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NATURE

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CONTENTS

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DEMOBILIZATION, REHABILITATION AND LAND USE

THE orderly release of men and women from the Armed Forces was rightly given first place in the domestic policy of the Government as outlined in the King's Speech at the opening of Parliament and in the Prime Minister's speech in the debate which followed. Subsequent events such as the sudden termination of Lend-Lease have only further emphasized that demobilization is the first and most urgent domestic issue in Britain.

Speed is indeed the essential factor in the success of any demobilization scheme, and while it can be claimed that the plans set forth in the White Paper last autumn are elastic, administrative action has been slow to give effect to that elasticity in accordance with the new situation. Much has been done, too, to educate public opinion as to the basic requirements in reconstruction plans : that is one outcome of the numerous schemes and plans for the reconstruction of Plymouth, Norwich, Manchester and other cities and towns which have been published during the last year or so. There is general appreciation that Government direction is a first need ; and the scepticism or dissatisfaction with which some pronouncements from the Ministry of Town and Country Planning and also the announcement of a Committee on National Parks have been received, make the more welcome the pledge in the King's Speech to formulate proposals to deal with the key problems of compensation and betterment in relation to town and country planning, as well as to improve the procedure for the acquisition of land for public purposes and to promote the best use of the land in the national interest. Moreover, in the recent War Office indication of its desire, if not intention, to keep its gunnery range at Harlech, we have had another example of the way in which departmentalism may defy the whole purpose of the War Works Commission and jeopardize not only at Harlech but elsewhere amenities, plans for rural improvement, housing, water-supply, road-making and other essential features of a national plan.

The relation of reconstruction plans as a whole to demobilization and the re-allocation of man-power, and the way in which demobilization as determining the available man-power is even more urgent than housing, the restoration of the export trade, or the provision of goods for civilian needs, is well brought out in a broadsheet "Framework of a Four Year Plan" issued by Political and Economic Planning. To what is said there as to the need for a four-year plan embodying a time and progress schedule for economic reconstruction, the main essentials of which are clearly understood by every citizen, the new situation following on the sudden termination of the War with Japan only adds emphasis. The broadsheet assumes that the War in the Far East would end late in 1946, and the priorities with which it is largely concerned and which are of the essence of a four-year plan have now become a matter of great urgency. The grave problems con-

fronting the United Nations Relief and Rehabilitation Administration, the implications of the attempt to rehabilitate Europe or even to relieve distress and prevent famine are scarcely yet understood in Great Britain, and even less in the United States. Until needs are balanced against resources and the maximum national production obtainable with our limited resources estimated, we cannot draw up the man-power budget referred to in the White Paper on Employment Policy, and without which no employment policy can be effective.

It is true that since the *Planning* broadsheet was published the outlook on defence has been radically changed by the advent of the atomic bomb as well as by the collapse of Japan. Decisions on the speed of demobilization, however, do not depend altogether on decisions on the ultimate size of the Armed Forces. Several millions must be demobilized in any event, and we cannot afford the waste of unemployment, whether disguised in uniform or not. Psychological reasons also stress the importance of speed, though here an equal essential is that the Government's policy should be clearly explained to all those whom it affects.

The value of the present broadsheet has not been affected by these fresh considerations, because its presentation of a man-power budget, following on an attempt to measure the total national production and to estimate how it should be divided between consumer goods and services, public and private investment and the other requirements of public authorities, is put forward as an illustration of how the job should be attacked and what is involved in doing it. In particular, the limiting effect which a bold programme of industrial investment must have on the volume of man-power available to meet consumer needs and especially the requirements of distribution and services must be kept in mind. Moreover, the important conclusion that only by some form of control of entry into the distributive trades can enough man-power be made available in the next four years to ensure the re-equipment and modernization of British industry, a rising standard of living, and, with it, an adequate housing programme, is a timely warning.

The estimate of the 'net national production' in this broadsheet is based on the broad assumptions of total industrial employment of levels of 16·1, 16·4, 17·1 and 17·4 millions for 1946, 1947, 1948 and 1949, respectively, as compared with 16·8 millions in mid-1944, and allowing for a net gain of about 1, 2, 3 and 3·5 million men and women released from the Armed Forces and from Civil Defence ; an average working week of the same length as in 1938, but increases of 9, 10·5, 12 and 14 per cent, respectively, in the production per man-hour, with the same terms of trade and with net income from foreign investments, at 1938 prices, of £80 million in each year. Assuming further that the Armed Forces will number 4, 3, 2 and 1·5 millions, respectively, in these years at a cost of £720, 540, 360, 270 million at 1938 prices, *Planning* arrives at an estimate of the net national production of £5,450, £5,430, £5,520 and £5,610 million for the four years in question.

This last assumption is clearly the one that will require most readjustment : it will not be easy to satisfy public opinion on the basis of any figures larger than 3, 2 and 1·5 millions in the Armed Forces for the first three years of the period, even if it is necessary to maintain a level of 1·5 millions for a few further years. It should be noted, moreover, that the latter figure is itself approximately double the level at which it has been computed the Armed Forces could be maintained on a voluntary basis with an intake of 300,000 recruits each year on national service for one year, but excluding trained reserves or 'territorials'. More than this is unlikely to secure public support, and it is evident at once that the man-power situation puts severe limits on our defence policy and in itself indicates the necessity for the speediest possible adjustment to a long-term basis if not to the final peace standard when order has been established.

The observations made in the broadsheet on economic demand, which may be said to arise from three sources—consumption, investment and public authorities' demand for goods and services other than investment—and on the priorities to be assigned not only to these needs but also within the categories between production for the home market and production for export, require much less qualification, and lead to the outstanding conclusion that the first post-war years should be years of heavy investment in building and industrial equipment, for this will be the prerequisite of a rise in productive efficiency and in the standard of living. Moreover, if building is to come first so that war-time damage and arrears can be made good as soon as possible, the resources available for the restoration and modernization of industry and of the public utilities will be drastically limited. Priorities will have to be fixed in peace as in war, and certain controls retained to make them effective.

Vital as investment will be, some rise in consumption should also be contemplated, particularly in regard to non-durable goods and the re-stocking of clothes, shoes, furniture, hardware and the like. At the same time, they should be produced in ever larger quantities for export, and this applies no less to investment goods of all kinds. These considerations lead *Planning* to some assumptions about the broad trends of defence, expenditure, consumption, investment and the foreign balance, and to the presentation of a table of national expenditure for the four years in which the net expenditure at 1938 prices increases from £5,450 millions to £5,610 millions, while expenditure on consumer goods and services increases over the period from £3,190 to £3,770 millions, investment expenditure from £160 in 1946 to £800 millions in 1947 and £915 millions in 1949, while public expenditure on other goods and services decreases from £2,300 millions in 1946 to £1,300 millions in 1947 and then to £1,000 millions.

From these general considerations, the broadsheet attempts to draw up a rough man-power budget for the same period, starting from the targets officially indicated for the building and coal-mining industries. For mining, the labour force is put at 830,000 through-

out the period; with 800,000, 950,000, 1,100,000 and 1,250,000 in the building industry for the four years, respectively. Allowance is made for contractions in agriculture from 1,100,000 to 1 040,000, and in the number of those employed in public service (including Royal Ordnance Factories, etc.) from 1,550,000 to 1,450,000; while it is assumed that the total labour force in the transport (and fishing) industries will remain stationary at the present level of 1,250,000, and that in the public utility services at 200,000. In distribution it is estimated that numbers will increase from 2,080,000 to 2,300,000, while those engaged in the professions, banking and insurance, domestic and other services such as entertainment, hotels, restaurants, etc., are put at 1,450,000, increasing progressively to 1,600,000.

With regard to the most effective distribution of the balance of 6,590,000 in 1946, increasing to 7,230,000 in 1949, the re-equipment of industry is considered the most important task, and since the bulk of this will fall on heavy engineering; it is considered that, on the whole, no great change is likely in the numbers employed in spite of war-time expansion. The labour force in the munition industries is regarded as likely to fall considerably from its 1944 level but to remain above its pre-war size for some time, and is estimated at 3·9–3·5 millions for the four years, leaving available for the consumer goods industries and "other manufactures", which include building materials, 2·7–3·7 millions for the same period. If building is given first priority, the man-power available for consumer goods production will be strictly limited and will not regain its pre-war level of 3·8 millions until after 1949.

Commenting finally on this rough man-power basis for a four-year plan, *Planning* emphasizes that man-power is the most valuable of our resources, and we cannot afford to squander it either in a plethora of unproductive services or in the pernicious waste of mass unemployment. Provided we take the necessary measures to avoid these dangers; that we do not starve industry of the man-power and resources needed for its rapid re-equipment; that we accept the need for a few years 'austerity' compared with pre-war standards; and that by our skill and initiative we re-establish our position in world trade; then there is, in the opinion of P.E.P., no unsurmountable economic obstacle to the achievement of an adequate solution of the housing problem and, generally, of a steadily rising standard of living. To those provisos there might well be added one to the effect that the priorities must be determined in the right order, and that the Government, having made its decisions, should take the necessary steps not merely to implement them but also to see that they are understood by the community generally, and that the reasons for any restraint or controls are fully appreciated and accepted by those whom they affect.

The importance of these last two points is not easily overstressed. Industrial development, whether in the development areas and trading estates or elsewhere, the housing programme, a national parks policy, and the reconstruction of the war-damaged towns or transport systems, involve control of the use of land, in order that the national resources may be utilized most effectively. It is not merely that sectional and departmental interests, however important, have to be balanced and adjusted with the other national interests the life of which depends on the same natural resource—the land; but also any reconstruction programme of food, work and homes must be so devised that the use of land will harmonize with all the main interests—the health and welfare of cities, agriculture, industrial development, transport and communications, food policy, forestry development, and national amenities such as national parks and public access to mountain and sea. But while much progress has been made towards the formulation of a national policy, little has yet been done to forge the instruments for giving effect to such a policy, nor have the vital decisions been taken on the main central difficulty—that of compensation and betterment.

Some of the elements in the situation, it is true, have evidently been defined. The Minister of Town and Country Planning has already announced his intention of introducing during the present session a Bill dealing with compensation and betterment, which it may be hoped will clear the ground for the local planning authorities to exercise far-reaching new powers with courage and constructive wisdom in the execution of the numerous plans already formulated. Simultaneously, Mr. Silkin announced that he was appointing a committee with Lord Reith as chairman "to consider the general questions of the establishment, development, organization and administration that will arise in the promotion of new towns in furtherance of a policy of planned decentralization from congested urban areas; and in accordance therewith to suggest guiding principles on which such towns should be established and developed as self-contained and balanced communities for work and living". This is an important step, and Mr. Silkin could scarcely have made a better choice for the chairmanship of the committee than Lord Reith.

The new committee will have to examine a wide range of problems, especially if "new towns" includes every kind of 'overspill' community which is intended to be more than a mere contiguous dormitory suburb. Meanwhile, Mr. Silkin will himself discuss with local authority organizations the difficult problem of fitting the new urban growth into the existing structure of local government. The committee itself may have to consider the utilization of some type of agency more flexible than a local authority, and subject to more direct social control than private industry, which can harness the efforts of both in promoting the development of communities in which work and homes, economic needs and community life are properly related; while Mr. Silkin may find it necessary to acquire the power to forbid further industrial development in over-industrialized areas, deleted from the recent Bill, as well as to ensure that no dereliction on the part of local authorities frustrate the best use of land in the national interest.

The steps taken by Mr. Silkin are only a beginning, but they are something to offset the concern aroused by such cases as the Harlech beaches ; and it would appear that technical difficulties are not to prevent a high priority being given to the pledge in the King's Speech to deal with the key problem of compensation and betterment. That is an essential step in achieving the programme of reconstruction to which the Coalition Government was no less committed than the present Government. The Prime Minister has shown in his broadcast speeches and in addressing the Trade Union Congress a clear appreciation of the importance of the Government taking the country into its confidence far more than has been possible during the last six years. The *Planning* broadsheet is a valuable aid in that work of educating public opinion ; but no educational work, however vital, can be a substitute for appropriate decision at the centre on the crucial issues and the right priorities.

PROBLEMS OF THE MODERN UNIVERSITY

Redbrick and These Vital Days

By Bruce Truscot. Pp. 216. (London : Faber and Faber, Ltd., 1945.) 10*s.* 6*d.* net.

"REDBRICK and These Vital Days" lacks nothing of the charm and vivacity which characterized "Redbrick University". Once again Mr. Truscot moves with the ease of long familiarity and experience among the problems of the modern university, asking searching questions and suggesting persuasive answers, inspired by a vision of the greatness of the university ideal and by much sound common sense. Here, however, his mordant wit is kept in rather firmer check. He replies indeed with spirit to the criticism of some of the strictures in his earlier book; but the present volume has more coherence and plan. There is less straying into side-issues and irrelevancies, and as a result Mr. Truscot presents us with a survey of the university as a part of the educational system as a whole that none should ignore who are concerned that the community should get the fullest value from that great increase in expenditure on the universities to which we are already committed.

A sense of values and a firm insistence on high standards are indeed the dominant notes of this book. It is a plea for quality as against numbers, for the maintenance of the highest tradition of academic freedom, "to know, to utter, to argue freely according to conscience", and for professional conduct and standards worthy of the university autonomy for which he pleads. His severest criticism and firmest warning are ever against conduct or policies unworthy of the highest traditions of the universities of Britain, or which endanger their independent status as national institutions. He urges a levelling up to the best of Britain's university tradition in freedom, resources, standards and spaciousness. His profound respect for the ideals and achievements of 'Oxbridge' are matched by an unmistakable conviction that 'Redbrick' has the capacity to make its own unique but equally worthy contribution to the service of the Britain, and indeed the world, of to-morrow.

The field over which Mr. Truscot ranges is even wider than in "Redbrick University", and on some of the questions his discussion may seem a little perfunctory. Not all his readers will be convinced without further argument as to the adequacy of his prescriptions even when they accept his diagnosis. None can mistake, however, Mr. Truscot's determination to put first things first, and where the solutions he suggests are unacceptable, the onus is on those who reject them to provide an alternative which avoids the dangers of which he gives clear warning.

Mr. Truscot deals first with the immediate problems of 'Redbrick University', and in his opening chapter he has a trenchant comment on the implications of the wholesale suppression of the arts courses on which we have in the past been wont to rely for the recruitment of several key professions as well as the administrator, whether in the higher ranks of the Civil Service or elsewhere. The fact that the training of those destined for such careers needs to be improved so that they are aware of the significance of scientific achievements and competent to appreciate the bearing of the scientific factors which enter into the problems they are required to handle, or even that it is desirable that those with a scientific training and administrative ability should be encouraged to follow an administrative career, should not lead us to forget that, as Dr. B. Ifor Evans has reminded us, the last thirty years have given a grim warning of the way in which science and technology in the hands of those devoid of a sense of values, which we derive in the main from the study of arts subjects, lead to chaos and barbarism. Mr. Truscot pays a deserved tribute to a broadcast of Prof. V. H. Galbraith, but the position could not be better put than in Mr. Truscot's own words, and the passage should not be allowed to escape the notice of the Ministers of Education or of Labour. The number of arts students to be released should be governed primarily by the capacity of the universities to complete their training, and that capacity is believed to exceed considerably the 3,000 students whose release has recently been announced.

In the same chapter, Mr. Truscot argues against a policy of large increases in the number or size of the universities of Britain. If more suitable and efficient entrance tests are applied, he questions whether numbers will rise by more than about 10,000 above their pre-war level, and he stoutly challenges the view that there can be at present anything like 60,000 who are kept out of the universities solely because of the cost. Mr. Truscot may tend to underestimate the post-war demand for science graduates if anything comes of the debate on the expansion of scientific and industrial research ; though even so, part at least of the demand for technologists would be met by the technical colleges and institutes which he would develop. Fundamentally, he is right to insist on the maintenance of standards and that, while no one should be debarred by lack of means, no one should be entitled to a university education unless he can profit by it. His estimate that if England had sixteen universities averaging 3,000 students each instead of the present eleven and total of 35,000 students all reasonable needs would be met may not be wide of the mark.

The remainder of this chapter deals with topics discussed more fully in his earlier book, such as the sabbatical year and the need for care in making permanent appointments. He suggests that universities should agree generally to make all post-war appointments temporary except to positions in

existence before the War began, and on the question of salaries he advances reasoned proposals differing considerably from those of the Association of University Teachers, particularly in his insistence on the dependence of the reputation of our universities on the quality of their professoriate and on the consequent need to raise such salaries to scales that will attract and keep men and women of the highest quality. In defence of such standards, Mr. Truscot is uncompromising and ruthless, and when he returns afresh in a later chapter to the case of the idle professor, the 'wigs are already on the green'.

