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POST-WAR FORESTRY IN GREAT BRITAIN

A LITTLE more than a year ago, the recommendations of H.M. Forestry Commissioners on the Post-War Forest Policy of Great Britain were reviewed in *Nature* (Sept. 25, 1943, p. 337). Their report (Cmd. 6447) was debated in both Houses in July 1943, receiving very general commendation and but little criticism. Meanwhile, the proposals have been receiving close attention from all who are especially interested in forestry, professionally or otherwise, and a good many reports and articles have appeared on the subject in newspapers and technical publications. Early this year, the Forestry Commissioners, after discussions with five of the leading societies interested in forestry, published a supplementary report on Private Woodlands (Cmd. 6500). A report on forestry policy has now been issued jointly by the Royal Scottish and Royal English Forestry Societies (Post-war Forestry, 1944)*, which include large numbers of woodland owners in their membership.

Though the figures for production of home-grown timber cannot yet be published, it is common knowledge that we have managed to meet the very large war-time demands for timber for all essential purposes despite very restricted imports. As the Forestry Commission has few plantations more than twenty years old, it is clear that private forests have had to shoulder by far the greater part of the burden, and the heavy demands on them are bound to continue for some considerable time yet. It can fairly be claimed, as it is in this report, that "in no other industry have the requirements of war-time so irretrievably destroyed the capital assets and the hope of profit for generations to come". Nearly a million acres of woodland in Britain will have been cleared in the two great wars of the present century. The rehabilitation of private woodland has accordingly a very strong claim to our most serious and early consideration.

In order to appreciate the proposals made in the Societies' report, it is necessary to recall the main features of the official policy that directly affect privately owned woodland. The first is the call for a considerable further increase of the total area under properly managed forest, the target being five million acres by the end of the next fifty years, with 1,100,000 acres to be planted in the first decade. This proposal has met with very general approval as both desirable and attainable, though the essential need for a stable policy and stable finance has everywhere been stressed.

The proposal then follows that, of the required five million acres, two million should come from privately owned woodland (which totals about three million acres in all), and a scheme for 'dedication' is put forward under which the owner undertakes : (i) to use the land in such a way that timber production is the main object ; (ii) to work to a plan, to be approved by the forest authority, which would lay

* Post-War Forestry. A Report on Forest Policy prepared by the Royal Scottish Forestry Society and the Royal English Forestry Society. Pp. 62. (Roy. Scot. For. Soc., 8 Rutland Square, Edinburgh. Roy. Eng. For. Soc., 48 Dover Street, London, W.1, 1944.)

down the main operations to be undertaken; (iii) to employ skilled supervision; (iv) to keep adequate accounts.

In return for these undertakings, the owner will receive monetary grants which, after consultation, have been agreed at £7 10*s*. per acre planted and a maintenance grant of 2*s*. 6*d*. per annum for each acre of productive woodland for fifteen years, from the date of dedication or planting: these grants to be reviewed after five years, and loans to be available at the rate at which the forestry authority is financed. The originally proposed alternative of a refund of 25 per cent of net expenditure will remain open, and the owner will have to determine which alternative is the more advantageous to him—the relation between the extent and cost of the planting to be done and the value of the timber to be felled being the controlling factor. Many owners consider that the proposed grants are still inadequate, particularly that of 2*s*. 6*d*. per acre towards maintenance of young plantations, and this might well be doubled. It is also urged on good grounds that the grants should be free of income tax (unless taxed as a business under Schedule *D*). A further point to which attention is directed is that many woods felled during the War could not be cleaned up at the time and a grant should be made towards the cost of doing this prior to replanting: although a case can often be made out, it would obviously be necessary to find some means of doing justice to those who have managed to do the work notwithstanding difficulties.

The present report, however, makes a very strong case for the claim that the Forestry Commission has not encouraged private forestry to the extent that was contemplated in the report to which it largely owes its existence, namely, that of the Acland Committee of 1918, and that the new proposals do not appear likely to provide an adequate remedy. The Societies consider they have good grounds for their assertion that much that was called for has been left undone or has been done only half-heartedly, and that their own approaches have either been discouraged, or after eliciting some show of interest, have not resulted in any permanent improvement. They also now point out that the Forestry Commission seems to be content to take over a considerable part of the private woodland instead of viewing the extent of dedication as the measure of success, the alternative of transfer being a penalty, not an objective. It is for these reasons, and because they see in State forestry a very powerful competitor for markets and labour, that they are very insistent on the separation of State forests and estate woodlands at a high level of administration and control.

This difficult question of the post-war forest authority in Britain is perhaps the main subject of the Societies' report. The Commission's proposal is for its own maintenance in much the present form, though the possibility of its coming under a Minister (the Lord President of the Privy Council is suggested) is examined and some devolution of powers is suggested. For private woodlands, a special committee of the Commission is proposed, the two executive Commissioners (for England and Wales, and for Scotland respectively) having separate assistants for State forests and private woodland, and divisional officers—there are at present nine in England and Wales and four in Scotland—having separate staffs for the two types of forest ownership. Any such organization is quite unacceptable to the Societies voicing the owners' view, and they have put forward a plan of their own. The Commission, or Board, should consist of about twelve members under a nominated non-technical chairman. There would be four technical commissioners (paid officers, two for State forestry and two for estate woodland), five regional representatives (unpaid men of standing in forestry appointed after consultation with the forestry societies, two for England, two for Scotland and one for Wales), and representatives of the main political parties as at present. Further, there should be committees for England, Scotland and Wales respectively, including co-opted members. The present composition of the Forestry Commission is not such as could be expected to inspire foresters with confidence, and these proposals should remove some of the objections raised against the present arrangements. The question of Ministerial responsibility is discussed at length because it is difficult of solution: that it is desirable is agreed; but there are strong objections to giving that responsibility to the Ministry of Agriculture, and all are agreed that the administrative differences between Scotland and England must not be allowed to split responsibility for forestry, and with it the forestry authority itself. At the same time, very close liaison is essential between forestry and agriculture administrations.

A major point of difference between the views of the present Forestry Commission and the Royal Scottish and Royal English Forestry Societies is in the place and value of local executive committees with owner representation. The Commission repeats its view that unified control is necessary, and that advisory committees to the divisional officers are best calculated to secure the necessary contact with owners. The Societies—and it is clear that the considerable majority of owners and independent and informed critics are with them in this—are far from favourably impressed by the Commission's record in its relations with the various bodies set up with advisory or consultative functions; indeed, they consider that the War Agricultural Executive Committees have been successful enough to indicate that executive committees of a similar type should meet the special requirements of estate forestry equally well. They accordingly suggest the setting up of twenty to thirty regional forestry committees to collaborate with the same number of regional officers for estate woodlands, "advising and actively assisting them with regard to the prosecution of their duties" and "making recommendations for the expenditure of monies"; moreover, the committees are to "exert effective supervision over" the regional officers, who would work under the technical commissioners for estate woodlands, not under the conservators for national forests. It is also proposed to set up three central committees including representatives of these regional committees, and to provide

channels of appeal for both interests in case of disagreement. However, as it is recommended that each committee should at first consist of a part-time paid chairman, a vice-chairman and one other member appointed by the forestry authority, together with two members selected by the appropriate forestry society, and that its structure and powers should be reviewed after five years, it cannot be charged that it is desired to deprive the regional officer of the technical backing he must have if he is to carry on his work efficiently, but only to ensure that he is amply informed of local circumstances and opinion. The success of any such organization will depend very largely on the personalities concerned, and the result will consequently vary greatly from region to region : it is, however, worth a trial, on the understanding that considerable executive powers are assured to the regional officer.

A minor comment may here be interpolated in the form of an expression of the confident hope that the designation 'conservator' will be reserved for senior officers of administrative rank (with some twenty years service), as is the practice throughout the British Empire, and as indeed the Forestry Commission proposes to do in changing its present divisional officers to conservators. There should be no difficulty in finding suitable titles for the local officers.

Another of the Commissioners' proposals which has met with general disapproval is the deliberate withholding of help and encouragement in respect of small woods (limiting acreage undefined). The Commissioners have modified their proposals after discussion to the extent of agreeing that the standard planting grant of £7 10*s*. per acre should be payable on small woods, not being suitable for dedication (many will be suitable in company with larger woods), but the Societies consider that the rehabilitation and effective management of small woods in Britain, which comprise about one million acres, should be one of the main objectives in any national policy. They think that their own proposals, with regional officers and committees for estate woodlands, and particularly the active encouragement of co-operative organization, would accomplish this desirable end. The experience of the Scandinavian countries is quoted in support, and attention is directed to the fact that a small beginning has already been made in Britain despite the fact that the State assistance afforded to agricultural co-operatives is expressly withheld from forestry co-operatives—a position which should be amended in the expected new Forestry Act. This problem of the small woods is one which affects directly a very large number of owners, and indirectly almost the whole population, since it is these small woods in their tens of thousands which contribute one of the chief and treasured characteristics to the landscape of Britain.

Another matter on which public opinion is not satisfied is the supply of trained men, and the pay and prospects of those employed in forestry work, from the head woodman up to the higher personnel of the Forestry Commission. Perhaps the chief need is for more regular rates of pay for qualified head foresters and skilled head woodmen. To quote the report, there has been a "vicious circle of low or irregular rates of pay, a dearth of competent applicants, indifferent management and a belief that forestry cannot afford to pay an attractive wage". Shortage of rural housing has often worsened the position.

It is well known to foresters who have been faced with the problem of introducing planned management in previously unmanaged or mismanaged forests that progress is often determined more by the building up of an efficient technically trained staff than any other single factor. The Societies review the past and present facilities for meeting educational needs in forestry in Britain and find them extremely inadequate and far too exclusively devoted to training men for the State forests ; they add some useful suggestions to those already put forward by the Forestry Commission.

Like almost every other informed critic, the Societies find the Forestry Commission's research programme totally inadequate in view of the general programme ; how inadequate is perhaps best reflected by their comment that they would like to see the proposed allocation of funds trebled by the end of ten years. It may well be asked how anyone can, nowadays, in view of overwhelming evidence to the contrary, make the assertion that seed selection and tree breeding are not urgent matters when it is proposed to plant some 4½ million acres. It is probable that genetical work could best be done at a research station such as the John Innes Horticultural Institution to derive maximum benefit from existing knowledge and experience in the several highly specialized fields which together constitute genetics ; but if the forestry authority does not stress the urgency of the work, contribute the special forestry point of view and facilities, and provide appropriate financial support, progress will be so slow that results will be obtained too late for the main opportunity for application, a position that has already prevailed in Britain far too long. A first step, one that could be taken immediately if belatedly, is to organize the selection of the best and most suitable stands of the important species, their reservation and tending for maximum seed production, and the collection, certification and distribution of seed from them, as is done in many Continental countries.

Then again, the economics of forestry, long neglected, should surely receive close attention and investigation in view of the proposal that the State should invest £41 million in the next ten years and should control private forestry as well. Forest management is closely linked up with economics and with land management generally, above all in estate forestry. The subject is not one which readily lends itself to the usual experimental research methods, but every wood the history of which is adequately recorded with costs constitutes in itself an economic experiment, and the research work to be done is a special comparative study of such experiments with the view of utilizing the results for better future management. The State proposes to scrutinize and approve the plans according to which dedicated woods are to be worked. What, it might

very well be asked, does the State forest staff know about the management of estate woodlands ? Granted they may now have more experience of large-scale plantation work in Britain than anyone else, but every professional forester knows that modern forest management is conspicuously absent from Britain, beginning with the Crown forests such as the New Forest and the Forest of Dean, while university instructors complain that they still have to take their students to the Continent to demonstrate the results of organized forest management.

Efficient management is to a very large extent conditional on the existence of adequate markets at prices yielding a margin over costs of production. Steps must accordingly be taken to develop markets for home-grown forest products, and to ensure that the State forests share them with estate woodlands. Markets for the large amounts of material of small dimensions available from thinnings in plantations are the chief need ; in fact, it is hard to see how forestry can flourish without them. Possible measures to this end cannot be discussed here.

Opinion is perhaps not so unanimous as to the need for special research on forest engineering problems. Thus many take the view that the necessary vehicles needed for extraction of forest produce over rough, cheaply built roads have already been developed for war purposes, and that industry can be relied on to devise improvements in tools, etc., once the need is made clear.

A further question that arises here is the administration of forestry research. Opinion among foresters seems definitely that it would not benefit by being transferred from the forestry authority to the Agricultural Research Council ; but that the present arrangement, under which the forestry authority consults a purely advisory committee, is unsatisfactory. The suggestion is that this committee should be strengthened by including greater representation of experienced foresters and by giving it much increased powers.

This review may be concluded on a note of warning. The need for a big extension and overall improvement of the practice of forestry in Great Britain is unquestionable : much of the work should have been done long ago and it behoves us to make up for lost time, but there is no field in which the motto *festina lente* is more appropriate than in forestry, where mistakes are likely to persist to mock one through several human generations. The Forestry Commission's new programme, commendable though it is in most of its items, flouts this motto in several respects. We have planted nearly half a million acres in the past twenty years, during which time we could without undue effort have won far more knowledge valuable for application to the next decade than we have. It is now proposed that we rush into a much bigger programme, and extend State control over private woodlands, not even allowing ourselves time to train the necessary personnel thoroughly. Surely the sound policy is to carry on at a more moderate rate within the competence of the available staff, and to put a considerable part of our new effort into research for application to our afforestation work. The ground that may be lost by proceeding cautiously during an initial period of thorough training and research, surveying and planning, can easily be made up by a later gradual planned expansion of the work, and its overall quality would certainly be considerably raised. The British Empire has established a high international reputation for its forestry work in India over the last seventy-five years : a start has been made in Great Britain, but our progress in all respects, except that of acreage under new plantations, has been so inadequate that we have if anything lost ground against the general advance. Let us make sure we do all in our power to start the coming post-war era on the best possible lines ; and there is no aspect of British forestry which calls more insistently for improvement than estate forestry, so let us see that its special problems receive the attention which is their due.

INTERPERSONAL RELATIONS IN EDUCATIONAL PRACTICE

The Social Psychology of Education

An Introduction and Guide to its Study. By Dr. C. M. Fleming. (International Library of Sociology and Social Reconstruction.) Pp. viii+110. (London : Kegan Paul and Co., Ltd., 1944.) 7*s*. 6*d*. net.

AN interesting trend in modern education is the declining concern with mere formal aspects of the mind, with attention, memory, reasoning, judgment and so forth. This has yielded to a new emphasis upon the child or pupil as a personality, as a social organism, as a member of diverse groups. The child's cognitive equipment is now seen in better perspective against his personal and home background, his emotions, attitudes, incentives and social orientation. Education ceases to be a study of rational faculties occasionally and accidentally disturbed by errors or by the vagaries of temperament. Perhaps the chief merit of Dr. Fleming's book lies in bringing home to the reader this change in education from being a cold, academic exercise to becoming a realistic guide in meeting the emotional, intellectual and social problems of the developing child and continually adjusting adult. Gently taking the teacher by the hand, Dr. Fleming leads him from his pedestal and shows him how to mingle easily among those he seeks to educate ; the reciprocal influences between teacher and taught are now brought into fresh focus. The author's exposition is not, however, confined to the class-room. Wherever educative processes are discernible, at home, in office or factory, in clubs or institutions, the common principles of interpersonal relations are shown to be active between the educator and his charge.

Part 1 deals first with the deliberate or unwitting manœuvres and tactics, so to speak, which the teacher and pupils employ in establishing and maintaining their respective positions. This leads to a consideration of the modifiability of individuals and groups of which they are members, as a result of the mutual interaction between them. Part 2 traces the converging influences of family, community, school and other groups on the developing child. Part 3 (inappropriately called "Teachers are also Persons") is mainly concerned with the criteria of emotional maturity, and Part 4 with the treatment of educational failures.

Not only in Part 1 but also throughout the book, attention is rightly and repeatedly directed to the changeability of almost the whole range of conduct as contrasted with the limited number of traits the relative fixity of which is so often exaggerated in importance. A significant corollary follows. Selection for different kinds of schooling, and classification on the basis of aptitudes, are not ends in themselves but a means to better tuition and guidance. A clear distinction must be kept between the supposed limits of an individual's educability, on one hand, and the possibilities within those limits, on the other. Current test scores and mental ratios may provide some index of the former; they are of little use by themselves in regard to the latter. But it is precisely here that the educator's chief task lies.

The guiding principle in the book is the idea that the essential characteristic of behaviour is its specificity, due to the particular social and material circumstances in which it occurs. Traits of personality are therefore represented as relations rather than as qualities, that is, as functions of the interaction between the individual and his environment, not as inherent in the individual. For example, leadership —a topic to which Dr. Fleming gives some prominence —is conceived as a part which a person may play in a suitable situation, not as an intrinsic or general quality like intelligence or stature which he always has with him, so to speak, and displays on all occasions. On this theory, the same individual might take the lead as a matter of course in some situations and be content to follow in others. Differentiation into leader and led would be determined by the configuration of interpersonal relationships whether in class-room, playing-field, debating club, political gathering, military crisis or social emergency. This view involves a rejection of the notion, still favoured by some older academic psychologists in Great Britain, of conduct being relatively consistent, fixed and almost predetermined by a set of inborn propensities. Dr. Fleming also discounts the importance of general and type factors in personality, a departure from current teaching which it is not so easy to justify and which should be further explored. It is important to note that although the conception of general factors in personality, the conception, that is, of basic tendencies manifesting themselves in similar ways in diverse situations, owes its statistical development largely to those who think in terms of a framework of instincts, it does not necessarily stand or fall with the latter.

Quite a few of the author's views seem to be intuitive rather than objective in basis. The theory that leadership qualities are specific (p. 25) is a case in point, however plausible it may sound. Another instance is the statement (p. 18) that a basic need for personal independence manifests itself at an early age in the need for possessions. This is not in accord with reports of social anthropologists (for example, Margaret Mead), or with observations of infant behaviour generally. In observing very young infants, one cannot help being struck by the way they cast aside any object after the momentary attraction has passed. They are, in fact, incapable of a complex trait like possessiveness by virtue of their limited 'temporal span', if by possessiveness is implied awareness of ownership.

More care might have been taken in the chapter on "Family Influences". The observation (p. 41) that "the measured intelligence of children may differ *somewhat* [italics mine] from that of their parents" certainly does not convey the limited predictive efficiency of a coefficient of correlation of 0·5 between the test intelligence of mid-parent and child cited by the author in the previous paragraph. Precision is also lacking in the remark (p. 41), "about 80 per cent. of feeblemindedness has been attributed to inheritance", while the statement (p. 42), "all delinquents do not come of criminal ancestry", though logically sound, gives an exaggerated notion of the importance of heredity in view of the fact that the proportion of ascertained delinquency with criminal inheritance is probably in the region of 15 per cent. There is little justification for the following sweeping generalization about such a heterogeneous group as juvenile delinquents: "on the whole, the evidence is that children showing delinquent tendencies come from unwholesome homes and that their emotional maladjustments are accompanied by emotional maladjustments on the part of the parents" (p. 42). There is nothing in this statement to suggest that the author appreciates the "plurality of converging causes" (Burt) to which, as is widely accepted, delinquency is due.

Some passages have rather a casual air about them, particularly those dealing with growth (p. 62). What, for example, is the reader expected to make of the observation "prediction [of physical and mental growth], except for averages of groups, is extremely hazardous, and even that is hazardous during the period of adolescence"?

These minor criticisms should not, however, deter students and practitioners of education alike from reading this fresh and stimulating approach to the social aspects of their problems. JOHN COHEN.

CHEMISTRY AND ATOMIC STRUCTURE

Recent Advances in Physical and Inorganic Chemistry

By Prof. Alfred W. Stewart and Dr. Cecil L. Wilson. Seventh edition. Pp. xii+512+5 plates. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1944.) 28*s*. net.

IN an attempt to keep pace with the remarkable advances in physical and inorganic chemistry since the sixth edition of this useful work was published, Prof. Stewart has made some drastic changes which have greatly increased its value. Dr. C. L. Wilson has contributed eight new chapters and has revised the rest.

Our ideas on atomic structure have undergone considerable change during the interval. The discovery of deuterium introduced a novel feature, for we have in hydrogen and deuterium two isotopes which differ so widely in atomic mass that they act like different elements. Not only is there an entirely new range of compounds to examine, but also a serious revision of physical constants is involved. It has been shown that although the atom may give rise to quite a number of different particles, namely, protons, neutrons, deuterons, electrons, positrons, α-particles and mesons, each of which is discussed in turn, the present view is that the nucleus is composed only of protons and neutrons. The mechanism whereby the other sub-atomic particles are projected is still uncertain. The high voltages produced by the cyclotron have given us high-speed protons, deuterons and α-particles. Neutrons can now be obtained by bombarding beryllium with high-speed deuterons instead of α-particles. Since a neutron carries no charge, it

is not repulsed by the nucleus and has therefore great penetrating power. Fermi has shown that all the elements from 7 to 72, when bombarded with neutrons, give radioactive products, whereas only the first twenty are disintegrated by charged particles.

Isotopes with different radioactivities but alike in both charge and mass are rarely encountered among natural radioactive products but can now be produced artificially. The difference between these so-called nuclear isomers is one of energy content. Interesting examples are given by the bombardment of indium by fast neutrons. The rather complex results, which are not all radioactive products, are illustrated diagrammatically. The nucleus, which is at first excited to a higher energy-level by impact with the accelerated neutron, may return to the ground state by losing γ-radiation; but more frequently β-radiation is observed instead, the emitted electron being orbital and not nuclear. Theories of extra-nuclear electronic structure are discussed historically, and it is shown that the use of the four quantum numbers leads to a probable distribution of electrons.

X-ray diffraction has probably been the most powerful single physical method devised for the ultimate analysis of matter. It has laid bare the structures not only of the diamond, graphite and alloys, but also of textile fibres and other complex molecules, and it has clarified our views on valency. Robertson has achieved remarkable success in plotting electron densities as a series of contour lines with the aid of a Fourier analysis. Electrons can also be diffracted, and although they are much less penetrating than X-rays they are much more active photographically and are well suited for examining tarnish films on metals. Atomic linkages can be measured by electron diffraction; and by using the electron microscope, a description of which is given, it is possible to photograph particles which are only 30 A. in diameter.

The chapter on conductance gives a clear account of the gradual development of the theories of ionic behaviour. The anomalies of strong electrolytes are still not completely solved, but the theory of complete ionization even in the solid state probably rests on a sure foundation, since such compounds act in a fashion entirely consonant with what is known of their fine structure.

AGRICULTURE IN URUGUAY

Investigaciones Agronómicas

Por Prof. Alberto Boerger. Tomo 1: Fundamentos de la Producción Vegetal. Pp. 758. Tomo 2: Genética; Fitotecnica Rioplatense. Pp. 1,043. Tomo 3: La Producción y el Hombre. Pp. 443. (Montevideo: A. Barreiro y Ramos S.A., 1943.) n.p.

THIS compendious work is difficult to appreciate. It is built around the investigations of the Uruguayan agricultural experiment station "La Estanzuela". The researches of this station are discussed in summary form in the text wherever they bear upon the general problems discussed; copious indexes and a full bibliography of the station's publications (commencing in 1912) are given. No complete chronicle or map of the station is supplied, and it is difficult to find a statement of its position. The book discusses many broad problems having a bearing on husbandry, including methods of investigation, laws of yield, mixed crops, autarky, and the system of Henry George; and sometimes gives unexpected information, such as a survey of the organization of plant genetical inquiry in the Argentine, Uruguay and the Brazilian province of Rio Grande do Sul.

