directors of Drug Houses (Australia), Ltd., manufacturing chemists and druggists, has been active in the war-time production in Australia of drugs previously imported.

FROM time to time correspondents have written offering to present unwanted issues of *Nature* to institutions or libraries. In view of the many losses sustained by French universities and libraries during the German occupation, and the difficulty in replacing such losses, readers may like to know that Prof. P. Auger, Commissariat de l'Education Nationale, 1 Carlton Gardens, London, S.W.1, is prepared to receive copies of *Nature* for dispatch to France.

LETTERS TO THE EDITORS

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

A Severity-Rate for Industrial Accidents and Sickness

THE effects of economic and social conditions upon absence from work initiated by sickness and injury are especially important at the moment in view of the changes in workmen's compensation arrangements proposed by the White Paper on Social Medicine and other similar publications.

All factories keep records of sickness and accident incidence, though they vary in detail. A factory showing a low rate of accident is not necessarily one where every possible safety measure is applied. A low accident-rate might equally well be due to inadequate facilities for reporting injury—an out-of-the-way first-aid room, an unsympathetic medical staff, or wage and compensation arrangements which make the workers fear loss of working time and so to carry on without reporting sickness or injury unless and until it proves serious. Such delayed reporting cases nearly always prove more serious than they would have had they received prompt medical attention.

These factors, which are external to purely industrial risk, considerably invalidate estimations based on the reported incidence of sickness or accidents. A secondary measure is required—a measure of the severity of reported cases. Severity, in this connexion, is best defined as the absence from work caused by sickness or injury.

Three main forms of severity estimation have been available for the preparation of accident statistics.

(1) 'Disabling accident' rate. Accidents which involve more than three days absence from work are reportable under the Workmen's Compensation Act and the Factory Acts. To this is often added a 'severe accident' rate, defined by the nature of injury. These are usually expressed as rates per 1,000 men (per year) or per 100,000 man-shifts.

(2) 'Lost time' records. Absence is recorded by an accountancy system in which cases still absent at the end of a records period are carried forward into the subsequent period. Thus the statistics are not completely related to any one records period. Arbitrary 'terminations' are introduced to avoid the cumulative effects of the very long term absences. Fatalities are considered separately.

(3) Estimation of lost time by the International Labour Office Severity Scale. This tabulates the average lost time caused by various injuries. It facilitates rapid preparation of statistics; but, by its nature, it is not susceptible to the effects of changes in economic or social conditions.

The following account briefly describes a new measure. It is approximate only, but further work is being carried out to diminish its error.

Given that the minimum delay in preparing sickness and accident statistics is desirable for practical purposes, an absolute measure is impossible. The aim, therefore, was to discover a theoretical distribution approximating to the actual distribution of absence, the constants of which could be calculated from incomplete data. The theoretical distribution chosen is that of the exponential law of decay. Its constants are (i) the origin, taken as the number of cases involving more than three days absence (conforming to the Workmen's Compensation and Factory Acts) and (ii) the logarithmic decrement, calculated from the origin and the number of cases involving more than thirty days absence. The thirty days specification is arbitrary, and is used so that the theoretical distribution can be calculated one month after the end of the records period. Thus each records period has self-contained statistics, and there is no need to take separate account of fatalities or cases of prolonged absence, although further work is required to make the extrapolated curve a more accurate estimate of these cases.

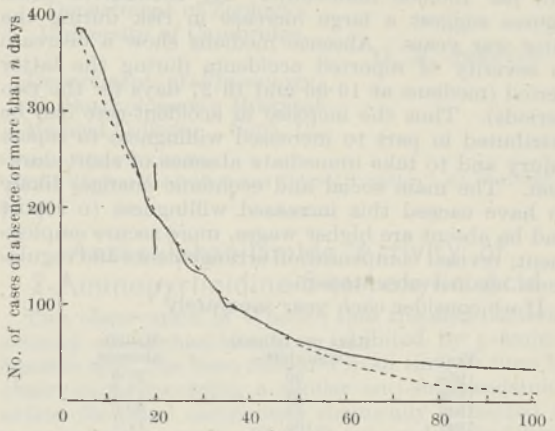

Fig. 1. DATA FOR 1938, 39, 40. FULL LINE, ACTUAL DATA; BROKEN LINE, THEORETICAL DISTRIBUTION. MEDIAN ABSENCE, 19·96 DAYS.

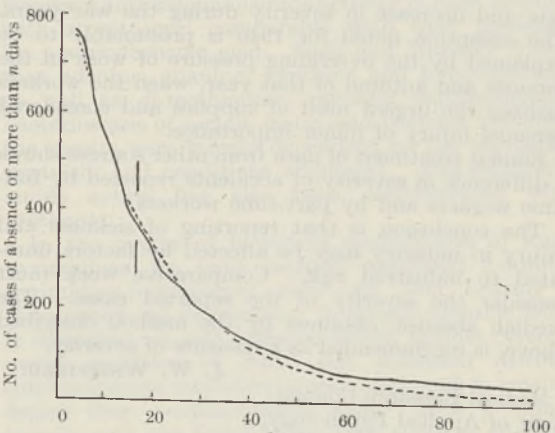

Fig. 2. DATA FOR 1941, 42, 43. FULL LINE, ACTUAL DATA; BROKEN LINE, THEORETICAL DISTRIBUTION. MEDIAN ABSENCE, 16·27 DAYS.

In the examples given (see accompanying graphs) number of cases of absence of more than n days is plotted against n. The logarithmic decrement is calculated:

$$\text{Logarithmic decrement} = \frac{\log A_3 - \log A_{30}}{27},$$

where A_3 is the number of cases absent for more than 3 days and A_{30} is the number of cases absent for more than 30 days.

The theoretical distribution is calculated:

$$\text{Expected } A_n = \frac{A_3}{e^{x(n-3)}},$$ where $x.\log e$ is the logarithmic decrement.

It is convenient to transform the logarithmic decrement into the half-period of decay. This gives the median absence:

$$\text{Median absence} = \frac{0{\cdot}3010}{\log \text{decrement}} + 3 \text{ days.}$$

The graphs show the method demonstrating a change in severity during the war years. Data are from one firm which has not changed its processes during this period, nor has there been any major change in the quality of labour employed. The disabling accident rate for 1938, 1939, 1940 is 86 per 100,000 man-shifts, and for 1941, 1942, 1943 it is 118 per 100,000 man-shifts. By themselves these figures suggest a large increase in risk during the later war years. Absence medians show a decrease in severity of reported accidents during the latter period (medians at 19·96 and 16·27 days for the two periods). Thus the increase in accident-rate can be attributed in part to increased willingness to report injury and to take immediate absence of short duration. The main social and economic changes likely to have caused this increased willingness to report and be absent are higher wages, more secure employment, revised compensation arrangements and regulations against absenteeism.

If we consider each year separately

Year	Rate per 100,000 man-shifts	Median absence
1938	90	21·9
1939	94	17·7
1940	78	20·5
1941	105	17·7
1942	119	15·4
1 43	131	16·8

These show the general trend of increase in accident-rate and decrease in severity during the war years. The exception noted for 1940 is presumably to be explained by the overriding pressure of work in the summer and autumn of that year, when the workers realized the urgent need of supplies and considered personal injury of minor importance.

Similar treatment of data from other sources shows a difference in severity of accidents reported by full-time workers and by part-time workers.

The conclusion is that reporting of sickness and injury in industry may be affected by factors unrelated to industrial risk. Comparative work must consider the severity of the reported cases. The median absence, obtained by the method described above, is recommended as a measure of severity.

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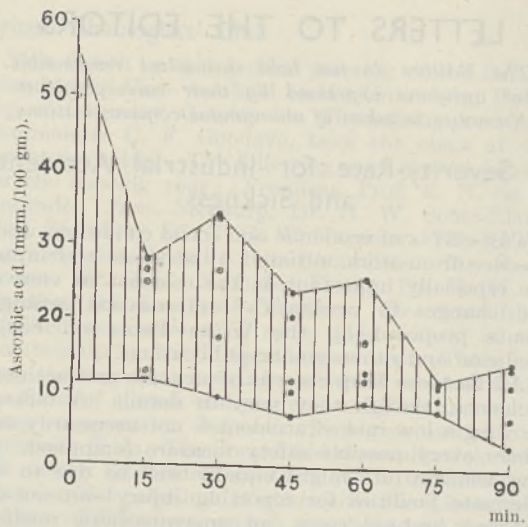
Sampling of Cooked Cabbage in Nutrition Surveys

IN the course of an investigation which we carried out at a local hospital during the winter, it became necessary to estimate the loss of ascorbic acid which occurred in cabbage in the interval between the completion of cooking and consumption in the wards and dining-rooms. This interval was usually between thirty minutes and one hour, during which time the cabbage was kept in water-jacketed boxes at 60–70° C. We failed to obtain satisfactory duplicate analyses of samples taken in the hospital, and it was therefore decided to carry out experiments under similar conditions in the laboratory.