Mr. Truscot sticks to the suggestions already made and, as in his former volume, his critique of research is shrewd and sound. This chapter, however, should not be read apart from the rest of the book. The insistence on the need for reform here is part of the plea that runs through the whole book for high standards, for the recognition not merely of new needs and new responsibilities for the nation in the post-war world, but also of new obligations too for the universities themselves, chief among which obligations is that of examining any question afresh in the light of changed conditions—even of principles considered as axiomatic and privileges which by long usage had come to be claimed as rights. He claims that the universities should help to formulate the new conception of society by their approach to their own problems, and that the newer universities in particular must trace out their own way, boldly but surely, with reference to the wants, real or supposed, of emergent society especially in their region.

Whether he writes of the reform of the curriculum, the distinction between narrowness and specialization, the content of the honours course, academic representation, autonomy and the implications of increased assumption of financial responsibility by the State, Mr. Truscot never loses sight of that high ideal, and it inspires all his suggestions. If he looks for no greater increase in the numbers of university students, he has no hesitancy in insisting on the need for greatly increased endowment. For residential developments he suggests that each of the newer universities will require a non-recurrent grant of about one million pounds, with a recurrent annual grant of about half a million for open scholarships, research and tutorial posts, travel grants and other facilities, in addition to the immediate increase of the annual grant to all the universities from the present two millions to ten millions.

No part of the book is more valuable than the thoughtful discussion of the implications of a substantial increase in the endowment of universities by the State and of the dangers of State control which follows; and Mr. Truscot champions the freedom of the universities from State control, from bureaucracy, or from party politics, whether that is expressed as control of the universities themselves or a more insidious tyranny over the academic individual by the university, as stoutly as he does the need for ample financial provision. Mr. Truscot looks ahead himself, and his outspoken book should at least stimulate a real attempt to grapple with some problems of academic freedom, university government and inter-university co-ordination where only hard thinking and foresight can avoid serious difficulties or dangers to-morrow.

When Mr. Truscot attacks internal abuses, it is because of their threat to the real motive power of the universities. Nowhere is this clearer than in his chapter on the university and its region, part of which has already appeared in *The Political Quarterly*. Mr. Truscot repeats his warning that we should regard with suspicion the demand that the university should continually be thinking of 'society', teaching citizenship, stimulating the social consciousness, supplying experts to local industries and the like. This may well provoke a storm of protest; but Mr. Truscot, who sees as clearly as anyone the guiding and steadying influence to the public mind on great issues which a university in a large city may well be, is right. Unless 'Redbrick' preserves its standards of scholarship, safeguards its intellectual autonomy, establishes the right relation between teaching and research, it can never function as the cultural centre of its region in the way he describes in this chapter.

The university, Mr. Truscot suggests, should be a regional power-house, but it must be sure about the nature and source of its power, and avoid diffusing its energy and indeed its life in beneficent but indiscriminate well-doing. A power-house, not a forcing-house; the monastic, not the crusader's tradition—these are the notes on which he passes to discuss as persuasively the implications first of the Norwood, and then of the McNair and of the Fleming Reports. The Norwood Report, for the most part, he welcomes unreservedly, though he points to the danger of allowing the interview, or school testimony, to rank equally with the written examination in the entrance test to the university. He holds, with the Report, that residence at university age is absolutely essential to an all-round education and must become inseparable from university life. He dissents from the report in its classification of the types of freshman, and suggests that five and not three types are to be distinguished, and that some provision should be made for excluding the 'narrow' candidate from academic life unless of exceptional brilliance. Of the allocation of scholarships and of the influence of the universities on the schools, he writes bluntly and at least lays bare the real issues. Whether his argument is acceptable or not, he writes no less appreciatively and trenchantly of the McNair Report, insisting that the fundamental studies and disciplines of all teachers, primary and secondary alike, are, at their apex, the concern of the universities, and he warmly welcomes the creation of the Foundation for Educational Research.

Finally, in the two chapters in which he discusses the public school problem and the Fleming Report, Mr. Truscot suggests as his own solution of this problem that we should concentrate on the task of raising the standards of day secondary schools to the level of the best public schools: to provide a brilliant or an industrious boy with the best of conditions for his work, tuition by highly qualified and technically skilled masters, contact with minds which will stimulate and enlighten his own, hygienic conditions in which to work, a well-stocked library, playing-fields for recreation, and the education which team games can give. Once again, Mr. Truscot gets down to the essentials, and though these concluding chapters are written from the point of view of the university itself, and the ways and means of ensuring that our universities neither miss any appreciable fraction of those who could profit by a university education nor be cluttered by those who are unable to do so, they will be read with interest and profit by many parents or teachers whether the boys and girls with whom they are concerned are proceeding to a university or not.

R. Brightman.

COLOUR FOR ANALYSTS

Colorimetric Analysis

By Noel L. Allport. Pp. xii+452. (London: Chapman and Hall, Ltd., 1945.) 32*s*. net.

ALTHOUGH the author of this book is described—and presumably describes himself—as a "pharmaceutical research chemist", it is clear that only an analytical chemist, in the severest sense of that term, could have produced it. Mr. Allport is, of course, an active analyst and his work is well known and highly appreciated among those who practise analytical chemistry. He has, in fact, produced precisely the kind of book that they would have expected of him—practical, helpful, critical, judicious.

Mr. Allport is obviously not to be reckoned among the old-fashioned chemists who have an acute feeling of misery—and even indeed a marked conviction of sin—if they finish an analytical procedure with anything but a burette or a balance reading. On the other hand, he would certainly have little mercy on the 'colorimetric' enthusiasts who chose to make measurements of colour absorption the end of every analytical procedure, even when methods of greater accuracy or greater ease (or both) are available. But he has selected, under five major headings—metals; acid radicals; substances of clinical and biochemical significance; alkaloids, hormones and vitamins; and miscellaneous substances—a series of colour reactions, all found by himself or known by him to be suitable for application to quantitative purposes with the degree of accuracy required. He warns the user in his general introduction both of the relatively low precision of colorimetric analytical methods, using 'precision' presumably in the American Chemical Society's defined sense of reproducibility, and of their liability to interference "by extraneous substances", which must affect the specificity and therefore the accuracy of the method, using 'accuracy' again in the sense of nearness to correct value.

There are, naturally enough, many well-known methods omitted, but no doubt always for a very good reason. Thus, it is obvious that a method for cholesteryl esters, as distinct from cholesterol itself, is absent because Mr. Allport does not think that there is one good enough to put forward. On the other hand, he has not hesitated to give a colorimetric method for sulphates in blood, where the micro scale of operations makes the classical methods, still to be preferred for most purposes, inferior to the colorimetric, if indeed available at all.

The book gives precise practical details for preparing solutions of which the colour intensity is to be compared with that of a standard, but very wisely confines itself to the description of the chemical analytical procedures involved, and omits the description and advocacy of particular kinds of apparatus, 'colorimeter', absorptiometer, spectroscope, on the correct assumption that they would be out of place in a book of this scope. Indeed, there would be no room to include such matter without making the book unwieldy. It is surely sufficient that Mr. Allport has covered a range of analytical methods for materials ranging from aluminium to vitamin A, from barbiturates to benzoyl peroxide, from vanadium to pilocarpine, from nitrates to saccharin.

The book is admirably produced and written in simple but unambiguous English. One may perhaps doubt whether Mr. Allport, or anyone else, ought to write "much data", but I have not noticed any other hint of solecism. It is, however, worth noting that Mr. Allport, severely practical as always, has taken up a position that, if not exactly a Promethean-like defiance of Zeus's thunderbolts, does at least suggest the cocking of a snook at the Publications Committee of the Society of Public Analysts and Other Analytical Chemists, of which important body he is himself a member! For he uses throughout his book the term *colorimetric* to refer not to "measuring the colour of light . . . under certain conditions", stated by the Committee to be the legitimate use, but to processes that are really those of colour comparison or absorptiometry. As Mr. Allport doubtless shares the Committee's views that it would be nice to give up the misuse of the term colorimetry, but that it is not possible to do so now, might he not include the scientific definitions of the relevant terms, and the reasons for or against using them, in subsequent editions of his book? Whether he does so or not, however, those editions will be deserved and welcome.

A. L. BACHARACH.

SCIENCE AND PIG-KEEPING

Pigs

Their Breeding, Feeding and Management. By V. C. Fishwick. Revised edition. Pp. 222+20 plates. (London: Crosby Lockwood and Son, Ltd., 1945.) 12*s*. 6*d*. net.

PIGS in Great Britain are at the moment under a cloud owing to their being in competition with man for cereal foods, their present numbers being only about 36 per cent the pre-war population. Since world production and transport of cereals, however, is likely to increase again before the increased supply of meat from other animals meets the world deficiency in this product, and since pigs breed and mature rapidly, the pig should soon come back into its own again. The appearance of this book by V. C. Fishwick on the breeding, feeding and management of pigs should therefore be particularly opportune; moreover, it is a most suitable book for those people back from the Forces who wish to take up pig-keeping on modern lines.

Although based on scientific research and experiment, the treatment is essentially practical, for the author is himself in charge of an experimental pig station and has had to incorporate results of modern scientific research into practical pig husbandry.

There is much also in the book to interest the student of biology; for example, the factors which influence the growth of suckling pigs are described, how the pigs in a small litter usually take the forward teats and grow better than those which have the hinder ones in a large litter. The factors which affect anæmia are also dealt with in detail, since this trouble is of common occurrence in young pigs. The details of the qualities required in a high-grade bacon pig are described; and results of feeding experiments are given, including rations and systems of feeding adopted during the War with the object of reducing to a minimum the cereals used. Experiments on the effect of feeding on the quality and melting point of the fat are also referred to, and there is a chapter on the principles of feeding as applied to the pig. A chapter on "Policy" includes such topics as indoor and outdoor methods of keeping, and division of production between the pork and bacon markets. Methods of housing and costs are also dealt with.

The book gives a simple account of the ways in which science can be applied in pig-keeping.

JOHN HAMMOND.

THE CORROSION OF METALS

THE summer meeting of the London and Home Counties' Branch of the Institute of Physics was held on July 7, in the Physics Department of the Imperial College of Science and Technology, and took the form of a discussion on "The Corrosion of Metals".

In a brief opening address, the chairman, Dr. S. Whitehead (acting-director of the British Electrical and Allied Industries Research Association), gave a broad survey of some of the main aspects of corrosion which, he said, may be regarded as the main disadvantage from which metals suffer when in competition with non-metals for industrial use. Many cases of corrosion of practical importance in industry are electrochemical in character; this type of corrosion can arise as a result not only of contact potential differences between different metals, but also of local variations in ionic concentration where an electrolyte is in contact with a single metal. The long-line corrosion effects observed in buried cables and water-mains are due to short-circuited concentration cells of this type. Electrolytic corrosion may also occur as a result of leakage currents from electrical installations. As a rule, the corrosive effects of A.C. leakage currents are many times less than those of an equivalent D.C. current; but there is some danger that an A.C. current may be partially rectified at joints in the pipe or cable. The practice of electrically bonding adjacent pipes and cables buried in the soil can be beneficial but may be the reverse; in some cases the balance of potential may thereby be so upset as to produce harmful corrosive conditions.

Dr. W. H. J. Vernon (head of Corrosion Section, Chemical Research Laboratory, D.S.I.R.), who discussed controlling factors in atmospheric and immersed corrosion, said that it should be recognized that most common metals are in a metastable condition and that corrosion is merely the transition back to the stable state. In order to prevent and counteract corrosion, it is essential to appreciate the factors governing the reaction. A broad distinction can be made between 'promoting factors' that initiate corrosion and 'controlling factors' that determine its velocity when once begun. In most cases the key to adequate preventive action is to be found in knowledge of the major controlling factor.

Dr. Vernon amplified his remarks with reference to the two main types of corrosive attack by electrolytes, namely, (1) the hydrogen-evolution type, and (2) the oxygen-absorption type. The former occurs in the case of the more electronegative metals when immersed in acid solutions, the cathodic reaction being:

$$2H^+ + 2e \rightarrow 2H \rightarrow H_2.$$

Here, providing there is no falling off in the rate of supply of acid to the metal, the controlling factor is the formation of obstructive films at either electrode. This rarely occurs at the anode; but obstruction to the cathodic reaction often arises as a result of the hydrogen overpotential. As a result, corrosion of this type may be reduced by the avoidance of impurities of low hydrogen overpotential in the metal itself.

Corrosion of the oxygen-absorption type is usually associated with the less electronegative metals and neutral electrolytes, the cathodic reaction being

$$2H^+ + 2e + O \rightarrow H_2O \text{ or, } 2e + O + H_2O \rightarrow 2(OH)^-.$$

In this case there is a much greater chance of the formation of an obstructive film at the anode, that is, of anodic polarization. Very commonly, however, the controlling factor is provided by the rate of access of oxygen to the cathodic parts of the system. Accordingly, corrosion of this type can often be controlled by preventing oxygen access, either by de-aeration or by the use of closed systems of water circulation. Incidentally, as an interesting scientific development, it has been found possible to devise an accelerated method of testing, in which the rate of corrosion is markedly increased by the use of oxygen under pressure.

Turning to atmospheric corrosion, Dr. Vernon pointed out that there are two main types of reaction: (1) metal-liquid reactions, and (2) metal-gas reactions. It is a common error to assume that reactions of the former type are analogous to those pertaining to conditions of complete immersion. This is not so because, although the promoting factors may be the same in both cases, the controlling factors are different. The rate of supply of oxygen, usually the controlling factor for corrosion of the oxygen-absorption type under conditions of complete immersion, no longer controls the metal-liquid reaction in atmospheric corrosion, because in the latter the thin films of moisture in contact with the metal are saturated with oxygen. Consequently, the physical and chemical properties of the corrosion products are generally the controlling factor; in some cases, the rate of supply of water to the surface is decisive.

As an example of metal/gas reactions, Dr. Vernon cited the corrosion of nickel by a dry atmosphere containing sulphur dioxide. In this case the initial reaction is an adsorption of sulphur dioxide at the surface, leading to the formation of sulphuric acid according to the equation:

$$2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4.$$

Whether a metal-liquid reaction or a metal-gas reaction will occur is mainly determined by the humidity of the atmosphere. Probably, for each metal there is a critical humidity, below which corrosion is of the metal-gas type and above which corrosion is of the metal-liquid type. Dr. Vernon illustrated the distinction, and also the effect of suspended solid particles, which is a peculiar feature of the atmospheric corrosion of iron or steel, by means of a series of experimental curves for the corrosion of iron in atmospheres of increasing humidities and of differing degrees of pollution. He concluded with a few remarks on the metal-gas reactions controlling the formation of the primary oxidation films below the critical humidity; the four types of oxidation/time curves so far observed—rectilinear, parabolic, logarithmic and asymptotic—are all amenable to mathematical analysis and can be interpreted in terms of the physical properties of the respective oxide films.

Dr. D. H. Bangham (British Coal Utilisation Research Association) contributed a note on the reaction between copper and oxygen, based on experiments carried out by Bloomer and himself many years ago. This has been concerned with the mechanism of the initial formation of the cuprous oxide film in the oxidation of copper and involved a series of determinations of the rate of oxygen absorption at progressively decreasing temperatures and pressures. At sufficiently high temperatures the oxidation process was found to follow the normal parabolic law, but, as the pressure and temperatures are reduced in successive experiments, the character

of the oxidation/time curve changes and a marked induction period is observed. The most interesting fact, however, is that in the case of tests at the lowest temperatures and pressures on cold-worked copper strip, as distinct from the usual specimens, which are annealed, a distinct periodicity in the oxygen absorption has been observed, the pressure within the apparatus oscillating between maximum and minimum values for prolonged periods. To explain the phenomenon it appears necessary to suppose the formation of an unstable mobile copper-oxygen adsorption complex :

$$\text{Cu (strained)} + O_2 \rightarrow [\text{Cu}, O_2]\ \text{(mobile)} \rightarrow \text{Cu (unstrained)} + O_2.$$

In these experiments the pressure oscillations did not greatly exceed the reading error of the McLeod gauge ; but other cases have more recently come to light where the same basic assumptions are necessary in order to explain first-order effects. Thus Frl. Leipus found that silver mirrors deposited chemically on glass become particulate at relatively low temperatures (implying migration of silver atoms) in the presence of oxygen but not in its absence.

Dr. J. C. Hudson (official investigator to the Corrosion Committee of the Iron and Steel Institute) presented a short paper on the corrosion of iron and steel, with particular reference to the work of the Corrosion Committee. The Corrosion Committee, which was founded in 1928 as a joint research committee of the Iron and Steel Institute and the British Iron and Steel Federation, under the chairmanship of the late Dr. W. H. Hatfield, now includes, in addition to the main committee (chairman, Mr. W. J. Dawson), five sub-committees, dealing with specific aspects of the corrosion problem, as affecting iron and steel. Of these, four, the Atmospheric Corrosion Sub-Committee (chairman, Mr. T. Henry Turner), the Marine Corrosion Sub-Committee (chairman, Prof. J. E. Harris), the Industrial Waters Corrosion Sub-Committee (chairman, Dr. J. W. Jenkin) and the Sub-Committee on the Corrosion of Buried Metals, are concerned with corrosion in the media respectively denoted by their titles. The fifth sub-committee, the Protective Coatings Sub-Committee (chairman, Mr. T. M. Herbert), is engaged on the important task of studying protective coatings and processes for iron and steel exposed to all media alike. In addition, the Committee has conducted considerable fundamental and laboratory research on corrosion, in which respect it enjoys the advantages of close liaison with the important corrosion-research schools at Cambridge and at the Chemical Research Laboratory, with which Dr. U. R. Evans on one hand and Dr. W. H. J. Vernon on the other, are closely associated ; reference should also be made to the work of the late Dr. G. D. Bengough in this field.