The book supplies many climatological data, but is no general statistical digest, and only incidentally yields information about agronomic practice in Uruguay and adjoining regions. Thus, from the description of a trial of rate of sowing of linseed, the reader can deduce that the normal rate of sowing must be about 70 kgm. of seed per hectare. Several factors affecting yield of the more important crops are thus brought to light, but no explicit information about local practice is given. The most important problem of selection before the Uruguayan wheat industry is stated to arise from the need of finding varieties not markedly affected by the date of sowing—which means, in effect, that what is wanted is wheat which will grow independently of the peculiar vagaries of the climate. It is a heartening sign that this and some other problems are reviewed regionally—with respect to the La Plata basin—and not merely nationally.

The author's interests are frankly in crop problems, and he includes many references to the relation between crops and livestock; but it may not be unfair to point out that the information about soils is less thorough than is warranted by the connexion between soils and plant growth. The deficiencies of agricultural investigation in South America seem to be those of a 'prairie' country of extensive agriculture where any established crop will grow more or less well, so that the obvious problems are on the surface; it is relevant to note that erosion is attracting attention, but that nothing much has been done about it yet except talking and writing in such general terms as those of this book.

The work may perhaps be summed up as the expression of the experience of one of the older generation of experimenters, who not only reviews the work of his own station but also includes the salient features of many problems to the solution of which the station has not contributed. If the book is regarded as a pool of some South American thought, it is legitimate to ask what streams have contributed to it and what it reflects.

Several tributes are paid to the work of R. A. Fisher and the revolution which his school of mathematical statisticians has effected in experimental technique. Fisher's methods have been extensively used in Uruguay and the Argentine by G. J. Fischer and others, and the book gives full acknowledgment to Fischer's work at least in so far as it emanates from La Estanzuela; this may outweigh the fact that no very recent European work on mathematical statistics is quoted. No later edition of Sir John Russell's "Soil Conditions and Plant Growth" is mentioned than the Spanish version of the sixth edition (1934); and Russell's review of the Woburn experiments, issued in book form in England, is quoted from a German abstract. In general, it seems that the author is better acquainted with recent Continental work than with British. The apparent tendency to ignore recent British contributions to agricultural science seems to lie deeper than a purely war-time shortage of books and other means of communication of ideas; though, if that shortage persists, the insulation of South America from British cultural and scientific ideas may become more serious.

HUGH NICOL.

The Journal of the Institute of Metals

Vol. 69, 1943. Edited by N. B. Vaughan. Pp. xxxvi+526+41 plates. (London: Institute of Metals, 1943.) n.p.

THE "Journal of the Institute of Metals" has acquired a very high reputation as a medium for the publication of the results of research upon the alloys of the non-ferrous metals. Despite the distractions of war, this reputation is thoroughly maintained in the volume under review. Starting off with a joint discussion with the Institute of Physics on the application of X-ray methods in the investigation of the equilibrium diagrams of metals, it contains some two dozen other papers on corrosion and surface protection, the structure of rolled aluminium and brass, spectrographic analysis, electron diffraction—the thirty-third May Lecture by Sir George Thomson—a thermodynamic study of the ageing of the copper-aluminium alloys by Prof. S. T. Konobeevski, of Moscow, together with many papers on the metallography of the light alloys of aluminium and magnesium.

It should by now be unnecessary to stress the fact that the high standard of the Institute's papers remains unaffected. Considering the difficulties of the times, this volume is a most creditable achievement, on which everyone concerned, and not least the editor, Mr. N. B. Vaughan, is to be highly congratulated. F. C. THOMPSON.

The Chemistry of Life

An Easy Outline of Biochemistry. By Dr. J. S. D. Bacon. (Thinker's Library, No. 103.) Pp. ix+118. (London: Watts and Co., Ltd., 1944.) 2*s*. 6*d*. net.

IT is a difficult task to write a book about a technical subject in non-technical language without floundering hopelessly in a mass of words. The author has overcome this by simply explaining these technical terms when they must be mentioned. The underlying idea is that biochemistry is the understanding and interpretation of living processes on the basis of chemical transformations which are capable of precise measurements. Recent methods used as tools by the biochemist, such as ultra-centrifugation, dialysis, electron microscopy, labelling with isotopes and respiration methods, are described. Mention is made of enzymes, hormones, evocators, genes, chemotherapy, viruses and bacteriophage. A useful feature is a glossary of technical terms, although it is doubtful whether understanding, for example, of the terms 'crystalloid' and 'purine' is increased by defining them respectively as "soluble substances of low molecular weight" and "a class of organic substances containing nitrogen with a characteristic molecular structure". T. F. DIXON.

Gérmen e Cultura

Por Prof. A. A. Mendes Corrêa. Pp. viii+234. (Pôrto: Instituto de Antropologia da Universidade do Pôrto, 1944.) n.p.

THE author would be the last person to claim that this volume contained new and important information. His aim has been rather to sit back and survey a number of problems and to give us his ideas generally: the articles included are, as it were, conversation pieces, some being on subjects of universal interest, others on matters of more particular importance to the Portuguese themselves and to their offspring in the New World. Such a series of conversation pieces, when composed by a scholar and humanist like the Director of the Institute of Anthropology of the University of Oporto, are always worth reading, and they will be found to be a useful antidote to the procession of single-track ideas generated by the overpowering pressure of the War. Portugal, it must always be remembered, is one of the few countries of Europe that has remained at peace.

The articles included in this volume are on various subjects and of different lengths. Most of them were delivered in the first instance as addresses to meetings of learned societies held in Portugal during the last few years. The title of the book is taken from that of one of the articles. Others deal with prehistory and history in Portugal, with the ethnology of Brazil, with the science of population, with methods of combating degenerative factors present in the Portuguese people, with half-breeds, with rhythm and culture, with the passage to sovereignty from bondage, etc. It is all somewhat general and philosophic, but none the less pleasant for that; a book well worth perusal by the fireside. M. C. BURKITT.

The Blood Pressure and its Disorders, including Angina Pectoris

By Dr. John Plesch. Pp. viii+149+5 plates. (London: Baillière, Tindall and Cox, 1944.) 15*s*. net.

DR. PLESCH divides his book into three parts. Part 1 contains a description of the principles and construction of an instrument which records the pressure changes within the brachial artery when this vessel is subjected to compression. The variations in the records obtained in different cardiac and peripheral vascular diseases are discussed. There is much useful clinical and physiological information in this part of the book, but the arrangement of the material makes it difficult to discover. As an additional instrument in the armamentarium of the cardiologist it is of considerable value, but it does not replace familiar and well-tried methods of diagnosis.

Part 2 is devoted to a discussion of the venous pressure and its variations in health and disease. This discussion covers a wide range and again contains many observations and hypotheses of interest to both clinician and physiologist.

Part 3 takes up the special condition known as angina pectoris, and discusses its pathology, physiology and treatment.

The book suffers much from the absence of a bibliography. Various authors are quoted in the text, but no references are given to their publications. The work of American and British investigators in the field of cardiology and vascular physiology receives scant attention.

Metallurgical Abstracts (General and Non-Ferrous)

Vol. 10, 1943 (New Series). Edited by N. B. Vaughan. Pp. xii+523. (London: Institute of Metals, 1943.) n.p.

THE "Metallurgical Abstracts" of work which comes within its own sphere is by no means the least valuable part of the activities of the Institute of Metals. The subject index alone of the volume under review extends to thirty-eight double-column pages, an indication in itself of the thoroughness with which the work is done. It will suffice for all those who have known this series of abstracts in the past to say that the latest addition is in every way up to the usual standard.

CHEMISTRY IN THE SERVICE OF MAN*

By DR. E. F. ARMSTRONG, F.R.S.

CHEMISTRY is the science which has discovered how things are composed, what properties they have and how they will react. Chemistry not only tells all about natural substances but also enables us to make new products rivalling the natural products in utility. Some of these safeguard health, others provide clothing, propel motor-cars, do a thousand other things and promise much more in future.

The manufacture by chemical synthesis of thousands of tons of substances of use to man depends on the availability of large quantities of suitable raw materials. The chemist wishing to make carbon compounds, which are without exception made up of longer or shorter chains of carbon atoms joined one to the other, seeks to start as early in the series as possible, generally from substances containing only two carbon atoms represented thus —·C — C— in his graphic formulæ.

To found a large-scale industry which is to handle many tens of thousands of tons, the raw material must be available in plenty and at world prices. It must bear no tax at this stage, a point largely overlooked by our politicians, or any other avoidable burden; in short, the price must be as low here in Britain as it is anywhere else in the world if the home industry is to be competitive.

The problem in making the large molecules or polymers composed of repeating units, which constitute many of the plastic materials, is to induce a large number of relatively small molecules to join together by chemical means. It would be a difficult and costly operation if we had to build the large molecule step by step; fortunately there is a trigger-like action between two carbon units at a high temperature, so that the energy set loose when they combine brings about a chain reaction in which perhaps a thousand units join together. The chemist has learned how to control the growth of the molecule so that the most suitable molecule-length may be obtained to suit the particular purpose for which the polymer is to be used.

The search for raw materials thus becomes one for two-carbon compounds; there are several alternative sources of these which it is proposed to examine here primarily in relation to their availability in Britain and the British Empire.

(1) Acetylene made by the action of water on calcium carbide, which in its turn is made from lime and coke by processes which need very large quantities of electric power: this power must necessarily be low-priced. In general such power, either in quantity or price, is not available in Britain, and it is not considered that any of the carbide production will be available for chemical synthesis.

(2) Two-carbon compounds made from alcohol by simple large-scale processes. Industrial alcohol is made by fermentation of carbohydrate materials, in particular from molasses which is imported in tank steamers just as is crude oil. It is recovered from the spent mash by distillation: other commercial products of the operation are carbon dioxide used to make 'dry ice' for refrigeration, and yeast. The formation of fermentable carbohydrates by plants is largely a function of the amount of sunlight—tropical countries have a great advantage over Britain in this respect. Our home cereals, required to feed man and beast, are too valuable to turn into alcohol except that limited quantity which is so profitably sold as potable spirits. The West Indian and other colonies need an outlet for their surplus carbohydrate material, and it is probable that industries can be developed there on the largest scale to produce material which can be easily transported to Britain for fermentation to alcohol.

(3) Two-carbon compounds made by the cracking of petroleum products. This industry is a modern adjunct to the refining industry which makes petrol, lubricating oils and burning oils.

(4) Two-carbon compounds made by catalytic synthesis from water gas and hydrogen. As water gas is made from coke, this is a simple form of oil from coal.

The oil-refining industry is only to a very minor extent established in Great Britain, since the discovery of a small native source of petroleum is a recent one. An increasing number of people consider its absence to be a very serious handicap, both because the country is deprived of these cracking products as the basis of the new chemical industry and because also the lack of this industry will mean the loss of incentive to our young men to become chemical engineers, of which more anon. The economic future of the synthetic, often called the Fischer Tropsch, process is still uncertain. It has been largely developed in Germany for military considerations.

Apparently if Britain is to develop these new synthetic chemical industries, the raw materials will be alcohol and/or cracking products. Both are being used to-day in America and there is the keenest competition between them, for example, as to which is the best raw material for the manufacture of synthetic rubber. Reports seem to indicate that the alcohol process is coming out well, which is of good augury for Great Britain where, as my analysis shows, it may be the most readily obtained raw material.

There is a great future for agriculture to supply raw materials, especially for chemical industry, sometimes called chemurgical materials. The sun and the rain and the soil enable man by the sweat of his brow to produce foodstuffs for man and beast. It is a wasteful process; too much depends on a variable market with manipulated prices, and much that is grown is left to decompose into simple products which return to the soil and the air. With cheap transport available and good organization, it should be possible to transform far more of what is grown into alcohol or protein and to lessen the waste. If this can be realized, great new employing industries can be set up in Britain and every yard of ground will be turned to account.

Lord Bledisloe has quoted with approval a statement "this nonsense world has too much chemistry, forgetting the living earth". Perhaps he is right in relation to farming, but reference is here made to the use of farm products as raw materials. In fact, there is need for more chemistry to help use the products of the farm, and we cannot do better than quote Mr. G. A. Sloan, president of the Nutrition Foundation:

"We think of cattle, corn, peanuts and soya beans primarily as food. In the future we will think of them also as sources of penicillin, synthetic fibres, hormones, vitamins, plastics and a host of new products which

* Extracts from the inaugural address to the Royal Society of Arts, delivered on November 1.

will increase the return to the farmers who raise them."

Some say we have not room to grow carbohydrates for alcohol in Britain, since we have only 1¼ acres per head of population. At least, we can avoid much waste, and there is the whole of the British Empire.

War experience has already taught that there is an economic use for all we grow when scarcity makes us take heed of our resources. Chickens, pigs, animal meat are not economic; milk production is! It is claimed, though not yet proved, that the yield of protein per acre in the form of yeast made from molasses calculated on the area of land required for the production of the molasses is several times greater than that of protein grown as soya beans, which have a high content of protein. It is also higher per acre than that obtained by feeding fodder crops to animals. In other words, 100 acres of sugar beet turned into molasses, turned into yeast would give more protein than 100 acres of grazing land turned into beef. These are the kind of sums which we may have to work out in the future.

The chemist has done much for food and will do increasingly more. There is an entirely proper prejudice in favour of fresh untreated foods; but we must, at least, know and understand everything about each one of them, and where the chemist can aid to make them safer to eat, more available, and guide their choice, his help should not be refused.

I wish here to direct attention to another phase of the food question, namely, that concerning proteins. Each protein is made up of a number of molecules of amino-acids, of which there are twenty different kinds. The protein molecules are very large, containing a thousand and more amino-acid molecules; they differ in the percentages of the various amino-acids present and may lack some of them altogether or contain the smallest quantities only. The individual amino-acids are joined end to end in a chain, the exact pattern of which has not yet been established for any protein; it is known to be constant for each particular protein.

The body breaks down the proteins, it eats into the individual amino-acids and uses these again to make its own protein: hence the importance of the individual amino-acids. Man and animals need most of them. Probably meat protein is so important a food because it contains those very amino-acids which we use to make muscle tissue. Nutrition experts are quite clear that a mixed diet is the best as a source of protein.

The scarcity, at least in war, and the cost of proteins make their economic production a matter of extreme importance. One main source is meat from animals, which convert vegetable protein in herbage into beef and mutton and pork; the process is a slow one. Another source is the pulses, seeds of high protein content which can be improved by selection and cultivation. Another source is fish.

The widespread cultivation of the soya bean is a notable example of progress in protein production. Unfortunately, this vegetable protein only ranks as second-class. Considerable interest, therefore, is attached to the production of protein in the form of yeast, which can be multiplied very rapidly in the course of a few hours. Whereas animals make their protein from the small amounts of organic vegetable protein in the very large quantities of herbage which they consume, the yeast cell is able to make its protein from ammonium salts, which are inorganic and manufactured from the nitrogen in the air. The technical question becomes whether yeast can be made in large quantity from carbohydrate material and inorganic nitrogen (ammonia) at a competitive price with meat. Inorganic nitrogen, a product of high-pressure technique, is to-day very cheap and available in unlimited quantity.

It is worth while giving some data about yeast production. They are based on U.S. experience. Baker's yeast is the chief yeast product; it is made to-day from carefully cultured strains having standardized activity in causing bread dough to rise in an appropriate number of minutes. Some 100,000 tons will be made in 1944. The vitamin content is not high, but it is possible to enhance it by changing the nutrient. Brewers' yeast is essentially a by-product of the fermentation of beer, and is not a raw material for another industry—more than 12,000 tons are available as a slurry, of which about one-third is recovered as cattle food and about one-tenth used as food or sold in the pharmacy. The vitamin content is some three times as great as that of bakers' yeast. The acceptance of brewers' yeast as food has led to the production in America of this type, grown especially for the yeast, that is, without hops, so that the product need not be debittered. The dried yeast has a high content of the vitamin B complex and retails for some 3*s*. a pound, a price which is reasonable on the basis of its protein content, which is about 46 per cent. A little calculation shows that yeast protein costs about 6*s*. 6*d*. per pound retail, whereas beef, with 19 per cent protein, selling at 2*s*. a pound, involves a protein cost of 11*s*. a pound. These figures are but an indication, but they are very suggestive of what can be done in the way of making protein quickly. Beef protein takes a year or more to make, yeast protein is a matter of twenty-four hours; beef certainly needs a larger acreage.

A specially suitable race of the yeast (*Torula utilis*) for the purpose has been recently developed in London, and factories are understood to be under construction to make it in Jamaica and Mauritius, where its first use will be for the under-nourished children in those Colonies. In the tropics, protein scarcity is often severe, but waste carbohydrates are plentiful. Certain races of yeast multiply so rapidly that the alcoholic fermentation is practically negligible. The yield of dried yeast in practice is 60 per cent of the fermentable sugar. It has been estimated in Germany that the waste sulphite liquors of the paper mills could make 100,000 tons of dry yeast a year, equivalent to 50,000 tons of protein. A development which is not very remote is the making of fermentable carbohydrates from wood. By what is known as the Scholler process, wood in presence of dilute sulphuric acid at a pressure of 4 atmospheres, the temperature being taken up to 190° C., is converted into easily fermentable glucose.

Largely within one generation, Britain and the United States have passed from a stage in which most of our food supply went directly from the farm to the consumer, to the present development in which the food industry processes and distributes a large and growing part of the total food supply. This could not have happened had it not been possible for the industry to do the job more efficiently, to provide better foods for the public at low cost. At first the development appeared to be on wrong lines from the point of view of optimum health, but the timely discovery of the importance of vitamins and the way to preserve and, indeed, obtain them has

altered this and made industry distribution of food of real benefit to mankind.

I would say a word about chemistry as a career. The nation needs many thousands of chemists, and the profession will attract an increasing number of young men. But the need is for enthusiasts with a real call to study and discover and make the furtherance of chemistry their life-work; those who think only that chemistry will give them an easy livelihood should be discouraged from entering the profession.

There will be countless opportunities in industry, in research and teaching, as well as in the professional branches of chemistry—the wise man will try to get experience in several of these before he settles down to his preference. While the material reward is important, and chemists, like others, must be properly paid, it is not everything, and many must be left free to pursue science for its own sake.

There is a tendency to place the utilitarian aspect of science too high, to associate universities, teachers and research with industrial development. This may have grave dangers if pursued too far; the universities must be left unfettered to pursue pure science, and endowed so as to make this possible. Their main function must remain to advance science for its own sake and they must avoid becoming tied to the wheel of commerce. "The wind of genius bloweth where it listeth."

In advocating the much more general teaching of science and scientific method throughout the schools, it is the scientific habit of thought that it is desired to cultivate, not mere scientific knowledge. The so-called practical man affects to despise theory, but he usually has a fairly intimate knowledge of his materials, gained by long experience, while if he is really practical, his methods are not far different from those of science. Where a knowledge of scientific method can help is in enabling new experiments to be devised which have a fair chance of success, or at least of teaching something. I have seen to my sorrow during this War far too many costly experiments made, the result of which a scientific man with knowledge could have easily predicted and which, therefore, were a waste of time and money.

The engineer, who is largely ruled by tradition, has intimate knowledge of the metals, but is being faced with the most varied requirements by industry for special plant to work at high temperatures and pressures, and to contain substances with corrosive and other unpleasant properties. To meet these difficulties a new class of engineer has arisen, the so-called chemical engineer, who supplements a sound general knowledge of engineering by a specialized knowledge of applied chemistry. There are degree courses at certain British universities for the training of such men. Actually, the country needs a great many more of them, perhaps several thousands, and the facilities for training them must be immediately increased.

I like to think of chemists as voyagers to a New World on uncharted seas of discovery, possessed of an Elizabethan quality as merchant adventurers. The Elizabethan age was one which had a soaring confidence; statesmen were not afraid to be something else as well—Bacon was alike man of science and philosopher. Science, industry, commerce, require art and skill to guide them; they need vitality for creative effort. It is our task to help to find them. It is not enough to search for true knowledge, for it is in the use of that knowledge we shall build our future.

The influence of war in accelerating scientific progress is often made the subject of comment. The reason for the greatly accelerated tempo is not far to seek—the needs are urgent, money is of no object, large-scale experiments are made possible, ample man-power is available. To Napoleon is credited the introduction of sugar beet in France to substitute for the West Indian sugar denied him by the blockade of the English Fleet; he also began the research which led to the preservation of foods by canning. This War has taken food preservation a stage further and developed the dehydration processing of food and much beside in the food industry: transport difficulties brought about by the submarine have forced these developments and produced a revolution, internal and external, in methods of transporting and preserving foodstuffs. Margarine was introduced during the 1870 War, but its development lagged until the War of 1914–18, and has been completed during this War, so as to put it on parity with butter. Perhaps the chief effect will be the great simplification of the problem of distributing food on a world-wide scale. Places and countries which are far distant, hard to reach and unhealthy, can now have normal healthy food supplies assured. Given also the advantages of refrigeration and air-conditioning, with power produced by the petrol engine, pioneering will lose half its terrors, while airports will become oases in the most savage lands.

Perhaps the person who is really encouraged by war is the technologist; hence the rather crude saying that science is useless until the technologist comes along and does something with the findings. Britain has made more than its quota contribution to discovery in pure research; it has largely left it to other nations to turn these discoveries to practical ends, and it is very slow to adopt them even when they are proved and of economic value.

It is comforting to read that even in the United States, where the speed of technical development is a cause for envy here, 'neophobia' exists, a term which means 'fear of the new' and that it may take ten or twenty years for a new product to become commercially successful. A wise friend of mine, H. A. Hopf, writes me that "every sensible person whose ideas are in advance of his times must have patience and persistence and a sense of humor".

It is claimed, and with a large degree of truth, that science, meaning the knowledge we have to-day in its various branches, has put those things which the individual wants, namely, food, work, security and freedom, within reach of all. The methods and ideas of science must become the dominant forms of thought and action in the future, but we must watch that talk is not substituted for action. Very few of those who offer Utopia to the public suggest that hard work will also be necessary and, indeed, must come first, if Utopia is to be earned. Forgotten is what Gilbert Cannan once expressed in "Pigs and Peacocks"—"laziness is the source of the whole trouble, letting the language, the traditions, the morals, the justice and the liberty of the race slip away"; there will be many who think this is just what is happening to-day.

It is widely advocated that the man of science and the engineer must exhibit depth and breadth of learning, and in particular see that the gifts of science are not wrongly used. The intention is good, but no man can control what others do with his inventions or their development. In fact, the developments during war, into which no question of econ-

omics is allowed to enter, are enormously greater and faster than they would have been during peace, and when peace comes mankind is assured of amazing benefits through them.

There is a hypothesis widely held by modern leaders of thought that the evolution of society, moving at an ever faster pace under the impetus given it by modern science, has up to now outstripped the capacity of human beings to adapt themselves. It is asked in the words of Herbert Read, "Is there a pattern or is it chaos; is it empty turmoil or is it progress?" That the world needs skill and vision to rebuild none will gainsay. Can we not say we are men of science and we believe we have the skill; we are artists and we believe we have the vision? Herein lies the future of this Royal Society of Arts. Shall we not repeat those Biblical words: "Be ye doers of the word and not hearers only, deceiving your own selves".

Perhaps then we may say with Shelley:

"The world's great age begins anew
The golden years return".

or with Carlyle: "Blessed is the man who has found his work—let him ask no further blessedness".

THE BIOLOGY WAR COMMITTEE

THE Biology War Committee was formed more than two years ago with the object of establishing a clearing-house through which ideas or knowledge relating to war-time biological problems could be exchanged between biologists and the Government. In order to ensure the closest liaison and co-operation, the Committee was linked to a special Joint Committee of the Department of Scientific and Industrial Research, the Medical Research Council, and the Agricultural Research Council. Moreover, it was agreed that while the Biology War Committee should cover the main fields of biology, medicine should be excluded and that representation should be weighted in favour of those fields which were not highly specialized and in which workers were not already closely linked with the three Government research councils.

In the exploratory period following on its initiation, the Committee was concerned in organizing and also establishing contacts with both Government Departments and biologists. Attention was also given to discovering the types of biological problems most likely to arise under conditions of war.