Cabbage was cooked, strained and kept at 60–70° C., samples being taken at intervals. The ascorbic acid content was estimated by titration with 2 : 6 dichlorophenol-indophenol, using a sulphuric acid/metaphosphoric acid solution for stabilizing the vitamin between sampling and estimation. It was again not found possible to obtain agreement between either duplicate or triplicate samples. Reference to the literature in which satisfactory analyses are given[1] revealed the fact that the cabbage used was either minced or finely chopped. We can confirm that there is no difficulty in obtaining good agreement between replicate samples of cabbage under these conditions. But a difficulty arises when it is not possible to use methods for homogenizing the cabbage, as in field work, where samples taken for analysis are usually those actually put out on to plates during the service of the meal. The results given in the papers referred to above apply only to ideal conditions which are rarely encountered in work of this sort.

An example of our results is given in the accompanying graph, which shows an attempt to construct a curve recording the loss of ascorbic acid on keeping cabbage hot. Five samples were taken at each time interval. An even wider variation in values was obtained when ten samples were taken; for example, 32–75 mgm.; 25–78 mgm. and 11–56 mgm. per 100 gm. cabbage. Some of these values are as much as ± 70 per cent from the mean. Care was taken that the samples analysed did not consist almost entirely of stalk or of leaf.

The experiments suggest that in field work, where an attempt is made to assess the ascorbic acid content of food actually consumed, it is not possible to obtain trustworthy results unless the food is normally mashed or minced before serving.

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[1] McHenry and Graham, *Biochem. J.*, **29**, 2013 (1935). Olliver, *J. Soc. Chem. Ind.*, **55**, 153T (1936). Gould, Tressler and King, *Food Res.*, **1**, 427 (1936). Stone, *Biochem. J.*, **31**, 508 (1937). Olliver, *Chem. and Ind.*, 587 (1941). Lampitt, Baker and Parkinson, *J. Soc. Chem. Ind.*, **62**, 61 (1943).

Distribution of Antithyroid Activity in Tissues

CONTINUING our investigation of the antithyroid function of paraxanthine and related compounds[1], we have carried out estimations of the antithyroid activity in mammalian tissues and blood.

All the extracts were made by methods similar to that described in our previous letter except that the purification was not carried beyond the mercury precipitate. The extracts at this stage contain other substances besides paraxanthine and it is possible that some of these are active. We have indeed evidence that suggests that the active substance in thyroid extracts is not identical with paraxanthine, though it appears to be related to it and may perhaps be formed from it in the body. Work on the identification of this substance is being continued.

In these circumstances we do not wish to contend that the active substance in any of the organs or fluids is paraxanthine, except that in liver, from which (as from urine[1]) paraxanthine has been isolated. It is, however, convenient to report the results in terms of paraxanthine, that is, as the concentrations of paraxanthine that would give the activities present in the extracts, and this we have done.

The true tissue contents will be higher than are given here owing to loss during the extraction. But since the process of extraction was similar for all the extracts, it is probable that the losses were of the same order in them all.

Antithyroid activity was estimated by the method described in the previous letter, in which use is made of the change of form of the temperature/heart-rate curve of the frog's heart. We have checked the accuracy of this method by estimating the paraxanthine in three solutions the strengths of which we did not know at the time of estimation. Our results were within 10 per cent of the true concentrations. We think that 20 per cent is the largest error that is likely to occur in the estimations. This error would not include losses during extraction.

Our results are given in the accompanying table. Each figure gives the result of extractions from a single sample of tissue, except the figures for liver which give the range of ten extractions.

Tissue	Source	Content μ gm. per gm. (wet weight)
Skeletal muscle	Cattle	1·2
Heart muscle	Cattle	2
Small intestine	Pig	1·7
Lung	Cattle	1·4
Liver	Cattle	0·2–0·9
Ovary	Cattle	8
Testis (immature)	Pig	4
Brain	Cattle	5
Spleen	Cattle	10
Thymus	Cattle	8
Pituitary	Cattle	8
Pancreas	Cattle	6
Thyroid	Cattle	500, 600, 750, 470.
Thyroid	Human (normal)*	600, 1,400, 750, 1,000, 833, 666, 700, 800, 830, 850, 770, 950.
Thyroid	Human (thyrotoxic)*	245, 133, 165, 105.
Thyroid	Human (adenoma)*	1,100, 1,100, 1,250.
Whole blood	Cattle	0·4 (per c.c.)
Whole blood	Pig	0·15 ,, ,,
Blood cells	Cattle**	0·0059 ,, ,,
Plasma	Cattle**	0·176 ,, ,,

* We are greatly indebted to Prof. H. M. Turnbull, of London Hospital, for these samples.
** From the same sample of blood. Content of the whole blood of this sample 0·132 μgm. per c.c.

The most striking features of these results are: (1) the very high activity of the extracts of thyroid tissue—on the average an extract of normal thyroid is 400–500 times as active as extracts of tissues such as muscle, intestine and lung; and (2) the wide variation of the activity of the thyroid extracts with the condition of the gland. In general, the concentration of antithyroid activity in the tissues runs parallel with the amount of iodine they contain. This is so in the thyroid as compared with other tissues, and it is also shown in the slightly higher contents of glandular tissues as compared with non-glandular[2]. Our thyrotoxic thyroids came from patients which had been treated with iodine before extraction of the gland; they would have contained as much iodine as normal thyroids[2]. It is of interest to find that the antithyroid contents of thyrotoxic thyroids are relatively low even after treatment with iodine.

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[1] *Nature*, 151, 728 (1943).
[2] Elmer, "Iodine Metabolism and Thyroid Function", 82, 86 (1938).

Anti-sulphanilamide Activity of 2-Aminopyrimidine-5-carboxylic Acid

THE observation of Woods[1], that the anti-bacterial activity of sulphanilamide is inhibited by *p*-aminobenzoic acid, has been followed from time to time by observations recording a similar anti-sulphanilamide action for other compounds chemically unrelated to *p*-aminobenzoic acid. Thus Harris and Kohn[2] have shown that *dl*-methionine antagonizes sulphanilamide action. Martin and Fisher[3] have reported that adenine possesses anti-sulphanilamide activity in mice infected with streptococci comparable with that possessed by *p*-aminobenzoic acid. Snell and Mitchell[4] found that adenine, guanine, xanthine and hypoxanthine, as well as *dl*-methionine, reversed sulphanilamide bacteriostasis of certain lactic acid bacteria, although the results were largely dependent on the particular organism and conditions employed. Anti-sulphanilamide action has also been demonstrated with urethane[5].

In the course of biological examination of some pyrimidines, we have recently examined 2-aminopyrimidine-5-carboxylic acid[6]—an acid bearing a close structural relationship to *p*-aminobenzoic acid. It displayed no anti-bacterial action against *Streptococcus pyogenes in vitro*, but possessed distinct sulphanilamide inhibitory powers, although in smaller degree than *p*-aminobenzoic acid. Thus *p*-aminobenzoic acid was found to be 2,000 times as effective as 2-aminopyrimidine-5-carboxylic acid in inhibiting sulphanilamide bacteriostasis of *Streptococcus pyogenes in vitro*.

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Imperial Chemical Industries, Ltd.,
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Sept. 19.

[1] Woods, D. D., *Brit. J. Expt. Path.*, 21, 74 (1940).
[2] Harris, J. S., and Kohn, H. I., *J. Pharmacol.*, 73, 383 (1941).
[3] Martin, G. J., and Fisher, C. V., *J. Biol. Chem.*, 144, 289 (1942).
[4] Snell, E. E., and Mitchell, H. K., *Arch. Biochem.*, 1, 93 (1942).
[5] Johnson, F. H., *Science*, 95, 104 (1942). McIlwain, H., *Science*, 95, 510 (1942).
[6] Ballard, E., and Johnson, T. B., *J. Amer. Chem. Soc.*, 64, 794 (1942)

Preparation of Cell-free Plasma Coagulase of *Staphylococcus aureus*

IN 1908, Much reported that certain strains of *Staphylococcus* had the property of coagulating oxalated or citrated human blood plasma. This is nowadays considered as one of the most characteristic features of pathogenic *Staphylococcus aureus*, and is used to differentiate it from various other cocci. To my knowledge, attempts to separate the plasma coagulase from the bacterial cells have so far failed; for example, in personal experiments by filtration of broth cultures through Seitz and Chamberland filters, separation of cells by the centrifuge. killing the staphylococci by heat or the vapour of ether or chloroform.