After a brief description of the experimental procedure adopted in the Committee's researches, in which a special feature is the conduct of tests under actual service conditions wherever possible, Dr. Hudson proceeded to state a few of the main conclusions drawn from the results.

The rate of general corrosion of ordinary mild steel in the open air varies according to the atmospheric pollution and humidity, in conformity with the principles already enunciated by Dr. Vernon in his paper. Where both factors are low, the corrosion-rate is almost negligible ; for example, at Khartoum, the rate is about 0·02 mil (thousandths of an inch) per year. Under conditions of high humidity in the tropics, the rate remains slight in the absence of marked industrial pollution, figures of about 0·5 mil/year being observed. In British climates, where the atmospheric humidity and rainfall are conducive to corrosion, the rate of attack is largely conditioned by the atmospheric pollution, with the result that it varies from about 1 mil per year in rural and marine atmospheres to about 4 mils per year in a highly polluted industrial one. These rates of corrosion in the open atmosphere show a tendency to decrease with time ; as a rule, no appreciable pitting is observed under normal conditions of outdoor exposure.

When completely immersed in sea-water, mild steel has been found to corrode at rates of 4–5 mils/year, while 1·5 mils/year is a representative figure for the rate of general corrosion of mild steel by clay soils. In these media, however, pitting is an important factor, and the rate of maximum penetration may exceed these figures considerably.

The influence of composition on the corrosion-rate of the ordinary irons and steels produced in large tonnages for structural purposes, as distinct from the highly alloyed rust-resisting steels proper, is most marked in the case of complete exposure in the open air. Under such conditions, ordinary British wrought irons are some 20 per cent less corrodible than ordinary mild steel ; they appear to owe this superiority largely to their high slag content, because Swedish wrought iron, which is prepared from high-grade ores smelted with charcoal and is of high purity, is up to 50 per cent more corrodible than mild steel under the same conditions. Moreover, ingot iron, a dead mild steel with the lowest practicable carbon content, shows no superiority to ordinary mild steel under these conditions.

The addition of small percentages of alloying elements to mild steel or wrought iron produces an appreciable improvement in corrosion resistance. In the open atmosphere, a steel containing 0·2–0·5 per cent copper loses approximately 20 per cent less weight than one containing no copper. The joint addition of 0·5 per cent copper and 1·0 per cent chromium produces a greater improvement, and doubles or trebles the corrosion resistance of the steel.

Dr. Hudson then gave a short account of the work of the Protective Coatings Sub-Committee. The most important protective coatings for iron and steel fall into two main groups : (1) paints, (2) metallic coatings. The earlier work of this Sub-Committee was devoted to a study of protection by means of paints, with special reference to the effect of the surface preparation of the iron or steel prior to painting. The results were summarized in a brochure entitled "The Protective Painting of Structural Steel" published by the Iron and Steel Institute. The main conclusions to be drawn from this work are that (1) the best results can only be obtained when paint is applied over properly prepared surfaces from which all rust and mill-scale have been removed ; this is best accomplished by pickling or shotblasting ; and (2) in many circumstances, particularly where paint is applied to a weathered and wire-brushed surface, it is important to use an inhibitive primer, such as one containing red lead.

The Protective Coatings Sub-Committee is now extending its studies of protective painting to include the formulation of the paints themselves. This work is being conducted in collaboration with the National Federation of Associated Paint, Colour and Varnish Manufacturers of the United Kingdom ; technical

details of the programme are in the hands of a joint technical panel under the chairmanship of Mr. F. Fancutt, consisting of three representatives of the Sub-Committee and three representatives of the Federation. The first series of tests arranged by this Panel will be concerned with priming paints for heavy structural steelwork, and is about to commence.

The use of metallic coatings for the protection of iron and steel against corrosion has increased considerably in recent years, because a larger number of metals and alloys has become available for the purpose, owing to developments in the means by which it is possible to apply them; for example, zinc can now be applied by cementation (a diffusion process in the hot state), electrodeposition, hot-dipping, or spraying. Accordingly, the Protective Coatings Sub-Committee decided in 1940 to undertake a systematic investigation of the behaviour of protective metallic coatings as applied to mild steel when exposed both to atmospheric and to marine conditions. Coatings of five metals, aluminium, cadmium, zinc, lead and tin and of two alloys, 82/18 cadmium-zinc and 88/12 lead-tin ('terne'), are included in the tests, and a report on the results of observations during the first four years exposure will be published shortly.

The work of the Marine Corrosion Sub-Committee has included an investigation of formulated anti-corrosive paints for the protection of iron and steel under conditions of complete immersion in sea-water; paints in a modified phenolformaldehyde/stand oil medium, pigmented with basic lead sulphate, in admixture with white lead, aluminium and other pigments, have been found particularly suitable for this purpose. The study of marine corrosion is indissolubly connected with that of fouling, and the Sub-Committee has a team of investigators working in this field also, at first under Dr. (now Prof.) J. E. Harris and at present under Mr. K. A. Pyefinch, in the laboratories of the Scottish Marine Biological Association, Millport.

Mr. P. T. Gilbert (British Non-Ferrous Metals Research Association) discussed various aspects of electrochemical measurements in corrosion studies and described in detail a multiple-recording apparatus which he has devised in collaboration with Mr. A. B. Winterbottom to record the variation with time of the electrode potential of corroding metal couples. This apparatus can be used for simultaneous tests on four complete couples and takes twenty-one individual records per cycle, including the potential differences between each member of each couple and a reference electrode, the corrosion current in each cell, together with various necessary subsidiary measurements of temperature, etc. The recording apparatus is a Cambridge thread recorder, dotting every ½ min., so that each individual reading is repeated at intervals of 10½ min.; the selection and sequence of the readings is controlled by a Post Office selector switch.

Mr. Gilbert discussed a number of general points relating to the design of apparatus of this type. The choice of reference electrode is important; the conditions of use in this case are rather severe for the usual types of reference electrode, and in addition it is desirable to avoid any possible contamination of the corrosive solution. The silver/silver chloride electrode fulfils these conditions most satisfactorily; it retains a constant potential provided that the chloride ion concentration in the solution does not vary. The choice of apparatus for the actual potential measurements is governed by the desirability that it should involve tapping the minimum current possible from the cell so as to avoid interference with the course of corrosion. This has been accomplished by using an electrometer valve circuit, which takes a negligible current of the order of 10^{-15} amp.

The supply of a stable voltage to the valve potentiometer over the fairly long periods covered by the experiments caused trouble at first, when the investigators relied on a 10-volt battery, so they constructed a circuit for ensuring a relatively constant voltage from a mains supply. Accurate measurement of the corrosion current may also present difficulties, owing to the complication introduced by the resistance of the ammeter needed to measure it; Mr. Gilbert described two methods of eliminating this factor.

The apparatus has been applied to a study of the variation in the electrode potentials of zinc and iron, when immersed in tap-water in increasing temperatures up to 85° C., the atmosphere over the solution being varied so as to include various mixtures of oxygen, nitrogen and carbon dioxide. The results have not yet been published, but information of the greatest interest has been obtained on the conditions under which in hot water, zinc becomes more noble as the temperature of the water rises and iron less so, with the result that the potential difference between these two metals becomes reversed. Obviously, this has an important practical bearing on the use of zinc coatings for the protection of steel parts used in hot-water systems, as it represents a complete reversal of the normal state of affairs in which galvanized coatings protect the iron or steel to which they are applied by sacrificial electrolytic action. In view of its importance, the matter is being investigated further.

In the last paper, Dr. W. G. Radley (controller of research, Post Office Engineering Department) described some practical instances of corrosion in telecommunication plant. The prevention of corrosion is an important problem to the Post Office, two typical sources of trouble being (1) the corrosion of the lead sheathing of buried cables, and (2) the corrosion of wires in telephone exchanges.

Dr. Radley said that, although all underground cables are laid in conduits, this does not eliminate corrosion, because no conduit is water-tight and the ground-water percolates in. Corrosion of the lead sheathing is of two main types, stray-current electrolysis and direct attack by ground-water. The solution of problems of stray-current electrolysis depends on tracing the leakage currents responsible for it to their source. Methods of determining stray currents by means of earth electrodes, such as that of Schlumberger, are not readily applicable to cables enclosed in a conduit, and the Post Office relies on simultaneous measurement of the current in the sheath at two points a short distance apart. For this purpose a highly sensitive but robust galvanometer is used, by means of which continuous readings of the stray currents can be recorded photographically. More recently, the possibility has been explored of making direct measurements of potential differences along the sheath by means of non-polarizable electrodes.

Chemical analysis and microscopic inspection of the corroded sheaths often give a clue to the nature of the corrosion; for example, in the absence of any abnormal concentration of chlorine ions in the soil water itself, it can generally be concluded that the presence of 5 per cent or more chlorine in the corrosion product is an indication of corrosion of the stray current type.

Attempts to reduce the attack by the substitution

of certain lead alloys for pure lead have not so far resulted in any decisive improvement and, although the use of other materials such as thermoplastic synthetic resins has been suggested, no satisfactory substitute for lead sheathing has been found. Laboratory tests show that the addition of silicates, phosphates, chromates, tungstates and molybdates reduce the plumbo-solvency of ground-waters, and since 1931, attempts have been made to make practical use of this fact by the incorporation of sodium silicate in the petroleum jelly used as a lubricant on cables. As a result, in localities where corrosion is mainly chemical, there has been a considerable increase in cable life.

As regards the corrosion of wires in telephone exchanges, Dr. Radley mentioned instances in which extensive failure occurred in unattended rural exchanges within a period of ten years. It is difficult to propound a theory accounting adequately for this corrosion, but humidity, the presence of electrolytes in the insulating wrappings, and potential differences between wires that are touching are contributory factors. Variations of atmospheric humidity are inevitable in exchanges of this type despite air conditioning, and under certain conditions condensation of moisture may occur on parts of the apparatus. Electrolytes are present in all cotton wrappings, but it has been found that they can be eliminated to some extent by washing the wrappings. The practical value of this process is under investigation. Cellulose acetate and acetylated cotton have a lower ash content than cotton and are used as the inner wrappings in place of natural silk.

In the course of the ensuing discussion Mr. J. S. Forrest gave some examples of corrosion of overhead power lines, Mr. Clarke discussed the effect of oxygen in solution on the rate of corrosion, and Mr. A. B. Winterbottom made a mainly mathematical contribution on the use of an optical method for the study of film formation.

SEX EDUCATION: AIMS, POSSIBILITIES AND PLANS*

By CYRIL BIBBY

WE come now to what many people will regard as the crux of the matter—when the appropriate facts have been encouraged, what may we expect to be the outcome in terms of sexual behaviour? What, indeed, do we *wish* to be the outcome?

We have to recognize that in Great Britain to-day there is a wide divergence of opinion on questions of sex morality, and in particular, on the question of pre-marital intercourse. For those of our fellows who accept the Church's teaching in its entirety, no queries will arise about the validity of the marriage institution. But increasingly young people are demanding some other justification for it, and those concerned with sex education must either find the justification or honestly admit that they know of none. I believe, however, that the search is not a very difficult one.

Those who see no intrinsic evil in sex may well feel that in a new Utopia the institution of marriage would have no place, that sex relations would be so governed by universal harmony that any contractual basis for living together would be quite unnecessary. But we are not living in a Utopia of perfect beings, and most of us, I imagine, feel that in our present society the married state has a good deal to be said for it.

I believe, however, that a disservice is done to the cause of sexual morality by those who fail to recognize any gradation in standards of behaviour, and lump together all types of pre-marital intercourse under the omnibus title of 'fornication'. I feel some impatience, moreover, with those who seek by their statements to convey the impression that young people to-day, in contrast with the virtuous youth of their own generation, are sunk in sexual vice. It might restore them to a sense of perspective were they to read the words of Alcuin of York, written before ever William of Normandy set foot on these shores. "Since the time of King Aelfwold . . ." he wrote, "the land has been absolutely submerged under a flood of fornication, adultery and incest, so that the very semblance of modesty is entirely absent." Substitute the name of any recent monarch, and there is the gist of many a modern lamentation.

Fulmination, I feel, is a good deal less effective with young people than reasoned argument. It is my experience that the much maligned youth of to-day *will* pay some attention to the views of a sympathetic adult who seeks to persuade them that not all conventions of sex behaviour are hypocritical and not all restraints puritanical. Let us not delude ourselves, however, that even with the most reasoned arguments in the world, all pre-marital sex relations would disappear. No amount of mere talk will of itself dam up the sexual urge of lusty youth. Far-reaching social changes are needed too, and among them is the removal of the all-too-many barriers to early marriage. Equally important is the need to give young people the feeling that they have some future and that there is something for which it is worth while to postpone their sexual satisfaction; to assure them that there is something that they can give to society and which will give them an honoured place in it, to inspire in them some burning sense of constructive social purpose.

One last word about my suggested definition of aims. I stated that sex behaviour should be according to a rationally determined code, but I do not prophesy what that code will be. It would be possible for us so to condition each new generation that it almost automatically thought and felt as its rulers desired: experiment along these lines achieved some considerable degree of success during the last twelve years in Nazi Germany. But, for me at any rate, no such reflex subservience to an authoritarian moral code is included in the aims of sex education. I am content to teach the facts as well as may be, to encourage an open and healthy attitude to sex, to insist on the need for determining conduct rationally—and to have faith that a generation so educated will be at least capable of taking correct moral decisions and making correct moral judgments.

When we leave the definition of aims and begin to draw up definite plans for action, there are, it seems to me, several dangers that must be avoided.

The first is that of Utopianism. There is a great temptation in sex education, as indeed in education generally, to draw up magnificent schemes that are totally irrelevant to the particular social setting within which they are to be put into practice. Let our plans, therefore, be impregnated through and through by an appreciation of what is possible and desirable here and now, not what might be in a brave new world.

* Continued from page 414.

The second danger is that of wasting energy on barren argument about whose job sex education is. For too long parents and teachers and medical practitioners have been, to use an Americanism, 'passing the buck' to each other. Sterile disputation about the precise allocation of degrees of responsibility must give way to serious preparation for getting on with the job in hand and to close collaboration between all who have any part to play.

Another danger is that of over-emphasizing sex and isolating it from the rest of life. To this danger some of the early pioneers fell prey. The perhaps inevitable result of their determination to bring sex into its place in the educational picture was that they painted a canvas on which it loomed over-large. In their rightful insistence that children should not remain in ignorance, they tended sometimes to overload them with information beyond the bounds of their curiosity, intellectual ability or emotional understanding. This tendency must be avoided. Sex education, like health education and character training generally, should permeate the whole of life. The better it is, the less obvious it will be. It will just fit in naturally and inconspicuously into the ordinary life of home, school and community, and will be noticeable only to the degree to which it is imperfect.

Never has the mental atmosphere of the country been so favourable to sex education as now, and now is the time to crystallize support. Talks to public meetings, men's and women's guilds, educational and other discussion groups, and so on, should be arranged in each area. Radio talks, film shorts, posters, newspaper advertisements, etc., can be used to a similar end on a national scale. If this were done with energy and determination, I believe that all opposition to sex education, except that of the confirmed obscurantists, could be overcome within a very short period.

There is another immediate problem that needs mentioning. While we are perfecting our long-term plans and awaiting their fruition, our schools send out into the world each year vast numbers of children who have had no sort of reliable sex education. We cannot afford to be perfectionists and do nothing because we cannot do the best. As a temporary measure, therefore, talks on sex should be arranged in youth clubs and the like, and specially devised lessons given in the schools. But the sooner we get rid of this patchwork procedure, the better.

We must concentrate a good deal of attention on the education of the educators, so that a continuous scheme of sex education may be put into practice at the earliest possible moment. Long-term plans must include drastic alteration in school, university and training college curricula—but we cannot wait for that. Side by side with these changes must go the organization of immediate help to present parents, teachers, youth leaders, medical men, nurses and religious and social workers. What can be done to give such help ?

I would agree with Charles Dickens when he wrote : "We thought that, perhaps, it is right to begin with the obligations of home, sir ; and that, perhaps, while those are overlooked and neglected, no other duties can possibly be substituted for them" ; and shall therefore consider parents first. Rosy optimism is worse than useless, and it must be recognized that many present parents are too ignorant to explain the facts of sex to their children, too indolent to remedy their ignorance, and too tangled in their emotional attitudes to be able to do much were they very encyclopædias of sexual knowledge. But not all present parents. Many are well informed and many others anxious to inform themselves. Many have a thoroughly healthy attitude to sex and many others are eager to attain it. With such there are great possibilities. Courses could be arranged for the parents of new entrants to the nursery or infant school, and perhaps again when their children pass on to the secondary stage. More systematic help and guidance could be given to expectant and nursing mothers at the clinics and welfare centres. The matter could be dealt with at village institutes, community centres, co-operative guilds and the like.