During the last two years memoranda and reports on a variety of problems have been prepared, some at the request of the Joint Government Committee and many on the Committee's own initiative. In addition, many other suggestions, inquiries and problems have been considered. The Committee is not, however, in the position to make public any summary of its activities to date since, on the grounds of the national interest, the Joint Government Committee considers that references to specific problems would be inadvisable. The Biology War Committee can, therefore, only state that the range of problems touched on or investigated is remarkably wide. In several instances the solution has required collaboration not only between biologists of varied interests but also with other scientific workers. In fact the complexity of some biological problems, where only one link in the chain of causation may be concerned with living organisms, has obscured to non-biologists the realization that some war-time problems are in part biological. Again, lack of detailed knowledge has caused some confusion in assessing biological problems—for example, the tendency to group into broad categories and therefore a failure to distinguish between allied noxious and innocuous species.

When the original Committee, set up jointly by the Association of Applied Biologists, the British Ecological Society and the Society for Experimental Biology discussed the formation of the Biological War Committee with the Joint Government Committee, it was felt that the future Committee's usefulness would be enhanced if the composition was based solely on representation by subjects. The experience gained over the last two years has fully confirmed this view. At the same time, the Biology War Committee has been considering how best to ensure flexibility under the changing conditions of the War, and the need for maintaining close contact with biological societies.

With these ends in view, the Committee has been reviewing both its organization and its constitution. It has been decided that, as hitherto, much of the work can best be carried out by a small executive committee working in conjunction with sub-committees set up to deal with specific problems and with powers to co-opt members outside the Committee.

It has also been agreed that the membership of the full Committee should be reviewed annually and that before the final list of proposed members is settled, the list for the ensuing year should first be circulated to biological societies asking for their comments and suggestions as to the representation of subjects. In addition, it has also been resolved that two members of the executive committee, which includes the officers, should retire annually, and that only one member should be eligible for re-election. For the offices of chairman and vice-chairman, it has been decided that the tenure should not exceed one year, but that the secretary and treasurer should serve for three consecutive years.

After consultation with biological societies, the composition of the Biology War Committee for the ensuing twelve months is as follows: A. L. Bacharach; F. C. Bawden, Rothamsted Experimental Station, Harpenden; G. E. Blackman (*secretary*), Department of Botany, Imperial College of Science and Technology, London, S.W.7; Prof. P. A. Buxton*, Department of Medical Entomology, London School of Hygiene and Tropical Medicine; Prof. H. G. Champion (*vice-chairman*), Imperial Forestry Institute, Oxford; Prof. A. C. Chibnall, Department of Biochemistry, Cambridge; C. Elton, Bureau of Animal Population, Oxford; Prof. H. Munro Fox, Department of Zoology, Bedford College, London; Dr. W. P. K. Findlay, Forest Products Research Laboratory, Princes Risborough; Dr. H. Godwin*, Botany School, Cambridge; Dr. J. Hammond (*treasurer*), Animal Nutrition Research Institute, Cambridge; Prof. A. C. Hardy, Department of Natural History, Aberdeen; Dr. H. Martin*, Long Ashton Research Station, Bristol; Dr. K. Mather, John Innes Horticultural Institution, Merton, London; Dr. A. T. R. Mattick, National Institute for Research in Dairying, Shinfield, Nr. Reading; Prof. J. W. Munro, Department of Zoology and Applied Entomology, Imperial College of Science and Technology, S.W.7; Dr. J. Needham, Department of Biochemistry, Cambridge; Dr. F. C. Pantin* (*chairman*), Department of Zoology, Cambridge; Dr.

* Members of the Executive Committee.

O. W. Richards, Department of Zoology and Applied Entomology, Imperial College of Science and Technology, S.W.7; Dr. M. A. H. Tincker, The Laboratories, Royal Horticultural Society, Wisley; Prof. T. Wallace, Long Ashton Research Station, Bristol; Dr. E. B. Worthington, Freshwater Biological Association's Laboratory, Wray Castle; J. Z. Young, Department of Zoology, Oxford.

OBITUARIES

Prof. J. H. Priestley

PROF. JOSEPH HUBERT PRIESTLEY died at Leeds on October 31 at the age of sixty-one. He was born at Tewkesbury in 1883 and educated at Tewkesbury Grammar School (of which his father was headmaster) and at University College, Bristol. He was a graduate of the University of London and, in 1905, took charge of the Department of Botany at Bristol. In 1911 he succeeded V. H. Blackman as professor of botany in the University of Leeds. On the outbreak of war in 1914, he was in command of the University Officers' Training Corps and, as a captain, went to France with the B.E.F. During 1915–19 he served on the Staff (Intelligence), being twice mentioned in dispatches and awarded the Distinguished Service Order. In 1919 he became a Chevalier of the Crown of Belgium. After his return to Leeds, he built up a large and active botanical department there. He was a fellow of the Linnean Society and president of Section K (Botany) at the British Association meeting at York in 1932. He had for long served on the Forestry Commission, and also took a very great interest in the work of local naturalists, particularly of the Yorkshire Naturalists' Union, of which he was president in 1925.

Priestley was a man of such extreme vigour that it is not easy to give a balanced account of his activities. Quite apart from his service as a staff officer, he left his mark in each of three fields, as an administrator, as a teacher and as a botanist. To some extent, his work in each of these fields suffered from his continued and intense interest in the others, but the wider range of accomplishment was characteristic of the man.

At the time of his death, Priestley was the senior professor at Leeds, had long been a member of the Finance Committee and had served as pro-vice-chancellor for some four and a half years. His opinion on any matter of university administration was worthy of his long experience and profound interest. He had an almost equally long acquaintance with the work of the Joint Matriculation Board, of which he served as chairman; and as the head of a large department he could have had few, if any, equals. His powerful administrative judgment was based on mastery of detail, on great practical capacity and on a profound appreciation of the mentality of his fellow-men.

His botanical work started with the investigation, with F. L. Usher, of the role of the pigments in photosynthesis and the attempt to study their action *in vitro*. He was, however, chiefly interested in problems of growth, and, coming under the philosophical influence of W. H. Lang, became with characteristic enthusiasm a keen student of developmental morphology and anatomy. His preoccupation was with the organism as a living entity, and his studies of cell wall structures were intended to emphasize the view that the composition of these structures reflects the growth activities of the cells that formed them. With his great practical gifts, it was natural that Priestley should also be interested in the practical bearing of his scientific work, and he devoted much time to subjects like the influence of electricity on field crops, the propagation of plants by cuttings (Master's Lecture to the Royal Horticultural Society, 1925) and, finally, spiral grain in timber. His later work focused attention particularly on the properties of growing cells and tissues, on development in monocotyledons and on cambial activity in trees. The purpose of his work was to show that the form and structure of an organ reflects the "organisation of growth" in the tissue which formed it.

No doubt views will differ on the question of whether Priestley's success as a teacher was greater or less than that as an investigator. He was certainly a born teacher and the impact on his students of his powerful and vigorous personality was tremendous. Those who were going to teach science must have profited enormously by acquaintance with his methods, which always focused attention upon the fundamentals of the subject under review. The gift for seizing the main point at issue was certainly an outstanding feature of Priestley's character and it ran through all his work, administrative, educational and scientific. Combined as it was with never-failing courage, boyish enthusiasm and outstanding vigour, it made him sometimes didactic, often provocative, always interesting and, as a whole, one of the most colourful persons in biology.

W. H. PEARSALL.

IN the death of Prof. J. H. Priestley the botanical world and the Department of Botany of the University of Leeds have lost a man of originality and genius. Though cut off from fulfilling the period of university service to the usual age of retirement, his life has been a full one, and the record of his achievements is one of which any man might be proud.

As an undergraduate at Bristol, though primarily a student of botany, Priestley also attended the honours courses in chemistry and physics, a training which gave him an exceptionally sound basis upon which to found his botanical studies. At the close of his studentship, at the early age of twenty-two, his gift for leadership was recognized and he was deemed worthy to take charge of the Department of Botany in University College, Bristol. Coming into botanical science at a time when many botanists had been absorbed in confirming and amplifying the great discoveries of the late nineteenth century, he brought to botany an alert mind and a fresh outlook, which undoubtedly owed much to his sound knowledge of the pure sciences. One of his first lines of investigation was an attempt to ascertain the first product of photosynthesis, but later his interests turned more and more towards developmental and causal studies; in this new line of attack on plant problems he often turned for advice and encouragement to Prof. W. H. Lang, of Manchester, of whose work and judgment he held a very high opinion. The results of his studies along these original lines, with the complementary teleological work of Haberlandt and his school, gave to botany a much more satisfying understanding of many plant structures. His last and most outstanding phase of research dealt with problems of tree growth; he was much absorbed in the dynamic problems of

cambial activity and vessel differentiation, and his connexion with the Forestry Commission gave him opportunities to apply his knowledge to problems of afforestation.

Priestley had an exceptional knowledge of the literature and a memory for recorded detail with a capacity to fit together such scattered pieces to give a picture of his problem as a whole, where each detail fell into its right place and assumed its right value. He was himself often the first to admit that suggested interpretations of certain new lines of investigation had found their way into print prematurely, but even in such cases the interest aroused stimulated such vigorous work on the subject in question, to prove or disprove his theories, that botanical science had much to gain. The recorded facts upon which his theories were based were always sound.

Throughout his long service to science, perhaps his outstanding merits, which will long outlive him in the work of his students, have been the inspiration for research, the importance he placed upon true recording of facts and soundly based and courageous attempts to interpret them. In his teaching he maintained a freshness of outlook by the continual introduction of new methods and facts, which, from his great fund of knowledge, he selected to illumine aspects of subjects which students previously thought they had fully assimilated.

L. I. SCOTT.
R. D. PRESTON.

Dr. Thomas Swinden

THE death of Dr. Thomas Swinden on October 27 at the age of only fifty-eight has deprived the steel industry of one of its ablest leaders, who during the past year had been playing an important part in the reorganization of research in iron and steel, and whose further help in that field would have been invaluable.

Dr. Swinden was born in Sheffield on August 15, 1886, and studied in the University of that city, being Mappin Medallist in 1905. During 1906–8 he held an 1851 Exhibition Scholarship, studying metallurgy at Stockholm and Uppsala. During 1909–13 he worked as a Carnegie Research Scholar, and was awarded the Carnegie Gold Medal. In 1913 he also obtained the degree of D.Met.

From 1909 Dr. Swinden was chief metallurgist to Samuel Fox and Co. of Stocksbridge, and was later works manager and director, but in 1932 he took up the important post of director of research in the United Steel Companies, Ltd., of which Samuel Fox had become an associate company. In this capacity he built up a remarkable research organization, with an able staff and well-equipped laboratories. Many valuable contributions have been made from this centre, both to metallurgy proper and to the study of refractory materials.

Besides controlling and guiding the research work of a large industrial concern and directing its application in practice, Dr. Swinden interested himself from the beginning in co-operative research for the whole of the iron and steel industry, and was one of the most active members of the committees and sub-committees set up jointly by the Iron and Steel Institute and the Iron and Steel Federation. Within the last few months he had assumed the chairmanship of several of these in succession to the late Dr. W. H. Hatfield, and he was an indefatigable worker for those committees. As a member of the Council of the British Iron and Steel Research Association which has recently been formed to take control of this work, he would have had many responsibilities in this field. During the War he took a leading part in the work of the Technical Advisory Committee on Alloy Steels, and was a member of the metallurgical mission to the United States in 1943, which imposed a considerable strain on those who took part in it.

Swinden's early papers dealt with the constitution and properties of the tungsten and molybdenum steels, and came at a time when there was very little information on such complex alloy systems. Later, he was responsible for much of the progress made in the production and use of steels with controlled grain size, and in recent years he and his collaborators did excellent work on the relations between carbon, oxygen and nitrogen in steel, making many improvements in the methods for estimating those elements, and making a special study of the low-carbon steels of the 'rimming' type.

Swinden was the most pleasant and courteous of colleagues. Very modest himself, he always gave full credit to his fellow-workers in his published work. His judgment on any disputed point was invariably trusted, on account of his wide practical experience and sound scientific knowledge. He was a faithful member of the Iron and Steel Institute, of which he had recently become a vice-president. He had received its Bessemer Gold Medal in 1941, as well as medals from the North East Coast Institution of Engineers and Shipbuilders and the Institution of Marine Engineers.

Always a hard worker, Dr. Swinden was found to be suffering from overstrain in the spring of this year and was compelled to take a rest. He had, however, apparently made a good recovery and had resumed much of his work, so his sudden death came as a shock. He had a happy married life, and leaves a widow and two sons to mourn his loss.

C. H. DESCH.

Dr. Paul Ostern

DR. PAUL OSTERN was killed by the Nazis in Lwow at the beginning of July 1941, during a pogrom in which several men of science, scholars, physicians and others died. Ostern is well known to biochemists all over the world: although young, he made brilliant contributions to biochemistry. Born in Zloczow in 1902, he studied medicine in Lwow, and joined my staff in 1927. Ostern was especially gifted for chemical work. Though he received no special chemical training, except in my biochemical laboratory, he was able to cope with the most difficult chemical investigations. It was he who succeeded in obtaining on a large scale not only inosinic acid from muscle but also adenylic acid: during the nineteen-thirties every laboratory which was using adenylic acid for research purposes acquired it, directly or indirectly, from the Laokoon factory in Lwow, where Ostern was collaborating, and where the preparation of adenylic acid from fresh meat was under his supervision. Only in 1937 this changed, when Ostern made his brilliant discovery of enzymatic synthesis of adenylic acid from adenosin and phosphate, the method now generally employed for the production of adenylic acid—also for therapeutic purposes.

After his first research work concerning the formation of ammonia in the heart and the transformations of adenylic acid in this tissue, Ostern spent some time abroad, where his work with Krebs in Freiburg

was interrupted by the Nazi seizure of power and Krebs leaving that country; with Verzar in Basel, and then with Krebs again, in Cambridge. In Lwow he participated in the team work, with myself and Dr. T. Mann, now in Cambridge, which led to the discovery of direct enzymatic transfer of the phosphate group from phosphoglyceric to adenylic acid, with the formation of adenosintriphosphoric acid, and to the chart of the linkage of chemical transformation in glycogenolysis, as now generally accepted. With T. Baranowski and J. Reis (now in the British Eighth Army), Ostern discovered (1935) the direct transfer of phosphate from adenosintriphosphoric acid to creatine, and the role of the phosphocreatine-creatine system as an alternating acceptor and donor of phosphate was disclosed; in 1936 he discovered that Harden-Young fructose-diphosphate is formed from the monoesters and adenosintriphosphoric acid, and this very important link in glycogenolysis and glycolysis, the inhibition of which by oxidizing agents, as recently found by Engelhardt, is the essential factor of the Pasteur effect, was discovered by Ostern and his associates. His last important discovery was made, with E. Holmes and D. Herbert, in 1939, during a short stay in Cambridge—that glucose is formed in the liver by way of phosphorolysis of glycogen and subsequent hydrolysis of the phosphoric ester. The formation of glycogen from the Cori ester by liver enzymes was then published by these workers, simultaneously with the St. Louis group.

In 1940 Ostern was appointed professor of organic chemistry in the Medical School in Lwow. Unfortunately, he did not leave the city when the Germans approached. His many friends abroad will deeply regret the untimely death of this outstanding scientific worker.

J. K. PARNAS.

Prof. Forsyth James Wilson

PROF. F. J. WILSON, Freeland professor of chemistry in the Royal Technical College, Glasgow, died suddenly on October 18. For the long period of thirty-eight years he had been associated with the College which he served faithfully and well; his first appointment was that of chief assistant to Prof. G. G. Henderson. During the period 1914–19 he served in the Army, ultimately as chemical adviser to the Eleventh Army Corps. On more than one occasion he was mentioned in dispatches.

In 1919 Wilson returned to the College to fill the chair of inorganic and analytical chemistry. On the transfer of Prof. I. M. Heilbron to the University of Liverpool, he succeeded, at his own request, to the chair of organic chemistry, and held that until the death of Prof. R. M. Caven, when the two chairs were amalgamated in the Freeland Chair. This is good evidence of his breadth of knowledge of the subject.

Born at Moffat in 1880, Dr. Wilson received his earlier training at the University of Edinburgh, from which he passed after a distinguished record to Leipzig, being associated there with Hantsch and Stobbe. On returning to Great Britain he joined Prof. A. G. Green at Leeds in research on dyestuffs.

In Glasgow, he took a lively interest in all the local sections of the various chemical societies and at different intervals acted as chairman. He was meticulous in his attendance at meetings, and his general bearing in discussion was always courteous. In due course he served on the councils of the Chemical Society and the Royal Institute of Chemistry, and held office for more than one period in each case. Nearest to his heart was perhaps the British Association, and he rarely missed a meeting of the Chemistry Section.

In the limited time available from heavy official and teaching duties, Wilson was actively engaged on research in organic chemistry, collaborating with many colleagues, among them Stobbe, Boon, Heilbron, and more recently with members of the present staff of the College, Sutherland, Hopper, Crawford, McLean, and others. His research work was mainly devoted to a study of stereoisomerism with special reference to derivatives of semicarbazide and thiosemicarbazide, and to the resolution of optically active compounds derived therefrom. Latterly, he developed a special interest in certain aspects of chemotherapy, and in this connexion was associated with Imperial Chemical Industries Ltd. He was a frequent contributor to the *Journal of the Chemical Society*. With Prof. Heilbron he published a very useful little book on "Chemical Theory and Calculations"; although now out of print, it earned well-deserved popularity among a wide circle of students some twenty years ago.

Wilson's work in and for the Royal Technical College, Glasgow, met with unqualified approval and success, and his influence upon his students as well as his personal relations with them were admirable. Many of them holding important positions throughout the world will recall with pleasure his warm personal interest in their well-being, both during and after college days. Of shy and retiring disposition, he was a man of considerable grace and charm, highly respected and esteemed by his colleagues, no less than by his students.

W. M. CUMMING.

Dr. Henry J. S. Sand

DR. HENRY J. S. SAND died, after a short illness, at Nottingham on October 18. He will be remembered as an electrochemist of international repute, and he had also published outstanding original work in other branches of chemistry.

Dr. Sand was born in Dundee on December 7, 1873. He received his early education at the High School, Dundee, and later at the Realgymnasium in Dresden. It was during these early years in Germany that the foundations were laid of his excellent knowledge of the German language. For a short time he studied under Hempel at the Dresden Polytechnic, and then continued his university career at Zurich, where his inaugural dissertation was published in 1898. Here he worked under Bamberger, studying organic chemistry, and was awarded the degree of Ph.D. Upon his return to England, Dr. Sand worked with Ramsay at University College, London, for a short period and then, as a holder of a Bowen Research Scholarship at the University of Birmingham during 1899–1901, commenced the studies in electrochemistry for which he is so well known.

In 1901 Dr. Sand took up the post of lecturer and demonstrator under Prof. Kipping at University College, Nottingham, and continued his researches. He was awarded the degree of D.Sc. at Birmingham in 1905. In 1914 he moved to London and held the post of senior lecturer in chemistry at the Sir John Cass Technical Institute, London, until 1921, after which date until he retired in 1938 he was head of the Department of Inorganic and Physical Chemistry.

Sand's published scientific work is contained in about fifty original papers with subjects varying in scope from laboratory apparatus of his own design and construction to theoretical discussions in thermodynamics. He was thus both an able and skilled experimenter and a thinker of wide scientific outlook. Outstanding among his original investigations are the work on electrode processes including diffusion at electrodes and over-voltage, the development of vacuum-tight seals for leading in wires to silica and glass vessels, and various improved methods of electrochemical analysis. Particularly among these should be mentioned the separation of metals by control of electrode potential and the use of 'internal' electrolysis for determination of metallic elements in the presence of larger quantities of less noble metals. In 1939, 1940 and 1941 there were published successively the three volumes of his "Electrochemistry and Electrochemical Analysis", a work upon which he had spent many years of thought and labour and which summarized the state of electrochemical knowledge to that date.

To those who had the privilege of knowing him, Dr. Sand was a most amiable man. His former colleagues and research students particularly will remember his tolerant and kindly criticism, his balanced judgment and his unfailing help, which he gave freely to all those who brought their problems before him. He will be remembered and missed by many friends all over the world, and they will think with sympathy of his widow, and his only son who is now serving with the British Army overseas.

ARTHUR J. LINDSEY.

WE regret to announce the following deaths :

Sir Joseph Arkwright, F.R.S., honorary bacteriologist at the Lister Institute, on November 22, aged eighty years.

Prof. Charles F. Park, emeritus professor of mechanical engineering at the Massachusetts Institute of Technology, director of the Lowell Institute School, on September 25, aged seventy-five years.

NEWS and VIEWS

The Times and Freedom of the Press

How often do readers notice the serial number at the front of a journal ? Yet this number is much more than a convenient means of identification used by publishers and printers ; as is pointed out in an article in *The Times* of November 25, it indicates the intention of continuing to produce the journal at short intervals, so that the reader can follow the progress of events—it is a sign of continuous and watchful activity. *The Times* has given this service to Great Britain for the past century and a half, and it has now proudly inscribed the number 50,000 on the front page of its issue of November 25. As the years have gone by, *The Times* has grown in stature, under a succession of distinguished editors, until it is now an organ of international repute.

The leading article of the 50,000th issue rightly ends on the note of the freedom of the Press. One of the first acts of an authoritarian regime is to suppress the expression of contrary views ; government by consent of the people, the very essence of democracy, requires a free Press, able to reflect and to guide public opinion. In times of war, a democracy must accept, however grudgingly, a considerable measure of dictation, including censorship of the Press. This suppression of facts in the interests of national security is an evil necessity under which every member of a democracy must chafe ; particularly is this restriction of publication felt in scientific circles, where the free interchange of news and views is the life-blood of progress. *The Times*, with other journals, has accepted the necessity of censorship, but it declares in no uncertain terms its policy for the future : "As the war draws to an end and the shadow of military necessity recedes, the immediate task will be to ensure that every encroachment of authority shall be rolled back from a field of responsibility in which, in a free community, it can have no place". It will have the support of all who value democracy in carrying out this policy in the years to come.

Communities and Industry

THE broadsheet "Location of Employment" issued by Political and Economic Planning is a timely contribution to the discussion of the fundamental questions in town and country planning on which early decisions must now be taken by the Government. The broadsheet attempts first to analyse the employment needs which are relevant to physical planning, and then considers how far those needs could be met on the scale of a community comprising not more than about 60,000 people. The conclusion is reached that a satisfactory variety of industry and occupation can usually only be provided for a group of communities, and not, as town-planners have often suggested, for each community separately. The important concept is not so much that of the community as that of the employment orbit, or the area in which any point can be reached within reasonable daily travelling time by the members of the community. For some communities it may be far better to improve communications with other places than to try to bring industry within the borders of the community. It should be possible for the majority of wage-earners to find work fairly near to their homes ; many jobs in secondary and tertiary industries can be located in the community itself, and the broadsheet points out that the employment exchanges, by the use of judicious and flexible placing methods, can help in this. Secondly, the time taken up in travelling to work can be cut down by improving transport and by careful layout and correlation of the several communities.

Even when communities have been grouped in this way for purposes of employment, there may still be some which have no economic future by themselves and are so isolated that they cannot be combined in a larger region. Such communities, *Planning* considers, should be closed down. Again, the employment orbits suggested may not be suitable units for the industrialist. The advantages he requires may not always be provided therein ; but it should be

possible to provide them in a region containing a number of such orbits. If there is movement of population from the congested cities, the 'overspill' is likely to be better accommodated and better employed if it is kept in close relation to a regional or sub-regional centre than if it is dispersed to independent new towns. Industrial development should be viewed on a regional scale, taking fully into account the existence of the traditional regions, and aiming at introducing new complexes of industry into these existing regions. The broadsheet points to several factors which increase the mobility of industry, but finally emphasizes the difficulty of applying the general principles indicated. Usually, in practice, the decision must be a balance between economic and social considerations, and close co-operation between the central Government and industrialists is needed.