In order to explain the inactivity of the filtrate or centrifugate, it has been taken as a working hypothesis that coagulase is not produced in such cultures, but is formed only in presence of plasma. This also had another basis in my finding that the rate of coagulation was independent of the age of broth cultures and was uninfluenced by repeated washing of the suspensions. Such results were opposed to the existence of preformed coagulase in cultures on ordinary media.

To verify the hypothesis that coagulase is produced only in contact with plasma, 10–25 per cent of human citrated plasma was added to a series of flasks containing nutrient broth. Control sets contained broth, and broth with sodium citrate only. All were inoculated with *Staphylococcus aureus*, three separate strains being tested. After twelve hours incubation at 37° C., the cultures were centrifuged and the supernatant fluid filtered through Chamberland *L3* filters. The filtrates, which were tested for sterility, were added in various amounts to separate 1 c.c.'s of concentrations of human citrated plasma ranging from full strength to 1 : 40 in 0·85 per cent sodium chloride solution. While filtrates of broth and broth *plus* citrate were inactive, the filtrates of plasma-broth cultures showed a very strong coagulating power; for example, one drop of 1 : 10 dilution coagulated concentrated plasma in two hours and 1 : 10 plasma in fifteen minutes. Thus it appears that cell-free plasma coagulase can be obtained when *Staphylococcus aureus* is grown in presence of human plasma.

There is also abundant production *in vivo* by *Staphylococcus aureus* of plasma coagulase, which can be demonstrated readily in pus, etc. This 'direct coagulase test', which will be described elsewhere, affords a very rapid and reliable method of detecting staphylococcal infections.

After the above letter was written, my attention was directed to a paper by W. Smith and J. H. Hale[1], who found that by means of 'Gradocol' membranes coagulase could be demonstrated in broth culture filtrates. It is of interest that, as I observed, the addition of plasma to a broth culture led to the appearance of coagulase which was easily filterable through filters of the Chamberland type, whereas in absence of plasma neither centrifugates nor filtrates were active.

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Oct. 11.

[1] *Brit. J. Exp. Path.*, 25. 101; 1944.

Ailanthus, Source of a Peculiar London Honey

THERE can be few beekeepers in the heart of London, and one would not expect the Metropolitan area to be a promising locality for honey production. I therefore welcomed an opportunity of examining a sample of honey from an apiary in Kensington not far from Kensington Gardens, which was brought to my notice in 1943, on account of its unusual flavour. This honey was of a pale greenish-brown colour and after about three months in store set with a fine granulation. The first impression on tasting it was of a mild floral bouquet, but this was followed by a persistent after-taste reminiscent of cats. This flavour recalls exactly the cat-like odour given off by elder flowers (*Sambucus nigra*) when they are drying, and at first suggested that elder might be responsible. The pollens obtained by dilution in water and sedimentation were examined, but *Sambucus* pollen was absent. The most abundant, forming 44 per cent of the total, came from the Tree of Heaven, *Ailanthus altissima*, which is common as a street tree in Kensington. This species is dicœcious, and the male flowers, especially, have a strong rather unpleasant odour recalling that of elder. A second major constituent was the sweet chestnut, *Castanea sativa*, the flowers of which also have a strong unpleasant aroma.

The fact that the peculiar after-taste is attributable to the *Ailanthus* was confirmed by the examination of a 1944 honey sample from the same apiary. In this (see table) *Ailanthus* pollen again preponderates, but *Castanea* forms rather less than 4 per cent of the total. The other major constituent in this season was privet, *Ligustrum vulgare*, which yields a coarse-flavoured honey, but this is of not uncommon occurrence and it is not responsible for the after-flavour.

POLLEN ANALYSES OF KENSINGTON HONEYS. THE FREQUENCY OF THE MAIN CONSTITUENTS IS EXPRESSED AS A PERCENTAGE OF THE TOTAL NUMBER OF POLLEN GRAINS.

Pollen type	Season	
	1943	1944
Tree of Heaven, *Ailanthus altissima*	44·0	37·7
Sweet chestnut, *Castanea sativa*	26·0	3·7
Privet, *Ligustrum vulgare*	6·2	28·8
Limes, *Tilia* spp.	6·6	4·0
Willow herb, *Epilobium angustifolium*	0·6	8·8
Horse chestnut, *Aesculus Hippocastanum*	0·6	1·7
Miscellaneous pollens	16·0	15·3
	100·0	100·0

Beekeepers are apt to attribute unpleasant flavours of unknown origin to the presence of honeydew in the honey. Off flavours from this cause are due not to the honeydew itself but to the sooty moulds that grow in it. Several fungi are concerned, probably the most abundant in Great Britain being *Cladosporium herbarum*. On the evidence of the sooty mould spores, there was very little honeydew in the honeys under review, the mould spores being 5·0 and 9·1 per cent as numerous as the pollen grains in 1943 and 1944 respectively.

The cat-like odour of elder flowers is lost when they are quite dry, and gives way to a pleasant aroma. In addition to medicinal and cosmetic uses, the flowers have been employed in food products to impart a muscatel flavour. The substances responsible for this flavour presumably are derived from the unpleasant smelling constituents of the essential oil. The nature

of the changes taking place in the oil is not mentioned in the literature, though oxidative changes may be involved. Bearing this in mind, the 1943 honey was tasted from time to time, and it was found that the cat-like flavour gradually faded and gave way to a muscatel flavour of increasing intensity. By July 1944, the cat-like flavour had disappeared entirely, leaving a delicious rich muscatel flavour. Honey is usually eaten within a short period of its production, but as with wines and cheeses it would pay to store some kinds until the flavour matures. This applies to *Ailanthus* and *Castanea* honeys, the latter also losing its strong flavour on keeping, and possibly other ill-flavoured honeys that a beekeeper would feed back to his bees in disgust.

Ailanthus honey does not appear to have been recorded hitherto from Great Britain, although it has been reported from time to time from other countries. Zander[1], for example, mentions a sample which he describes as having a strong peculiar flavour recalling muscatel; evidently this was not fully matured. I am indebted to Mr. A. Chesnikov for the honey samples.

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[1] Zander, E., "Pollengestaltung' und Herkunftbestimmung bei Blütenhonig" (Berlin, 1935).

Larval Growth-Stages of *Agriotes sputator*

THE analysis of wireworm populations has been impeded by lack of knowledge of the number of growth-stages through which wireworms pass during their larval life. In the course of a study of wireworm larvæ, I have found that the growth-stage to which any larva belongs can be determined by counting the number of teeth on the borders of the spiracles.

There are eight growth-stages, and the average number of teeth per row for each stage is as follows: on the thoracic spiracles, I, 3–4; II, 4·5–6; III, 6·75–9·75; IV, 10·5–14·25; V, 15·25–20·75; VI, 21·5–30·5; VII, 32·5–40·5; VIII, 42–62; and, on the abdominal spiracles, I, 0·25–2; II, 2·75–4; III, 4·5–6; IV, 6·75–9·25; V, 9·75–13·75; VI, 14–19·5; VII, 20–28·5; VIII, 29·25–39. All the spiracles of 950 larvæ have been examined, and all the larvæ, although collected at different times of the year, fall into these eight groups.

To count the teeth on all the spiracles is too laborious a process for large-scale work, and a method has therefore been devised whereby the growth-stage can be ascertained by examining a minimum number of spiracles while maintaining an accuracy of more than 97 per cent. The quick method is as follows. Count the teeth on the two outer rows of either thoracic spiracle. If the average number per row falls within the ranges of the eight groups given in column 1 of the accompanying table, the growth-stage is determined as indicated. If it does not, count the teeth on the other thoracic spiracle and test the average number of all four rows now counted against the groups in column 2. If the growth-stage remains still uncertain, recourse must be had to the abdominal spiracles, the teeth on one, two or three of which can be counted and tested similarly against columns 3, 4 and 5 of the table. If desirable, the teeth on any abdominal spiracles can be counted first, and columns 3, 4 and 5 consulted. Should this not show to which growth-stage the larva belongs, the thoracic spiracles should then be examined. By this quick method, all the larvæ can be placed in their growth-stages by counting the teeth on no more than five spiracles.

A full account of the investigation is being prepared for publication.

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TABLE FOR DETERMINING THE LARVAL GROWTH-STAGES OF THE WIREWORM *Agriotes sputator*.