So far as teachers are concerned, it is reasonable to expect a much more thorough preparation. Most of what is needed to provide the necessary background to sex education should indeed be part of the normal professional training course. All teachers need an understanding of the child's bodily, intellectual and emotional development, and this can only be based on a knowledge of fundamental physiological and psychological principles. It would also be very valuable for teachers to have an understanding of the sexual behaviour and problems characteristic of children of various ages, and to study in more detail those of the age-range which they are specially preparing to teach. Moreover, since sex education in the school will be effective in proportion as sex education in the home is not neglected, teachers need also to understand something of the problems of home life and infant training. All teachers need also to be equipped with certain fundamental data which will enable them to answer adequately questions which happen to arise in their school lessons. This implies that all teachers in training—whether they are going to teach the functioning of living things or the structure of dead languages—should take a course in human and social biology. Some training is needed also in the technique of sex education. The ways in which the various subjects of the school curriculum may be utilized as media of sex instruction, the value of various extra-curricular activities in the development of character, the effect of the general school routine and tone upon the fixing of sex habits and attitudes—all these should be studied. Specialist teachers, such as biologists, will naturally need a still fuller preparation.

If it be objected that there is no time to study all this, so much the worse for the very inadequate period of training which is still considered sufficient for teachers.

In the future we may have such teachers, but there are few to-day. In the meantime, then, what can be done ? Most present teachers of biology have the background which will enable them to pick up the necessary extra factual knowledge quite quickly, and many of them have the requisite personality. What is most needed in such cases is courses of instruction by specialists, dealing in part with those physiological and psychological aspects of sex which are not normally covered in university and training college syllabuses, and in part with the technique of sex instruction in the school. Such courses will not make first-rate sex educationists of all who attend them, but at any rate some of the teachers will then be competent to deal with the subject with their pupils, and the others will at least have some understanding of what is aimed at.

Now what of youth leaders ? It is encouraging to note that the 1944 McNair Report comments that :

"There are three matters which are of great significance for young people—religion, politics and sex. They are certain to arise, sooner or later, in any discussions with boys and girls on social conditions or their own physical, mental or spiritual problems. Leaders must therefore be prepared to face them." When the county colleges envisaged in the new Education Act become a reality, they will presumably provide a useful channel for guidance in these matters. In the immediate future, we shall have to do the best we can under the present very difficult conditions of inadequately trained youth leaders, poor club accommodation and so on. The difficulty is, moreover, accentuated by the fact that most of the club members will have received little or no sex education in earlier years. Apart, therefore, from definite lectures to the young people themselves, such as were suggested earlier, the main advance must be that of giving a general background of knowledge to youth leaders, which will help them to deal more effectively with the problems of behaviour which always arise in youth work and to give helpful personal guidance to their club members.

We must recognize, however, that most young people spend only a few hours each week in their youth organization and the major part of their daytime at work. Parallel with what is done in the club, therefore, it seems essential to tackle also the environment in factory, shop and office. The co-operation of industrial welfare workers and of shop stewards and trade union officials should, therefore, be enlisted in any balanced programme of sex education work.

Now let us consider the medical profession. What part has it to play in sex education ? The quite common opinion that medical men are peculiarly qualified to give sex instruction is, I suspect, an aftermath of the feeling that sex is in some way abnormal, and therefore to be handled only by medically qualified persons. This idea, I hope, is dying out rapidly and the role of the medical practitioner should be estimated without prejudice.

Any other than elementary instruction on the venereal diseases is clearly the medical man's province, as are other problems of sexual pathology ; while a great deal of work in preparation for marriage, concerning the technique of intercourse, the practice of contraception and so on, is largely medical in nature. Medical practitioners also, particularly those specially concerned with the young child, should be able to give much helpful advice to parents.

But those medical practitioners who aspire to be sex educators will need to give careful study to the psychological aspects of sex as well as to its physiology ; and they will need sociological insight too. Sex relations and marriage are not purely medical problems. Equally they are problems of politics and economics, of passion and of friendship, of intellectual companionship and mutual respect. Is it too much to hope that medical training might in the future pay more attention to these and other related matters ? No doubt, as in the training of teachers, there is the difficulty of already overcrowded syllabuses. But would not some little study along these lines be of more value to the general practitioner and his patients than a painfully acquired familiarity with the fine details of human anatomy ?

Other health workers, too, have a part to play. Particularly in rural areas, the district nurse and health visitors could do much to bring about a more enlightened attitude to sex among the parents with whom they come into contact. But to be really helpful to the mothers they meet, they will in most cases need further preparation themselves. Having already a good background knowledge, it should be fairly easy for them to extend their understanding. In the future this extra field should be part of their training ; for the present, special short courses should be arranged.

The question now arises : Suppose that all these different categories of people *do* attend special courses of instruction—will that guarantee their suitability to play a part in sex education ? The answer, I suggest, is quite clearly 'No'. He who would undertake sex education with success needs many qualities which may bear little or no relation to special training or academic attainment. The first essential is personal sex adjustment and an absence equally of prudish disinclination to discuss sex and prurient tendency to discuss it to excess. In all education the teacher needs a sympathetic understanding of the pupils, but this applies with special force in sex education. Hypocrisy and narrow-mindedness are fatal. Honesty and tolerance are essential. Imagination is needed too—the ability to sympathize with the feelings of a child and to understand the perplexity of the adolescent, while yet retaining the mature judgment and emotional stability of the adult. One other quality I would add—that of a sense of humour. I know no solvent of strain more effective than laughter, and the person who cannot throw in a joke now and then has no place in sex education.

This is both a warning and an encouragement. It is a warning against judging people's suitability for sex education by their paper qualifications, and an encouragement to those thousands of good-hearted but modest folk in the street who wish to help in sex education but have been doubtful of their ability to do so.

It is now generally agreed that sex education should not be considered as an isolated subject ; and its integration with the rest of education, it seems to me, has two main aspects. One aspect is that of sex education as part of health education generally, and the other is that of sex education as part of a wider education for family life.

There, surely, is a worthwhile task in which many organizations could play an important part. Could not sex education grow into something much wider and richer if really close collaboration and co-ordination were achieved between all the bodies doing sex education work, the moral and social welfare organizations, those concerned with marriage guidance and family planning, organizations dealing with heredity, eugenics and population problems, those working in the field of maternal and child welfare, and so on ? This is obviously a matter requiring close and critical consideration by all the organizations concerned, and I commend the suggestion to their attention.

Among other matters which are simply crying out for attention is that of research. A very considerable volume of sex education work is being carried out—and, I venture to think, with some success. But we cannot close our eyes to the fact that it is all being done quite empirically. We have our ideas about the amount and degree of accuracy of the sex knowledge of the people we are trying to educate ; but we have no exact knowledge. We have general impressions of what their attitudes to sex and sex behaviour are—but we have no exact knowledge. We make estimates of the relative efficacies of the various techniques of sex education—but again we have no exact know-

ledge. The securing of this exact knowledge should be high up on our list of priorities. Just how it should be carried out I am not competent to say—that would need the combined intelligence and experience of educationists, medical practitioners, psychologists, social workers, statisticians and field research workers.

People's attitudes to sex, like their attitudes to any other aspect of human life, do not crystallize in isolation, but are shaped and impregnated by the views of their fellow-citizens and by the whole structure of the society in which they live. That is why some enthusiasts for sex education live in a fool's paradise. Imagining that it is possible in a few lectures to overcome the influence of years of living in a society with distorted views of sex, they are due for disillusion. The best results will follow from sex education only when the whole of our society is remodelled, and our children grow up from the earliest days surrounded by adults who feel that sex is an excellent and joyous thing in which man and woman join as equal partners, sharing benefits and responsibilities alike. Meanwhile, our scheme of sex education must not be drawn up *in vacuo*, as if sex attitudes and sex behaviour were things fixed and immutable. If it is to be really potent, it must be sex education for our particular social setting.

FAMILY FOOD CONSUMPTION IN THE UNITED STATES*

A VALUABLE report has been issued* giving a detailed account of the analysis of data obtained in the United States during a large-scale inquiry into family spending and saving, of which food consumption returns formed a part. It also includes a useful discussion of the various techniques which can be employed in collecting data and the way in which choice of method may affect the picture given by the returns.

Since the United Nations Conference on Food and Agriculture focused attention on the responsibility of a government for the standard of nutrition in the area under its control, reports which describe in detail the way in which different countries conduct dietary surveys in their own territories should find a ready welcome.

The first essential is a basic stock-taking in order to obtain an over-all picture of the food resources of the territory and the nutritional requirements of the community. This provides the background against which more detailed surveys can be tested and on which plans for betterment can be based. There are, however, many territories for which such a simple balance sheet cannot yet be prepared, because the necessary basic data are not available. Imports and exports are usually known with considerable accuracy, but acreage under food crops and the yields normally obtained are not. In some areas there is no information regarding the total number of people forming the community, far less any details of the population distribution in terms of age, sex, and occupation. Without such information nutritional work can at best be only a patchy process, and is apt to be confined to the few more fortunate individuals who happen to come under observation.

A satisfactory balance sheet does not in itself ensure that all is well. It assumes that food is being distributed according to need, and that is a thing which rarely happens. For this reason continual surveys are required in order to provide information about distribution and the factors which determine it. There is no simple way of obtaining this information, and all the methods so far employed have decided limitations. Clearly the smaller the unit that is observed, the greater the number of records which must be kept if the results are to be used as an indication of trends in the community as a whole. Yet if the unit consists of more than one individual, the possibility of maldistribution still exists.

Usually the family has been chosen as the unit for observation. Maldistribution of food may (and often does) occur inside the family; but it nevertheless represents a compact catering unit, and the individuals composing it are on the whole subject to the same controlling influences.

The present study has taken the family as the unit and it claims to represent "the entire civilian housekeeping population of the United States". The distribution inside the sample is said to check very well with census data, but all breakdowns are given in percentages, and the actual size of the sample does not appear to be stated. It would, however, have been possible to handle a very large number of budgets as no direct measurements were undertaken.

In the United Kingdom, the Ministry of Food has run a continuous "War-time Food Survey" in which the investigators have visited the families and supervised all weighings and record-keeping. Since one investigator cannot cover more than ten families at a time (visiting on alternate days during the survey week) the number of records that can be collected is limited by the number of investigators available. It is, however, a method which involves direct measurement and it also affords an opportunity of assessing the relative effects of other influencing factors.

In contrast to this, the present inquiry was conducted as follows:

"Each housekeeping consumer unit interviewed was requested to give detailed food information for the previous week as well as the information on income and expenditure for all goods and services for the calendar year 1941 and for the first quarter of 1942."

A food schedule was provided listing 177 food items, and the information sought was (*a*) food bought during the preceding seven days—quantity and price; and (*b*) food eaten during the preceding seven days—quantity (specifying whether home-produced, bought, or other), and price. Among additional information required was "the number of meals furnished from home food supplies in the seven days covered by the food schedule for each family member, boarder, guest, or paid helper in the household".

The chief criticism against conducting an inquiry in this way is that it is too much in the nature of a memory test, and is therefore subject to all the frailties of that human mental process. The authors are not unaware of this weakness; they themselves say:

"The method used in this study to obtain food consumption data is, of course, subject to some error. It is not expected that the homemaker can recall with great precision the exact quantities of each of the kinds of food consumed. There may be some understatement and some overstatement that is not compensated for within a single schedule. However, it is believed that in the averages for fairly large

* Family Food Consumption in the United States. (U.S. Department of Agriculture, Miscellaneous Publication No. 550.) Pp. vi+157. (Washington: U.S. Government Printing Office, 1944.) 20 cents.

groups of families these are compensating errors, particularly for items consumed by most families."

The interpretation of the data, however, turns so much on this assumption that the errors are compensating ones that it would seem well worth while to organize a survey specially to test the truth of it. A memory test for impersonal facts might be expected to produce compensating errors; but food consumption is so closely linked with community culture and with individual likes and dislikes that the memory picture of food consumed must surely be subject to such influences and therefore liable to uncompensated errors. At present the justifiability of the assumption remains a matter of opinion.

The other major factor limiting the usefulness of this survey is the fact that it covers one season of the year only. The influence of this factor is, however, given due consideration in the discussion relating to each group of foodstuffs in turn.

On the sociological side the returns are grouped according to (1) urban, (2) rural non-farm, and (3) rural farm families, and then further subdivided according to income class. Differences were found, and these differences (in the records) are real, whatever the causes of them may be. As usual, improvement in dietary went up with improvement in income-level inside each main group and, as might have been expected, the biggest differences in the 'consumption patterns' were between the farm families and the urban ones. The rural non-farm families occupied an intermediate position. The authors point out that:

"Farm families had a better opportunity than non-farm families to maintain and improve upon their usual levels of food consumption in the face of rising food costs, food shortages, and reduction in the variety of foods offered for sale because such a large share of their total food supply was obtained from the farm."

It was found that 90 per cent of the milk, 95 per cent of the eggs, 60 per cent of the meat, poultry, fish, fats and oils, 25 per cent of the sugars and sweets, and 20 per cent of the grain products consumed by farm families were produced by themselves.

In terms of nutrients, the farm families' dietaries were superior to the urban ones in calcium, protein, riboflavin and iron, equal in thiamin and vitamin A, and inferior in niacin and ascorbic acid.

The intermediate position of the rural non-farm families is considered to reflect "the ability of many of these families to produce part of their food supply at home and to buy some farm products at lower prices than families in cities", in addition to the fact that they tended to be also of intermediate standing with regard to income.

To other survey workers possibly the most interesting part of the report will be Appendix B, dealing with the methodology. Family consumption records are always complicated by meals taken out and by odd meals given to visitors. The authors point out that "the size of family from the point of view of food consumption is not merely a count of persons, but a count of meals consumed by the persons in the family". For this reason they took the total number of meals served during the week, divided by 21, and called the resulting figure "size of family". 21 was used for the divisor because it was the usual number of meals served to each person each week. Meals taken away from home were not counted. This method of breakdown ignores age, sex and activity, and results obtained by it can only be used for comparative purposes if the communities surveyed are of similar composition. In this case the non-farm groups contained fewer children and men, and the physical activity of the adults was less than in the farm groups.

Requirements were assessed in detail in terms of "equivalent nutrition units". This is a modern variation of the old man-value computation. The use of man-value scales fell into disrepute because they were based on calorie needs only, and disregarded the fact that the requirements for other nutrients do not run parallel. Relative units can, however, be quickly calculated for any set of recommended allowances. In this study "the scales of relatives have been derived from the daily allowances for calories and the specific nutrients recommended by the Food and Nutrition Board of the National Research Council, May 1941. The dietary needs of the moderately active man were considered equal to one nutrition unit; the needs of the other sex-age-activity groups are expressed in relation to those of the moderately active man". Thus a girl of 13–15 years of age counts as 0·93 of a man unit for calories, 1·62 for calcium, 0·74 for riboflavin, and so on.

An alternative method of assessment is that which finds the requirements of the community by adding together the requirements of each sub-group and then divides the resultant totals by the total number of persons. This gives weighted requirements *per capita* and was the method used in the report, "Food Consumption Levels in the United States, Canada, and the United Kingdom".

In the present report, the data have been arranged and re-arranged in many different ways (there are forty-five very detailed tables), and in fairness it must be said that the authors do seem to have directed attention to all possible sources of error and to the limitations imposed by the methods they adopted. This is an attitude of mind that should be encouraged.

M. W. Grant.

OBITUARIES

Mr. E. Lancaster-Jones

The death occurred on September 9 after a short illness of Ernest Lancaster-Jones, keeper of the Science Library. He was born at Radcliffe on November 8, 1891, and was educated at Bury Grammar School. Later, with a mathematical scholarship, he proceeded to Christ's College, Cambridge, and graduated in 1914.

In 1915 he was commissioned in the East Lancashire Regiment, transferring in the following year to the Royal Engineers, with which corps he served for three years in Greece, Macedonia and Egypt. In 1916 he married Geraldine Hilda Anne Farnham, of Burnham-on-Sea, who died in 1942.

In 1920 Lancaster-Jones was appointed assistant at the Science Museum, where he performed valuable work assembling and developing the collections of acoustical and electrical instruments, on geodesy and surveying, and was responsible for the Museum handbook on the geodesy and surveying collections, which appeared in 1925. The introduction from Budapest to Britain in 1920 of the first Eötvös torsion balance provided a unique opportunity for studying the gravitational method of applied geophysics, and Lancaster-Jones devoted himself wholeheartedly to the development of this subject. Frequently, investigations could only be made during the

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

COMMONWEALTH OF AUSTRALIA

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

FELLOWSHIP IN ELECTROTECHNOLOGY

The Division of Electrotechnology of the Council for Scientific and Industrial Research is concerned with the development of standards for electrical measurements at all frequencies. It is desired to extend the activities of the Division to cover fundamental work on dielectrics, and to this end a Fellowship in Electrotechnology is being established, open to University graduates who have been actively engaged in the study of dielectrics.