Selection of Medical Students

IN an earlier issue (*Nature*, 154, 315, Sept. 9, 1944) the possibility that intelligence tests might be used as aids in the selection of candidates who wish to undergo a medical training was discussed in relation to the proposals of the Goodenough Committee on Medical Schools and the Planning Committee of the Royal College of Physicians for the selection of medical students by personal interview rather than by examinations alone. Drs. O. G. Edholm and Q. H. Gibson (*The Lancet*, 294, Aug. 26, 1944) have now published the results of their work on examination results as intelligence tests. This work was done at Queen's University, Belfast, where second-year medical students have, for the past three years, carried out "an intelligence test, using Raven's Progressive Matrices" (J. C. Raven, Progressive Matrices, London, 1938). The scores obtained were compared with examination results. The students included 20 per cent women, and the average age of both men and women students was 19½ years. These authors conclude that "one of the most striking and important points which emerges from these results is the high mental ability of the average medical student, as measured by the matrix test". They quote the report of the Planning Committee of the Royal College of Physicians as saying that the average medical student of to-day is lacking in initiative and curiosity, with poor ability to arrange and interpret facts and little precision in the use of words. "If we accept this statement," these authors comment, "either unusually great ability is necessary to avoid these faults, or they are not primarily due to any lack of intelligence." Other critics of the mental ability of the average medical student might take this statement to heart.

More pertinent to the selection of future medical students is the conclusion of Drs. Edholm and Gibson that "a fairly rigid process of selection has already been applied by the time the student reaches his second year". This would seem to confirm the view expressed in *Nature* (*loc. cit.*) that "Selection can . . . be imposed too early, and the value of the natural selection of the medical school and the hospital can be underestimated". Discussing the question whether the matrix test would be valuable for the selection of medical students, these authors conclude that the results of previous examinations form a more reliable index of results in future ones. They find no reason to think that the medical students of Queen's University are not representative of the intelligence of medical students generally; but they think that further work should be done to show whether their results are generally applicable. R. G. Inkster (*Roy. Acad. Med., Ireland*, Sect. Anat. and Physiol., March Meeting, 1944) obtained results similar to theirs; but he used an entirely different intelligence test. The authors do not wish to imply, however, that success in examinations is the only criterion of the satisfactory student.

Spectrographic Discussion Group

THE Spectrographic Discussion Group was formed in 1941 as a result of approaches made to the various users of spectrographic equipment in the Glasgow area. It was considered that, in view of the extent to which industrial concerns and Government departments were applying spectrographic methods of analysis and the very rapid developments which were taking place in this branch of science, it would be of value if those directly interested in spectrography were able to meet at intervals and discuss the various problems which arose in the course of their work. Further, it was considered advisable that representatives of the principal technical institutions and of manufacturers of spectrographic equipment should have the opportunity to attend these discussions. The fundamental policy of the Group required the free interchange of ideas and co-operation in tackling any problems which arose as a result of discussion. Although originally confined to members in the Glasgow area, the success of the Group was such that, in a relatively short time, members representing concerns in Aberdeen, Sheffield, London and other parts of the country were admitted. Meetings of the Group are held in the Royal Technical College, Glasgow, at intervals of approximately six weeks. The chairman is Mr. S. D. Steele, of Babcock and Wilcox, Ltd., Renfrew, Scotland. It has always been considered of first importance that the nature of these discussions be informal, and that in no sense should the Group acquire the character of a society. In this respect it has been found necessary to limit membership to those directly interested in spectrography and also to control membership by invitation. The success of the Group and the progress made have been so marked that it is felt that groups of a similar nature established throughout Britain would be most beneficial.

Long Ashton Research Station

THE annual report of the Long Ashton Research Station for 1943 has now been published. Several important changes in senior staff appointments mark the period covered, for Prof. B. T. P. Barker, director of the Station during its first forty years, has retired, being succeeded by Prof. T. Wallace, while Mr. A. W. Ling, though still remaining chief agricultural advisory officer in the Bristol Province, has been appointed principal of the Seale Hayne Agricultural College, Devon. The research work undertaken during the year continued to be closely concerned with current problems of the food production programme of the Ministry of Agriculture, and many useful results were obtained, only a few of which can be mentioned here. Tests made with apples, swedes, carrots and potatoes showed that ½–1 per cent naphthalene–acetic acid exerts a delaying action on bud-growth, a fact which should prove of practical importance in preventing sprouting of stored potatoes, while an allied compound, naphthoxyacetic acid, sprayed at the rate of twenty parts per million, had a stimulating effect and increased the yield of Tardive de Leopold strawberries. Outstanding results have

been obtained with dichlor-diphenyl-trichlorethane (D.D.T.) as an insecticide, and the compound seems to merit field trial as a substitute for lead arsenate. Records of mineral-deficiency responses in plants have been extended, and symptoms for twenty-three new crops added to the list. As regards advisory work, a total of 10,880 letters were dispatched and forty-three papers published in scientific journals by members of the Long Ashton, Berkeley Square and Campden staffs.

Indian Woods for Textile and Jute Mill Accessories

IN *Indian Forest Bulletins* Nos. 121 and 122 (1943) (Forest Research Laboratory, Dehra Dun) substitutes are proposed for imported cotton mill shuttles, bobbins, etc. In Bulletin No. 121, by M. A. Rehman, the results of tests carried out at the Research Institute, Dehra Dun, on the suitability of Indian timbers for cotton mill shuttles for power looms, to replace cornel and persimmon ones imported from America, are described. A large number of timbers considered suitable for their known characteristics were tested. After elimination, the seasoned and selected blanks of woods which appeared promising were sent out for manufacturing trials. The finished shuttles were then tested in weaving mills under factory conditions. Results have shown that the light-coloured sapwood of *Diospyros melanoxylon* or ebony is the best Indian timber so far tested for shuttles. It gives about 50 per cent of the life of imported timber. Other species mentioned in the Bulletin are being used in parts of India where the particular timbers are more easily obtainable.

Bulletin No. 122, by M. A. Rehman and Chheda Lal, treats of the care and seasoning of woods for bobbins, picker arms and jute mill rollers. Suggestions are made for using indigenous woods for the manufacture of these implements; for example, imported bobbins were of beech, birch and maple. Sixteen Indian species of woods belonging to fifteen genera growing in different provinces have been tried out. Species of four of these genera are used extensively throughout the country for bobbin-making. Their life does not appear to be much more than 30 per cent of the imported bobbins. Picker arms and jute mill rollers are also discussed.

Forests of Trinidad

THE present position of forestry in Trinidad (Trinidad and Tobago, Forest Dept. Admin. Report for Year 1943. Trinidad and Tobago: Govt. Printer) appears to be of considerable interest. There are not many British Colonies which can state that the general position with regard to forest reservation is eminently satisfactory, and that the forest reserves occupy 22·7 of the total area of the Colony "after deducting the area leased to the U.S.A."; and further, that "almost all the forest reserves are now governed by Working Plans under which some form of elementary yield control has been introduced". This is, or should be, the first object in management to be aimed at by the trained forest officer; but, whatever the reasons, it has been neglected in most of the forest regions under the Colonial Office. As elsewhere in the British Empire, the bar-restrictions in timber imports have resulted in the demand for unseasoned local timber exceeding the supply. This being the case, it is difficult to follow the argument that high costs (these prevail everywhere), low volume production per acre (common to the tropical mixed forest generally), and high loss in conversion of tropical woods make it doubtful whether any such supply from the natural mixed forests could in normal times compete with imports. The exploitation of the more or less gregarious *Mora* forests has been under consideration for years; it is now said that there is a high conversion loss owing to the refractory nature of *Mora* as a timber. It would appear that there is now an unexpected chance to introduce, as has always been the case in most parts of India, the indigenous Trinidad timbers to the population in such a manner as to render their use a permanency in the Colony. There is no mention in the report of a recognition of the advantages offered to the type of forests existing in Trinidad by the introduction of a plywood mill.

British Astronomical Association

A BROCHURE entitled "The British Astronomical Association. Its Nature, Aims and Methods" has been issued by the Association with the main object of encouraging amateurs to undertake astronomical work. Fourteen sections are now in existence, and valuable work is still being done in spite of the difficulties of war conditions. Novices need not be deterred even if they have very little instrumental equipment; in some cases, such as the observation of meteors, auroras, zodiacal light and in historical research, etc., no equipment of any kind is necessary. Proof of the important work that amateurs can do is afforded by a recent triumph of the Computing Section under Mr. J. G. Porter; with the help of four members of this Section, a definitive orbit of Comet Pons-Winnecke has just been computed (*J. Brit. Astro. Assoc.*, 54, 7; 1944). This is probably the first time in the history of astronomy that a body of amateurs has computed a definitive orbit, and it is a testimony to their wonderful patience and skill in handling figures that this formidable work has been accomplished.

Fifty-four years of work by members of the Association have seen much accomplished and also an increasing interest in astronomy. The membership has had a remarkable growth within the last few years and now exceeds 1,200. During the War, the Association moved its meeting place and library to the premises of the Royal Astronomical Society, Burlington House, Piccadilly. Information regarding conditions of membership, etc., should be addressed to the secretary at the above address. Mr. F. J. Hargreaves retired from the presidency in October and the new president is Mr. P. J. Melotte, of the Royal Observatory, Greenwich.

Public Health in Turkey

THE *Asiatic Review* of October contains an interesting article by Bay Nuzhet Baba on the public health effort and social assistance in Turkey. The central authority in charge of health and social assistance is the Ministry of Health and Social Assistance. Free treatment of the sick, campaigns against epidemics and diseases, especially malaria, trachoma, typhoid fever and dysentery, all fall within the sphere of activity of the Ministry. To the Ministry also are entrusted the supervision of maternity homes, hospitals and sanatoria. In order to emphasize the importance of medical examination of school children, dental care, vaccination against small-pox, inoculations, etc., the Ministry has drawn up regulations whereby municipalities are obliged to provide such

services free of charge. Museums have been established and exhibitions arranged to propagate hygienic principles, and posters and pamphlets are distributed to the villages and displayed in public places.

Insect Pests of Food

THE Ministry of Food has published, under the title of "Insect Pests of Food" (London: H.M. Stationery Office, 5*s*. net), two important papers on moths and their larvæ affecting stored products. They are designed to provide a reliable and up-to-date guide to the identification of the insects referred to. Although the two papers are primarily for the use of the Ministry's inspectors, they will be valuable to anyone concerned with the pests in question. The paper on lepidopterous larvæ affecting stored products is by Dr. H. E. Hinton and was originally published in the *Bulletin of Entomological Research* (34), and that on the moths by Dr. A. S. Corbett and Mr. W. H. T. Tams is reprinted from the *Proceedings of the Zoological Society of London* (113 B).

Domestic Electrical Accessories

THE design and installation of electrical accessories for domestic purposes was dealt with in a paper read by F. C. Fuke in London recently before the Institution of Electrical Engineers. The paper states the requirements which the design of electrical accessories must fulfil and how such requirements can be met. Contacts and switching are dealt with at some length, because of their effect upon the performance and life of most accessories. The fundamentals of fuse design are given, as well as the reason for possible indiscriminate operation between fuses of different types. The need to break away from some time-honoured practices is shown, with particular reference to plugs and tumbler switches, and solutions based on theoretical and practical considerations are presented. The author considers that British Standard Specifications should be confined to setting standards of performance, with interchangeability only where required, and that constructional details and dimensions should be omitted so as to give maximum freedom for development and, therefore, progress in design.

Botanical Periodicals at Oxford

A CATALOGUE of interest and value to all research workers and teachers in botany who wish to consult out-of-the-way journals as well as those more easily obtained has just appeared in the "List of Periodicals" issued by the Library of the Botany Department at Oxford. The purpose of the Library is, of course, to serve in the first place the needs of the Department, and this list was naturally prepared to that end; it is, however, now available for limited circulation. It is obvious that the privilege of borrowing books for use outside Oxford can only be granted in exceptional cases and through recognized channels; but the list will undoubtedly be of assistance to those in need of periodicals otherwise obtainable only with great difficulty and to whom these channels are available. The list is clearly annotated, the information being obtained chiefly from the periodicals themselves, and a useful feature is that all journals with current numbers in the Library are printed in bold type.

Recent Earthquakes

THE United States Coast and Geodetic Survey, in co-operation with Science Service and the Jesuit Seismological Association, has determined the provisional epicentres of five recent earthquakes. The first, on August 7, at 3h. 25·3m. G.M.T., had its epicentre at 16·9° S., 71·5° W., which is in Peru. The second, on August 10, at 1h. 52·7m. G.M.T., had its epicentre at 51·4° N., 130·5° W., which is south of Queen Charlotte Islands, off British Columbia. The third, on August 18, at 10h. 33·1m. G.M.T., had its epicentre at 35° N., 137° E., which is in Japan. The depth of focus of this shock was probably near 200 km. The fourth shock occurred on August 24 at 23h. 37·8m. G.M.T., and had its epicentre at 15° N., 93° W., which is in Guatemala. The depth of focus of this shock was slightly less than 100 km. The fifth earthquake occurred on September 5 at 4h. 38·8m. G.M.T. It had its epicentre at 45° 01′ N., 74° 44′ W.

On October 6, at about 5.30 a.m. local time, an earthquake in Anatolia, south of the Dardanelles and near the ruins of Troy, is reported to have destroyed 4,000 buildings in Ayvalik, Edremit, and the surrounding district, and to have caused the deaths of 44 persons; 112 others are reported injured as a result of the earthquake. Further news of this shock is awaited.

Announcements

SIR FRED CLARKE, director of the Institute of Education and professor of education in the University of London, will retire under the age limit on September 30, 1945, and the University has appointed Prof. G. B. Jeffery, Astor professor of mathematics at University College since 1924, to succeed him in the post of director of the Institute.

BRIGADIER GEORGE MACDONALD, assistant director since 1939 of the Ross Institute of Tropical Hygiene, London School of Hygiene and Tropical Medicine, has been appointed director of the Institute and will take up his appointment on release from the Services.

DR. A. G. SANDERS has been appointed medical adviser in China to the British Council and has arrived in Chungking. Dr. Sanders is one of the group of Oxford workers, led by Sir Howard Florey, who developed and extended Sir Alexander Fleming's earlier work on penicillin. He was chiefly responsible for the design and construction of the apparatus used for large-scale laboratory production of penicillin. The primary object of his visit is to investigate and organize the exchange of information between China and Britain on matters of importance in medical science and practice; and he will be working under the direction of Dr. Joseph Needham, director of the British Council Cultural Scientific Office at Chungking.

SIR JOHN RUSSELL, who has for the past eleven weeks been in a nursing home where he has undergone a surgical operation, is sufficiently recovered to be able to return shortly to his home at Campsfield Wood, Woodstock, Oxfordshire.

THE following appointments have recently been made by the Colonial Office: R. A. Butt, to be assistant conservator of forests, Uganda; J. D. Farquhar, to be assistant conservator of forests, Palestine; G. Watkins, to be assistant conservator of forests, Tanganyika; R. D. Hodgins, to be veterinary officer, Northern Rhodesia; R. P. Lee, to be veterinary officer, Tanganyika; H. S. Darling, plant protection officer, Palestine, to be entomologist, Uganda.

The vacancies advertised in these columns are available only to applicants to whom the Employment of Women (Control of Engagement) Orders, 1942-8, do not apply.

COMMONWEALTH OF AUSTRALIA

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH — DIVISION OF INDUSTRIAL CHEMISTRY

Appointment of Organic Chemist.

Applications are invited for appointment to a position as organic chemist on the staff of the Council's Division of Industrial Chemistry, Melbourne. The appointee will be required to carry out work on alkaloids, particularly those with pharmacological or insecticidal value, from Australian native plants and trees.

An applicant should have a University Degree in Science or equivalent qualification and have special training in organic chemistry with systematic research experience in organic synthesis.

The salary will be in the range £A560 to £A640 (actual), depending on the qualification and experience of the successful applicant.*

Applications, stating age and nationality and giving particulars of qualifications and experience and of present employment and accompanied by copies of not more than four testimonials, should reach the Secretary, Australian Scientific Research Liaison Office, Australia House, Strand, London, W.C.2, not later than Dec. 31, 1944.

(Signed) G. A. COOK,
Secretary.

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

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

COUNTY BOROUGH OF SUNDERLAND

EDUCATION COMMITTEE
TECHNICAL COLLEGE

The Education Committee invite applications for the position of PRINCIPAL of the above-named College (which is affiliated to the University of Durham in the Schools of Engineering and Electrical Engineering in the Faculty of Applied Science), at a salary of £1,000 per annum, plus war bonus. The person appointed must be between 35 and 50 years of age and an Honours Graduate of a British University.

Canvassing members of the Committee, directly or indirectly, until after the first selection of candidates by the Committee, will disqualify the applicant by or on whose behalf such canvassing shall have been made.

Particulars of the appointment and forms of application may be obtained from the undersigned, to whom they should be returned, together with not less than three recent testimonials, endorsed "Technical College—Appointment of Principal," on or before Dec. 23, 1944.

W. THOMPSON,
Director of Education.

Education Offices,
15 John Street, Sunderland.

ESSEX EDUCATION COMMITTEE

SOUTH-EAST ESSEX TECHNICAL COLLEGE AND SCHOOL OF ART

Longbridge Road, Dagenham

SCIENCE DEPARTMENT

Required, in January or as soon as possible, permanent full-time LECTURER IN PHYSICS to B.Sc. Special standard. Candidates must possess good Honours Degree and should have had some research or industrial experience. Some knowledge of applied Industrial Physics an asset.

Salary: Burnham (Provincial) Scale.

Further particulars and forms of application obtainable from the Clerk to the Governors at the College on receipt of a stamped addressed envelope.—Applications, with copies of two recent testimonials to be sent to the Clerk to the Governors by Saturday, Dec. 9.

B. E. LAWRENCE,
Chief Education Officer.

County Offices,
Chelmsford.

UNIVERSITY OF ABERDEEN

LECTURESHIP IN GEOGRAPHY

The University Court will shortly proceed to the appointment of a Lecturer in Geography to commence duty on Oct. 1, 1945, or on a date to be arranged.

The salary will be £650 to £800, according to the qualifications and experience of the person appointed. The person appointed will come under the Federated Superannuation System for Universities.

Persons desirous of being considered for the office are requested to lodge their names with the Secretary to the University on or before March 31, 1945.

The conditions of appointment may be obtained from the undersigned.

H. J. BUTCHART,
Secretary.

The University, Aberdeen.

MOUNT VERNON HOSPITAL AND THE RADIUM INSTITUTE NORTHWOOD, Middlesex

Senior Technician required to take charge of Physics Workshop and be responsible for servicing and development of continuously evacuated and other *x*-ray apparatus. Commencing salary according to experience, but not less than £360 per annum. Federated Superannuation Scheme in force.

Appointment will be irrespective of Ministry of Labour permit for immediate transfer.

Applications, giving qualifications and experience, accompanied by copies of testimonials, to be forwarded to the Secretary by Dec. 22, 1944.

UNIVERSITY OF LIVERPOOL

The Council invites applications for the post of Assistant Lecturer (Grade III) in the Department of Zoology, at a salary of £350 per annum. The tenure of the appointment will be for one year in the first instance.

The successful candidate will be expected to lecture and undertake researches on fresh-water Zoology and to assist in the teaching of General Zoology.

Applications, together with three testimonials, should be forwarded to the undersigned, not later than Jan. 20, 1945, from whom further particulars may be obtained.

STANLEY DUMBELL,
Registrar.

UNIVERSITY OF OXFORD

SIBTHORPIAN PROFESSORSHIP OF RURAL ECONOMY

Applications are invited for the above Professorship, and should reach the Registrar of the University not later than Feb. 24, 1945. Stipend £1,200 a year with an additional sum of £200 a year by way of special allowance in respect of duties as Head of the Department. Retiring age 65.

Further particulars may be obtained from the Registrar, University Registry, Oxford.

HARRIS INSTITUTE, PRESTON

Wanted, TWO ASSISTANTS, one in the MECHANICAL and one in the ELECTRICAL ENGINEERING DEPARTMENT.

Applicants should hold a degree of a British University or have equivalent qualification.

The salary will be in accordance with the Burnham Scale for Technical Schools.

Application forms may be obtained from the undersigned and should be returned not later than Dec. 18.

T. M. NAYLOR,
Principal and Secretary.

NORTHAMPTON POLYTECHNIC

ST. JOHN STREET, LONDON, E.C.1.

LECTURER required in the Applied Chemistry Department. Honours Degree in Chemistry essential, research and/or industrial experience desirable. Qualifications and experience in fuel technology a recommendation.

Salary in accordance with London Burnham Scale, plus war bonus.

Particulars and form of application from the Secretary.

UNIVERSITY COLLEGE OF NORTH WALES, BANGOR

Laboratory Assistant required in the Department of Botany. Salary £240—£15 per annum—£300, plus war bonus and superannuation. Further information may be received from the undersigned with whom applications should be lodged as soon as possible.

F. P. G. HUNTER,
Bursar and Acting Registrar.

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 Laboratory Assistant (Grade I) in the Department of Botany. Salary £4 to £8 per week. Initial salary according to qualifications.

Applications as soon as possible to the Secretary.

Graduate Assistant Physicist is required for the Research Department of the Fine Cotton Spinners' & Doublers' Association, Limited. Previous textile experience is not essential, but good mathematical standard with sound mechanical sense and interests are desirable. A knowledge of statistics, with some experience of photography and photomicrography would be additional advantages.—Applications, giving age, qualifications, industrial experience (if any), and salary required, with copies of testimonials, should be forwarded to the Director, Research Department, The Fine Cotton Spinners' & Doublers' Association, Rook Bank, Bollington, nr. Macclesfield.

Applications are invited for four posts at the Cereals Research Station, St. Albans. (1) Physical Chemist; (2) Biochemist. Applicants should have some research experience. Commencing salaries £350 per annum. (3 and 4) Two Technical Assistants, preferably up to Inter B.Sc. standard, for research on milling and allied engineering problems; commencing salaries £250 per annum.—Apply Director, Cereals Research Station, Old London Road, St. Albans.

Company manufacturing Insecticides, Fungicides, etc., requires Technical Advisory Representatives specializing in treatment of agricultural and horticultural crops. Technical qualifications are essential and commercial experience in the field desirable. The post will entail visits to farms, etc., over fairly wide territories.—Apply, stating age, qualifications, and full details of experience, to Box 270, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Technical Assistant required for abstracting and indexing in the Information Bureau of an Industrial Research Association in London. Knowledge of Chemistry essential; ability to read French and German, and to copy type an advantage. Salary according to qualifications and experience.—Reply, Box 271, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Large Company in London (Scheduled under Essential Work Order) require services of technically qualified lady to search patent and technical literature and prepare abstracts (ability to translate French or German scientific literature an advantage). Stamped addressed envelope should not be enclosed.—Applicant should state full particulars of qualifications, experience, age, and salary required to Box 268, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Young Engineer or Physicist with good Mathematical qualifications required for development work on turbines. Industrial experience not essential, but applicants must show some evidence of sound training in fundamentals of thermo-dynamics and strength of materials. Salary £350 to £500 per year, according to qualifications and experience. Good position is offered, with prospects of advancement.—Apply in writing, stating age, qualifications, and experience, to the Manager, Employment Exchange, Warwick Road, Wallsend.

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 £460 per annum, plus 12½ per cent war bonus.—Apply, Chief Chemist, Genatosan Ltd., Loughborough.