Thoracic spiracles		Abdominal spiracles		
1	2	1	2	3
I 3–3·5	I 3–4	I 0–2	I 0–2	I 0–2
II 5–5·5	II 4·5–6	II 3–3·5	II 2·5–3·75	II 2·5–4
III 7–9·5	III 6·75–9·75	III 4·5–5·5	III 4·25–5·75	III 4·3–6
IV 11–13·5	IV 10·5–14	IV 7–9	IV. 6·5–9	IV 6·5–9·3
V 15–19·5	V 15–20·75	V 10·5–13	V 10·25–13	V 9·8–13·3
VI 22–30	VI 21·5–29·75	VI 14·5–18·5	VI 14·25–18·5	VI 14–18·8
VII 32–39·5	VII 31·75–40·25	VII 20·5–27·5	VII 20·25–27·75	VII 19·5–27·7
VIII 42–62	VIII 41·75–62	VIII 30–40	VIII 28·75–40	VIII 28·7–40

Reduction by Carbon Dioxide of Susceptibility of Beans to Tobacco Necrosis Viruses

A COMPLICATING factor in the use of the local-lesion technique for estimating the concentration of plant viruses is that a standard inoculum may give widely different numbers of lesions on different leaves. Differences in age of the plant, nutrition, illumination and position of the leaf on the plant can all affect the susceptibility; but it is unknown whether they do so by altering resistance to injury during inoculation, or whether they produce more fundamental changes in the physiology of the injured cells which prevent infection. We have found that exposing plants to atmospheres containing 30–60 per cent carbon dioxide greatly reduces the susceptibility of bean plants (*Phaseolus vulgaris*, var. Canadian Wonder) to tobacco necrosis viruses. As this reduction can be brought about by exposure after inoculation, the effect is presumably due to physiological changes within the cell and not to the number of entry points opened during the inoculation.

The reduction in the number of local lesions depends on the length of exposure to carbon dioxide. To quote one experiment: plants exposed immediately after inoculation for 15, 30, 60 and 120 minutes gave 46, 39, 17 and 13 per cent of the number of local lesions produced on control plants. When plants are exposed for two hours to the gas mixture, they show the same reduced susceptibility whether inoculated with the virus immediately

before or immediately after exposure. The changes responsible for the fall in susceptibility are readily reversed on returning the plants to air, and four hours after exposure to carbon dioxide the treated plants are again as susceptible as untreated controls. Also, plants inoculated for four hours before exposure to carbon dioxide produce as many lesions as control plants.

The effect is unlikely to be a direct inactivation of the viruses, for they are unaffected by long exposure to saturated solutions of carbon dioxide. As exposure is ineffectual four hours after inoculation, it seems that within this time the virus is normally established in tissues where it multiplies, and that some changes in the metabolism of the cell prevent this establishment in the treated plants. Longer exposures than two hours could not be tried as they damaged the plants: even exposure for two hours causes obvious damage unless exposure is made below 10° C. We were, therefore, unable to see if carbon dioxide reversibly inhibits the multiplication of these viruses after they are established, as Woods[1,2] claims that treating plants with potassium cyanide reversibly inhibits the multiplication of tobacco mosaic and tobacco ringspot viruses. Woods attributes this effect to a reversible change in the respiratory system; as carbon dioxide can also reversibly affect respiratory systems of plants, the two phenomena may be related.

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[1] Woods, M. W., *Science*, **91**, 295 (1940).
[2] Woods, M. W., *Phytopath.*, **33**, 77 (1943).

Alternaria Solani on Tomato

THIS fungus, causing the well-known 'early blight' of potatoes and tomatoes in some countries, has not hitherto been found attacking tomato plants in Britain. There are, however, a few early records, none relating to serious outbreaks, which unfortunately were accompanied by incomplete and inadequate descriptions or by none at all and which, in the light of more recent knowledge of the species, are open to doubt.

In September 1944, in outdoor plantations in Kent and Sussex, this disease was found causing severe leaf and stem spotting to such a degree that, in one instance, a plantation of 1¼ acres assumed a withered or 'scorched' appearance. Lesions occurred at the calyx end of the fruits, which started to rot and fall to the ground.

The fungus associated with the disease may be referred to *Alternaria Solani*, and all the symptoms induced on tomato agree fully with those described in other countries.

It has been thought advisable to make this preliminary announcement before the tomato crop of the 1944 season in Britain has been finally dealt with. A paper describing the occurrence in detail has been prepared for publication.

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Electron Mobility in Large Molecules

IN an earlier paper[1], I discussed the longitudinal and transverse polarizabilities of a number of bonds, as calculated from data on refractivity, Kerr constant and depolarization factor. The C–C single bond was exceptional in having a very high ratio (*c.* 100 : 1) of the longitudinal to the transverse polarizability. This indicates that in this bond the electrons can be displaced much more readily in a direction parallel to the bond than in a direction at right angles. It was suggested that this factor might be of importance in connexion with the structure of long-chain compounds.

It appears now that a number of measurable physical properties—polarizability, charge transfer spectra, colour, fluorescence, electrical conductivity and the Van der Waals' forces—are all closely related and may be of great significance with regard to the chemical and biological properties of large organic molecules.

In a series of papers[2], Mulliken has discussed charge transfer spectra and the effects of hyperconjugation. As the name implies, the charge transfer spectrum arises from transitions from an excited state which has an ionic wave function corresponding to the displacement of electrons within the molecule. The more highly conjugated and the more elongated is the structure, the nearer are the normal and the excited states, and the further the spectrum is pushed towards the visible. There is a corresponding enhancement of refractivity and, if the transitions in question are sufficiently intense, colour may also arise. These properties are particularly well exemplified among the polyenes, and Mulliken has suggested that they are related to the tendency of these molecules to polymerize. In β-carotene, his calculations indicate that an electronic charge oscillates over about 32 per cent of the length of the system of eleven conjugated double bonds.

In his theory of the dispersion forces, London[3] has shown the connexion between polarizability and the Van der Waals' forces. In a later paper[4], he has used my anisotropic bond polarizabilities and has also considered the forces between large molecules containing extended electronic oscillators. These forces ('monopole forces') are highly specific and no longer additive. Their range extends far beyond that of the ordinary Van der Waals' forces of small molecules, and this may be of significance in connexion with rubber-like elasticity and the aggregation of polymeric molecules into fibres. The forces are particularly strong in the case of conjugated systems, where the electronic oscillators are of considerable length and of relatively low frequency. Moreover, with regard to electrical conductivity, such a system ". . . forms something like a miniature piece of metal . . .".

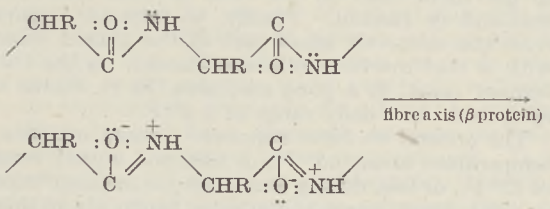
The connexion between polarizability and electrical conductivity had also been noticed by Herzfeld[5]. Among the elements, electrical conductivity is attained when the polarizability, as measured by the refractive index, reaches a critical value equal to the cube of the atomic radius. Weiss[6] has discussed fluorescence and the approach to metallic properties among highly conjugated and carcinogenic hydrocarbons. In graphite, the conjugation reaches a very high level: there is appreciable conductivity, and metal-like salts can be obtained. In these, the anions

(for example, HSO_4^-, ClO_4^-) lie between the lattice planes of the graphite.

The high electron mobility in conjugated systems, arising from the delocalized π orbitals, thus gives rise to very distinctive properties. Moreover, Mulliken has shown that a certain degree of conjugation ('third order' conjugation or 'hyperconjugation') exists even in fully saturated organic molecules. Hyperconjugation is a delocalization effect whereby C–H bonds tend to donate electrons to C–C and other bonds, and this is found to be a stabilizing influence in all organic molecules. It would appear, therefore, that there is an incipient injection of electrons into the chain and a certain degree of longitudinal electron mobility (quasi-conductivity) in any organic system. This effect is much increased whenever multiple bonds are also present. In this connexion, Bateman and Jeffrey[7] have recently observed a significant degree of bond shortening (to 1·43 A.) in the central bond of a 1 : 5 diene (geranylamine hydrochloride).

Mulliken has suggested that C=O groups can give rise to a very energetic type of hyperconjugation. Shortening has been observed in the C–C bonds in $CH_3.CHO$ (to 1·50 A.)[8] and in oxalic acid (to 1·43 A.)[9].