Applications, in duplicate, should reach the Australian Scientific Research Liaison Office, Australia House, Strand, London, W.C.2, not later than November 9, 1945.

The appointment will be for a period of three years and the salary will be at the rate of £A940 per annum.

The successful applicant will be expected to take up his work in Sydney, New South Wales, at the National Standards Laboratory. The work will be carried out within the Division of Electrotechnology, and the facilities of the Division, including laboratory space and equipment, will be available to the Fellow. Provision will be made for specialized equipment where necessary.

An applicant should hold a University degree, with honours, in electrical engineering or in science with physics as a major subject, and should have had wide experience in fundamental electrical research. A thorough knowledge and experience of electrical measurement, particularly at high frequencies, is desired.

It is expected that the Fellow will devote the whole of his time to fundamental research as outlined above. He will be asked to introduce others into the work and to advise the Council on the establishment of research in this field on a more permanent basis.

The same conditions regarding leave, travelling expenses and the like as are applicable to officers of the Council will apply to the Fellow.

(Signed) G. A. COOK,
Secretary.

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

THE ROYAL SOCIETY

SORBY RESEARCH FELLOWSHIP

The Committee representing the Royal Society and the University of Sheffield, appointed to administer the Sorby Research Fund, invites applications for a Sorby Research Fellowship.

The appointment will be for five years in the first instance but may in special circumstances be prolonged for further periods; it will commence as early in 1946 as can be arranged. The emoluments of the Fellow will be at the rate of £800 a year and he will be required to become a contributory member to a superannuation scheme on the lines of the Federated Universities Scheme. He will be required to pursue his investigation at the University of Sheffield, unless this condition is dispensed with when the nature of the investigation requires that the work should be done elsewhere. Applications will be considered from workers of experience proposing researches in any branch of science, but the regulations provide that a new appointment shall preferably be in a subject differing from the previous one. The retiring holder was appointed for research in experimental entomology.

Copies of the regulations and forms of application may be obtained from the Assistant Secretary of the Royal Society, Burlington House, London, W.1. Applications must reach the Royal Society not later than December 1, 1945. Candidates are requested to submit the names of two referees, but testimonials are not desired.

UNIVERSITY COLLEGE NOTTINGHAM

The Council invites applications for the post of LECTURER IN INORGANIC CHEMISTRY. The salary scale for this grade of appointment is £425–£700 per annum.

Further information, and form of application, which must be returned not later than Saturday, October 20, may be obtained from the Registrar.

COUNTY BOROUGH OF BOLTON EDUCATION COMMITTEE

TRAINING COLLEGE FOR TECHNICAL TEACHERS.

Applications are invited from suitably qualified men and women for the following permanent appointments to the staff of the new Training College for Technical Teachers which will open in Bolton in January, 1946.

(*a*) *Senior Lecturers.*

Salary Scales: Men, £600 × 20 to £750 per annum.
Women, £500 × 20 to £650 per annum.

(*b*) *Lecturers.*

Salary Scales: Men, £400 × 20 to £650 per annum.
Women, £350 × 20 to £550 per annum.

Applicants should have qualifications and teaching experience in Technical Subjects (engineering, building, commerce or science); or experience in the training of teachers, or both.

To a large extent the staff will be engaged on pioneer work, and originality, initiative and a disposition for investigation and research are desirable.

Application forms and further particulars may be obtained from the undersigned to whom completed applications should be submitted not later than October 23, 1945, endorsed "Training College".

W. H. HAYWARD,
Chief Education Officer.

Education Offices,
Nelson Square,
Bolton.

THE UNIVERSITY OF QUEENSLAND

LECTURER IN BACTERIOLOGY

Applications for the above-mentioned position are invited and must be forwarded to reach the undersigned not later than November 17, 1945.

The normal salary range of the position is £550–£700 per annum (Australian currency), but this is subject to cost of living fluctuations. It is at present subject to the addition of a cost of living allowance at the rate of £32 per annum, making the actual range at present rates £582–£732 per annum (Australian currency). The rate of commencing salary will depend upon the qualifications and experience of the appointee.

Conditions of appointment and application forms may be obtained from the Agent-General for Queensland, and the Universities Bureau of the British Empire, London.

C. PAGE HANIFY,
Registrar.

UNIVERSITY OF ABERDEEN

LECTURESHIP IN THE DEPARTMENT OF PHYSIOLOGY

The University Court will shortly proceed to the appointment of a Lecturer in the Department of Physiology.

Salary £400–£500.

Persons desirous of being considered for the office are requested to lodge their names with the Secretary to the University on or before January 15, 1946.

Conditions of appointment may be obtained from the undersigned.

H. J. BUTCHART,
Secretary.

The University,
Aberdeen.

UNIVERSITY OF ABERDEEN

THE CHAIR OF NATURAL PHILOSOPHY

The CHAIR OF NATURAL PHILOSOPHY under the patronage of the University Court becomes vacant through the resignation of Professor John A. Carroll, M.A., Ph.D.

The salary proposed is £1,450.

Persons who desire to be considered for the post are requested to lodge their names with the Secretary of the University by February 15, 1946.

Conditions of appointment may be obtained from the undersigned.

H. J. BUTCHART,
Secretary.

The University,
Aberdeen.

WOLVERHAMPTON AND STAFFORDSHIRE TECHNICAL COLLEGE

Vacancy for TEACHER (man or woman) of BIOLOGY. Ability to add subsidiary Physics or Chemistry an advantage. Salary in accordance with Burnham Technical Scale. Conditions, etc., on application to the Clerk to the Governors.

F. LONSDALE MILLS.

Education Offices, North Street,
Wolverhampton.

NORTHAMPTON GENERAL HOSPITAL

Applications are invited immediately from registered medical practitioners for the appointment of whole-time PATHOLOGIST.

In accordance with the recommendation of the British Medical Association, the appointment will be a temporary one in the first instance and will be re-advertised, in due course, when the holder will be entitled to submit an application.

Salary £1,000 per annum. Federated Superannuation Scheme in force.

Applications, accompanied by copies of three recent testimonials, to be sent to the Superintendent.

ST. MARY'S HOSPITAL MEDICAL SCHOOL

DEPARTMENT OF PHYSICS

Applications are invited for the post of full-time DEMONSTRATOR in the above Department, duties to commence as soon as possible. Salary, £350 per annum.

DEPARTMENT OF BIOLOGY

Applications are invited for the post of full-time JUNIOR DEMONSTRATOR in the above Department; duties to commence as soon as possible. Salary £300 per annum.

Applications should be submitted as soon as possible to the Secretary, St. Mary's Hospital Medical School, Paddington, W.2.

GIRTON COLLEGE, CAMBRIDGE

A TUCKER-PRICE SCIENTIFIC RESEARCH FELLOWSHIP of the value of £250 a year, tenable for three years, and open to women graduates of any University, is offered for research in Mathematics, Natural Sciences and allied subjects. Further particulars can be obtained from the Secretary, Girton College, Cambridge, to whom applications should be sent on or before January 15, 1946.

Patents Section of large industrial concern near London requires an assistant having sound knowledge of organic chemistry preferably of at least B.Sc. standard. Working knowledge of French and German and good experience of patents work essential. Salary according to age, qualifications and experience, full details of which should be given. Box 422, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

A physical chemist and an organic chemist are required for the Research Department of a large firm in N.W. England. Candidates for either post should have a first-class honours degree and not less than five years research experience, preferably in high polymers or cellulosic derivatives. Salary according to qualifications and experience. Box 423, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Assistant Physicist required by industrial research and development laboratory for work in microwaves and applied electron optics. Some post-graduate research experience desirable. Salary according to qualifications, experience and ability. Box 421, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Laboratory Steward required for cancer research laboratory, to take charge of animal house. Experience of line breeding essential. Salary according to grade (A or B) under B.H.A. approved scale, up to £5 per week, depending on experience. Applications should be sent to The Director of Research, Glasgow Royal Cancer Hospital, 132 Hill Street, Glasgow, C.3.

The National Institute of Agricultural Botany, Huntingdon Road, Cambridge, invites applications for the post of Crop Recorder at the Institute's Sub-Station in Hampshire.

Applicants should have had a sound training in agriculture and/or botany and preference will be given to those with experience of field trials and advisory work.

Salary scale £400 to £650 plus War Bonus. Full particulars can be obtained on application to the Secretary at the above address.

Technical Librarian required; previous experience in indexing technical literature essential; permanent post, generous superannuation and good salary according to qualifications. Apply by letter only, stating age and full particulars of experience to Secretary, Copper Development Association, Grand Buildings, Trafalgar Square, London, W.C.2.

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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night, and often under very difficult and trying weather conditions, but his determination and outstanding ability enabled him to devise new methods and instruments, and he soon acquired an international reputation.

Lancaster-Jones was transferred to the Science Library, where he was appointed keeper in 1938. He was largely responsible for the rapid development of the Library, enabling it to contribute so effectively towards the scientific war effort of the country. He possessed a wide knowledge of scientific literature, coupled with a natural organizing ability and an unusual capacity for work. During recent years he found additional interest in the activities of the Association of Special Libraries and Information Bureaux, and played a major part in the introduction of microfilm methods into Great Britain.

'L. J.', as he was affectionately called, was greatly respected by all who knew him. A man free of all conceit and pretences, he was completely sincere and unassuming. He was a deep thinker and a shrewd judge of human character, and successfully combined firmness and discipline with ease and friendliness. His love of various kinds of sport was only equalled by his fondness for children. Early last year he married Eleanor Joyce Chapman of London, and with her and his son and daughter we mourn the loss of a sincere and valued friend who had so endeared himself to us.

H. Shaw.

We regret to announce the following deaths:

Prof. W. B. Cannon, C.B., For.Mem.R.S., emeritus professor of physiology in Harvard Medical School, on October 2, aged seventy-three.

Prof. Roscoe G. Dickinson, professor of chemistry at the California Institute of Technology, known for his work on the X-ray analysis of crystals, photochemistry and reaction kinetics, on July 13, aged fifty-one.

Sir David Milne-Watson, Bart., recently governor of the Gas Light and Coke Company, on October 3, aged seventy-six.

Dr. J. C. Mottram, director of the Research Laboratory, Mount Vernon Hospital, Northwood, Middlesex, on October 4, aged sixty-five.

Mr. H. M. Pendlebury, of the Museums Department, Kuala Lumpur, on September 22, from the effects of three and a half years captivity in Japanese hands.

Prof. J. Strong, C.B.E., emeritus professor of education in the University of Leeds, on October 7, aged seventy-seven.

NEWS and VIEWS

Prof. G. B. Jeffery, F.R.S.

Dr. George Barker Jeffery, the new director of the Institute of Education, University of London, was associated with University College, London, from 1909 onwards, as an undergraduate, a lecturer in the Department of Applied Mathematics, and for twenty-one years as Astor professor and head of the Department of Pure Mathematics. He broke the continuity of this long service with a year at the London Day Training College (now the Institute of Education) and two years as professor of mathematics at King's College, London. His many valuable contributions to mathematical journals deal mainly with the applications of pure mathematics to physical problems, in particular Einstein's relativity theory. As Astor professor he set himself to develop a school of pure mathematics in London and took a leading part in the activities of the London Mathematical Society. He has figured prominently in the affairs of University College. As pro-provost of the section of the College in evacuation at Bangor, his diplomacy at the outset paved the way for a happy co-operation. Taking a keen interest in student life, he laboured to preserve the traditions of the College and to weld the students into a corporate whole. On returning to London in 1944, he took the lead in instituting student hostels. A member of the Senate of the University of London, he has taken a wide interest in educational problems, in the schools as chairman of the Matriculation and Schools Examinations Council, in the University as a member of the Academic and External Councils and as dean of the Faculty of Science. He has always urged the claims of women to equal educational opportunities, especially in the London medical schools. His flair for clear thinking has steered many difficult matters through University channels.

Astor Chair of Mathematics, University of London: Prof. H. Davenport, F.R.S.

Prof. Harold Davenport has been appointed to the Astor chair of mathematics in the University of London in succession to Prof. G. B. Jeffery and is beginning his duties at University College this session. He comes from Accrington Grammar School, the University of Manchester and Trinity College, Cambridge, of which he was formerly a fellow. He is a fellow of the Royal Society and was recently professor of mathematics in the University College of North Wales, Bangor. He has established his position as one of the most distinguished of the younger English mathematicians. His researches have been specially in the field of the analytic theory of numbers in the tradition of Hardy and Littlewood, whose pupil he was. His appointment represents a notable addition to the strength of the mathematical professoriate in the University of London, and is peculiarly happy in view of the close association of University College, London, with the University College of North Wales during the first five years of the War.

Dr. C. Ainsworth Mitchell and *The Analyst*

Dr. C. Ainsworth Mitchell, who has been editor of *The Analyst* since 1920, has just retired from this position but retains his connexion with the Society of Public Analysts and Other Analytical Chemists in the capacity of honorary librarian. During the twenty-five years of his editorship, the scope and reputation of *The Analyst* have steadily increased, and it is largely through his exertions that it has attained its present high place among scientific journals and has become recognized as the most comprehensive record of current analytical work in chem-

istry throughout the world. In fact, the sales to non-members now greatly exceed in number the membership of the Society itself. Dr. Mitchell became a member of the Society of Public Analysts in 1894 and was co-editor with Dr. Bernard Dyer of the jubilee volume, which gave a most interesting account of the progress of the Society from its foundation in 1875. Dr. Mitchell is well known for his work on oils and fats, on vinegar manufacture, and particularly on the chemistry of writing inks and materials, and is the author of much original work in these fields of applied chemistry. His knowledge and experience in the examination of manuscripts and documents have been of service to the courts on many occasions, and his close association with the forensic world was recognized by his election in 1935 as president of the Medico-Legal Society. He is succeeded as editor by Mr. J. H. Lane, who has been assistant editor since 1936.

Australian Council for Scientific and Industrial Research: Retirement of Mr. Gerald Lightfoot

Mr. Gerald Lightfoot has retired from the post of secretary to the Australian Council for Scientific and Industrial Research. Mr. Lightfoot has been associated with the Council since its inception, and has played an important part both in the building up and in the running of what is now a great and very effective organization. Mr. Lightfoot has had varied experience; he took a first class in the Mathematical Tripos at Cambridge in 1898 and was called to the Bar at Middle Temple in 1902. A few years later he went to Australia and joined the Commonwealth Public Service, and in 1920 was appointed chief executive officer of the Commonwealth Institute of Science and Industry. When this body was reconstituted in 1926 as the Council for Scientific and Industrial Research, he was appointed secretary, and he held this position until his retirement. He reported to the Commonwealth Government on the work and organization of scientific research institutions in Great Britain and the United States, and in 1937 he visited North America, Great Britain and Europe in connexion with an extension of the Council's activities. Much of the information gained on this visit was used in extending the Council's work to the secondary industries and in the setting up of several new divisions before the War.

Those who have been associated with Mr. Lightfoot in his work have high admiration for his sound judgment in dealing with major affairs, for his human understanding and kindness in dealing with people, and for his unfailing attention to detail in handling the numerous minor problems which accompany administration. Fortunately, he remains a member of the Council, which will continue to have the benefit of his advice and experience. He has been succeeded as secretary by Mr. G. A. Cook.

Botanist for India at Kew

It has been announced in *Science and Culture* (India) that Dr. Debabrata Chatterji has been appointed by the Government of India to the post of assistant for India at the Royal Botanic Gardens, Kew. Dr. Chatterji had a brilliant academic career in the Presidency College, Calcutta. After a short period of service as a lecturer in botany at Vidyasagar College, Calcutta, Dr. Chatterji went to the University of Edinburgh in 1937, where he submitted a thesis on "The Endemic Flora of India and Burma" for his doctorate (*J. & Proc. Roy. Asiatic Soc. Bengal*); in this connexion he worked at the Royal Botanic Gardens, Kew, and the British Museum. Returning to India in 1939, Dr. Chatterji took up the post of lecturer in botany at the Agricultural College, Mandalay. Owing to progress made by the Japanese, he was forced to leave Mandalay in March 1942, and from April 1942 he served as a systematic botanist in the Botanical Survey, Government of India, for about a year. Since July 1943, he has been a lecturer at Cotton College, Gauhati, Assam. In 1939, Mr. K. N. Kaul of the University of Lucknow was the first Indian appointed an assistant for India at Kew. Mr. Kaul returned to India at the end of 1944 and will now be succeeded by Dr. Chatterji.