Wanted immediately Chemist, not necessarily qualified, but with knowledge of Photography essential, to take charge of Photographic Laboratory near London. Permanent, progressive post-war appointment.—Box 272, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Assistant Physicist required. Duties mainly connected with radiotherapy and post-graduate lectures. Commencing salary £350 p.a., plus war bonus.—Applications, with testimonials, to reach Secretary, Barnato Joel Laboratories, Middlesex Hospital, W.1, not later than Dec. 11.

Physicist or High Vacuum Technician wanted for development of Discharge Lamps. Consulting Contract might be considered.—Detailed application, indicating remuneration required, to Box N./P., c/o "Scientific," Cliffords Inn, London, E.C.4.

Quartz Microscope Lenses, etc., needed urgently for biological research of national importance. Offers of quartz microscope slides (3 in. x 1 in.) and cover slips, quartz condenser, quartz lenses suitable for ultra-violet microscopy, will be most acceptable and should be addressed to Box 269, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2, giving relevant details and price.

For Sale: Microscope, Beck. Two oculars. 1/2 in., 1/4 in., 1/12 in., o i objectives, focusing substage with Abbe condenser.—Box 273, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Urgently required for Research purposes, Tinsley portable moving coil reflecting D.C. Galvanometer for 1,000 to 2,000 ohms.—Apply, Box 266, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Marine chronometer, split seconds chronograph watch, astronomical or regulator clock all wanted.—Write, Box 262, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Wanted: Complete sets and runs of Scientific Periodicals, including NATURE and Learned Society publications.—The Scientific Book Supply Service, 5 Fetter Lane, London, E.C.4.

Microscopes, of all descriptions, only a few available, second-hand, perfect condition. Send details of your requirements, enclosing 3d. stamp.—Telephone or correspondence only: Chards, Forest Hill, S.E.23 (Spring Park 1628).

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THE FARADAY SOCIETY

A GENERAL DISCUSSION ON

The Application of Infra-Red Spectra to Chemical Problems

will be held on Tuesday, 2nd January, 1945, from 10 a.m. to 5 p.m. at King's College, Strand, London, W.C. 2.

The following contributions will be discussed:

G. B. B. M. SUTHERLAND, H. W. THOMPSON and others.—"Developments in the Technique of Infra-red Spectroscopy".

G. B. B. M. SUTHERLAND, D. A. RAMSAY and P. B. FELLGETT.—"The Application of Infra-Red Spectroscopy to the Structure of Polymers".

N. SHEPPARD and G. B. B. M. SUTHERLAND.—"Some Infra-Red Studies on the Vulcanisation of Rubber".

C. G. CANNON and G. B. B. M. SUTHERLAND.—"The Infra-Red Spectrum of Coal".

G. B. B. M. SUTHERLAND and H. A. WILLIS.—"Some New Peculiarities in the Infra-Red Spectrum of Diamond".

H. W. THOMPSON and P. TORKINGTON.—"The Infra-Red Spectra of Compounds of High Molecular Weight".

P. TORKINGTON and H. W. THOMPSON.—"The Infra-Red Spectra of Fluorinated Hydrocarbons I".

D. H. WHIFFEN, P. TORKINGTON and H. W. THOMPSON.—"The Use of Infra-Red Absorption for Analysis".

R. B. TEMPLE and H. W. THOMPSON.—"Infra-Red Absorption of Some Furan Derivatives and Related Compounds".

D. M. SIMPSON.—"The Assignment of the Vibrational Frequencies and the Force Field of the Ozone Molecule".

L. KELLNER.—"The C-C Valency Vibrations of Organic Molecules".

G. K. T. CONN.—"The Application of Infra-Red Spectra to Chemical Problems".

It is hoped that the papers will be issued in advance proof before the meeting. No charge will be made to members, who should apply to the Secretary of the Faraday Society. The charge to non-members is 5s. In order to conserve the Faraday Society's paper supplies no excess number will be printed, and no application received at the Society's Office after the 12th December, 1944, can in any circumstances be entertained.

There will be a short adjournment for luncheon at the Holborn Restaurant at about 1 p.m. (price 8s. 6d.). In order that accommodation at luncheon can be reserved, application, with remittance, must be made by members and by visitors to the Secretary, the Faraday Society, 6 Gray's Inn Square, London, W.C.1, not later than 19th December, 1944.

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LETTERS TO THE EDITORS

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

Generic and Specific Trivial Names of the Tertian and Quartan Malaria Parasites

THE "Official List of Generic Names in Zoology" was established by the International Congress of Zoology in order to promote stability in zoological nomenclature by placing on record the correct names of the principal genera in each of the classes and orders of the animal kingdom, together with their type species. Hitherto names have been placed on the "Official List" in *Opinions* rendered by the International Commission on Zoological Nomenclature, but in 1943, the International Commission decided that it was desirable to make the "Official List" more readily available, and accordingly decided to publish it as soon as possible in convenient book form and with a full index. The preparation of the "Official List" for publication in this way, which was begun in the autumn of 1943, involved the checking of all the relevant bibliographical and other references to the generic names concerned and their type species. In the course of this work, errors were detected in a number of the *Opinions* containing decisions relating to the "Official List". These errors are being brought at once to the attention of the International Commission with the view of its rendering an *Opinion* as soon as possible containing such rectifications as may be necessary.

Among the errors detected were errors in the entries in *Opinion* 104 (published in 1928) relating to the author's name and date of publication of the generic name for the malignant tertian malaria parasite (*Laverania* Feletti and Grassi, 1889). Further, in the case both of this name and of that for the quartan parasite (*Plasmodium* Marchiafava and Celli, 1885) the type species was found to have been cited under a name which was not the correct name under the International Code of Zoological Nomenclature.

The names of these parasites, as recorded in *Opinion* 104, are the names now universally employed for these species in the enormous medical and technical literature relating to malaria, and it would clearly be as wrong as it would be impracticable to attempt to introduce changes in such names merely on grounds of zoological nomenclature. In the present case such changes would be particularly undesirable, since they would involve the transfer of the specific trivial name *malariæ* from the quartan parasite (on which it was bestowed by Grassi and Feletti, 1890), by which name this species is universally known, to the malignant tertian parasite on which, in 1881, it had been independently bestowed by Laveran (and by which name this species is never called). Transfer of trivial names in this way causes great confusion, and the only solution in such a case is for the International Commission to use its plenary powers to suspend the rules in order to validate the names currently in use.

It was accordingly decided early in 1944 to invite the International Commission to deal with this question under its plenary powers, and, for this purpose, a thorough investigation into the highly complicated literature of these names was made, with the assistance of Sir Rickard Christophers and Brigadier J. Sinton, whose paper, "The Correct Name of the Malignant Tertian Malaria Parasite", published in 1938 (*Brit. Med. J.*, ii, 1130; 1938), must form the starting point of any work on this subject. In the course of this investigation, names previously overlooked were brought to light and other unsuspected nomenclatorial difficulties were disclosed. A paper setting out in detail the present position under the International Code and containing recommendations to the Commission for placing the whole matter on a satisfactory footing has been prepared and will appear in the next part of the *Bulletin of Zoological Nomenclature*, the official organ of the International Commission on Zoological Nomenclature.

Quite recently, the officer in charge of malaria control in war areas, Atlanta, Georgia, U.S.A., communicated to the International Commission an application prepared by Drs. Curtis W. Sabrosky and Robert L. Usinger, U.S. Public Health Service, directing attention to the errors in *Opinion* 104 and requesting the International Commission to use its plenary powers to suspend the rules for the purpose of validating existing nomenclatorial practice in regard to these parasites. This application has since been published in *Science* of September 1, 1944. It is extremely gratifying to the Executive Committee of the International Committee to find that malariologists in the United States, working independently, have reached substantially identical conclusions in regard to this matter, since this should greatly facilitate the early adoption by the International Commission of an *Opinion* setting this matter at rest once and for all.

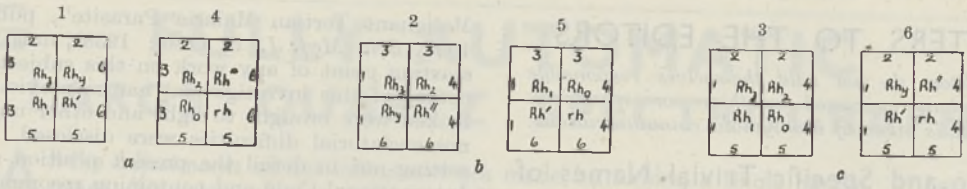
In order to secure the widest support for the action proposed to be taken, the Executive Committee, on behalf of the International Commission, invites expressions of opinion from specialists concerned in any aspect of the malaria problem. Such communications, which should be addressed to the International Commission on Zoological Nomenclature at its Publications Office, at 41 Queen's Gate, London, S.W.7, will at once be published in the Commission's official organ, the *Bulletin of Zoological Nomenclature*, in order that the whole of the material relating to this case may be before the commissioners when reaching their decision.

FRANCIS HEMMING.
Secretary,
International Commission on
Zoological Nomenclature.

A Nomenclature of Subgroups of the *Rh* Factor

SINCE Race added two further hypothetical allelomorphs tentatively called Rh_y and Rh_z to the six genes recognized by Wiener[1], which had been independently discovered by Taylor and Race (namely, Rh_1, Rh_2, Rh_0, Rh', Rh'' and rh), the terminology is somewhat confused. Recently Race[2] has described Prof. R. A. Fisher's ingenious system of three allelomorphic antigens named *Cc*, *Dd*, *Ee*, with Greek lettering for the antisera. They predict the existence of two as yet undiscovered antisera η and δ. The disadvantage of this scheme is the duplicate system of lettering.

The nomenclature now suggested is simple; it is based on the numbering of the antisera 1 to 4[3], and could easily be extended. It is proposed that the reaction of cells should be expressed in terms of the



sera with which they react. Its value lies chiefly in the naming of phenotypes, so that at a glance it may be seen exactly with what sera the cells have been tested. Eight genes have now been postulated, and their reactions with the four sera so far discovered can be set out as follows:

Red cell genes	Antisera 1	2	3	4
	Anti Rh_1	Anti Rh_2	Standard	*St*
Rh'	+	—	—	—
Rh_y	+	+	—	—
Rh_z	+	+	+	—
Rh_1	+	—	+	—
Rh''	—	+	—	+
Rh_2	—	+	+	+
Rh_0	—	—	+	+
rh	—	—	—	+

It will be seen that the table is completely symmetrical, and that cells which react with serum 1 fail to react with serum 4 and *vice versa*. Thus the reactions of the eight genes can be arranged as in the accompanying diagrams at (*a*).

The two undiscovered antisera of Fisher we will call 5 and 6. Thus the reactions of serum 5 and serum 6 will be related to those of serum 2 and serum 3, in the same way as serum 4 is to serum 1, and are shown as (*b*) and (*c*) in the diagrams.

From these diagrams can be seen the possible antisera which may arise by stimulation with any one of the eight genes. For example, Rh_z will react with sera 1, 2 and 3 and will therefore be designated Rh_{123}; again, Rh_1 will react with sera 1, 3 and 5 and will therefore be called Rh_{135}. Thus the conclusion by Stratton[4] that Rh_0 can stimulate the production of sera 1, 2 and 3 would appear to be incorrect—Rh_0 can produce or react only with sera 3, 4 or 5.

A complete comparison of names of sera and genes with their corresponding reactions, including those of the two undiscovered sera, is given in the accompanying table. My numbering of sera and genes is compared with the original names and Prof. Fisher's recent notation described by Race[2].

REACTIONS OF EIGHT GENES TO SIX POSSIBLE ANTISERA (FOUR OF WHICH ONLY HAVE BEEN FOUND).

Wiener *et al.* Race and Taylor			Antisera: Anti Rh_1	Anti Rh_2	Standard	*St* ? *Hr*	As yet undiscovered	
Fisher's notation			I'	H	Δ	γ	η	δ
Suggested numbering			1	2	3	4	5	6
Red cell genes								
Rh'	*Cde*	Rh_{156}	+	—	—	—	+	+
Rh_y	*CDe*	Rh_{126}	+	+	—	—	—	+
Rh_z	*CDE*	Rh_{123}	+	+	+	—	—	—
Rh_1	*CdE*	Rh_{135}	+	—	+	—	+	—
Rh''	*cDe*	Rh_{246}	—	+	—	+	—	+
Rh_2	*cDE*	Rh_{234}	—	+	+	+	—	—
Rh_0	*cdE*	Rh_{345}	—	—	+	+	+	—
rh	*cde*	Rh_{456}	—	—	—	+	+	+

Selected from my series of families with fœtal hæmolytic disease, four illustrative cases show the mechanism of immunization of the mother, who can only become sensitized to an antigen of her husband which she herself does not possess.

There appears to be some variation in the response of individuals to similar antigenic stimulation. Thus an *Rh* negative mother (Rh_{456}) with a homozygous Rh_1 husband (Rh_{135}) usually produces a mixture of two antisera 1 and 3, giving together 87 per cent positive reactions (Wiener's anti-Rh'):

	Father	Mother	Antiserum produced
Case 1 Mrs. Ba.	Rh_1Rh_1 135	*rhrh* 456	Nos. 1 and 3

But in some identical matings the antiserum 1 giving 70 per cent reactions (Wiener's anti-Rh_1) may be produced:

	Father	Mother	Antiserum produced
Case 2 Mrs. Br.	Rh_1Rh_1 135	*rhrh* 456	No. 1

In these cases we must suppose that some antiserum 3 (Wiener's standard) is called forth, but only in such weak titre that it is not detectable under the conditions of the test, since we do find that the sera 1 and 3 may be in varying proportions so that it is sometimes possible to dilute out the antiserum 3 from the mixture retaining antiserum 1 in a strong workable titre. In the same way the figures 1 and 3 may be present in the genotype of the stimulating fœtal cells and yet an apparently pure antiserum 3 (Wiener's standard) may appear in the maternal serum:

	Father	Mother	Antiserum produced
Case 3 Mrs. R.	Rh_1Rh_z 135 123	*rhrh* 456	No. 3

Similarly, the two components of mixtures of antisera 2 and 3 giving 87·0 per cent positive reactions (Wiener's anti-Rh'') may vary, and we can only expect a pure antiserum 1 or antiserum 2 in cases where it is not possible for antiserum 3 to be stimulated, that is, where the figure 3 occurs in the genetic formulæ of both husband and wife:

	Father	Mother	Antiserum produced
Case 4 Mrs. M.	Rh_2Rh_3 234	Rh_1Rh_1 135	No. 2

As yet, antisera 5 and 6 have not been demonstrated, although cases with a suitable genetic arrangement have been encountered. It may be just chance that no antibodies have been stimulated, or it may be that factors 5 and 6 are only weakly antigenic and do not readily provide the stimulus.

JOHN MURRAY.
Central Pathology Laboratory, Sector V,
Stoke Mandeville Hospital,
Bucks.

[1] Wiener, A. S., *Proc. Soc. Exp. Biol. and Med.*, **54**, 316 (1943).
[2] Race, R. R., *Nature*, **153**, 772 (1944).
[3] Murray, J., *Lancet*, **2**, 594 (1944).
[4] Stratton, F., *Nature*, **153**, 773 (1944).

Gramicidin S and its use in the Treatment of Infected Wounds

ANTISEPTICS of biological origin are now well known since the pioneer investigations of Fleming on penicillin and Dubos on tyrothricin. In our laboratory early in 1942 an attempt was made to isolate the strains of *Bacillus brevis* from Russian soils in order to prepare tyrothricin similar to that of Dubos. In the course of this work we isolated from soil a new strain of aerobic sporulating bacillus possessing some unique characteristics. It is well known that alcoholic extract of the acid precipitate of the culture of *B. brevis* contains an amorphous body, designated by Dubos and Hotchkiss (1941) as tyrothricin, which can be afterwards fractionated by special procedures into two individual crystalline substances, gramicidin and tyrocidine hydrochloride. In distinction from this, alcoholic extract of the acid precipitate from our strain consists almost entirely of the antibacterial substance, which is not amorphous but is directly crystallizable from the alcoholic solution. This crystalline substance can be further purified and obtained in the form of colourless needles with the melting point 267–268°. Hence it is different from gramicidin (m.p. 228–230°) and tyrocidine hydrochloride (m.p. about 240°). The bacteria producing this substance were designated as the strain of Gause-Brazhnikova, and the substance itself as gramicidin *S* (Soviet gramicidin).

Chemical properties and antagonistic effect of gramicidin S. Gramicidin *S* differs from tyrothricin, gramicidin of Dubos and tyrocidine hydrochloride by its easy solubility in chloroform. We had an opportunity of comparing directly gramicidin *S* with the original preparation of tyrothricin, obtained from Lederle, Inc., New York. Further, we were able to compare the properties of our strain of bacillus with that used by Lederle for the commercial production of tyrothricin. It was occasionally discovered that a batch of tyrothricin obtained from Lederle is heavily contaminated with spores of some bacillus. This bacillus was found to be identical with that described by Dubos, and with its aid we prepared a batch of tyrothricin identical with that offered by Lederle. It was observed by us that the spores of the Dubos strain of bacteria are much more resistant to the action of ethyl alcohol than the spores of the strain of Gause-Brazhnikova.

Although gramicidin *S* is similar to tyrothricin in many respects, a direct comparison shows that it is about four times more efficient in killing staphylococci than tyrothricin. Numerous tests made with various strains of pyogenic cocci on the nutritive media containing 10 per cent of human blood serum have shown that 25 gamma of gramicidin *S* per 1 c.c. of the medium is sufficient to kill staphylococci, whereas 100 gamma of tyrothricin is required for the same effect. These experiments were made with the commercial preparation of gramicidin *S*, which is now available in bulk. (Staphylococci are killed by pure crystalline gramicidin *S* at a concentration of 3 gamma, and *B. coli* at 50 gamma per 1 c.c. of the nutritive medium.) In the case of streptococci and pneumococci, 6 and 12 gamma of gramicidin *S* respectively are sufficient for the killing action, whereas about 3 gamma of tyrothricin has the same effect. It follows from these data that gramicidin *S* is more regular in its action upon various genera of pyogenic cocci, whereas tyrothricin has a weak action upon staphylococci and a strong effect upon streptococci and pneumococci. Because septic wounds containing staphylococci cause the most trouble, the advantage of gramicidin *S* for surgical practice is obvious.

The action of gramicidin *S* upon gas bacilli was studied by a number of methods. It was found that 10 gamma of this substance per 1 c.c. of the medium is sufficient to kill *Cl. Welchii* and *Cl. histolyticus*.

The toxicity of gramicidin *S* equals that of tyrothricine: the median toxic dose for intraperitoneal injections in rats is 15–20 mgm. per kgm. weight.

The use of gramicidin *S* in the prophylactic treatment of experimental infections was also studied. Experimental lacerated wounds of muscles in guinea pigs were infected with *Cl. Welchii*, treated either by gramicidin *S* solution (experiment) or by physiological saline (controls), and repaired. The mortality in experimental animals was 5 per cent, whereas in controls it attained 53 per cent. Similar experiments were made on rats, where the experimental wounds were infected by garden soil. The mortality of controls was 100 per cent, whereas in the rats treated by gramicidin *S* it was only 40 per cent.

Clinical results. Clinical application of gramicidin *S* was studied in 573 cases. The original 4 per cent alcoholic solution of gramicidin was diluted by water to make the concentration of gramicidin 400–800 gamma per c.c. of the liquid. These solutions were applied daily either locally, or introduced into cavities. The results of clinical observations can be summarized as follows.

The first group of cases includes septic gunshot wounds of the hip; the suppuration following heavy burns of the abdomen, breast, hip and hands; abscesses of the abdominal wall; heavy anaerobic phlegmones, etc. The application of gramicidin *S* has led to: (1) rapid disappearance of bacteria in the wound and successful epithelization; these processes were controlled by cytological and bacteriological observations; (2) successful preparation of the wound for subsequent surgical treatment (secondary joint or the transplantation of the skin); (3) in some cases the septic state disappeared through the elimination of the local suppuration process.

The second group of cases includes septic gunshot wounds of the larynx, chronical otitis, etc. The application of gramicidin *S* dramatically arrests the suppuration and rapidly improves the general state of the patient.

The third group of cases consists of empyæmas. Removing the pus by a syringe and introducing 50–100 c.c. of a water solution of gramicidin *S* into the pleural cavity two or three times is usually sufficient to eliminate the infectious process entirely.

The fourth group of cases includes osteomyelitis. The heavy suppurations of gunshot fractures are rapidly arrested by the local application of gramicidin *S*. In the cases of chronical osteomyelitis the application of gramicidin *S* immediately after the performance of sequestrectomy arrests the further spread of suppuration.

Details of experimental and clinical work with gramicidin *S* have been published in a monograph entitled "Soviet Gramicidin and Wound Healing", which is issued in Moscow in Russian. Copies of this monograph are available, and can be sent on application.

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Symmetrical and Asymmetrical Post-reduction in Ascomycetes

THE analysis of asci has shown that a pair of allelomorphic genes may segregate at the first meiotic division (pre-reduction) or at the second (post-reduction). Post-reduction may be symmetrical, with two like genes adjacent in the middle of the ascus, or asymmetrical. The analysis of 77 asci of *Neurospora sitophila* by Whitehouse[1], and 31 by Wilcox[2], Dodge[3] and Lindegren[4] has given the six possible patterns of the sex genes in the following numbers:

Pre-reduction	+ + — —	26
	— — + +	24
Symmetrical post-reduction	+ — — +	10
	— + + —	11
Asymmetrical ,, ,,	+ — + —	18
	— + — +	19

The distal end of the ascus is represented to the left. There were thus 37 asymmetrical and 21 symmetrical post-reductions. The probability of so great a divergence from equality by chance is 0·049. If we add to these the figures obtained by Whitehouse for the segregation of 'weak', which is at least 41 units from 'sex' in the same chromosome, and of 'orange', which is in a different chromosome, based on 31 asci, and Dodge's data for albinism, which is also in a different chromosome based on 7 asci, we find 49 asymmetrical and 27 symmetrical reductions. The probability of obtaining such unequal numbers by chance is 0·016. On the other hand, Lindegren's data on 273 asci of *Neurospora crassa* show 14 asymmetrical and 25 symmetrical post-reductions. The difference is not significant; but it is unlikely that a larger count would show a majority of asymmetrical post-reductions. So asymmetrical post-reduction seems to be more frequent, at least for some genes, in *N. sitophila*, but not in *N. crassa*. Zickler's[5] results on *Bombardia lunata* show a slight but significant excess of asymmetrical post-reductions for the characters *lactea* and *rubiginosa*.

The greater frequency of asymmetrical post-reduction can be explained if the relative position of the chromatids generally remains unaltered during interphase.

Full details will be published elsewhere.

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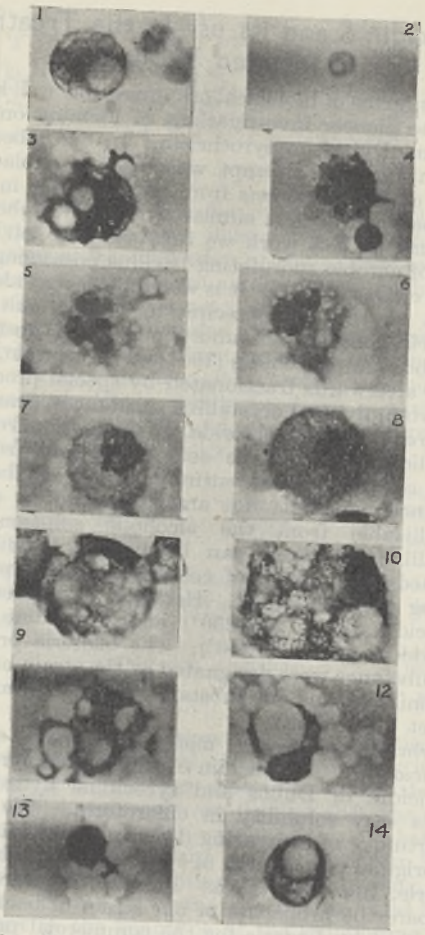
[1] Whitehouse, *New Phytol.*, **41**, 23 (1942).
[2] Wilcox, *Mycologia*, **20**, 3 (1928).
[3] Dodge, *Mycologia*, **22**, 9 (1930).
[4] Lindegren, *Bull. Torrey Bot. Club*, **59**, 119 (1932).
[5] Zickler, *Planta*, **22**, 573 (1934).