A system of this type is the polypeptide grid of the proteins in which the C=O bonds are in the 1 : 5 position to each other. Two alternative formal bond structures can be written as follows (see also Huggins[10]).



This system would be expected to have an appreciable electron mobility over the full length of the molecule and along the axis of the protein fibre. This may be of importance in connexion with the activity of nerve and muscle. By contrast, the fibres of plants, in which there is no nervous system of the type existing in animals, is based on cellulose. In this substance, opportunities for conjugation are much smaller than in protein. Cellulose fibres would thus be expected to show a lower electrical and optical activity and a higher chemical stability than corresponding fibres based on protein.

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Red Stannous Oxide

A CENTURY ago, Fremy[1] and Roth[2] described the preparation and properties of red forms of stannous oxide. More recently, Bury and Partington[3] and Weiser and Milligan[4] were unable to obtain these. The matter seemed worth investigating again in the light of a paper by Ehret and Greenstone[5] on red zinc oxide.

In work still in progress, it has been found possible to obtain products in all respects identical with those described by Fremy and by Roth, though by slightly different experimental procedures.

Fremy's method of preparation was modified by precipitating a solution of stannous chloride, containing hydrochloric acid, with excess of aqueous ammonia, heating the resulting thick suspension of stannous hydroxide for some time on the water bath, and finally evaporating thin, even films of the suspension to dryness in large porcelain dishes. After repeatedly decanting with boiled distilled water, and drying in vacuum, a deep orange powder is obtained.

Roth's oxide was obtained by heating a suspension of stannous hydroxide in very dilute acetic acid in presence of sodium hypophosphite. The product is deep crimson and of larger grain size than that obtained by Fremy's method.

The presence of free tin in the red oxides could not be established by amalgamation or by conductivity measurements. X-ray diffraction powder photographs taken with cobalt $K\alpha$ radiation showed the patterns from the two red oxides to be identical, but different from those of normal tetragonal stannous oxide and of stannous hydroxide.

The red stannous oxide appears, therefore, to be a distinct crystalline modification.

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Oct. 30.

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Mr. F. Lincoln and the Cavendish Laboratory

MR. F. LINCOLN, who has been on the staff of the Cavendish Laboratory for fifty-four years and has been laboratory steward since 1902, retired on September 30. Generations of research students have passed through the Laboratory during the years of Lincoln's reign, and he is widely known to physicists throughout the British Empire and in other countries.

We are making him a presentation to mark our gratitude for his long and devoted service to the Laboratory, and I have written to past and present Cavendish men inviting subscriptions. There must, however, be many whom I have not been able to reach by a letter, and I would be glad to receive contributions from readers of *Nature* who wish to be associated with this gift to Mr. Lincoln.

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SUITABILITY OF A COOL MARITIME CLIMATE FOR SEED POTATO PRODUCTION

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DURING a survey of the South African coastal areas, a test was devised for deciding if the climate of a maritime area was suitable for growing seed potatoes. It needs only the simplest apparatus, and has both practical and theoretical advantages over the current method of aphid surveys, which it might well supplement or replace.

In the seed potato areas of maritime climates—and we are concerned here with no other—freedom from the aphids which spread virus diseases depends, Davies[1,2] showed, on conditions which check their flight. These conditions are low temperature, high relative humidity, and wind. Wind will be considered later. The temperatures and humidities which are specially relevant are those during the warmest part of the day when aphids most readily take to the wing. Suitable limits of temperature are determined fairly easily. Actual reference to good seed areas suggests that the average daily maximum temperature for June, when migration normally occurs from winter hosts to potatoes, should not greatly exceed, and should preferably be somewhat less than, 65° F. It is the factor of relative humidity which has been the stumbling block. Records at the warmest part of the day are often not available. Davies[3] resorted to records for 9 a.m. in his survey of the Scottish areas. This is unfortunate. It implies without warrant a small rise in temperature during the day, for it is only in climates with small daily ranges of temperature that one can rely upon high relative humidities in the morning persisting for the rest of the day.

Paradoxically, one may dispense altogether with records of relative humidity as a measure of the humidity factor, and concentrate solely on the need for a small daily range of temperature. A small range ensures not only that the drop in relative humidity during the day is small, but also that the level of humidity is high, in the sense that small daily ranges are characteristic of climates in which moisture is abundant enough greatly to restrict the daily change of temperature by radiation. The relation between the relative humidity at the warmest time of the day and the daily range of temperature depends largely on latitude, season and climate; but our problem can be simplified by restricting it to finding what is a suitable daily range in a zone between fairly narrow limits of latitude, during a single month, June (or December in the southern hemisphere), in a cool maritime climate in which the mean maximum temperature for this month is about 65° F. or somewhat less. We can do this empirically, by referring to successful seed areas. The evidence which follows is that the daily range for June (measured as the difference between the mean maximum and mean minimum temperatures for the month) should be less than about 13° F. for a good area; that a range of 16° F. or more indicates unsuitability for seed; and that between these limits lie doubtful cases and, probably, cases in which the established meteorological stations are not exactly representative of the potato fields in the district.

In the western counties of Eire, where the dangerous aphid, *Myzus persicæ*, is extremely rare on potatoes[4], the daily range averages 11·4° F.[5]. In Scotland the areas found by Davies[3] to be nearly free from *M. persicæ* have an average range of 12·9° F. (Montrose, 13·7° F.; Banff, 11·6° F.; and Fortrose, 13·4° F.), while in the poor seed areas the average is 16·2° F. (Dundee, 16·9° F.; Edinburgh, 13·4° F.; Perth, 18·3° F.; and Cupar, 16·3° F.). In North Wales the range is 8·1° F. at Holyhead (Anglesey), where *M. persicæ* has been consistently scarce[6,7]; 13·1° F. at Aber (North Caernarvonshire), a 'moderately' good area[7]; and 16·5° F. at Sealand (Flintshire), a poor area for seed[1]. In Cornwall and Devon, to judge by the scant number of meteorological stations in the official list[5], the areas chosen by Staniland[8] for seed have a range of about 10·9° F. (Ilfracombe, 10·6° F.; Woolacombe, 10·0° F.; Bude, 12·8° F.; Newquay, 10·2° F.). Many areas were rejected by Staniland for reasons irrelevant to this discussion (presence of eelworm, proximity to market gardens, etc.); taken on the whole, *M. persicæ* is scarce over most of Cornwall, and the daily range is small, averaging 12·2° F. for the seven stations in the official list. By contrast, to give on a large scale an example of an area where *M. persicæ* is generally abundant in potato fields, the daily range at thirty-four stations in the English Midlands varies from 15·0° F. to 19·8° F., with an average of 17·6° F.; and similar high ranges are usual in all English and Welsh counties which, in Samuel's map, are shown to get more than 25 per cent of their seed from Scotland or Ireland. Finally, to take an example from the relatively small part of the United States with a cool maritime climate, Eureka, on the Californian coast, is a good seed area (M. R. Harris *in litt.*), and has a daily range of 9·2° F.

The criteria we have adopted—a mean maximum temperature about 65° F., or less, and a daily range of 13° F., or less, during June—are for readings taken in a Stevenson screen at the usual height above short grass. In applying the test to any site one is ultimately concerned with averages over many years, but in practice substantial accuracy may be possible in a single season by determining from old-established meteorological stations in the neighbourhood what correction must be made for seasonal abnormality.

Because it uses only a maximum and minimum thermometer and a Stevenson screen and because of the ease of taking readings, which any intelligent farmer could do, the test meets the need for surveys in enough detail to take into account local physical features (particularly aspect, altitude, and exposure to sea-winds) which greatly affect climatic suitability for seed production; and one hopes that the end of the War will see the release of enough meteorological apparatus to allow surveys to be started without delay. Existing records tell in broad outline what land is worth surveying. In South Africa, for example, a really suitable maritime climate is limited to a narrow barren strip along the west coast. In England and Wales sites with daily ranges not greater than 13° F., and mean maximum temperatures not above 65° F. during June are most likely to be found in the Isle of Man; Anglesey; Caernarvonshire; the western half of Merionethshire, Cardiganshire, and Carmarthenshire; Pembrokeshire; the western tip of Glamorganshire; Devonshire, especially the north to a depth of about fifteen miles from the coast, and to a lesser extent the south coast; Cornwall; the coast of Dorsetshire; and areas of varying depth along the

south and east coast from Hampshire (especially the Isle of Wight) to Norfolk. Whether conditions other than climate are suitable in these areas is beside our point.