Radar During the War

During recent months, much has been published in the daily Press on various aspects of the many different applications of the new technique known as radiolocation or radar; and in *Nature* of September 15, Sir Robert Watson-Watt gave a comprehensive account of the manner in which radar had grown from a classical scientific experiment into a wide series of ramifications developed under the intensive pressure of war. H.M. Stationery Office has now published a pamphlet entitled "Radar—a Report on Science at War" (price 1*s.* net), which is a reprint of an official report issued by the United States Information Service. After briefly surveying the early history of radar both in Great Britain and in the United States, the pamphlet gives an interesting account in general, non-technical language of the important and very interesting part which radar in its various applications played at different stages of the world war. Although the U.S. Naval Research Laboratory and later the U.S. Army were conducting experiments in the reflexion of radio waves from ships and aircraft from the year 1930 onwards, British radar is credited with having been developed at a faster pace from 1935 under the immediate threat to Britain's security. Before the United States entered the War, however, the efforts of American and British laboratories were combined as the result of an agreement between the two Governments in 1940 and the visit of a British Technical Mission to Washington in September of that year. From that time onwards, the combined efforts of the two nations in research and development, training of personnel, and the operational use of this new weapon at sea, on land and in the air make a fascinating story. The concluding section, on "Radar in the Peacetime World", refers to the effect which the spectacular advances in radio technique made during the war years will have on the future of television and in improving the safety of travel by sea and air. The number of men who have been trained in radio and radar techniques and maintenance is enormous, and many of these will turn their attention to the extended application of electronics in all directions in a manner which is likely to have a profound and far-reaching effect on our daily life.

Education in International Morality

The inaugural meeting of the United Nations Fellowship was held on September 27, when Prof. R. A. Tsanoff, of the American Army University Centre, Shrivenham, Berks, and professor of philosophy in the Rice Institute, Houston, Texas, opened a discussion on "The Problems of Education in

International Morality". Prof. Tsanoff stated that ethics is pre-eminently concerned with the expanding universe of moral ideas, especially of duties and obligations. The lack of correlation—and consequent lack of adjustment—between the scientific and technological and the political worlds has been, in the main, responsible for the disharmony of war. The basic world lesson of the recent conflict, and of the stupendous part played in it by science and technology, points once again the warning finger, that mankind ignores the political implementing of a scientific age at his peril. A global age demands a global politics. The conciliation of, and co-operation between, nations is not merely good ethics; it is the very condition of survival. Neither is a mere truce between the Great Powers enough; they must learn to think in terms of the unity which unites rather than of any disunity which might separate. The recognition of the underlying unity of civilization demands a revolution in the moral and educational outlook—the correction of the 'national political' to the 'global political' outlook. Some countries will have further to go than others to reach this, and, in practice, the change-over will not be easy, for the scarcely dormant and deeply rooted subconscious prejudices of preceding ages will be a constant drag on progress.

The next meeting of the United Nations Fellowship will be held at 29 Gordon Square, London, W.C.1, on October 15, when Prof. Norman Bentwich, professor of international relations, University of Jerusalem, will speak on "The Educational and Cultural Organization of the United Nations". The honorary secretary of the Fellowship is Captain O. H. Cooke, 12 Woodlands, North Harrow, Middlesex.

German Military Maps

A COLLECTION of German military maps is on public exhibition during this month at the Royal Geographical Society's House at the corner of Kensington Gore and Exhibition Road. A few of these maps are shown on wall panels: the remainder can be seen in the Map Room on request. These maps are of interest in connexion with German plans for the invasion of England. Those shown on the wall panels include a plan of London on the scale of 1/20,000, emphasizing, in colour and by symbols, buildings and areas of special importance; for example: government offices; main railway stations, marshalling yards, tracks, and bridges; hospitals, industrial sites, and post offices; scientific institutions and historic buildings. A numbered key in the margin gives identifications and brief particulars. There are similar plans on a large scale (1/10,000) of Birmingham, Cardiff and South Shields. A night-flying target map of London, 1/100,000, is also displayed; target areas, outlined in red, include docks, airfields, reservoirs, etc. Other exhibits are a sheet of the *Stellungskarte* of Great Britain, about 2½ inches to the mile, with military information; a sheet, London (West), of the air edition of the German Army map, 1/200,000, with airfields conspicuously marked, and a sheet, Tipperary, of a 1/100,000 map of Ireland. Most of these maps are reproductions on slightly different scales, with additional information overprinted, of maps published by the Ordnance Survey. Official surveys of most countries in Europe were also reproduced by the German Staff, for example, Spain, Portugal, Turkey, Greece and Russia, and representative sheets of these are exhibited.

Announcements

LIEUT.-COLONEL L. P. KIRWAN has been appointed secretary of the Royal Geographical Society in succession to the late Mr. A. R. Hinks. Colonel Kirwan was engaged before the War on archæological and anthropological work, including much work in the field in Egypt, the Sudan, Arabia and England, and for the last three years has been employed on the joint staff in the offices of the War Cabinet.

PROF. BENGT EDLÉN, of the University of Lund, will deliver a lecture before the Physical Society on "The Spectral Structure of the Inert Gases" on October 19. The lecture will be given in the rooms of the Royal Society; fellows of the Royal Astronomical Society are also invited.

DR. A. M. WARD has been appointed principal of the Sir John Cass Technical Institute, London, E.C.3, in succession to Mr. George Patchin, who will retire at the end of the present year. The Institute has arranged full-time day classes in chemistry, physics and mathematics for the London B.Sc. degree.

The U.S. Typhus Commission Medal has been awarded to Dr. Francis G. Blake, dean of Yale University School of Medicine, and Dr. Kenneth F. Maxcy, professor of epidemiology at Johns Hopkins School of Hygiene and Public Health, for "exceptionally meritorious service". Dr. Blake initiated and directed investigations of classical importance on the clinical features and prevention of scrub typhus. Dr. Maxcy was commended for "his observations made in the field under difficult campaign conditions, which clarified earlier knowledge of the conditions under which this disease occurs and added greatly to information about the special conditions which were making this disease a health hazard of paramount importance to American troops".

THE U.S. War Department states that the Secretary of War has approved a project whereby certain outstanding German men of science and technicians are being taken to the United States to ensure that full advantage be taken of significant developments deemed vital to American national security. The individuals selected have volunteered to go to the United States and have been chosen from fields where German progress is of significant importance and in which these specialists have played a dominant part. Throughout their temporary stay in the United States they will be under the supervision of the War Department.

THE following promotions and transfers in the Colonial Service have recently been made: A. G. Beattie (deputy director of agriculture, Nigeria), to be director of agriculture, Nigeria; C. W. L. Fishlock (agricultural officer, Uganda), to be senior agricultural officer, Uganda; H. D. Huggins (agricultural economist, British Guiana), to be agricultural economist, Jamaica; W. T. O. Maidment (agricultural officer, Uganda), to be senior agricultural officer, Uganda; F. R. Sanders (agricultural officer, Tanganyika), to be senior agricultural officer, Tanganyika; C. E. Duff (assistant conservator of forests, Northern Rhodesia), to be senior assistant conservator of forests, Northern Rhodesia; C. Swabey (conservator of forests, Jamaica), to be conservator of forests, British Guiana; W. Pulfrey (geologist, Kenya), to be senior geologist, Kenya; F. E. Tavener (assistant director of surveys, Nigeria), to be director of surveys, Uganda.

LETTERS TO THE EDITORS

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

Detection of Birds by Radar

PERMISSION has now been obtained to publish the fact that birds can reflect radio waves with sufficient strength to be detected by radar sets. Evidence of this was given to us in the summer of 1941 by Dr. E. S. Shire, then developing centimetric radar equipment at the Air Defence Research and Development Establishment, Ministry of Supply. Confirmation was obtained by G. C. Varley in September 1941, when echoes observed on an operational centimetric set at Dover were established by visual checks to come from gannets (*Sula bassana*) flying singly above the sea. The facts were published in a secret report of the Army Operational Research Group, Ministry of Supply, in April 1942. Much fuller details, with numerous further records, were published in a secret report dated February 1945.

Since 1941, there have been numerous well-authenticated records of birds being detected by radar, first from England, then from Malta and Gibraltar, and later from New Zealand and the United States of America[1]. Indeed, with the introduction of higher powered transmitters late in 1943, bird echoes became such a menace on British coast-watching equipment that we specially trained radar operators to distinguish them from echoes of operational importance. Confusion has occurred with aircraft; but the latter are usually quickly differentiated by their greater speed. More serious is the possibility of confusion with fast-moving ships. Birds not infrequently travel with a ground-speed similar to that of a fast-moving ship, and at long range the echo from a bird flying fully in the beam of a radar set can be equal in strength to that from a ship which is below the lowest maximum of the vertical polar diagram. Birds have given rise to several E-boat scares and to at least one invasion alarm.

That birds give radar echoes is not surprising when it is realized that heavy rain is also detected. Single birds may give echoes not much smaller than those from metal spheres of comparable size. The species involved have been mainly the larger sea and shore birds, such as gulls (*Larus* spp.) and grey geese (*Anser* spp.). However, when in flocks even birds so small as a starling (*Sturnus vulgaris*) have produced echoes large enough to be a nuisance to radar operators. Experimental proof that birds can produce radar echoes was obtained by Major J. A. Ramsay of Coast and Anti-Aircraft Experimental Establishment, when he suspended a herring gull (*Larus argentatus*) from a captive balloon in such a way that the echo from the bird was clearly separable from that given by the balloon.

As yet, the radar results have produced little of ornithological interest except to show how frequently birds fly at night over the sea. However, the radar stations concerned have rarely been allowed to follow bird tracks once their identity has been established. There are two other serious difficulties: first, that of getting visual confirmation of the source of the echo, and secondly, that of following a bird track continuously on a coastal radar set owing to marked variations in signal-strength, including complete fading, due to the bird passing through successive maxima and minima of the vertical polar diagram.

On January 12, 1945, a long track was obtained on birds which later crossed the East Anglian coast near a Royal Observer Corps post, where they were identified as grey geese from their calls. (The pink-footed goose, *Anser brachyrhynchus*, is much the commonest species of goose in the area concerned.) One R.A.F. radar station plotted the birds for fifty-seven land miles, which the birds covered in 99 minutes, giving a ground speed of 35 m.p.h. Adding the plot from a neighbouring station, they covered another 22 miles in 40 minutes (33 m.p.h.). They were travelling on a bearing of 287° at an approximate height of 5,000 ft. The Air Ministry Meteorological Office state that at the time in question the wind at this height was probably about 40 m.p.h. from 070°. If this wind speed is correct, the geese were travelling with an air speed of about 25 m.p.h., which seems rather slow. This record constitutes much the longest timed track so far available for any bird in flight.

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Autotrophic Flagellates as the Major Constituent of the Oceanic Phytoplankton

ALL plankton surveys record the catches of diatoms and often of peridinians, but as a rule little mention is made of the autotrophic flagellates, though it appears quite possible that they make up the greatest proportion of the oceanic vegetation; being very minute they mostly pass through the finest silk nets. Their importance has been pointed out by Gross[1], who, however, supposes their mass to be much less than that of the diatoms and peridinians.

In 1919, Allen[2] published a fundamental observation, that culture methods gave far higher counts for plankton organisms than did either netting or centrifuging. Since then, the mass of plant material in the annual crop has been calculated from the consumption of carbon dioxide and of phosphate[3] and in addition of nitrate, and silicate[4]. These estimations gave 1,200–1,600 tons wet weight per sq. kilometre for the English Channel for all but silicate. The silica consumption gave only 110 tons, and diatoms alone take up silica. It was supposed that the low figure for silica was due to its being dissolved and used over again several times. This process would have to be relatively rapid, as the phosphate is all used up in the spring, mostly in a few weeks. In fact, however, the siliceous test of the diatoms is extraordinarily insoluble. Diatoms, with their fine markings perfect, are dredged from the ocean depths and are recognizable in geological deposits; they are of much importance in identifying oil-bearing strata. Miss F. A. Stanbury and I have tried to dissolve diatom tests in alkaline solutions, from the alkalinity of sea-water upwards to *p*H 11, both at air temperature and at about 100° C.; we have not succeeded, even with trials of long duration. Furthermore, Coupin[5] showed that diatoms get the substance of their siliceous valves from the silica of silicates of aluminium, not from vitreous or gelatinous silica.

Again, measurements of the light-extinction coefficient of sea-water indicate that it is everywhere much greater than that of distilled water. The difference appears to be due to a suspension of very finely divided mineral matter; this dissolves slowly, and so the silica removed by diatoms is restored, as it is also by the upwelling of the bottom water due to thermal circulation or impact against oceanic banks. Diatom valves may disappear, but Hart[6] has shown that this is due to their fragmentation in the gut of Crustacea, such as *Euphausia superba*.

All these observations are entirely in accord with the view that autotrophic flagellates and peridinians together constitute by far the larger portion of the oceanic phytoplankton. As the peridinians are usually less abundant than the diatoms, the bulk of the productivity may well be accounted for by the flagellates.

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Occurrence of the Diphyllobothriidæ in Ireland

Interest in the Diphyllobothriidæ has been aroused by the reported occurrence of plerocercoids in the trout of reservoirs in South Wales[1], in Poulaphouca near Dublin[2], and in Northamptonshire[3]. A general survey of these outbreaks has been given by Lapage[4]. In the Dublin outbreak two species of *Diphyllobothrium* are involved. One of these, which has as definitive hosts three species of gulls, was identified by Baylis[5] as *D. dendriticum* (Nitzsch, 1824) and was considered by him to be identical with the South Wales parasite. The other species, of which the adults were found in cormorants and shags, have been identified tentatively by Dr. Baylis (personal communication) as *D. ditremum* (Creplin, 1825). The separation of the plerocercoids of these two species has not yet been effected.

A third species, *D. latum* (Linn., 1758), has for long been known to occur in Ireland. The species was first recorded from man in Ireland by Bellingham[6]. A number of modern cases have been published, all from patients in the County Leitrim area[7]. Dr. T. V. McLoughlin kindly sent a further specimen of *D. latum* to us. This specimen was obtained in October 1944 from a boy aged fourteen, who gave a history of occasionally eating perch from Gardice Lake, Co. Leitrim. Accordingly it was considered desirable to examine fish from this district.

Perch were obtained from Gardice Lake and from the first half-mile of a canal which passes through this Lake and joins it with a number of other lakes in the vicinity.

Seventy-nine perch were examined, and of these thirty-five were infected with plerocercoids. The fish varied from 9·5 to 24·7 cm. in length, sixty-one ranged from 10 to 15 cm. and sixteen from 15 to 20 cm. The findings for these two groups are given in Table 1.

Table 1.

No. of plerocercoids per fish	Nil	1	2	3	4	5	6	7	8	
No. of fish in Group 1 10–15 cm. in length	40	14	5	2	–	–	–	–	–	61 fish examined
No. of fish in Group 2 15–20 cm. in length	4	4	2	2	1	1	–	1	1	16 fish examined

Two of the fish examined are not included in the table; one of these, 9·5 cm. in length, contained no plerocercoids, and the other, 24·7 cm. in length, contained thirteen plerocercoids. Similar plerocercoids were found in each of two perch obtained from Lough Allen on the River Shannon, Co. Leitrim.

Plerocercoids from the Gardice Lake perch were used in the following experiment. Two adult dogs were fed, one with eight and one with two plerocercoids. In the fæces of the dog which had received eight plerocercoids *Diphyllobothrium* ova were present sixteen days later. This animal continued to pass ova for four weeks. The worms were then passed spontaneously. Ova were found in the fæces of the second dog twenty-seven days after feeding. This animal was given an anthelminthic eighty-two days after feeding and two specimens of *D. latum* were obtained. We are indebted to Dr. H. A. Baylis for examining one of these.

A superficial comparison between the *D. latum* plerocercoids and the plerocercoids obtained at Poulaphouca Reservoir, Dublin, is of interest as several morphological and ecological differences were observed.

The *D. latum* plerocercoids were opaque and had a dull white appearance. Living specimens were only sluggishly motile and seldom relaxed sufficiently to lose their typical irregular, deeply wrinkled appearance. When killed in tap water, the scolices usually remained invaginated and the deep wrinkles, in varying intensities, were always present. Of the eighty-one plerocercoids located in the fish from Gardice Lake, seventy-one were found in the skeletal muscles and only ten in the peritoneal cavity or abdominal viscera. On section, no inflammatory reaction was observed in the surrounding tissue.

Plerocercoids from the fish of Poulaphouca Reservoir are rather translucent and have a glistening white appearance. When living they are actively motile and except when strongly contracted deep wrinkling is not apparent. They invariably relax when killed in tap water, their scolices evaginate and assume a lanceolate or almond-shaped appearance, and wrinkles are never present although some specimens show segmentation. Two plerocercoids were found in the skeletal muscles of one out of one hundred and ninety-eight infected trout examined to date from Poulaphouca Reservoir. Otherwise the infection in these fish was confined to the viscera and subserous tissues of the abdominal cavity; an inflammatory mass of blood-stained granulation tissue was frequently present.