Cell Contents of Milk

BEING interested in the study of the cell contents of milk, I have investigated the colostrum bodies present in fresh human and cow's milk. I devised two methods of studying the milk cells: in wet films, staining the nuclei with methylene blue; and by dry films, staining with May Grunwald Giemsa. The smears were made from fresh milk, at the commencement of lactation, and some smears were made from the cells deposited after centrifuging.

In the wet films, I found different groups of cells. (1) The first group were cells with polymorph nuclei, which appeared to be just a little larger than the normal polymorph, and their cytoplasm seemed to be formed by small fat droplets. (2) The second group were mononuclears containing a similar number of fat droplets to the previous group of cells, the droplets varying in size from those contained in the polymorphs to drops of more or less the size of red blood corpuscles. A few of the mononuclears in this group were two or three times the diameter of a polymorph. Their appearance was similar to the cells observed in the fluid obtained from some hæmorrhagic cysts in thyroid glands (described elsewhere). (3) The third group was composed of mononuclears containing a smaller number of fat droplets. Some of the smaller cells contained only one drop of fat and a small quantity of cytoplasm, giving the cell the aspect of a lymphocyte attached to a fat droplet.



Wet Films. Nos. 1 and 2. A mononuclear full of fat droplets; and a lymphocyte containing one drop of fat.
Dry Films (stained with May Grunwald Giemsa). Nos. 3, 4, 5, 6. Different polymorphs with different sizes of fat droplets.
Nos. 7, 8, 9, 10. Mononuclears in full process of secretion of fat droplets.
Nos. 11, 12, 13. Cellular remnants of fat secretion. In Nos. 12 and 13 the remnants appear as lymphocytes.
No. 14. Protoplasmatic remnants framing some fat droplets.

In the dry films, the cells could also be divided into groups and confirmed what we had previously seen in the wet films. By careful observation, however, it could be seen that the cells were not in three distinctly different groups, but were linked together by intermediate cells. The groups observed in the dry films were as follow: (1) The first group was formed by polymorphs which appeared to be of the neutrophil variety, part of their cytoplasm consisting

mainly of empty vacuoles. The material contained in these vacuoles had probably been dissolved in the alcohol used as a solvent for the stain. These polymorph cells had different aspects, and the vacuoles contained in them were of different sizes. In some of the cells the nucleus was compressed by the large size of the fat droplets, and in the cells generally the change in the nuclei towards a mononuclear could be followed clearly. (2) The second group consisted of a range of mononuclear cells of different sizes, each having a large quantity of cytoplasm containing vacuoles. Some of the cells were of very large size, and some of the vacuoles contained in these large cells had a diameter about the size of a red blood corpuscle. (3) The third group consisted of cells still containing vacuoles; but the cells were closer to the classical description of a peripheral blood monocyte. It could be observed that some of these cells in evolution were linked with the lymphocyte, and some of the lymphocytes present still contained vacuoles in their cytoplasm.

Another fact which could be seen clearly was that some cells liberate portions of their cytoplasm, each such portion taking on the form of a round drop. Some of these free cytoplasmic portions still framed empty vacuoles.

After systematic observation of different specimens of human and cow milk in which I had followed the monoglandular fat secretions, I was able to draw similar conclusions to those arrived at after my study of blood formation, previously published elsewhere.

My grateful thanks are due to my technician, Mr. Jeffrey B. Dean, who has made the photomicrographs.

Conclusions. (1) It appears that a number of fat droplets, if not all, are not produced by the mammary gland itself but are carried there by cells. (2) The cells responsible for the carriage of the fat are a kind of polymorph neutrophil. (3) The cell that secretes the fat droplets is the same polymorph neutrophil that carries the fat to the gland, but it changes its nuclear morphology and its size before it undertakes the process of secretion. (4) After secreting and expelling its cytoplasmic fat droplets, the cell has the appearance of a lymphocyte.

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Determination of Molecular Weights by the Cryoscopic Method

THE difficulty of obtaining consistent results in the determination of molecular weights by the cryoscopic method has led Brancker, Leach and Daniels[1] to suggest a modified form of the classical cryoscopic equation. The difficulty arises from the fact that as the concentration of the unknown solute is changed, the molecular weight, as calculated by the classical equation, does not remain constant. In order to overcome this difficulty, these workers used the equation

$$\Delta T = K_f m^b.$$

In this laboratory we have confirmed that unless special methods of calculation are used, inconsistent results are invariably obtained, the inconsistency becoming more marked as the molecular weight of the unknown increases. It has been found, however, that results can be duplicated within narrow limits by the use of the above modified equation. Table 1 shows the results obtained on a series of oils. Duplicate figures on each material were obtained with different samples of solvent (benzene). The cryoscopic constant was determined on each sample using naphthalene as solute, and five depressions of freezing point were determined on each material, including standardizations with naphthalene.

TABLE 1.

Oil	b	$\log K_f$	M	(M Theoretical)
Dibutyl phthalate	1·0173 0·9990	0·6885 0·6953	256·1 259·4	278
Tricresyl phosphate	0·9927 0·9751	0·6890 0·6921	349·1 335·1	368
"Octoil S"	1·0968 1·0789	0·6885 0·6890	340·2 341·5	426
"Octoil"	1·0314 1·0186	0·6885 0·6890	352·5 352·0	390
"Litton" oil	0·9597 0·9723 0·9350	0·6953 0·6953 0·6885	486·1 491·0 487·6	—
Pump lubricating oil	1·0162 0·9925	0·6953 0·6890	301·1 311·8	—
"Arochlor 1254"	1·0129 1·0228	0·6921 0·6953	327·9 315·8	—
"Apiezon A" oil	0·9468 0·9584	0·6890 0·6885	445·1 448·7	—
"Apiezon B" oil	0·9613 0·9495	0·6953 0·6885	523·7 515·9	—

It will be seen that the results are very consistent. It is also interesting to note that values of b in excess of unity may be obtained. The cause of this has not been determined. Dibutyl phthalate, tricresyl phosphate, 'Octoil' (di-octyl phthalate) and 'Octoil S' (di-octyl sebacate) were obtained commercially, and as they were to be compared with other materials, no attempt was made to purify them. A comparison of their theoretical and determined molecular weights has been made in Table 1. While the discrepancy between these figures is fairly large, it must be remembered that the materials were not pure, and in addition the determined figures on each sample are in very good agreement. The modified equation is admittedly empirical and must be judged as such until other methods of checking molecular weight determinations have been carried out.

Brancker, Leach and Daniels have compared the results obtained with the classical equation with those obtained with the modified equation. In their table of results, they have calculated K_f according to the latter equation and substituted in the classical. Another method of calculation would be to calculate K_f and the unknown molecular weight at the same concentration of solute in both cases, using the classical equation.

Neither of these methods is permissible. The latter is only applicable when the molecular weight of the unknown is of the same order as the standardizing solute (namely, 128 in the case of naphthalene).

It must be borne in mind that the use of osmotic or cryoscopic methods for determination of molecular weight lead to a 'number average', and hence comparable values are only obtained when equal molalities of solution are used in both K_f and unknown molecular weight determinations. For example, the concentration of an unknown compound

of molecular weight 400–500 should be four times as high when its depression is found as the naphthalene concentration when K_f is determined.

This method of calculation has been used for 'Litton' oil (Table 2), and it will be seen that the average result obtained is comparable with that obtained by the modified equation. The figures in the second column of this table are those obtained from the classical equation using the cryoscopic constant calculated from the modified equation.

TABLE 2. COMPARISON OF RESULTS OBTAINED USING MODIFIED AND CLASSICAL EQUATIONS.

("Litton" oil).

Modified equation		Classical equation		"Number average" (see text)	
495·1		451·2		476·8	
489·8		455·9		478·7	
481·7	491·0	452·9	460·0	474·2	481·4
488·9		463·3		483·1	
499·4		476·6		494·2	

From the figures obtained in this Laboratory, there seems to be little doubt as to the greater consistency of results using the modified equation over those obtained by the classical method of calculation. For purposes of laboratory control of products, this is essential.

A comparison of results obtained by osmotic and cryoscopic methods of determination of molecular weight would be interesting and may prove of considerable importance in the determination of molecular weights of high polymers.

I wish to thank Dr. A. P. M. Fleming, director of research and education, Metropolitan-Vickers Electrical Co., Ltd., for permission to publish these notes.

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[1] Brancker, Leach and Daniels, *Nature*, **153**, 407 (1944).

Formation of Sulphamic Acid during the Thermal Decomposition of Ammonium Sulphate

THE thermal decomposition of ammonium sulphate appears to have received little attention since the recorded observations of Jänecke in 1921[1]. Consequently it has become accepted that decomposition results first in the formation of ammonium acid sulphate with the liberation of ammonia, and then, after partial elimination of water from the acid sulphate, the pyrosulphate is formed.

Recent observations in this laboratory have revealed that sulphamic acid is also formed during the thermal decomposition of either the normal or the acid sulphate. Analyses of residues obtained from heating A.R. ammonium sulphate at 400° C. indicated that they consisted predominantly (90 per cent) of ammonium pyrosulphate, together with small amounts of the acid salt and unchanged ammonium sulphate. However, it was found that when the residues were treated with water and redried at 150° C., the resulting increase in weight was greater than could be accounted for by hydrolysis of pyrosulphate to the acid salt. This indicated that one of the components of the mixture contained even less water than ammonium pyrosulphate, and the presence of sulphamic acid was thus suspected.

Quantitative measurements of sulphamic acid by the gas volumetric method of Meuwsen and Merkel[2] have shown that about 5 per cent of sulphamic acid is present after 1 hour at 400° C. The results given in the accompanying table are representative of the composition of the residues obtained.

The evolution of sulphur dioxide and nitrogen from strongly heated ammonium sulphate, which has previously been ascribed to the decomposition of the acid salt[3], is probably due to the thermal decomposition of sulphamic acid which is first formed.

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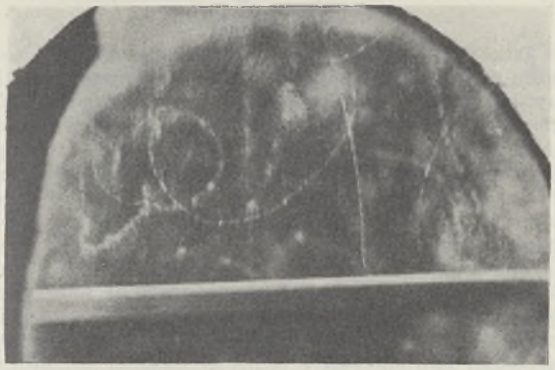
[1] Jänecke, *Z. angew. Chem.*, **34**, Aufsatzteil, 542 (1921).
[2] Meuwsen and Merkel, *Z. anorg. allgem. Chem.*, **244**, 89 (1940).
[3] Smith, *J. Soc. Chem. Ind.*, **14**. 629 (1895).

$(NH_4)_2SO_4$ (gm.)	Temperature °C.	Time of heating (hr.)	Residue (gm.)	Composition of residue (per cent).			
				$(NH_4)_2SO_4$	NH_4HSO_4	$(NH_4)_2S_2O_7$	NH_2SO_3H
5·0000	400	1·0	3·5499	10·3	13·5	70·2	5·7
5·0000	400	1·25	3·4817	9·9	11·2	73·2	5·7

Application of a Randomly Operated Large Wilson Cloud Chamber for the Determination of the Mass of the Meson

DURING recent years, increasing interest has been shown in the accurate determination of the mass of mesons, which have been supposed to constitute the penetrating component of cosmic rays. The most direct evidence that such particles have an intermediate mass lying between that of an electron and a proton comes from cloud chamber observations. The momenta of the particles and ionization they produce are directly available from the measurements on the cloud chamber tracks, and are found to be compatible with theory only when the particles are assumed to possess a mass roughly equal to 200 times the mass of an electron. An accurate determination of the mass is possible only when the particle can be photographed near the end of its path through space, and this occurs rarely. Slow mesons seem to be particularly rare in counter-controlled photographs with a thick lead plate inserted inside the chamber, apparently because (1) they have extremely short range in heavy material, (2) they have a large probability of decay, nuclear absorption and transformation into neutrettos[1]. Hence they fail to trip the lower counter of the coincidence system.

A large randomly operated cloud chamber has been found[2,3] to be very satisfactory for such investigations, and with the view of determining the mass of mesons, their decay products and the absorption processes, such a cloud chamber has been built. Progress has been very slow, and due to shortage of films only three hundred photographs could be taken altogether, of which the accompanying photo-



graph is one. The interesting feature of the track marked by an arrow is that it ends just a centimetre above the lead plate. The absence of any decay product in the neighbourhood indicates the absorption of a meson by a nucleus present in the gaseous volume of the chamber. The charge carried by the particle is negative. It is interesting to note that decay products are obtained only in the case of positive mesons, while negative mesons show absorption. Rassetti[4] has pointed out that this may be because slow positive mesons are repelled by the positively charged nuclei. The other suggestion given by Hamilton, Heitler *et al.*[1] is that when a meson has reached an energy which is lower than four times its rest energy, the chance that it will be transformed into a neutretto on interacting with a nuclear particle is so large that only 21 per cent of them can reach the end of their range as charged mesons.

The ionization density along the photographed track is too heavy to allow direct counting under the microscope. Another method that has been experimentally verified and used by Williams and is particularly suitable for large ionization density is the counting and measurement of the long free paths of the particle observed along the track which appear as gaps. The average number of such free paths, greater than g cm., is given by the well-known formula of random collisions, $n = Il \times e^{-Ig}$, where I is the ionization density and therefore the inverse of the mean free path, and l is the length of the track. In this case only one free path was measured on 5·2 cm. of track and was found to be 0·056 cm., being corrected for the width of the track. Hence $5{\cdot}2\,I \times e^{-0{\cdot}056\,I} = 1$ and $I = 113$ ions/cm., which after correction for temperature and pressure gives $I = 106$ ions per cm. at N.T.P.

The track was photographed in a magnetic field of 1,060 oersteds. The curvature was measured by finding the value of the dips at different points along the track. The radius of curvature was found to be 76 cm. Hence $H\rho = 8{\cdot}056 \times 10^4$ gm. cm.

Now $pc = 300\,H\rho$ ev. On substitution of the values, we obtain $p = 48\,mc$, where m is the mass of the electron. From the work of Williams and Terroux[5] the primary ionization has been found to vary as $\beta^{-1\cdot4}$, where $\beta = v/c$. They give the primary ionization density for an electron of velocity 0·96c as 22 ions/cm. in air. Thus for the incident particle

$$\beta = 0{\cdot}96(22/106)^{1/1\cdot4} = 0{\cdot}31.$$

$$\text{But } p = M\beta c/\sqrt{1-\beta^2} = 48\,mc,$$

where m is the mass of the incident particle.

$$\text{Hence } M = 48\,m.\sqrt{1-\beta^2}/\beta = 147 \text{ cm.},$$

on substituting the value of β. The mass of the incident particle is thus in fair agreement with the mass of the meson, obtained by different workers.

Further work is in progress.

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[1] Hamilton, Heitler and Peng, *Phys. Rev.*, **64**, 78 (1943).
[2] Williams, *Proc. Roy. Soc.*, A, **172**, 194 (1939).
[3] Maier-Leibnitz, *Z. Phys.*, **112**, 569 (1939).
[4] Rassetti, *Phys. Rev.*, **60**, 198 (1941).
[5] Williams and Terroux *Proc. Roy. Soc.*, A, **126**, 289 (1930).

Vapour Pressure of Solids at Low Temperatures (and the Origin of the Planets)

IN a letter on the origin of the solar system, in *Nature* of January 29, Dr. Harold Jeffreys speaks of the importance of estimating the vapour densities of ordinary solids at the hypothetical temperatures of the condensation of the planets; the problem, as he puts it, being largely whether a gas at some not very small fraction of 10^{-15} density can condense at 400° A.; he adds that he has not been able to find data on the subject.

In the past, during studies of theist cosmology, I made an estimate of the vapour density of iron, which is no doubt the least easily condensed of the substances significant in the planetary matter, finding it to be about 10^{-44} at 273° A., and the temperature for saturation at the sort of density of iron supposed to exist in galactic space (10^{-29}) to be about 400° A. Much rougher corresponding values for calcium oxide, based on a boiling point estimated as best one could, were 10^{-113}, and 1400° A.

In the foregoing the latent heat of vaporization was assumed to be constant, but a more accurate estimate (yet not differing widely from the other) is obtained as follows:

Iron will probably have closely the normal 'Trouton quotient', 21, as mercury has: hence its molecular latent heat at its boiling point (2723° A.) will be $2{,}723 \times 21 = 57{,}183$ cal. Now while the molecular (specific) heat of the monatomic gaseous iron will not change much with temperature, that of the solid is known to increase between 273° A. and 1273° A., as if to become trebled* at 2723° A.: so that, in the Clausius-Clapeyron equation $d \log_e p/dT = L/RT^2$, we add to L (= 57,183) the difference between the heat capacities of the gas and the solid (or liquid) between the two temperatures considered (which is

$$14{,}250 - \frac{0{\cdot}00465\,(T-273)^2}{2}\Big).$$

Then

$$\log_e \frac{p \text{ at } 2{,}723^\circ}{p \text{ at } 273^\circ} = \frac{1}{R}\left[\frac{-57{,}183}{T} + \frac{14{,}250}{T} - 0{\cdot}00465\left(T - 546\log T - \frac{78{,}000}{T}\right)\right]_{T=273^\circ}^{T=2{,}723^\circ}.$$

$$= 119 - 5{\cdot}7 + 2{\cdot}9 - 0{\cdot}6 = 115{\cdot}6;$$

whence the vapour pressure at 273° A. is $10^{-50\cdot26}$ atmospheres, corresponding to a density of $1{\cdot}3 \times 10^{-53}$, while the temperature of condensation at a density

* *Note added in proof.* 'More than doubled' is perhaps nearer the case: however, a factor of only one and a half would be sufficient.

10^{-x} is roughly $273 \times (53/x)°$, that is, 910° A. at a density 10^{-16} (500° A. at 10^{-29}).

It is evident, of course, that 'earthy' substances would condense very much more easily still.

As the error in the 'Trouton quotient' is most unlikely to be greater than 10 per cent (which makes an 8 per cent error in the index of the result), and an error of as much as 50 per cent in the specific heat makes only a 10 per cent error in that index, the estimates have presumptively considerably more than the accuracy essential to the purpose.

The subject will be discussed more fully elsewhere.

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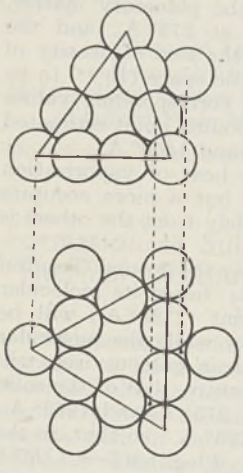
Open Packing of Spheres

IN their study of the open packing of equal spheres, Heesch and Laves[1] do not consider cases in which the number of spheres with which each sphere makes contact is greater than four; and at first sight it might not perhaps appear worth while to go further, for in the cubic arrangement of spheres which Barlow[2] styled his "second kind of symmetry", each sphere makes contact with six, and it has a density of 0·524.

Another and much more open arrangement with six-point contact is, however, possible; part of this structure is shown in the accompanying figure. For the sake of clearness only the spheres of the initial layer are indicated in the plan. The centres of these spheres lie at the vertices of a plane tessellation of equilateral triangles and hexagons. The spheres of the second layer lie over the centre of alternate triangles of the first layer. The third and all other odd-numbered sheets are congruent with the first but are translated. The fourth and all other even-numbered layers are congruent with the second but are also translated. These translations are of such a kind as cause the spheres of successive sheets to lie on the edges of regular tetrahedra, four spheres on each edge, as shown in the figure. The seventh layer lies over the first.



This structure has a density of 0·370, which must be reckoned remarkably low having regard to the fact that in it each sphere makes contact with as many as six others: it bears comparison with the well-known structure of diamond in which, although each sphere makes contact with only four, the density is 0·338.

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[1] Heesch, H., and Laves, F., *Z. Krist.*, **85**, 443 (1933).
[2] Barlow, W., *Nature*, **29**, 186 (1883).

The Perithecial Stage of *Didymella Lycopersici*

THE perithecial stage of the fungus that causes stem rot of tomato was found and described in 1921 by Klebahn[1], who named it *Didymella Lycopersici*. It was apparently not observed again until I found it in October 1943 on a single plant growing at Long Ashton, and since then mature perithecia have been found on three occasions*. Confirmation of the identity of the fungus has been obtained in pathogenicity experiments with single ascospore cultures.

The plant on which perithecia were found in October 1943 was one of a number that had been grown experimentally, out of doors, in pots of soil collected from a field where stem rot had severely attacked two successive crops of outdoor tomatoes. The characteristic basal stem lesion appeared early in August, but it was not until the middle of October that the plant was carefully examined. Pycnidia were then present on the upper part of the lesion; but below them, and down to soil-level, numerous perithecia were present among the disintegrating remains of the cortical tissues. At the end of December 1943, perithecia were found at or near ground-level on a number of plants at Evesham. These plants formed part of a group that had succumbed to artificial inoculation with pycnidial cultures during the summer. In the middle of July last, the perfect stage was again seen on pieces of diseased stems of affected greenhouse plants, collected at the end of May and kept moist on the surface of soil in a pot. The material had been examined from time to time but it was not until the middle of July, by which time the bulk of the cortical tissues had disappeared and only a few fructifications remained, that perithecia were found. Lastly, some diseased outdoor plants, grown from infected seed, were examined at the end of July, and one of them bore perithecia. The perithecia occurred well below ground-level, in a place that must have been approximately at soil level when the plant was in the propagating box. The cortex in this region had entirely disappeared, and scattered perithecia were attached to the woody tissues.

Klebahn[1] stated that perithecia appear after overwintering. His conclusion was based on observations on pieces of diseased stem, exposed in the open during winter, on which perithecia were observed the following April. My observations show that perithecial development is not dependent on an overwintering period, but may occur at any time of year. The constant presence of perithecia near to the soil suggests that moisture supply and, possibly, soil nutrients may be factors governing their formation.

This appears to be the first record of the occurrence of perithecia of *D. Lycopersici* under natural conditions on the host. The observations have largely been confined to outdoor plants, but it is not unlikely that the perithecial stage also occurs on glasshouse plants attacked by stem rot. Notwithstanding the proved viability of the imperfect, pycnidial stage, it is possible that perithecia may play a more important part in the survival of the fungus than has hitherto been recognized.

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* These observations were made while the writer was a member of the scientific staff of the Agricultural Research Council.

[1] Klebahn, H., *Z. Pflanzenkrankheiten*, **30**, 1 (1921).

'Pasmo' Disease on Wild Flax, *Linum angustifolium*

THE summer of 1944 was outstanding in Ireland with regard to the severity of flax diseases. Both *Phoma* and rust (*Melampsora Lini*) were widespread and virulent, the first mentioned being particularly bad on crops raised from home-saved seed.