Temperatures during June do not adequately explain variations in the prevalence of *M. persicæ* from year to year. These variations are closely linked with conditions during winter[7,10]. Thus, in Cornwall and Devon the very hard winter of 1939–40 greatly reduced the numbers of *M. persicæ*, and the potato crop which followed was lightly infested[8], even though the summer of 1940 was unusually hot and dry. But very cold winters are not characteristic of *maritime* seed areas. The contrary is demonstrably the case. To take as examples places in North Wales which have already been cited, minimum temperatures during January are higher at Holyhead than at Aber, and at Aber than at Sealand; while, to illustrate on a larger scale, the general run of winter minima is appreciably higher in the good seed areas of Ireland, North Wales and south-western England than in the English Midlands, and at least as high in the Scottish seed areas as in the Midlands[5].

Because they carry the taint of interference by irrelevant winter temperatures, aphid surveys in maritime climates must often be continued tediously for many years if they are to be sound. But speed is not the only advantage of the June temperature test. It is unaffected by the often remediable proximity of Brassicæ or other winter hosts. Further, being a test of the climatic conditions which govern the flight of *M. persicæ*, it measures the tendency towards migration; and the number of winged migrants to potato fields is, Whitehead[7] believes, a finer test of the aptness of an area for seed than the crude total of aphids, mostly wingless, which eventually multiply in the fields and are ordinarily the subject of a survey.

Wind has not been discussed, because its independence as a separate factor is questioned. It is true that Davies[2] showed in the laboratory that wind (above 3·75 m.p.h.) stopped the voluntary flight of aphids, but this does not imply that all wind is beneficial. In the maritime type of seed area a hot dry wind would be out of place and counter to the need for a cool temperature and a high relative humidity. All we can consider as unquestionably beneficial are cool, moist winds which, in the type of area under discussion, we can for all practical purposes take to be sea-winds. Their prevalence needs no elaborate system of wind roses for its measurement; it can be recognized simply by the intensity of the maritime influence on the climate, as determined, among other methods, by the June temperature test. In support of this view is the recognized fact that mere bleakness and high altitude are no adequate substitute for exposure to the sea.

The test applies only to a cool, maritime climate, and it would save confusion to point out that such a climate is only one of at least three in which infestation of potatoes by *M. persicæ* can be controlled naturally. The bulk of the world's seed potatoes is grown in areas with a cold, continental winter. These include most of the seed areas of continental Europe, of continental North America and (because the weather there moves from west to east) even most of the Atlantic seaboard of the United States and Canada. In these areas the requirements for good seed are very different. Finally, *M. persicæ* is scarce on potatoes in a very hot, dry climate, a fact systematically exploited in South Africa[11]. Here the desirable features are the opposite of those in a cool maritime climate: a mean maximum temperature during the summer months of about 90° F., a daily range of 28°–35° F. or more, and strong, hot, dry land-winds.

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[11] *Nature*, **153**, 589 (1944).

ONTARIO RESEARCH FOUNDATION

ACCORDING to the report of the Ontario Research Foundation for the year 1943, that year saw a peak in the activities of the Foundation; for the first time since 1928 the problem of allotting laboratory space became acute. Some decision as to whether increased or permanent extensions are justified will be required in the near future. A second limiting factor has been the supply of trained research workers; until the demands from military departments and the war industries diminish, it will be impossible to devote adequate and sustained attention to post-war problems. The transition period might be shortened if research relating to post-war problems were given a higher rating in the system of controls and restrictions. It was not until shortly before the present War that any considerable use was made of the Foundation's facilities other than for routine services and short-term investigations, and at present the Foundation cannot establish enough fellowships to take care of the demand for research. This change is largely due to the gradual development and diffusion of a correct understanding of the relation between industrial scientific research and economic stability. It would add greatly to the stability and continuity of scientific research if the Governments concerned would encourage and not disallow the establishment of reserves for research.

The services of the Department of Engineering and Metallurgy have been almost wholly engaged on research or production associated with the War. The Gauge-Testing Laboratory has operated with approximately the same staff as in recent years. The gauges now being submitted by the inspection board of private manufacturers require steadily increasing skill and accuracy. The important contribution of the Physical Testing Laboratory is indicated by the increase in the number of test reports sent out from 350 in 1940 to 3,200 in 1943. The facilities have been improved by the addition of a 10,000-lb. tensile testing machine. The Heat-Treatment Laboratory handled 70 per cent more work than in the previous year. The general testing and short-term studies of the Textile Department slightly decreased. There exists in Canada a definite need for standards for moisture content of textiles, based on Canadian conditions of climate, and for an independent laboratory equipped to perform this service and issue certificates which will generally be accepted. A suggestion was made during the year that the Foundation should equip such a laboratory for testing wool

tops, but owing to the shortage of trained men response to the idea has not been possible. The process developed for setting the twist in rayon yarns has been in successful operation throughout the year, and a possible extension to the 'Nylon' field after the War is anticipated. Textile oils developed in the Department met all the requirements of the industry in plant trials. There is evidence that the consumer demand for quality-controlled goods is increasing.

The Department of Biochemistry has investigated on a pilot-plant scale some processes for producing glycerol from wheat, and the study of methods for hydrogenating linseed oil to plastic shortening has continued. The Vitamin Laboratory continues to study and evaluate the latest suggestions for determining quantitatively various vitamins in foods, and a study is in progress to determine the minimum amount of protein required to maintain rats in good health when the diet is adequate in all other respects. Research on synthetic rubber has been co-ordinated with that of the Canadian and American Rubber Committees. The possibilities of raising the quality of Buna *S* by addition of small amounts of chemicals to standard butadiene–styrene mixtures have been explored.

The Department of Agriculture has now collected all the material for a detailed map of the physiography of Southern Ontario, and has found that the photographs of the Royal Canadian Air Force offer a rapid method of obtaining accurate boundaries of physical land features. A thorough search has been made of geological literature relating to this and similar areas in preparation for writing a monograph of the physiography. A detailed study of regional agriculture in Old Ontario was continued; and in the Pathology Laboratory research was continued on problems associated with *Ascaris lumbricoides* infection of hogs, using guinea pigs in the experimental work, as well as on the blood parasites of ruffed grouse.

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES

ANNUAL CONGRESS

THE South-Eastern Union of Scientific Societies held its forty-ninth annual congress at High Wycombe on October 14—a single day of sessions and excursions attended by sixty representatives and members. It was organized by the Buckinghamshire Archæological and Architectural Society.

A representative assembly to transact the business of the seventy constituent societies was held in the Royal Grammar School, founded by the Knights of St. John and Jerusalem. For the ensuing year, Brigadier F. A. E. Crew was inducted as president of the Union. After many years as professor of animal genetics in the University of Edinburgh, he has recently been appointed to the Bruce and John Usher chair of public health at Edinburgh; and he is now serving at the War Office as director of biological research; his address was appropriately devoted to "The Biology of War". At the Guildford Congress in 1942, Dr. J. Ramsbottom in his address upon a similar theme (*Nature*, **150**, 241; 1942) came to the conclusion that "Competition in modern man is, for the most part, sociological and not biological". Brigadier Crew considers that "most of the causes of war have their origins, not in the biological constitution of man, but in the constitution of the social aggregates which man has formed and fashioned". Industrialized societies produce so full a routine of work which the ordinary man must carry out to earn a living that war may be welcomed for its stimulating excitement and loosening of conventional bonds. In brief, war is a great adventure because social conventions have not made an adventure out of peace. It is doubtful whether modern war is eugenically selective. "The lethality of a missile propelled from a gun or dropped from the skies has no relation whatsoever to the biological qualities of the man who releases it, and the winning of a combat or of a war is no proof of the biological superiority of the victor". There is a school of thought which teaches that war is definitely dysgenic. Possibly the flower of a generation is destroyed by war, but the flower is not so important as the seed and there is no proof that casualties in the War of 1914–18 seriously affected the physique of the present combatants. "Final victory in war rests with that contestant whose population is caused to increase more rapidly as the result of it." The present groups of mankind represent two widely different ideologies and cultures; it may matter very much indeed to humanity generally, for the next few generations at least, which of these shall prevail.

At the sectional sessions the following papers were read: "The Evolution of the Dwelling House", by E. Yates; "Archæological Work in Bucks", by Flight-Lieut. E. Clive Rouse; "Fungi as Food", by Dr. J. Ramsbottom; "Man and the Migration of Phosphorus", by Dr. K. P. Oakley; "A Plan for Local Social Science Workers", by A. Farquharson; and "The Fauna of New Guinea", by Miss L. Evelyn Cheesman.

In the afternoon, E. A. L. Martyn conducted a walk around Chipping Wycombe of interest to archæologists; naturalists visited Hughenden Valley, and others were shown the geological features of the district.