Fish from some Irish waters other than those mentioned above were examined. In the following localities plerocercoids, which superficially appeared similar to those from Poulaphouca Reservoir, were found in trout (*Salmo trutta*), salmon (*S. salar*) and char (*Salvelinus colii*).

TABLE 2.

County	Habitat	No. of fish examined	No. of fish infected	Remarks
Wicklow	Reservoir	14 brown trout	13	Fish 19–31·7 cm. in length. Plerocercoids present varied from 2 to more than 200 per fish
Dublin	,,	17 brown trout	1	Single infected fish 63 cm. in length had 3 plerocercoids
Mayo	Lough Mask	3 brown trout	2	Fish 30·5–35·7 cm. Those infected contained 32 and 10 plerocercoids respectively
Galway	Four lakes in Connemara	25 brown trout	2	Two infected brown trout, 35 and 36·7 cm., had 3 and more than 100 plerocercoids. Uninfected fish were less than 15 cm. in length.
,,	,,	20 sea trout	6	Sea trout, 22·3–41·3 cm. Only one or two plerocercoids in each fish
,,	One of these lakes	3 salmon	1	Infected salmon, contained two plerocercoids
Donegal	Lough Esk	3 char	3	Each char contained more than 50 plerocercoids

Mortality owing to the presence of the parasites was not recorded in any fish other than those from the Poulaphouca Reservoir.

One of us (M. D. H.) is in receipt of a grant from the Medical Research Council of Ireland.

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Periodate Oxidation of Sugars in Neutral Phosphate Buffer

WHEN yeast mannan was oxidized with sodium periodate in phosphate buffers of various *p*H values, it was discovered that the amount of oxygen consumed during the oxidation is enormously increased when the *p*H of the solution is raised above 4–5. At *p*H = 7, the consumption of oxygen is about ten times as large as at *p*H = 3 [1]. It was shown that two thirds of the mannan molecule is oxidized to carbon dioxide at *p*H = 7 and 50°. The reaction seems to be catalysed by phosphates, for the velocity of oxidation is much lower in an acetate buffer of *p*H = 5·3 than in a phosphate buffer of the same *p*H.

A number of sugars and similar compounds have been oxidized in the same way by sodium periodate in a phosphate buffer of *p*H = 7·0 at 50°. The concentration of periodate in the solution was about 0·05 m. The amount of periodate consumed was determined by iodometric titration in an excess of the same phosphate buffer. At this *p*H, iodate does not react with potassium iodide, and each mole of periodate will liberate only two atoms of iodine. The time required for complete oxidation was 12–15 hours except in the case of α-glycerophosphate, which was oxidized very slowly. The accompanying table gives the end values of oxygen consumption in these experiments compared to the results found by other investigators in strongly acid solution.

Substance	Phosphate buffer *p*H = 7·0	Strongly acid solution	
	Atoms of O per mole	Atoms of O per mole	Found by
Xylose	4·4	4	Khouvine, Arragon[3]
Glucose	5·2	5	Fleury, Lange[3]
Mannose	5·2	5	Fleury, Lange[3]
Fructose	5·3	5	Khouvine, Arragon[3]
Mannitol	5·2	5	Malaprade[4]
α-glycerophosphate (sodium salt)	5·9	1	Fleury, Paris[5]
α-methyl glucoside	10·1	2	Hérissey, Fleury, Joly[5]
Glucose-*l*-phosphate (potassium salt)	8·8	2 (theoretical)	Not investigated
Maltose	18·1	10*	Ahlborg[7]
Trehalose	19·6	4	Jackson, Hudson[8]

* At *p*H = 3, maltose consumes only 4 atoms of O per mole (Ahlborg, not published).

A preliminary investigation showed that other disaccharides (sucrose, lactose, melibiose) also consume 16–19 atoms of oxygen per mole when oxidized under the same conditions.

The following conclusions may be drawn from the experiments:

(1) Monosaccharides and polyalcohols, the carbon chain of which is broken completely by periodate oxidation in acid solution, are oxidized in the same way in a neutral buffer.

(2) If a mono-, di- or poly-aldehyde containing hydroxyl groups is formed by acid periodate oxidation, much more oxygen will be consumed in neutral than in acid solution, and the bulk of the molecule is oxidized to carbon dioxide. Probably the 'normal' oxidation first takes place, yielding formic acid, formaldehyde and the oxaldehyde, which is then broken down completely.

The Warburg method was employed to measure the amount of carbon dioxide liberated during the oxidation. One of the side bulbs of the Warburg flasks contained 0·1 m. $NaIO_4$ solution and the other 4 *N* H_2SO_4. The oxidation was started by tipping the periodate into the solution. When no more carbon dioxide was evolved, the acid was added from the other side bulb to expel all carbon dioxide from the solution. The following results were obtained:

Substance	Moles of CO_2 per mole	Temperature
α-glycerophosphate (sodium salt)	2·0	50°
α-methyl glucoside	3·8	40°
Glucose-*l*-phosphate (potassium salt)	3·7	40°

The complete course of this new type of periodate oxidation cannot be accounted for as yet. Probably there are also other oxidation products in addition to formaldehyde, formic acid and carbon dioxide. Even in acid solutions the same reaction may be observed as a secondary reaction, at least when the temperature is raised to 40°–50°. That will explain why

some investigators have found that the periodate consumption increases slowly all the time and never comes to a standstill.

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Influence of Vitamin E on the Utilization of Carotene from Oils

IN a previous communication[1], it was indicated that the variations in growth response of vitamin A-deficient rats to carotene dissolved in different oils may be due to the difference in vitamin E contents of the oils. The effect of equalizing the level of tocopherol in the supplements has since been studied and the results found to support the explanation.

Young rats were depleted of vitamin A reserves on a diet consisting of 68 per cent sucrose, 18 per cent extracted casein, 10 per cent brewers' yeast and 4 per cent Osborne and Mendel salt mixture, and supplemented with 1 μgm. of calciferol a week. When symptoms of deficiency were observed, the rats were divided into groups and given the supplements of carotene and tocopherol, six days in the week, as stated in the accompanying table. The fæces of the rats were collected for fifteen days, and the excreted carotene determined by the method of Ramasarma and Hakim[2].

The vitamin E contents of the groundnut, olive and coco-nut oils used in the experiment, determined by a modification of Moore's procedure[3], were 386, 175 and 0 μgm. per gm. respectively. It may be seen that the total vitamin E ingested by rats in groups *G*, *O* 2 and *C* 3 was practically the same, namely, 38·6 μgm. daily, as also in groups *O* 1 and *C* 2, namely, 17·5 μgm. daily.

Group	No. of rats	Supplements	Gain in wt. 3 weeks (gm.)	Gain in wt. 5 weeks (gm.)	Carotene excreted %
G	6	1 μgm. carotene in 100 mgm. groundnut oil	16	22	7
O 1	6	1 μgm. carotene in 100 mgm. olive oil	12	16	0
O 2	6	1 μgm. carotene and 21·1 μgm. α-tocopherol in 100 mgm. olive oil	14	20	0
C 1	5	1 μgm. carotene in 100 mgm. coco-nut oil	4	7	0
C 2	6	1 μgm. carotene and 17·5 μgm. α-tocopherol in 100 mgm. coco-nut oil	9	13	0
C 3	6	1 μgm. carotene and 38·6 μgm. α-tocopherol in 100 mgm. coco-nut oil	14	17	trace

The control groups of rats given the different oils, and one group on tocopherol in coco-nut oil, declined in weight and died.

The results show that the wide variations in growth-response to 1 μgm. of β-carotene in groundnut, olive and coco-nut oils were reduced when pure α-tocopherol was added to the oils low in tocopherol, and the total intake of vitamin E thus equalized. The slight persistent difference might be due to the occurrence in the oils of other isomeric tocopherols which are more efficient antioxidants than α-tocopherol[4].

Gridgeman[5] failed to confirm the vitamin A-E synergy, but the results given above support Hickman's[6] conclusions. Experiments with other dosage levels of tocopherol are in progress.

I am grateful to Prof. V. Subrahmanyan for his keen interest in the work, and to the Lady Tata Memorial Trust for the award of a scholarship.

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Frost Injury Simulating Virus Disease Symptoms on Potato Foliage

THE production of virus-free seed potatoes has been a matter of increasing interest in the British Isles during recent years. The methods of building up healthy stocks originally adopted in Ireland and now being favoured elsewhere consist, briefly, in the scientific testing of selected plants in the glass-house and the subsequent propagation of proved healthy units in isolation in the field. Foundation stocks produced in this manner are distributed to the growers, whose crops are subject to a rigid system of inspection before being certified for seed purposes.

In the working of such a scheme, not the least difficult part is that of the potato inspector, who must diagnose virus infection in the field; and it is in this connexion that we wish to direct attention to the effects of frost on potato foliage. The majority of agriculturists are familiar with the type of injury caused by late spring frosts, such as occurred in April and May of this year; and it is probable that most potato inspectors can also recognize the after-effects of such frosts although these may not be obvious until four to six weeks after the damage has occurred. These effects have been described by Murphy and McKay in a previous publication[1]. Little appears to be known, however, regarding the possible damage to potato foliage caused by the dropping of night temperatures below freezing point during June and early July. So far as we are aware, the only previous reference to such injury is that by MacMillan[2], who describes the development of necrotic spots on the tops of potato plants due to sudden cooling at night during summer. Symptoms of this type have not been observed by us, but evidence of a circumstantial character has been accumulating which suggests that cold nights in early summer are liable to produce other effects which may be mistaken for virus disease symptoms. As in the case of late spring frosts, it would appear that these effects may show up almost immediately, or their development may be delayed until leaves which are still folded at the critical period become fully expanded. A few instances will serve to illustrate this point.

In 1929, one of us (R. McK.), in company with the late Dr. Davidson of the Department of Agriculture, inspected a crop of potatoes grown for seed purposes in a low-lying peaty field in Co. Donegal. The crop consisted of five varieties, Up-to-Date, Sharpe's Express, Kerr's Pink, King Edward and Arran Chief. These were grown in contiguous long strips of twelve drills each in the order named. A sharp frost had occurred on July 7, and when the inspection was made ten days later, the top growth of the Up-to-Date, Kerr's Pink and Arran Chief was strongly mottled and the leaflets somewhat distorted, while only an occasional plant of Sharpe's Express and King Edward showed pale blotches. The result was that at a distance of thirty yards, the location of the former varieties was clearly discernible by reason of their yellowish mottled hue. Although any individual affected plant might reasonably have been diagnosed as suffering from virus infection, the previous history of the crop, and the manner in which the symptoms developed, left no doubt that the effect was entirely due to frost. The difference in reaction of the varieties was ascribed to the fact that a dense mass of foliage was present on those which showed most mottling, while the drills of Sharpe's Express and King Edward were still open. The erect tops of the latter would therefore have been drier owing to the free circulation of air about them.

In the same year, another suggestive incident occurred in one of the Northern counties. A crop of Arran Victory grown from a special stock of certified seed was rejected on inspection because practically every plant showed mottling. Seed from the same stock planted on higher ground on a neighbouring farm produced a perfectly normal crop and was awarded a stock certificate. The inspector took the view that in the former case old seed must have been mixed with the new in order to augment the crop. The plants were seen by one of us about the middle of August, but by that time they were approaching maturity and foliage symptoms were obscured by a deposit of spray. It was noticed, however, that the field was situated in a hollow, and, suspecting frost injury, an interest was taken in the subsequent history of the stock. In the following year, a crop from the tubers of the supposedly diseased plants was absolutely free from mottle ; the stock was continuously grown in isolation, and six years later its descendants were sufficiently healthy to qualify for the highest grade certificate.

In July 1944, complaints were made that certain crops of Arran Pilot potatoes grown in Ireland from certified seed showed widespread mosaic, while seed from the same stock grown in other localities produced normal plants. During the last week of June 1944, night temperatures of 35° F., 32° F. and 33° F. were registered in Dublin, while in many inland localities and in the north one or more degrees of frost occurred. Samples of the affected Arran Pilot plants were obtained by us, and the tubers taken from them were grown both in the glasshouse and out of doors this year. No disease symptoms appeared in any of the plants, and tests revealed that the only virus present was an extremely mild strain of virus X. Here again, the circumstances suggested that frost was responsible for supposedly severe virus disease symptoms.

More direct evidence of the development of mosaic mottling in potato foliage due to low temperatures was obtained this year. On March 26 a severe frost occurred which caused considerable damage out of doors. In a cold greenhouse at the Albert Agricultural College devoted to the propagation of virus-free potato units, it was observed on April 9 that whereas the plants generally were unaffected, one small shoot of a President plant displayed a conspicuous light and dark green mottling of the leaves, typical of that produced by a non-necrotic strain of virus X. This shoot had emerged close to the rim of the pot and was about 2½ in. high when first noticed, while the central shoots were 6–7 in. high. Having first ascertained that the affected shoot originated from the tuber sett, tests were made which established conclusively that it was not infected with any of the known mosaic viruses. Moreover, the remainder of the plant failed to show any disease symptoms up to the time of maturity, nor was it possible to demonstrate the presence of virus in its foliage. Accordingly, it is believed that the mottling was an effect of low temperature, acting on a shoot which was rendered susceptible by reason of its stage of development and location of its tip close to the soil or rim of the pot just at the critical period.

Although the available evidence is mainly of a circumstantial character, it is sufficiently suggestive to warrant an investigation of frost effects in general on potato foliage. In the meantime, potato inspectors who observe wholesale mottling of crops grown from certified seed should bear in mind the possibility of frost injury, and should endeavour to have representative plants scientifically tested before condemning the stock. For various reasons, the cold wind-swept northern districts are those favoured for the propagation of seed potatoes, and it is just in such localities as these that low night temperatures are most likely to prevail during the summer months.

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[1] Murphy, P. A., and McKay, R., *J. Dept. of Lands and Agric.*, **26**, 295 (1926).
[2] MacMillan, H. G., *Phytopath.*, **10**, 423 (1920).

An Arsenic-Resistant Tick

The article "Biological Control as a Supplement to Chemical Control of Insect Pests", by Dr. W. E. Ripper in *Nature* of April 15, 1944, mentions seven species of injurious insects which have evolved races more resistant to certain insecticides than are the ordinary populations of those insects.

We have encountered this phenomenon in an arachnid, *Boophilus decoloratus* (Koch), a one-host tick, commonly called the 'blue tick' in South Africa. Resistance to arsenical dips was first noticed in this tick in 1938 at East London, South Africa, when the trouble was confined to a small area. Its spread, north and south along the coast, was rapid, and in 1940 it was clear that the arsenic-resistant tick had established itself in the Bathurst district. This was sufficiently close to our laboratories to allow us to make extensive experiments and observations. We are unable to recall here the long and varied series of experiments carried out during the past five years, when many thousands of ticks have been treated with many different chemicals. The results of these experiments were often inconclusive owing to our uncertainty of technique and also to the fact that we were dealing with mixed populations of ticks.

In 1944 we began investigations on a new chemical which enabled us to perfect our technique. How-

ever, it was not until May 1945 that we obtained a sufficiently large number of ticks from a presumed 'non-resistant' area to test alongside ticks from a presumed 'resistant' area. These two gatherings of ticks arrived at our laboratories within forty-eight hours of each other, and batches of a hundred fully engorged female ticks from each locality were dipped in arsenical solutions of different concentrations. A hundred ticks from each area were treated in tap water as controls. After dipping, the ticks were dried in a manner simulating natural conditions, and they were then placed in pairs in tubes and kept in an incubator at 25° C. and 100 per cent relative humidity.

In both cases the tap water had little or no effect on laying, as 95 per cent and 93 per cent of the ticks so treated laid large batches of eggs, and hatching was also heavy.

Ticks from the presumed 'non-resistant' area responded readily to the arsenical treatments, as only 37 per cent laid after treatment in 0·16 per cent As_2O_3 (7-day dipping strength), while 0·32 per cent As_2O_3 and 0·64 per cent As_2O_3 reduced laying to 7 per cent and 1 per cent respectively. The effect of the arsenic on hatching was also apparent, as only three batches of eggs laid by ticks treated in 0·16 per cent As_2O_3 showed partial hatching. The treatment has to all intents and purposes resulted in a perfect control.

On the other hand, ticks from the presumed 'resistant' area were little affected by the arsenical washes, as laying occurred in 95 per cent, 83 per cent and 63 per cent of the ticks treated in 0·16 per cent, 0·32 per cent and 0·64 per cent As_2O_3 respectively. Hatching was also fairly heavy, as 76, 68 and 35 of the batches laid by ticks treated in 0·16 per cent, 0·32 per cent and 0·64 per cent As_2O_3 showed hatchings. In this case the treatment has resulted in a very imperfect control, even with concentrations of As_2O_3 which would injure cattle.

It is also interesting to note that the arsenical solutions produced a well-marked time-lag in egg laying, which is also further emphasized in the hatchings. This lag is so constant that it cannot be explained by experimental error.