During an examination of some species of wild flax as to their probable role in the perpetuation of common flax diseases, a pycnidial fungus was found on the leaves and stems of *Linum angustifolium*; and, on incubating affected material, horn-like tendrils of four-celled spores were extruded from the pycnidia. Morphologically, the causal organism agreed with published descriptions of *Sphœrella linorum*, the cause of 'Pasmo' disease of flax. Using spore suspensions, cross-inoculations on seedlings of *Linum usitatissimum* showed that the disease went over readily to the ordinary flax. Lesions and typical pycnidia containing three septate spores soon developed, and the symptoms on the host here corresponded closely with those described for 'Pasmo' disease. The plants of *L. angustifolium* on which the disease was originally found came from a farm in one of the southern counties. Flax has been cultivated both on this farm and in its vicinity for a number of years, and seed of foreign origin frequently used.

Colhoun and Muskett[1] issued a warning note in *Nature* as to the danger of introducing 'Pasmo' disease into these islands. Although not yet recorded on ordinary flax in Ireland, it is probable that a close inspection of the crop will show this disease to be present. In any event, the indications are that not only has the disease been introduced in the past but also that it has already become established on a native weed. In this connexion it is interesting to note that in New Zealand the 'Pasmo' disease soon after its introduction established itself on *Linum marginale* (an introduced weed), and the disease was afterwards more abundant on this plant than on neighbouring crops of cultivated flax[2].

Incidentally, it may be mentioned that the seedling blight fungus *Colletotrichum linicola* was also found on plants of *L. angustifolium*, and here again cross-inoculations showed the fungus to go over readily to cultivated flax.

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Oct. 5.

[1] Colhoun, J., and Muskett, A. E., *Nature*, **151**, 223 (1943).
[2] Newhook, F. J., *New Zealand J. Sci. Tech.*, A, **24**, 102 (1942). (Abst. *Rev. Appl. Mycol.*, **23**, 17 (1944).)

Wilt Disease of Flax in Great Britain

FOR the last three seasons a serious disease has occurred in some experimental plots at Aberystwyth in which oil varieties of flax, *Linum usitatissimum* L., have been grown. *Fusarium Lini* Bolley (*F. oxysporum* Schlecht form *lini* (Bolley) Snyder and Hansen) has been repeatedly isolated from the stems, roots and seeds of the diseased flax plants. This species, first described by Bolley[1] in 1901 as the cause of wilt disease of flax in America and recorded as occurring in Ireland by Pethybridge and Lafferty[2] in 1920, has not previously been reported in Great Britain.

F. culmorum (W. G. Sm.) Sacc. has also been found closely associated with *F. Lini* on flax seed. Rost[3] claims that *F. culmorum* causes a foot and root rot of flax and up to 100 per cent loss in germination under adverse weather conditions. In view of this statement further work is in progress on the pathogenicity of this species alone and in combination with *F. Lini*.

The two species of *Fusarium* mentioned above were identified by Dr. W. L. Gordon of the Dominion Rust Research Laboratory, Canada, to whom they were sent through the Imperial Mycological Institute, Kew, and I gratefully acknowledge this assistance.

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[1] Bolley, H. L., Proc. 22nd Ann. Meet. Soc. Promotion Agric. Sci., 1 (1901).
[2] Pethybridge, G. H., and Lafferty, H. A., *Irish J. Agric.*, **20**, 325 (1920).
[3] Rost, H., *Angew. Bot.*, **20**, (6), 412 (1938).

Stridulations in the South African Egg-eating Snake, *Daspeltis scaber*, Linn.

MANY strange vocal sounds have been attributed to snakes, but none substantiated. At this Snake Park I have listened carefully both during the day and night, at all seasons and particularly at mating periods, and have never heard any sound other than a hiss. Just recently, however, I observed stridulation in an egg-eater, and have since confirmed this in other specimens.

Normally, the egg-eater is a quite docile snake and can be handled with impunity. An occasional specimen, however, can be easily irritated, when it will throw its body into a series of horseshoe-shaped coils with the head in the centre. By doing this, the scales of any two opposing portions of the body point in opposite directions. The snake writhes its body in such a manner that new coils are continually added on the inside of the horseshoe; at the same time the body is slightly inflated to act as a resonator. In the process of writhing, the tips of the scales rub against each other and produce a rasping sound which is amplified by the inflation of the body. This sound is very similar to a hiss and can easily be mistaken for it. Each spasm of writhing is kept up for only 15–20 sec., and during this time the snake opens its mouth and strikes.

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Meaning and Scope of Social Anthropology

PROF. A. R. RADCLIFFE-BROWN'S article in *Nature* of August 26 has just come to my notice, and I hasten, regrettably late I fear, to write to point out that his able exposition of meaning and scope of anthropology does scant justice to Prof. F. C. Bartlett,

whose Huxley Lecture, as I understand it, cannot bear the interpretation placed on it.

Prof. Radcliffe-Brown says that Prof. Bartlett "would give no place in anthropology to archæology, to linguistics, . . . to ethnology . . . or to social anthropology". He must, I think, have misunderstood what Prof. Bartlett said. What Prof. Bartlett did was to advocate a more intensive empirical and, so far as possible, controlled study of the behaviour of contemporary social groups. He stated very clearly in the fourth paragraph of his lecture, as printed in *Nature* (Dec. 18, 1943), that there were many other concerns of anthropology which he hoped would "continue to be studied vigorously". He excluded archæology from anthropology only to the extent of treating it as an aspect of that study which had not "kept close to empirical fact", and he stated specifically that it could be adopted as a line of approach to the four main branches of anthropology which did rely on such "empirical fact". Linguistics I do not think Prof. Bartlett mentioned at all by name, but one must in reason assume them to be one of those unspecified branches of anthropology which he wished to have vigorously pursued; as for ethnology and social anthropology, as defined by Prof. Radcliffe-Brown, I can infer nothing from Prof. Bartlett's lecture except that he regards their study with the greatest approval and appreciation, and is anxious only to "forge a link closer than ever before" between the work of the anthropologist and the psychologist in their pursuit.

Prof. Bartlett is a psychologist and his whole lecture was, naturally, given specifically from a psychologist's point of view, though I doubt if he would endorse the views expressed by Prof. Radcliffe-Brown as to the nature of psychology and 'psychologies'.

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Origin of Semitic Languages

THE mouth gesture theory of the origin of human speech as it is put forward by Sir Richard Paget and by Prof. Alexander Jóhannesson[1] is certainly a valuable contribution to research on the origin of human speech, although it is not favourably regarded by comparative linguists to-day. It seems that they want to leave the matter to the anthropologists, who are beginning to show considerable interest in it.

A predecessor of Sir Richard Paget and Prof. Jóhannesson was the philosopher Schopenhauer. In his "Psychological Observations" he writes[2]:

". . . Natural gesticulation such as commonly accompanies any lively talk, is a language of its own, more widespread even than the language of words—as far, I mean, as it is independent of words and alike in all nations."

". . . As I have said, the most interesting and amusing part of the matter is the complete identity and solidarity of the gestures used to denote the same set of circumstances even though by people of different temperament, so that the gestures become exactly like words of a language alike for every one. . . . And yet there can be no doubt but that these standing gestures which everyone uses are the result of no convention or collusion. They are original and innate —a true language of nature. . . ."

Schopenhauer, however, makes a proviso:

". . . Strictly speaking, what I get from gesticulation alone is an abstract notion of the essential drift of what is being said. . . . It is the quintessence, the true substance of the conversation and it remains identical no matter what may have given rise to the conversation or what it may be about."

I have tried, in a work as yet unpublished, to reconstruct in another way the origin of human speech and to demonstrate the identity of the Indogermanic and Semitic languages. I do it with the help of the facts of physiology, of 'animal languages', the 'language' of the suckling and the psychology of primitive men. It was possible to deduce most of the words of the Indogermanic and Semitic languages from this reconstructed first language.

A combination of the two theories may perhaps help to further progress and to shed more light on the origin of the most human faculty of human beings.

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[1] *Nature*, **154**, 466 (1944).
[2] Translation by T. Bailey Saunders in "Studies in Pessimism".

First Use of Current-Bedding to Determine Orientation of Strata

IN a recent letter[1], Dr. Archie Lamont directed attention to John Kelly's account, published in 1864, of the use of current-bedding to decide which way up strata were lying. Kelly gave the credit for the discovery of the method to Patrick Ganly. Ganly had given a description of it to the Geological Society of Dublin in 1856[2], but he had been using it much earlier.

Recently, three volumes of letters on geological subjects written by Patrick Ganly to John Kelly and Richard Griffith between 1838 and 1848 have come to light among the records in the Valuation Office in Dublin. These are at present deposited in the library of the Royal Irish Academy, through the courtesy of the Commissioner of Valuation. In one of the letters, dated June 18, 1838, from Dingle, and in another, dated July 16, 1838, from Glengarriff, he uses the method to work out the local structures. Both letters are accompanied by sketches of current-bedding. In the first case he deduces an inversion in the Dingle Beds at Fahan, and in the second shows that in passing from the Red Slate Series to the Black Slate Series (from the Old Red Sandstone to the Carboniferous Slate) south-east of Glengarriff, "the natural order of the succession of the strata accords with their present order of superposition".

Ganly was one of the boundary surveyors engaged on the Griffith Valuation of Ireland. He was employed by Griffith on geological work, and his surveys seem to have been the basis of much of the revision of the later editions of Griffith's geological map of Ireland, first published in 1838.

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[1] *Nature*, **145**, 1016 (1940).
[2] "Observations on the Structure of Strata", *J. Geol. Soc. Dublin*, **7**, 164 (1856).

PROGRESS OF GEOLOGY IN THE U.S.S.R.

SOVIET writers have good cause for satisfaction in the achievements of their country in the field of geology since the Revolution of 1917. This justifiable self-satisfaction has a less justifiable corollary in the constant emphasis on the backwardness of pre-Revolutionary Russia. The pace of scientific progress has increased everywhere in the last few decades, both from its own momentum and because of the vast increase in the number of workers in the field; but this should not detract from our appreciation of the worth of earlier patrons and scholars working in less favourable circumstances.

Russia could boast a mineralogical museum, of a sort, as early as 1716. It was founded by Peter the Great, who was also responsible for the start of a systematic survey of the Russian Empire. By the middle of the century, the great Russian scientific worker M. V. Lomonosov (1711–65) was actively engaged in geological work, and later in the same century, in 1773—a date at which no similar institution existed in Great Britain—the Mining Institute of St. Petersburg was founded. It is true that in the eighteenth century and even later the bulk of the geological work in Russia was carried out by foreigners, among whom the name of Sir Robert Murchison is outstanding. Gradually, however, the Russian geologists asserted themselves and a number of them achieved recognition in the international sphere. Such were A. A. Inostranzev, I. V. Mushketov, M. V. Pavlov, A. P. Karpinsky, E. S. Fedorov, F. Y. Loewinson-Lessing and many others. It is claimed, however, that the progress made during the past twenty-five years exceeds by far all previous achievements. This is probably true, if one considers the scale of the geological research and the number of workers engaged. It is estimated that in 1914 no more than three hundred professional geologists existed in Russia, and that vast territories such as Siberia, Central Asia and the Caucasus were served by only a handful of men. Although it is impossible to estimate the present numbers engaged in geological work in the U.S.S.R., it must be at least ten times as large. At the last International Geological Congress held in Moscow in 1937, the Russian membership exceeded 1,500 members, and this figure did not include many junior workers.

This Congress and the recently published book[1], which is the main subject of this review, must be taken together as an attempt to make widely known the results of a quarter of a century of endeavour in the field of geology (and the kindred sciences of mineralogy and petrology) and the stages by which those results were achieved. The Congress aimed mainly at the enlightenment of non-Russian men of science; on those who were fortunate enough to be present in Moscow and on the elaborate field excursions it will leave an indelible impression. For those who have no such personal recollections, the guide-books and published abstracts of papers provide no adequate substitute. On the other hand, the collection of twenty-five articles on the various branches of geology which comprise the "Progress of Geological and Geographical Sciences in the U.S.S.R. during Twenty-five Years" are very full and well documented, but they are in Russian.

Each article is the work of a prominent authority on its subject, and the whole collection is edited by the veteran Russian geologist V. A. Obruchev. All branches of geology are represented (including one article on geography) with the exception of palæophytology and the regional geology of European Russia, which are missing because the War has absorbed the energies and the time of the men who were to have been responsible for them. It is impossible in this review to give an adequate exposition of the book, but it may be useful to indicate some of its most important points.

First come the articles dealing with the progress made in mineralogy and petrology. These are very informative and they provide a good account of the work of different research schools, such as that on crystal optics originated by E. S. Fedorov, physico-chemical analysis by N. S. Kurnakov, mineral synthesis by D. P. Grigoriev and geochemistry by V. I. Vernadsky and A. E. Fersman. In petrology, naturally, the name of F. Y. Loewinson-Lessing comes first, but much has been achieved by many other petrologists—D. S. Belyankin, B. M. Kupletsky, V. N. Lodochnikov, A. N. Zavarizky and others. The Petrographical Institute founded in 1931 is in a way unique in the whole world, and in the short period of its existence has published, besides the periodical *Travaux de l'Institut Petrographique*, a great number of monographs on the regional petrography of the U.S.S.R., on various rocks and rock-forming minerals. Technical petrology is also extremely well developed in the U.S.S.R., and a number of workers are engaged on the study of slags, cements, fire-resisting materials, glass and cast basalt.

The articles dealing with the progress of palæontology are rather short. On the other hand, those on stratigraphy are the longest and the most valuable of the book. The industrial prospecting for coal, oil and bedded ores is no doubt partly responsible for the progress made in these branches of geology, and it is significant that the greatest amount of work has been done in the study of Carboniferous and Tertiary rocks, the main sources of coal and oil. This does not preclude the achievement made in the study of other systems, and geological mapping and surveying is constantly on the increase all over the territory of the U.S.S.R., but more particularly in the Urals, Siberia, Central Asia and the Caucasus. During this new survey, many startling discoveries have been made, discoveries which have often led to a complete revision of previously accepted knowledge. Stratigraphical work nearly always involves tectonics, and the technique of tectonic investigation recently developed in western Europe and the United States has been applied with the greatest effect by Russian workers. The major tectonic problems, sometimes called geotectonics, have received a good deal of attention, and as so often happens have become involved in a tangle of conflicting hypotheses of a highly speculative nature. For example, a well-known Russian geologist, M. M. Tetiaev, raised a storm recently by a hypothesis which postulates that the tectonic movements are mainly due to the expansion of the earth's interior, and that the folded mountains are due to the pressure exercised by the expanding core against the rigid earth's crust. Many other tectonic hypotheses have been proposed and demolished.

The remaining articles deal with the progress made in engineering geology, applied geophysics, the study of permanently frozen ground, the study of coal, oil shales and oil, and geography. Particularly interesting are articles describing the two new geological museums: the Chernyshev Central and Prospecting

Museum at Leningrad, opened in 1931 and containing collections illustrative of the progress of the geological survey of the U.S.S.R.; and the Karpinsky Geological Museum at Moscow, opened in 1934 and containing 72,250 specimens of minerals. These are arranged in five separate collections: systematic, geochemical, genetic, crystallographic and applied. Another interesting aspect of the status of geology in the U.S.S.R. is the establishment in 1920 of the Ilmen National Park in the southern Urals for the preservation and study of the famous mineral localities of precious stones and other minerals as well as flora and fauna.

The progress made in the U.S.S.R. in the utilization of mineral wealth is described independently in a short article by V. I. Kryzhanovsky[2], in which he gives a review of the achievement in the exploration and utilization of various ores. Only a few outstanding examples can be given here: the discovery of very rich iron ore at Magnitogorsk in the southern Urals, nickel and titanium in the southern Urals and Kola peninsula, molybdenum and tungsten ores in Siberia and Central Asia, bauxite at Tichvin (near Leningrad) and the Urals, tin ore (previously unknown in the U.S.S.R.) in Central Asia. There is also a description of the progress made in the prospecting and mining of gold, platinum, uranium, radium, manganese, coal and oil, borates, etc. But probably the most spectacular discoveries are those of apatite in the Kola peninsula and potash salts in the Urals, both of them of great importance in agriculture. The apatite deposits of the Kola peninsula, discovered in 1921, are the richest in the world, with an estimated reserve of 2,000 million tons. Since this discovery, a new industrial area with two new thriving towns has sprung up in a previously deserted arctic tundra. Besides apatite, a number of other minerals were discovered in the Kola peninsula, such as nepheline, pyrrhotite, titanium ores, ores of rare elements, kyanite, garnet, etc.

The discovery of potash salts at Solikamsk in the northern Urals is no less spectacular. The reserves of sylvite at Solikamsk are estimated to be five times greater than those at Stassfurt in Germany, hitherto regarded as the richest deposit in the world, and still more deposits are being discovered as the survey progresses.

The mineral wealth of the U.S.S.R., always known to be enormous, is rapidly coming within reach of the miner and thus provides a solid foundation for an ever increasing industrialization. The contributions made by geologists and miners to the defence of their country are thus inestimable. S. I. TOMKEIEFF.

[1] "The Progress of Geological and Geographical Sciences in the U.S.S.R. during Twenty-five Years". In Russian. Edited by V. A. Obruchev. (Moscow-Leningrad: Academy of Sciences of the U.S.S.R., 1943.)
[2] Kryzanovsky, V. I. "Les fossiles et la defence de l'URSS", *Bull. Acad. Sci. URSS.*, Ser. Geol., No. 6, 3 (1941).

CHEMISTRY IN RELATION TO MEDICINE

IN a recent lecture before the Royal Institute of Chemistry* on some recent advances in chemistry in relation to medicine, D. H. Hey gives an interesting and concise account of the astonishing contributions which have been made in this field during the last ten years. The beginning of this century saw the introduction of the first therapeutic compound of major importance which had been made to the chemist's design, namely, aspirin, first made in 1899. At the present rate of progress, Dr. Hey suggests, the present major diseases and scourges of mankind will be completely controlled well before the end of this century. This will seem to some medical men an optimistic prophecy; but certainly recent work gives every reason to hope for its realization. One difficulty, however, is that the human talent which slays these dragons so rapidly discovers almost as quickly new causes of disease which defeat existing remedies; and although we may banish the major scourges, we should give equal attention to the minor ones, some of which cause incalculable unhappiness and economic loss and are untouched by our most efficient therapeutic compounds—the 'common cold', for example.

Dr. Hey deals with the sulphonamides, the amidines, the antibiotics (such as penicillin) and the steroid hormones (testosterone, œstradiol and progesterone). "It is no exaggeration to say that the new sulphonamide derivatives prepared during the last seven or eight years can be numbered by the thousand, but the vast majority of these have never been tested *in vivo*". The author explains how the chemist has juggled with the sulphonamide hydrogen atoms in the sulphonamide molecule to produce sulphapyridine, sulphathiazole and other compounds which are now being widely used, and he discusses the properties and bacteriostatic actions of these.

The history of the development of the amidines illustrates the tortuous paths by which final success is sometimes attained. Hey traces the origin of the work on the amidines to an early observation by Koch on parathyroid tetany. Methylguanidine was found in the urine of animals suffering from this, and it was found that administration of methylguanidine or of guanidine caused a fall in blood sugar. Guanidine compounds of greater activity but less toxicity were then sought out, and synthalin and synthalin B were introduced for the oral treatment of diabetes; but they caused too much damage to the liver. It was also found that trypanosomes consume, in artificial cultures, large quantities of glucose, and it was hoped that synthalin, by reducing the blood sugar, would interfere with the development of the trypanosomes and so would be useful for the treatment of sleeping sickness. Lourie and Warrington Yorke found that it did affect the trypanosomes, but not because it reduced the blood sugar but because it was trypanocidal, while insulin was not. This led to the discovery of less toxic drugs of this type, some of which have been tried for the treatment of trypanosomiasis and also, by virtue of their antibacterial action, for the treatment of burns and wounds. *The Lancet* (796, June 17, 1944), for example, discusses the use of propamidine (4 : 4′-diamidinodiphenoxypropane) for the treatment of sepsis in burns and wounds, pointing out that the work of F. R. Selbie and J. McIntosh (*J. Path. and Bact.*, 55, 477; 1943) and of J. W. Allen, F. Burgess and G. R. Cameron (*ibid.*, 56, 217; 1944) and of others indicates that the toxicity of this drug requires care in its use and selection of suitable cases. *The British Medical Journal* (725, May 27, 1944) discusses the relative advantages and disadvantages of the diamidines and antimonial compounds for the treatment of kala-azar and gives further references to the literature about them.

* "Some Recent Advances in Chemistry in Relation to Medicine". By Dr. D. H. Hey. Pp. 24. (London: Royal Institute of Chemistry, 1944.)

The blood anti-coagulants heparin and dicoumarin provide an equally interesting story. People receiving large and continued doses of salicylates should also receive vitamin K_1 or some related compound which will, by maintaining the synthesis of prothrombin in the blood, counteract the anti-coagulant action of salicylic acid due to its reduction of prothrombin. The fact that dicoumarin can be degraded to salicylic acid completes the story.

The author's treatment of the genital hormones is no less interesting and illuminating. The diagrams of the molecular structure of the compounds described help the inexpert reader very considerably.

G. LAPAGE.

RADIO PLANNING IN THE U.S.A.

THE present War has been accompanied by great advances in the application of radio technique to communications and other purposes, and much thought is already being given to the conversion of the results of this work to peace-time conditions. Among the major problems of a post-war world will be the allocation of different portions of the radio-frequency spectrum among the various interests involved, and the consideration of the trend of broadcasting with both amplitude and frequency modulation, and of television. In the United States of America, the body responsible for frequency allocation and for controlling the standards used in the systems developed for the various radio services is the Federal Communications Commission; and in November 1942 the chairman of the Commission, Mr. J. L. Fly, suggested that an organization representative of the radio industry and of the personnel involved therein might be set up to consider the technical requirements of the future in the field of radio. Accordingly, a Radio Technical Planning Board (R.T.P.B.) was set up during 1943; and an account of the organization and work of this body to date has been given by its chairman, Dr. W. R. G. Baker, in the June issue of the *General Electric Review* (U.S.A.).

The objectives of the Board are stated to be the formulation of sound engineering principles and the organization of technical facts which will assist in the development, for the public interest, of the radio industry and the radio services of the nation. The sponsors of the Radio Technical Planning Board are those non-profit-making associations and societies which have an important interest in radio and which indicate a willingness to co-operate in achieving the objectives of the Board. At the present time, there are twelve such bodies which contribute an annual sum of 1,000 dollars or more towards the expenses of the Board, while in addition, there are six non-contributing sponsors.

The article referred to above contains an illustrated detailed account of the organizational structure of the Board and its constituent panels, involving a total personnel of about six hundred at the present time. Under the staff and administrative committee, thirteen panels have been set up to deal with subjects covering the whole field of radio communication, broadcasting, television, facsimile, navigation and the use of high-frequency equipment for industrial, medical and scientific purposes. Each panel is under the chairmanship of a leading engineer in the particular branch of radio concerned, and he is assisted by the most competent specialists available.

An illustrated coloured chart accompanying the article shows that the frequency spectrum with which the Radio Technical Planning Board is concerned extends from 40 kilocycles per second to at least 500 megacycles per second. In view of this broad field, and the number of individuals involved, it is perhaps unlikely that there will be a preponderance of unanimous recommendations emanating from the work of the Board. Even in the absence of very many strong majority proposals, it is considered that the work of the Board will serve a useful purpose in bringing to light many controversial points and in amassing and disseminating a large amount of technical data and information which will be of undoubted value in the planning of radio applications after the War.

THE NILE BASIN

IN recent years the Egyptian Government has published various monographs dealing with the Nile and its waters, including Dr. J. Ball's "Contributions to the Geography of Egypt". Now Dr. H. E. Hurst, director-general of the Physical Department, has compiled a general non-technical account of what is known of the Nile basin and the floods of the Nile, as well as an account of the various barrages*. The publication is well illustrated by one coloured and several black and white maps and diagrams. There is, however, no bibliography.