The annual congress is normally held in June, but this year it had to be postponed until the autumn as the original proposal to hold it in July at the Slough Social Centre proved impracticable. T. D.

CURRENT MEASUREMENT AT VERY HIGH FREQUENCIES

A PAPER by G. F. Gainsborough entitled "Experiments with Thermocouple Milliammeters at Very High Radio Frequencies" (*J. Inst. Elect. Eng.*, **91**, Part III, No. 15; Sept. 1944) describes work conducted at the National Physical Laboratory under the auspices of the Radio Research Board. In order to assess the performance of commercial thermocouple milliammeters at frequencies up to 700 Mc./s., a reference standard air-milliammeter was first developed by the author, following principles first described by J. A. Fleming in 1910. Each of two similar air cells connected by a capillary tube with a liquid index contains a resistive wire which can be heated either by an alternating or direct current. With a capillary tube of 1 mm. bore, and using a low-power microscope to observe the index, the apparatus described in the above paper gave readings of current of the order of 10 mA., which could be reproduced with an accuracy of 1 part in 1,000. The sensitivity

could be altered by using capillaries of different bore, and filaments of different resistance.

With the aid of this instrument as a reference, an examination was made of some ordinary commercial vacuo-thermocouple milliammeters, in which the heaters are made of various well-known resistance alloys, and the thermocouple is separated electrically from its heater. One type of instrument tested contained a heater of one of the nickel-chromium-iron alloys; and a calibration of this instrument showed that its readings were subject to errors of more than 25 per cent for currents of less than half the maximum, this error falling relatively sharply to about 1 per cent over the top third of the current range. An investigation of this phenomenon showed that the material of which the heater wire was made was ferromagnetic at room temperature, but that the Curie point occurred at about 70° C., which was well within the working temperature range of the heater when supplied with its normal current. A simple method of examining the magnetic properties of the heater wire provided a confirmatory demonstration of this effect, and also enabled other samples of wire to be selected with the Curie point outside the working temperature range. When some new thermocouple milliammeters containing heaters of this alternative material were calibrated against the air milliammeter at a frequency of 100 Mc./s., the readings of the new instrument were indistinguishable from those of the standard.

With the aid of the experience gained in this work, various patterns of vacuo-thermocouple instruments were designed for higher frequencies. Considerable care was necessary in arranging the calibrating apparatus; but the results showed that for the new instruments, which were made on a commercial basis, the calibration at 700 Mc./s. agreed with the low-frequency calibration within the limits of experimental error, which was not more than 1 per cent of the maximum current.

In the concluding section of his paper, the author points out that when two such instruments are connected in series as closely together as possible, their readings usually differ widely when the circuit containing them is supplied with current at 700 Mc./s, unless some unusually great precautions are taken. It is suggested that, in practice, the opportunities of applying such devices usefully as milliammeters will be few at frequencies greater than 100–200 Mc./s. Nevertheless, instruments of the types described will have wide applications of relative signal magnitude at higher frequencies, and they may also have an important use as milliwattmeters.

WEST CUMBERLAND AND ITS UTILIZATION

THE industrial region of West Cumberland coincides in the main with the coalfield and has its foci in the ports of Whitehaven, Workington and Maryport. With a total population of 150,000, there were 35,340 insured persons in 1932 and 36,870 in 1937. Out of the 1932 total, no less than 15,577, or nearly 45 per cent, were unemployed, and West Cumberland was scheduled as a depressed or 'special' area by the Special Areas Act of 1934. A careful and detailed study[1] by Prof. G. H. J. Daysh (at present directing the regional research work of the Ministry of Town and Country Planning) has surveyed the rise and fall of the chief industries and serves to emphasize the overwhelming dependence on coal-mining, iron and steel—industries which were especially affected by the depression of the 'thirties. The activities of the Special Areas Commissioner, Mr. E. G. Sarsfield-Hall, aided by the West Cumberland Development Council, were accordingly directed towards securing a diversification of industry and particularly to attracting light industries able to employ the available female labour.

The War has seen not only a return of prosperity to the old industrial centres but also has witnessed the building of vast works in hitherto untouched country, thus extending very considerably the former industrialized area. The problem for the future is thus of even wider import than it was in 1939. In the White Paper on Full Employment, the Government has accepted the recommendations of the Barlow Commission relating to dispersal of industry, and it is almost certain that West Cumberland will be constituted a 'Development Area' in which the Board of Trade, as the responsible Ministry, will encourage industrial development. The appearance of a cyclostyled report[2] by a business man and practical engineer whose companies have works in the area is thus opportune, and in his plan Mr. W. C. Devereux suggests industries which will provide employment for an additional 9,145 persons (compared with 18,615 estimated to be required by existing industries). The new industries proposed fall into three groups: (*a*) textiles, including wool and rayon; (*b*) engineering and skilled metal work; (*c*) canning and processing of agricultural produce.

It is, unfortunately, far from obvious that the basic causes of depression in West Cumberland have been realized. With the development of electric power, industry, even heavy industry, is no longer tied to the coalfields, with the result that transport facilities have become the dominant factor in industrial location. Broadly speaking, West Cumberland is at the end (apart from limited sea-traffic through the ports) of a branch line both of railway and road from Carlisle, and the obvious location for new industry is Carlisle rather than the coalfield, since Carlisle is on a main route with Scottish markets on one hand and English on the other. The advocates of a main through west coast road, crossing the head of Morecombe Bay by a viaduct, have recognized the importance of placing West Cumberland on a main through road route with direct access to Lancashire. Incidentally, such a road would open up to tourist traffic the delightful stretch of coast, with its magnificent views of the Lakeland mountains, from Millom to St. Bees Head.

Physical planning is essentially the right allocation of land for all the varied needs of the nation, and the advent of the much criticized Board of Trade into the field of post-war planning creates many problems. The West Cumberland development area overlaps the proposed national park, and there is no doubt that if encouragement is given to the continuance of industry in some of its war-time locations, then the enormously important influx of wealth from holiday visitors will cease. Seaside holiday homes are at present occupied by munition workers: only a central planning authority can decide their rightful future use in the national interest.

L. DUDLEY STAMP.

[1] "West Cumberland (with Alston), A Survey of Industrial Facilities". (Whitehaven: West Cumberland Development Council, Ltd., 1938.)

[2] "An Industrial Plan for West Cumberland, 1944." By W. C. Devereux. (Slough: High Duty Alloys, Ltd., Trading Estate.)

FORTHCOMING EVENTS

Saturday, November 18

QUEKETT MICROSCOPICAL SOCIETY (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Papers.

SHEFFIELD METALLURGICAL ASSOCIATION (at 198 West Street, Sheffield, 1), at 2.30 p.m.—Mr. R. A. Hacking: "Technical and Economic Problems in the Heavy Iron and Steel Industry".

Monday, November 20

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Prof. E. Capstick: "Milk", (1) "Dairy Education and Technological Training" (Cantor Lecture).

INSTITUTION OF ELECTRICAL ENGINEERS (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Discussion on "The Effect of Welding on Electricity Supply" (to be opened by Dr. H. G. Taylor).

ROYAL GEOGRAPHICAL SOCIETY (at Kensington Gore, South Kensington, London, S.W.7), at 8 p.m.—Mr. S. H. Beaver: "Minerals and Planning".

Tuesday, November 21

ROYAL SOCIETY OF ARTS (DOMINIONS AND COLONIES SECTION) (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Prof. Daryll Forde: "Social Development in Africa and the Work of the International African Institute".

ROYAL INSTITUTION (at 21 Albemarle Street, Piccadilly, London, W.1), at 5.15 p.m.—Mr. F. C. Bawden: "Plant Viruses and Virus Diseases", (i) "The Behaviour of Viruses in Infected Plants".

INSTITUTION OF CIVIL ENGINEERS (RAILWAY ENGINEERING DIVISION) (at Great George Street, Westminster, London, S.W.1), at 5.30 p.m.—Mr. Hugh O'Neill: "Metallurgical Studies of Rails".

INSTITUTION OF ELECTRICAL ENGINEERS (RADIO SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Discussion on "New Aspects of Post-War Interference Suppression" (to be opened by Mr. P. R. Coursey).

Wednesday, November 22

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Prof. L. M. Heilbron, F.R.S.: "The New Insecticidal Material D.D.T." (Aldred Lecture).

INSTITUTE OF FUEL (MIDLAND SECTION) (at the James Watt Memorial Institute, Birmingham), at 2.30 p.m.—Mr. A. Stirling: "The Practical Aspects of Reheating and Heat Treatment Furnace Insulation".

PHYSICAL SOCIETY (COLOUR GROUP) (in the Physics Department of the Imperial College, Imperial Institute Road, South Kensington, London, S.W.7), at 3.30 p.m.—Mr. E. N. Willmer: "Retinal Structure and Colour Vision".

INSTITUTE OF FUEL (NORTH-WESTERN SECTION) (joint meeting with the LIVERPOOL ENGINEERING SOCIETY) (at the Municipal Annexe, Dale Street, Liverpool).—Dr. A. C. Dunningham and Mr. B. M. Thornton: "Mechanical Stokers for Shell Type Boilers" (Précis and Discussion).

Thursday, November 23

ROYAL INSTITUTION (at 21 Albemarle Street, Piccadilly, London, W.1), at 2.30 p.m.—Prof. James Gray, F.R.S.: "Locomotory Mechanisms in Vertebrate Animals", (i) "Aquatic Locomotion—Fins as Propellers, Brakes and Mechanisms of Directional Control".

LINNEAN SOCIETY OF LONDON (joint meeting with the ZOOLOGICAL SOCIETY OF LONDON) (at Burlington House, Piccadilly, London, W.1), at 3.15 p.m.—Dr. Maria Skalińska: "Polyploidy in *Valeriana officinalis* Linn. in relation to Ecology and Distribution"; Mr. R. Winckworth: "From Linnaeus to Lamarck": Prof. F. Wood-Jones, F.R.S.: "Time and Lamarck" (the Discussion on the Lamarck papers will be opened by Prof. J. B. S. Haldane, F.R.S.).

PHYSICAL SOCIETY (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 5 p.m.—Prof. M. N. Saha, F.R.S.: "A Physical Theory of the Solar Corona".

Thursday, November 23—Friday, November 24

IRON AND STEEL INSTITUTE (at the Institution of Civil Engineers, Great George Street, Westminster, London, S.W.1).—Discussion on "Blast Furnace Operation and Problems".

Thursday, November 23

At 11.30 a.m.—Discussion on Fuel Consumption.

At 2.45 p.m.—Discussion on Furnace Operation and Problems.

Friday, November 24

At 10.30 a.m.—Discussion on the Preparation of the Burden (with special reference to Ore Beneficiation and Sinter).

At 11.45 a.m.—Discussion on Refractories.

Friday, November 24

PHYSICAL SOCIETY (OPTICAL GROUP) (in the Physics Department of Imperial College, Imperial Institute Road, South Kensington, London, S.W.7), at 2.30 p.m.—Mr. E. Wilfred Taylor: "Notes on the Evolution of the Inverting Eyepiece"; Instructor-Captain T. Y. Baker: "Achromatism of two Thin Separated Lenses and of a Cemented Doublet"; Mr. B. K. Johnson: "A New Modification of a Ray Plotter" (demonstration).

ROYAL INSTITUTION (at 21 Albemarle Street, Piccadilly, London, W.1), at 5 p.m.—Dr. E. F. Armstrong, F.R.S.: "The Gas Industry—Yesterday and Tomorrow".

INSTITUTION OF MECHANICAL ENGINEERS (in conjunction with the MANUFACTURE GROUP) (at Storey's Gate, St. James's Park, London, S.W.1), at 5.30 p.m.—Mr. C. A. Gladman: "Drawing Office Practice in relation to Interchangeable Components".

INSTITUTE OF FUEL (SCOTTISH SECTION) (at the Royal Technical College, Glasgow), at 5.45 p.m.—Dr. W. Reid: "The Mining of Coal".

Saturday, November 25

ASSOCIATION FOR SCIENTIFIC PHOTOGRAPHY (joint meeting with the SCIENTIFIC AND TECHNICAL GROUP OF THE ROYAL PHOTOGRAPHIC SOCIETY) (at 16 Princes Gate, South Kensington, London, S.W.7), at 3 p.m.—Mr. G. Parr: "The Electron Microscope"; Dr. E. M. Crook and Mr. L. V. Chilton: "Photographic Materials for use in the Electron Microscope"; Dr. D. G. Drummond: "Applications of Electron Micrography in Textile Research".

APPOINTMENTS VACANT

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

CHEMICAL ENGINEER by an important Engineering Company in the Midlands—The Ministry of Labour and National Service, Room 432, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. C.2195.XA) (November 28).

SCIENTIFIC OFFICER (temporary) to take charge of the MATHEMATICAL and COMPUTATIONAL WORK of the Admiralty Computing Service—The Ministry of Labour and National Service, Room 432, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. A.702.A) (November 28).

WATER ENGINEER—The Clerk to the Trowbridge, Melksham and District Water Board, 22 Silver Street, Trowbridge (endorsed 'Water Engineer') (November 30).

SPEECH THERAPIST—The Director of Education, Education Office, 8 City Square, Dundee (December 1).

DEMONSTRATOR IN HUMAN PHYSIOLOGY, and an ASSISTANT KEEPER to be responsible for the Zoological Collections in the Manchester Museum—The Registrar, The University, Manchester 13 (December 1).

ENGINEER (Water Supplies) by the Gold Coast Government Public Works Department—The Ministry of Labour and National Service, Room 432, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. E.1094.A) (December 11).

AGRICULTURAL SCIENTIFIC OFFICERS (temporary) on the staff of the National Institute of Agricultural Engineering, Yorks.—The Ministry of Labour and National Service, Room 432, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. F.3066.A) (December 11).

GEOPHYSICIST (temporary), a GEOLOGIST (established), and a GEOLOGIST (temporary), on the staff of the Geological Survey, Department of Industry and Commerce—The Secretary, Civil Service Commission, 45 Upper O'Connell Street, Dublin (December 20).

TECHNICAL ASSISTANT IN THE ELECTRICITY DEPARTMENT—The General Manager, Electricity Offices, Fruensway, Hull (January 1).

LIBRARIAN—The Secretary, Society of Antiquaries of London, Burlington House, Piccadilly, London, W.1 (January 31).

CHAIR OF ENGINEERING—The Secretary, The University, Aberdeen (March 31).

SENIOR LABORATORY ASSISTANT IN THE DEPARTMENT OF ZOOLOGY—The Secretary, Bedford College for Women, Regent's Park, London N.W.1.

PRINCIPAL OF THE MERRIST WOOD FARM INSTITUTE, Guildford—The Chief Education Officer, County Hall, Kingston-upon-Thames, Surrey.

RESEARCH WORKER on the nature and composition of the anti-anæmic principle in liver, and a RESEARCH WORKER to prepare and employ purified or crystalline digestive ferments—The Courtauld Institute of Biochemistry, Middlesex Hospital, London, W.1.

HYDROGRAPHICAL SURVEYOR for the Basrah Port Directorate, Iraq—The Ministry of Labour and National Service, Appointments Department, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. A.4962.S).

TEACHER FOR PHYSICS AND CHEMISTRY—The Acting Principal, Technical Institute, Sheerness, Kent.

HORTICULTURAL ADVISER (man) and an ASSISTANT HORTICULTURAL ADVISER (man or woman)—The Chief Education Officer, County Hall, Kingston-upon-Thames, Surrey.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Social Insurance. Part 2: Workmen's Compensation. Proposals for an Industrial Injury Insurance Scheme. (Cmd. 6551.) Pp. 32. (London: H.M. Stationery Office.) 3*d*. net. [289

Science in Post-Primary Education with reference to the Scientific Education in Schools of Pupils of 11–18 and its relation to their subsequent Training in Universities and Colleges. Interim Report of a Sub-Committee of the Association of Women Science Teachers. Pp. vi+22. (London: John Murray.) 1*s*. 3*d*. net. [210

Re-Educating Scotland. Edited by Naomi Mitchison, Robert Britton and George Kilgour. (Published for Scottish Convention.) Pp. 48. (Glasgow: Scoop Books, Ltd.) 1*s*. 6*d*. [210

Other Countries

Bashford Dean Memorial Volume. Archaic Fishes. Edited by Eugene Willis Gudger. Article 7: The Breeding Habits, Reproductive Organs and External Embryonic Development of *Chlamydoselachus*, based on Notes and Drawings by Bashford Dean. By E. W. Gudger. Pp. 521–634+6 plates. Article 8: The Heterodontid Sharks; their Natural History, and the External Development of *Heterodontus japonicus*, based on Notes and Drawings by Bashford Dean. By Prof. Bertram G. Smith. Pp. 647–748+7 plates. (New York: American Museum of Natural History.) [49

Smithsonian Institution. War Background Studies, No. 20: China. By A. G. Wenley and John A. Pope. (Publication 3770.) Pp. v+85+25 plates. (Washington, D.C.: Smithsonian Institution.) [49