The Nile basin, embracing about one tenth of the area of Africa, extends far beyond the confines of Egypt; but its most important aspects are peculiar to Egypt and the Anglo-Egyptian Sudan. A brief historical survey might perhaps have stressed how near the truth Ptolemy came regarding the sources of the Nile, though he was largely discredited until the end of the nineteenth century. The physical history of the river is sketched and Ball's hypothesis of Lake Sudd is discredited. The discovery of flint implements a few metres above the present level of the river at Khartoum is a blow to the theory of a lake which existed until a late date, when it was supposed to have overflowed to the north and joined the Bahr-el-Jebel and Blue Nile waters to the Nile. The distribution of early implements suggests that the stone people of the Nile valley probably lived in a warm and humid climate. Since that climate changed to its present character, Dr. Hurst believes that there is no evidence of periodic changes, though there are irregularities from year to year. Nor does he find any connexion, which has been suggested, between sunspot activity and Nile flow or the level of Lake Victoria.

While the hydrology of the Nile is fairly well known, there is still a little uncertainty about the origin of the rainfall which causes the floods. Abyssinia provides 84 per cent of all Nile water and 70 per cent of flood water; but the old theory that this water originates from the Indian Ocean monsoon seems to be fallacious. Rainfall on the east and south of the Abyssinian plateau is scanty compared with that on the west, to which, in the flood season, the winds blow across Africa from the Gulf of Guinea. It seems

* Ministry of Public Works, Egypt: Physical Department Paper No. 45. A Short Account of the Nile Basin. By Dr. H. E. Hurst. Pp. iv+77+9 plates. (Cairo: Government Press, 1944.) P.T.40.

probable therefore that the flood waters which irrigate Egypt originate in the Atlantic. The small contribution which the rain of the Lake Plateau makes to the Nile flow is put at about 16 per cent of the total flow. The Blue Nile is the great feeder, but the importance for this river of Lake Tana has been exaggerated; other tributaries are more important than the one draining Tana. The waters of the White Nile are dammed up by those of the Blue Nile when the latter is in flood, and much of the White Nile waters then, as at other times also, is lost by evaporation.

Dr. Hurst concludes with some suggestions for improving control of the river. The amount of water lost by evaporation in the Bahr-el-Jebel swamps is enormous. Possible ways of preventing this loss are either by the embankment of the Jebel and the Zeraf to prevent the spilling of water into the marshes, or the construction of a new straight channel outside the swamps into which the flow could be diverted. The loss of water on the Bahr-el-Ghazal Basin also calls for preventive measures. There is also the problem of constructing a dam below Lake Albert in order to use that lake as a storage reservoir. Another among the schemes touched on is the proposal for a power-station at the Aswan Barrage.

PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON

IN the current number of the *Proceedings of the Zoological Society*, comprising Parts 1 and 2 of Volume 114, the division into two series (A and B) has been discontinued. Accordingly, all papers will now be published in a single annual volume, containing four parts. The issue of the *Proceedings* in three series, (A) General and Experimental, (B) Systematic and Morphological, and (C) Abstracts of papers communicated at the scientific meetings, was introduced in 1937, and at the same time the practice of giving a serial number to each volume. Previously the volumes were referred to only by the year of issue, which occasionally introduced some uncertainty about the date of publication, since the last part of the volume for any particular year might not appear until January or February in the following year. A further complication arises as a result of the large number of pages contained in the *Proceedings* of some particular years, which necessitated their being bound in two volumes, and title pages and contents sheets were supplied for this purpose. It thus became necessary to refer to the first or second 'volume' of each year of issue. The use of a serial volume number, which will be printed on all future parts, will obviate this necessity, and simplify bibliographic references to publications in the *Proceedings*.

The present number comprises ten papers dealing with a wide variety of subjects. F. W. Rogers Brambell has a paper on the reproduction of the wild rabbit, *Oryctolagus cuniculus* (L.), based on the examination of 957 males, 1,529 females and 1 inter-sex, obtained in Caernarvonshire between February 1941 and June 1942. A very interesting problem arises in connexion with the pre-natal mortality. It is estimated that at least 60 per cent of litters conceived are lost owing to the death and reabsorption of all the embryos, the majority of which die on or about the twelfth day. The mean number of young born to each adult female is found to be between 10·35 and 11·70 per annum. Ti-Chow Tung and Yu Fung-Yeh Tung give an account of experiments supporting their view that in the goldfish, *Carassius auratus*, there exists some centre comparable to the amphibian grey crescent from which the organizer region later arises. R. I. Pocock discusses the races of the North African wild cat. E. J. Popham describes the changes in an aquatic insect population produced by using minnows as predators. A significant difference between the population of three Corixids collected each week was observed, and after the introduction of the minnows the relative proportions of Corixids adapted to the background increased. Robert Gurney deals with the systematics of the crustacean genus *Callianassa*, and G. H. Findlay describes the development of the auditory ossicles in the elephant shrew, the tenrec and the golden mole. G. P. Wells has a paper emphasizing the inadequacy of our knowledge of even the commonest laboratory animals. The neuropodia and notopodia of *Arenicola marina*, L., are described in detail, and for working out the anatomy of the intricate musculature the use of polarized light is recommended. L. S. Ramaswami gives an account of the heart and associated vessels in some genera of *Apoda*, and V. V. Tchernavin gives a revision of the subfamily Orestiinæ and a revision of some Trichomycterinæ, including descriptions of new species based on material preserved in the British Museum, a great part of which was collected by the Titicaca Expedition, of the species of these little-known groups of freshwater fishes.

RUSTY WATER AND MOSQUITO BREEDING

WE have received a report by Mr. K. B. Williamson, malaria research officer, Penang (c/o Ross Institute of Tropical Hygiene, London School of Hygiene and Tropical Medicine, W.C.1), on an "Investigation of Ferruginous Waters in relation to the Breeding of Malaria-carrying Mosquitoes". It is a common observation among malariologists in the tropics that waters containing rusty deposits or bearing iridescent surface films of precipitated iron are generally free from mosquito larvæ, and the possibility of utilizing this fact for the control of mosquito breeding has often been mooted. But exact information about the composition of waters of this kind and about the source of the iron has been wanting. Mr. Williamson's report is based on the examination of various types of rusty waters on Hampstead Heath and elsewhere in the neighbourhood of London and around Malvern, as well as upon his experiences in Malaya. It deals mainly with questions of chemistry.

Iron occurs in water: (1) in particulate form as colloidal ferric hydroxide ('iron rust'), the particles being so small that the water is quite clear; it is this colloidal iron which is unstable and readily gives rise to solid aggregates in the form of surface films or precipitates; (2) in true solution as ionized salts of ferrous or ferric iron; (3) as non-ionized organic complexes.

The humic matter derived from the slow rotting of excess vegetation present in soil combines with both ferrous and ferric iron and exerts a stabilizing influence on the colloidal ferric oxide. Humic matter is itself antagonistic to the breeding of most species

of malaria-carrying mosquitoes. Excess of rotting vegetation in contact with the soil will thus exert a dual benefit.

A provisional attempt has been made to classify ferruginous waters. A ferruginous water is defined as one that contains a minimum of two parts per million of iron in solution or colloidal suspension. Many so-called 'rusty' waters show merely a deposit of rust-coloured sediment which has been thrown down at an earlier date; a deposit of this kind affords no proof that the water continues supercharged with iron. On the other hand, superficial films of 'rust' supply a more immediate indication of the presence of an unstable excess of iron in water. Such iron may be derived (i) from underground mineral sources such as pyrites, (ii) from vegetation rotted under anaerobic conditions in marshy soil, the iron-containing humus forming organic complexes with the iron present in the superficial soil, or (iii) in small amount, from the rotting of vegetation alone in the water.

On the biological side the work is incomplete. Observations on the natural fauna and flora of ferruginous waters have been rather limited; but such waters are characterized by an almost complete absence of water insects, aquatic helminths, Crustacea and Algæ. It has been found by experiment that mosquito larvæ (*Anopheles maculipennis* var. *atroparvus*), newly hatched from the egg, are unaffected by the iron-containing waters provided they are fed; but when placed in samples of such waters without added food they soon die of starvation. It is, therefore, concluded that mosquito larvæ fail to develop in rusty water from lack of food, which is ascribed in the main to the inimical effects of colloidal iron upon the growth of Algæ, Protozoa and other micro-organisms. There is no evidence that iron-containing surface films will suffocate the larvæ.

FUEL RESEARCH

THE Melchett Lecture for 1944 of the Institute of Fuel was delivered on October 12 by Dr. J. G. King on the "Pattern of Fuel Research". Under this title he gave an account of the progress of fuel research seen as a whole, with main branches and subsections fitting together into patterns although the work may have been done in many places, by various organizations and individuals.

The three main patterns chosen were the hydrogenation, the gasification and the study of the constitution and properties of coal. Dr. King gave a survey of the development, from the first observations of Bergius in 1912, of the hydrogenation of solid coal, of the liquid products of carbonization and of petroleum. Actually the conversion of solid coal to liquid fuels ranging from heavy oil to light spirits and hydrocarbon gases involves an interwoven sequence of stages. Behind the large-scale operations now in use stands an immense volume of patient experiment to fix the choice of catalysts, temperature, pressure and other conditions necessary for success, some of which has been done at the Fuel Research Station under Dr. King's direction.

The carbonization of coal in ovens or retorts carries the limitation that only about one fourth of the raw coal can be recovered in the gaseous form. By gasification in the gas producer, it is possible to recover nearly all the fuel in a fluid form but unsuitable for public supply. It came to be recognized that by substituting oxygen for air and working at pressures above atmospheric, the products of gasification could be modified in chemical composition to give a product more suited for public distribution. It happens that in our generation, the technique of oxygen production has so developed as to make it possible to use oxygen in fuel manufacture—at least in some countries. In Great Britain the Joint Research Committee of the Institution of Gas Engineers and the University of Leeds has pursued the problems involved for nearly ten years. It is found that a range of technique is possible, from direct hydrogenation of coal to methane, reaching to a synthesis of methane from the product of pre-gasification of coke by oxygen and steam. These investigations are now in the stage of large-scale operation. In the long run, the successful achievement of this part of the pattern of fuel research can have far-reaching effects.

Dr. King's third main branch of the pattern covers the study of coal constitution and properties both physical and chemical. This includes the immense volume of work done in laboratories all over the world. It would appear that the results of this work, though marked often by ingenuity and industry, have been, in the main, of academic value only, and no clear pattern is revealed. It is thus unlike the first two branches, which concern themselves with the developments of processes. The study of constitution and properties must, however, be of assistance to them.

Dr. King's lecture can be commended as an excellent picture of the pattern of current research on fuel.

FORTHCOMING EVENTS

Saturday, December 2

INSTITUTE OF PHYSICS (LONDON AND HOME COUNTIES' BRANCH) (at the Royal Institution, Albemarle Street, London, W.1), at 2 p.m.—Conference on "The Selection and Training of Personnel for Industry" (to be opened by Major F. A. Freeth, F.R.S.).

GEOLOGISTS' ASSOCIATION (at the Geological Society of London, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Dr. G. M. Lees: "The Geology of the Oilfields of the Middle East".

SHEFFIELD METALLURGICAL ASSOCIATION (joint meeting with the IRON AND STEEL INSTITUTE and the SHEFFIELD SOCIETY OF ENGINEERS AND METALLURGISTS) (at the Royal Victoria Station Hotel, Sheffield), at 2.30 p.m.—Discussion of Papers presented to the Iron and Steel Institute.

Monday, December 4

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Dr. S. K. Kon: "Milk", (3) "Milk in relation to Human Nutrition—Recent Aspects" (Cantor Lecture).

FARMERS' CLUB (at the Royal Empire Society, Craven Street, Strand, London, W.C.2), at 2.30 p.m.—Mr. H. R. Davidson: "Pigs in the Long Range Policy".

ROYAL GEOGRAPHICAL SOCIETY (at Kensington Gore, South Kensington, London, S.W.7), at 5 p.m.—Dr. J. K. St. Joseph: "Air Photography in Archæology".

SOCIETY OF ENGINEERS (at the Geological Society, Burlington House, Piccadilly, London, W.1), at 5 p.m.—Mr. E. S. Waddington: "The Welding of Aluminium"; Dr. H. G. Taylor: "Light Alloy Welding".

Tuesday, December 5

ROYAL ANTHROPOLOGICAL INSTITUTE (at the Royal Geographical Society, Kensington Gore, London, S.W.7), at 1.30 p.m.—Mrs. Olive Murray Chapman: "A Journey across Madagascar".

BRITISH SOCIETY FOR INTERNATIONAL BIBLIOGRAPHY (at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2), at 2.30 p.m.—Mr. W. C. Cooper: "The Classification and Indexing of Technical Aeronautical Information"; Dr. J. A. Wilcken: "Abstracting, Indexing and Classification".

ROYAL INSTITUTION (at 21 Albemarle Street, Piccadilly, London, W.1), at 5.15 p.m.—Sir Henry Dale, O.M., G.B.E., Pres.R.S.: "Modern Developments in Chemical Therapeutics", (i) "Beginnings of Chemotherapy".

INSTITUTION OF CIVIL ENGINEERS (STRUCTURAL AND BUILDING ENGINEERING DIVISION) (at Great George Street, Westminster, London, S.W.1), at 5.30 p.m.—Prof. A. J. Sutton Pippard and Letitia Chitty: "Some Problems presented by Cable Bracing".

QUEKETT MICROSCOPICAL SOCIETY (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 7 p.m.—Exhibits.

Wednesday, December 6

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Dr. C. A. P. Southwell: "Petroleum Production in England".

GEOLOGICAL SOCIETY OF LONDON (at Burlington House, Piccadilly, London, W.1), at 2.45 p.m.—Dr. George Martin Lees: "The Geology of the Oilfields in Great Britain".

GEOLOGICAL SOCIETY OF LONDON (at Burlington House, Piccadilly, London, W.1), at 3 p.m.—Scientific Papers.

ROYAL ENTOMOLOGICAL SOCIETY OF LONDON (at 41 Queen's Gate, South Kensington, London, S.W.7), at 3.30 p.m.—Dr. C. B. Williams: "A Recent Entomological Tour of South America on behalf of the British Council".

INSTITUTION OF ELECTRICAL ENGINEERS (RADIO SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Dr. L. Essen: "The Measurement of Balanced and Unbalanced Impedances at Frequencies near 500 Mc/s and its Application to the Determination of the Propagation Constants of Cables".

ROYAL PHOTOGRAPHIC SOCIETY (SCIENTIFIC AND TECHNICAL GROUP) (joint meeting with the KINEMATOGRAPH SECTION and the BRITISH KINEMATOGRAPH SOCIETY) (at 16 Princes Gate, South Kensington, London, S.W.7), at 6 p.m.—Discussion on "Photographic Aspects of Sound Recording".

Thursday, December 7

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", (iii) "Locomotory Mechanism in Typical Tetrapods—Limbs as Co-ordinated Struts and Levers".

CHEMICAL ENGINEERING GROUP (joint meeting with the INSTITUTION OF CHEMICAL ENGINEERS and the BRISTOL SECTION OF THE SOCIETY OF CHEMICAL INDUSTRY) (in the University Chemical Department, Woodland Road, Bristol), at 5.30 p.m.—Mr. R. T. Pemberton: "Ion Exchanges Applied to Water Treatment".

INSTITUTION OF ELECTRICAL ENGINEERS (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Mr. G. A. Juhlin: "Standardization and Design of A.C. Turbo-Type Generators".

Friday, December 8

ASSOCIATION OF APPLIED BIOLOGISTS (at the Imperial College of Science, South Kensington, London, S.W.7), at 11.30 a.m. (in the Botanical Lecture Theatre)—Mr. T. Goodey: "Eelworm Disease of Onions—Some Recent Investigations": at 2.15 p.m. (in the Metallurgical Lecture Theatre)—Mr. F. R. Petherbridge: "The Biology and Control of the Carrot Fly"; Mr. A. Roebuck: "The Carrot Fly in the Midlands"; Mr. G. Fox-Wilson: "Investigations into the Control of the Carrot Fly under Garden Conditions".

INSTITUTE OF FUEL (SOUTH WALES SECTION) (at the Engineers' Institute, Cardiff), at 4.30 p.m.—Mr. J. O. Samuel: "The Application of Flocculation and Flotation Principles to the Recovery of Low Grade Fuel".

ROYAL ASTRONOMICAL SOCIETY (at Burlington House, Piccadilly, London, W.1), at 4.30 p.m.—Discussion on "Astronomical and Geophysical Periodicities" (to be opened by Dr. Harold Jeffreys, F.R.S.).

ROYAL INSTITUTION (at 21 Albemarle Street, Piccadilly, London, W.1), at 5 p.m.—Lieut.-Colonel E. F. W. Mackenzie: "London's Water Supply—Safeguarding its Purity in Peace and War".

Saturday, December 9

BRITISH MYCOLOGICAL SOCIETY (in the Department of Biology, Chelsea Polytechnic, Manresa Road, London, S.W.3), at 12 noon.—Annual Meeting; at 2 p.m.—Mr. R. W. Marsh: "Mycological Contacts".

Saturday, December 9—Sunday, December 10

ASSOCIATION OF SPECIAL LIBRARIES AND INFORMATION BUREAUX (at the Royal Society, Burlington House, Piccadilly, London, W.1).

Saturday, December 9

At 11.30 a.m.—Sir Frederic Kenyon, G.B.E., K.C.B.: "Organized Knowledge in the World of the Future".

At 2 p.m.—Symposium on "The Empire Contribution to the Flow of World Information".

At 4.30 p.m.—Mr. G. K. Wilkie: "Trade Catalogues in Commercial Libraries".

Sunday, December 10

At 11 a.m.—Mr. Geoffrey A. Shires: "The Technical Information Bulletin and What to Put In It": Mrs. Lucia Moholy: "Developments and Extensions in the Use of Microfilm".

At 3 p.m.—Discussion on "The Status and Education of Special Librarians and Information Officers".

At 5 p.m.—Mr. B. Agard Evans: "Some Aspects of a New Technical Information Service in War-time".

APPOINTMENTS VACANT

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

EDUCATIONAL PSYCHOLOGIST—The Director of Education, County Offices, Oxford (December 8).

SPEECH THERAPIST (full-time)—The Chief Education Officer, County Offices, Chelmsford (December 8).

LECTURER (full-time) IN ELECTRICAL ENGINEERING—The Principal, Technical College, Bradford Place, Walsall (December 9).

ASSISTANT MASTER (full-time) to teach Mechanical Engineering Subjects in the Day School of Engineering and the part-time Day and Evening Engineering Courses—The Principal, Hendon Technical College, The Burroughs, Hendon, London, N.W.4 (December 9).

LECTURER (full-time) IN PHYSICS to B.Sc. Special standard—The Clerk to the Governors, South-East Essex Technical College and School of Art, Longbridge Road, Dagenham, Essex (December 9).

DEPUTY BOROUGH ELECTRICAL ENGINEER—The Borough Electrical Engineer, Electricity Showrooms and Offices, 197–199 Chiswick High Road, London, W.4 (December 11).

ASSISTANT (full-time) to teach ENGINEERING Subjects in the Stockton-on-Tees Technical School and Evening Institute—The Director of Education, Shire Hall, Durham (December 11).

ASSISTANT LECTURER IN PHARMACEUTICAL CHEMISTRY in the Chemistry Department, and a LABORATORY STEWARD IN THE DEPARTMENT OF ZOOLOGY—The Registrar, University College, Nottingham (December 11).

SIBTHORPIAN PROFESSORSHIP OF RURAL ECONOMY—The Registrar, University Registry, Oxford (February 24).

LECTURER IN GEOGRAPHY—The Secretary, The University, Aberdeen (March 31).

ASSISTANT IN THE BOROUGH ANALYST'S DEPARTMENT—The Town Clerk, Town Hall, Burnley, Lancs. (endorsed "Assistant, Analyst's Department").

LECTURER IN THE APPLIED CHEMISTRY DEPARTMENT—The Secretary, Northampton Polytechnic, St. John Street, London, E.C.1.

TEACHER (experienced and well qualified) OF MATHEMATICS AND SCIENCE—The Principal, Technical Institute, Darnley Road, Gravesend.

DEPUTY LIBRARIAN in scientific library—The Secretary, Geological Society of London, Burlington House, Piccadilly, London, W.1.

HEAD OF THE BOTANICAL ECOLOGICAL SECTION—The Secretary, Scottish Seaweed Research Association, Ltd., 28 Rutland Street, Edinburgh 1.

PHYSICAL CHEMIST, a BIOCHEMIST, and two TECHNICAL ASSISTANTS—The Director, Cereals Research Station, Old London Road, St. Albans.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Transactions of the Royal Society of Edinburgh. Vol. 61, Part 1, No. 8: The Petrography of the Franz Josef Fjord Region, North-East Greenland, in relation to its Structure; a Study in Regional Metamorphism. By Dr. N. E. Odell. Pp. 221–246+4 plates. 8s. 6d. Vol. 61, Part 1, No. 9: The Cephalopoda of Scottish and Adjacent Waters. By Dr. A. C. Stephen. Pp. 247–270. 6s. (Edinburgh and London: Oliver and Boyd.) [1210

Post-War Forestry. A Report on Forest Policy prepared by the Royal Scottish Forestry Society and the Royal English Forestry Society. Pp. 62. (Edinburgh: Royal Scottish Forestry Society; London: Royal English Forestry Society.) [1710

Edinburgh and East of Scotland College of Agriculture. Calendar for 1944–1945. Pp. 58. (Edinburgh: Edinburgh and East of Scotland College of Agriculture.) [1710

British Rubber Producers' Research Association. Publication No. 50: The Molecular Weights of Rubber and related Materials, 5: The Interpretation of Molecular Weight Measurements on High Polymers. By G. Gee. Pp. 6. Publication No. 51: The Course of Autoxidation Reactions in Polyisoprenes and Allied Compounds, Part 8: The Photo-Oxidation of Methylelaidate, by Donald A. Sutton; Geranylamine, by Donald A. Sutton. Pp. 4. Publication No. 52: On the Calculation of Certain Higher-Order Bethe Approximations. By W. J. C. Orr. Pp. 28. (London: British Rubber Producers' Research Association.) [1710

Other Countries

South African Institute for Medical Research. Annual Report for the Year ended December 31st, 1943. Pp. 47. (Johannesburg: South African Institute for Medical Research.) [189

U.S. Office of Education: Federal Security Agency. Vocational Division Leaflet No. 14: Teachers are Needed. By Walter J. Greenleaf. Pp. ii+26. (Washington, D.C.: Government Printing Office.) 10 cents. [209

New Zealand. Eighteenth Annual Report of the Department of Scientific and Industrial Research. Pp. 58. (Wellington: Government Printer.) 1s. 3d. [229

Victorian Bush Nursing Association. 32nd Annual Report and Statement of Accounts to 30th June 1943. Pp. 158. (Melbourne: Victorian Bush Nursing Association.) [310

U.S. Department of Agriculture. Circular No. 702: Productive Management of Honeybee Colonies in the Northern States. By C. L. Farrar. Pp. 28. (Washington, D.C.: Government Printing Office.) 10 cents. [510

Field Experiments on Sugar Cane in Trinidad. Annual Report for 1943. Pp. 202. (Trinidad: Government Printer.) [610

Sudan Government. Wellcome Chemical Laboratories, Sudan Medical Service, Khartoum. Report of the Government Analyst for the Year 1943. Pp. 8. (Khartoum: Wellcome Chemical Laboratories.) [610

Les nouvelles méthodes insecticides et les épidémies. Par A. L. Lepigre. Pp. 14. (Alger: Centre National de la Recherche scientifique.) [610

Catalogue

D.D.T.: a Review. By Dr. V. H. Chambers, G. L. Hey and N. K. Smitt. Pp. 24. (Wheathampstead: The Murphy Chemical Co., Ltd.)