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African Explosives and
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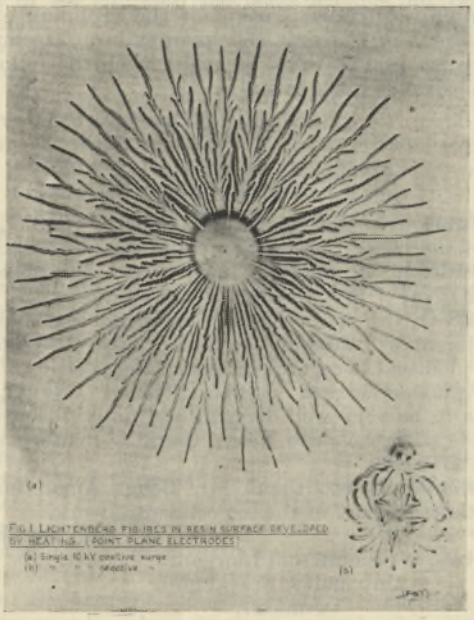
Electric Discharge on a Dielectric Surface (Lichtenberg Figures)

The following method of developing a latent Lichtenberg figure on the surface of certain types of solid dielectrics is very successful. So far, only a 'silicon' type of synthetic resin, 'Novalak' (fusible phenol formaldehyde polymer), ester gum and cumar resin have been used; but it appears necessary merely that the dielectric should be hard and brittle at ordinary temperatures and should soften quickly at some higher temperature. For example, in one experiment a piece of the resin was fused and poured on a clean glass plate to form, when cool, a hard smooth and uniform coating. This was placed between a needle point and an earthed metal plate. A single positive (or negative) voltage surge of magnitude 10 kV. was applied. No change of the surface was visible. On gently heating the resin coating, however, until the softening temperature was just reached, thread-like grooves appeared which, in a few moments, assumed the characteristic form of a Lichtenberg figure. At this instant the heating was stopped, otherwise the figure disappeared rapidly as the resin liquefied.



To photograph the figure, the coated plate was placed in a photographic enlarger, in the position normally occupied by a negative. A black disk superimposed over the image of the illuminant, formed in front of the lens, stopped all the emergent light except that differently refracted by the minute grooving. The accompanying reproduction shows the results obtained with a positive and negative surge respectively.

It is hoped to give later a detailed explanation of the mechanism; its association with bound electrostatic charges and the resultant attraction is clear.

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Formation of an Addition Compound of Calcium Silicate and Sodium Fluoride

In connexion with some experiments concerning the decomposition of calcium fluoride by fusing with silica and sodium carbonate, the formation of needle-shaped crystals was observed. The crystals were analysed, and it appeared that the formula of the compound must be Ca_2SiO_4NaF, as is seen from the following data:

	% CaO	% SiO_2	% Na	% F.
Observed	51·5	28·6	11·0	8·5
Calc. for Ca_2SiO_4NaF	52·36	28·04	10·74	8·87

An X-ray investigation of the compound by the Laue, rotation, and Weissenberg methods has given the following results. The Laue symmetry is $C_{2h}-2/m$. The deviation from the symmetry $D_{2h}-mmm$ is, however, very slight. The diagonal axis

is perpendicular to the direction of the fastest growth of the crystals. The dimensions of the unit cell are the following: $a = 20{\cdot}6$ A., $b = 21{\cdot}1$ A., $c = 7{\cdot}55$ A., $\beta \sim 89{\cdot}5°$. The density is 2·98. This value corresponds to 27·6, that is, 28 formula units in the unit cell. As in all photographs the reflexions from the faces $h0l$ with $h + l = 2n + 1$ and $0k0$ with $k = 2n + 1$ are missing, the space group $C_{2h}^5 - P2/c$ is probable. An investigation of the grouping of the 252 atoms in the unit cell has not been attempted.

Powder photographs of melts with the following compositions were taken:

(1) $2(2\ CaO + SiO_2) + NaF$
(2) $2\ CaO + SiO_2 + NaF$
(3) $2\ CaO + SiO_2 + 2\ NaF$
(4) $2\ CaO + SiO_2 + 3\ NaF$.

Preparation 1 showed the reflexions of Ca_2SiO_4NaF and some other lines which could not be identified. Preparation 2 showed only the reflexions of Ca_2SiO_4NaF. Preparations 3 and 4 showed the lines of Ca_2SiO_4NaF and of NaF. In all photographs the interferences belonging to the Ca_2SiO_4NaF phase were identical as regards intensity and position. Thus the stoichiometrical composition of Ca_2SiO_4NaF seems to be very well defined, and no addition compounds with the ratio NaF : Ca_2SiO_4 greater than 1 seem to exist.

I should like to thank Mr. Bengt Åman for his assistance in part of the experimental work.

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June 27.

Emission Bands of the Fluctuation Type in the Spectrum of Iodine

As part of an investigation undertaken in this laboratory on the emission spectra of halogens and halogen derivatives of methane[1], the emission spectrum of iodine is being studied. The spectrum is excited by a high-frequency as well as a transformer discharge in iodine vapour of pressure equivalent to the saturated vapour pressure of iodine at room temperature. A Steinheil 3-prism glass spectrograph and medium Hilger quartz and constant-deviation glass spectrographs have been used as resolving instruments. Super Panchro-press *P* 1200 and Process Regular *B* 20 Kodak plates were used.

The spectrum in all cases consists of a large number of diffuse broad bands in the region 4800–3450 A. to which, only, the present note relates. Previous investigators[2] have, however, recorded in this region only wave-lengths of the maxima of two continuous (?) bands at 4800 and 4300 A. and a weak one at 4020 A. In the present experiments the so-called continuous band at about 4800 A. is one of the eight diffuse bands which form one group. Similarly the band at about 4300 A. is one of the seven and that at 4020 A. one of the five bands in the second and third groups respectively. Between 3950 A. and the well-known continuum at 3414·3 A., we have the fourth group of such diffuse bands.

All these details are more clearly brought out on the process than on the panchromatic plates, which do not give much contrast. It is probably for this reason and also because low-dispersion instruments are generally used in this rather difficult region, particularly below 4100 A., that the details of the spectra might have escaped the attention of previous investigators. Thus, for example, the four bands observed here between 4094 and 4017 A. appear, under low dispersion, as a single band. The accompanying table gives the wave-lengths of the maxima of all the bands observed in the region 4750–3475 A. The intensities given refer to visually estimated values for the bands as obtained on the process plates, the sensitivity of which falls rapidly above 4350 A. For this reason, the intensity values of the first group of bands do not give correct information of the relative intensities of these bands. The panchromatic plates show that the bands at 4747·2 and 4662·1 A. are, along with that at 4575·6 A., the strongest in the first group.

Group	Int.	λ in air (A.)	ν vac.	Group	Int.	λ in air (A.)	ν vac.
	0	4747·2 *B*	21059		10	3944·1	25347
	1	4662·1 *B*	21444		2	3918·7	25511
	3	4575·6 *B*	21849		6	3879·7	25768
	2	4517·7	22129		6	3855·8	25928
I	4	4471·0	22360		3	3820·1	26170
	2	4430·7	22563		4	3798·0	26322
	3	4389·4	22776		1	3770·4	26515
	3	4353·3	22965		1	3751·2	26651
					1	3739·5	26734
	5	4316·8	23159		2	3720·1	26873
	8	4280·9	23353	IV	2	3685·6	27118
	8	4241·8	23568		2	3668·9	27248
II	6	4201·5	23794		2	3640·2	27463
	5	4155·5	24058		2	3622·8	27595
	4	4123·3	24246		2	3600·7	27764
					2	3577·4	27945
	5	4093·5	24422		1	3535·4	28277
	5	4067·0	24581		?	3513·1	28457
III	5	4044·9	24716		1	3500·1	28562
	3	4017·4	24885		1	3479·6	28731

The bands seem clearly to belong to the so-called fluctuation type of bands[3] and are probably due to a transition between two electronic states, the lower of which possesses a flat potential energy curve. The first three bands are very broad (*B*), the over-all widths being about 332, 239 and 240 cm.$^{-1}$ respectively. All the other bands which are also broad have an average width of about 115 cm.$^{-1}$. This fact probably indicates that the flat final level is common to all of them. Excepting the first three bands in group I, the average wave-number difference between successive bands in the first two groups is about 214. The same difference in bands of group III is about 154. The bands of group IV appear to occur in doublets of which six are very obvious and are shown as such in the table. The average wave-number difference of these doublets is again of the order of 158. The occurrence of these two wave-number differences ($\sim$ 214 and 154) strongly suggests that the bands are due to the diatomic molecule I_2. This and the fact that the bands occur in four distinct groups suggest that they involve more than one electronic level for their initial states, the wave-number differences between corresponding bands of successive groups being of an order of magnitude which is too big to be regarded as a vibrational frequency of the iodine molecule. Further elucidation of these bands must await the investigation on the other regions of the iodine spectrum which is in progress.

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June 4.

[1] Cf. Asundi, Singh and Mishra, *Curr. Sci.*, **12**, 204 (1943).
[2] Cf. Curtis and Evans, *Proc. Roy. Soc.*, A, **141**, 603 (1933).
[3] Herzberg, "Molecular Spectra", 462 (1939).

CARNEGIE INSTITUTION OF WASHINGTON

ANNUAL REPORT

YEAR BOOK No. 43 of the Carnegie Institution of Washington for 1943–44 covers the year July 1, 1943–June 30, 1944, including the reports of the executive committee, of the auditors and of the president, together with reports on departmental activities and co-operative studies, and a bibliography of publications of the Institution, November 1, 1943–October 31, 1944. The report of the president, discussing chiefly the Institution's plans for the future and the problems of transition from war to peace, points out that military research is likely to continue on a more extensive basis after the War. Recognizing the conviction that the United States must participate actively in definite efforts to maintain the peace, he points out that the world has the best opportunity possible for a long peace if the United States remains strong, and an essential ingredient is continued attention to possible military applications of science. Such military research in normal times can be more appropriately done by organizations the work of which is closer to definite application than the Institution itself.

The most important element in the Institution's planning is definition of the programmes of the several departments, and such definitions should not be so rigid as to exclude the seizure of unexpected opportunities. Dr. Vannebar Bush also emphasizes the Institution's need of men of different talents and calibre, since research is usually an affair of well-constituted teams; but mediocrity in its objectives or accomplishments cannot be tolerated. An adequate approach to the formulation of long-range programmes of research in the different departments can be made only if the aims of the Institution as a whole are clearly grasped. In view of the opportunity of the Institution for the interpretation and dissemination of scientific research, he suggests that reasonable and dignified provision for such efforts might appear in its plans. It is important to ensure that its internal policies and external relations are in sound condition for the task. He also comments on the beneficial results of relations between industrial research laboratories and those of the Institution.

The report of the Department of Astronomy refers to a reduction in the astronomical work of the Mount Wilson Observatory. The most interesting observational result of the year was the resolution of several extragalactic nebulæ among the two companions of the Andromeda nebula and the central region of the Andromeda nebula itself. For this purpose, red-sensitive photographic plates were used with a filter transmitting a very limited spectral region. The participation of the Geophysical Laboratory in the war effort continued along the same lines during the past year as described in the last two annual reports. The report includes abstracts of a few papers published in technical journals during the past year and representing previous work of the laboratory. The Department of Terrestrial Magnetism continued its analyses of cosmic data, which have continued to increase polar, geomagnetic, ionospheric and auroral correlations. The Department undertook to serve as a clearing house for observations of sunspots by American observers pending re-establishment of communications with the international centre at Zurich. Important contributions leading to improvement of the radio-communication circuits resulted from the continued operation of ionospheric recorders, and the 60-in. cyclotron was completed in December 1943. The report of this Division also includes an account of cosmic ray studies at the California Institute of Technology and of cosmic ray research at the University of Chicago.

The Division of Plant Biology continued to devote much of its effort to problems arising out of the War and, in co-operation with the College of Pharmacy of the University of California, investigated the isolation of a new antibiotic, chlorellin, which is obtained from the green unicellular alga *Chlorella*. Facilities for the culture of larger quantities of the organisms and methods for the extraction of chlorellin have been worked out, and some preliminary tests made with animals. In co-operation with the U.S. Soil Conservation Service, the staff of the Division has also undertaken a programme for the production of new range grasses, utilizing principles recently worked out in the Division. Grass stocks from many parts of the world are being employed, and in 1943 seven different cross-pollinations were made between members of two sections of the genus *Poa*; these have been augmented by twenty-four additional combinations tried under better conditions during 1944. The hybrids obtained demonstrate that remotely related species of *Poa* can be crossed successfully. Hybrids are sought that will combine hybrid vigour and greater climatic tolerance, drought and disease resistance and greater soil-holding capacity with a longer period of use for livestock. Very little field-work has been done in any of the Division's projects.

The Department of Embryology continued its studies on the physiology of reproduction in the Rhesus monkey and other animals on a small scale. The report includes brief accounts of work in human embryology, the exchange of substances between the blood and surrounding tissues, tumour studies, nutrition and the comparative anatomy of primates.

The Department of Genetics investigated the origin of resistance to penicillin in *Staphylococcus aureus* and has found that strains resistant to increasingly higher concentrations can be produced by selection, resistance apparently being acquired through mutation. X-ray experiments with *Penicillium notatum* have shown that morphologically detectable mutants can readily be induced, and the frequency of mutants increases with the dosage, reaching 45 per cent at 100,000 roentgens. Studies of mutation in bacteriophages showed that radiation causes a marked delay in their reproduction. A study of the genetics, taxonomy and ecology of flies related to *Drosophila pseudoobscura*, representing a two-year period, is included, and is chiefly concerned with clarifying the concept of biological race and with methodology of racial studies. Investigations on the incidence of spontaneous mouse leukæmia confirm that the role of longevity is far more complex than had been supposed and appears to depend on numerous variables, both genetic and non-genetic. Polyploidy investigations recorded concerned the Russian dandelion and hemp; where, as a war emergency project, an attempt has been made to produce a strain of fibre hemp with reduced marihuana content. Endocrine studies on doves and pigeons have shown that the development of endosteal bone following dosage with œstrogenic hormone occurs in the absence of the parathyroid glands, and the evidence indicates that it is probable that most of the 'bound' calcium is attached to the phosphoprotein, serum vitellin. The Nutrition

Laboratory continued to be concerned mainly with war research projects, carried out a special investigation on the metabolism of diabetes mellitus, and made a study of physiological clinical interest on the breathing pattern and rate of air flow in asthmatic patients. Special projects in the biological series also reported include the results of studies on Diatomaceæ, embryology, embryological pathology and reproductive physiology, the maintenance of a *Drosophila* stock centre in connexion with investigations on the constitution of the germinal material in relation to heredity, and the influence of nutrition on the chemical composition of the normal body.

THE BRITISH PIG-RAISING INDUSTRY

AS a part of farming which has had very low priority during the war years, pig production shows clearly some of the major problems confronting the British livestock industry. The scope and form of development must depend upon the broad framework of policy as laid down by the State; yet a policy as a whole is often difficult to break down into terms applicable to individual farms and herds. Throughout the discussions on pig production at the meeting on July 17 of the British Society of Animal Production, it was obvious that these considerations were well in the minds of all speakers, though the question of what will be the post-war politico-economic status of the pig industry was not directly raised.

Pre-war, pig production was largely based upon imported feeding stuffs, and often, like poultry, it was carried out on specialized, intensive lines. During the last five and a half years, breeders and feeders have had to rely on home-grown food supplies, eked out where possible by swill and house refuse. Must the industry now await, even passively, the return of large importations of maize and other feeding stuffs? Or must it continue as a dispersed, small-unit enterprise—pigs on all farms—using home-produced fodders?

The change-over from pre-war methods to war-time expedients required considerable modifications of husbandry and management, yet the pig breeder had often little enough evidence or experience to help him solve the local nutritional problems exposed by the locally available foodstuffs. The investigations in Northern Ireland described by Prof. R. G. Baskett formed one of the attempts to help in the immediate adjustments of feeding methods to means. The disadvantages of oats as pig feed were well recognized, but the trials showed that, with proper precautions as to their low starch equivalent value and high fibre content, oats could be used so as to give satisfactory live-weight gains, though with less efficient food utilization. Prof. Baskett considers that similar use of oats could be made in other parts of the United Kingdom where they are the main crop, although he holds the view that, in the long run, the pre-war levels of pig population must depend upon a return to maize imports. On the other hand, practical opinion from the west of Scotland, supported by experience in parts of England, such as East Anglia, did not share this view, but favoured a more intensive exploitation of local foodstuffs, together with greater attention to appropriate management. In any circumstances the pig enterprise on a farm, whether general or specialized, needs careful planning, not merely for supply and use of feeding stuffs but also in regard to buildings, husbandry and disease control. In all these there is still great scope for improvement, which, together with more knowledge and practical experience in the feeding of potatoes, barley and dairy by-products, holds promise for an expansion and increasing efficiency of pig production. Confidence in the future would be greater provided that there were an intensification of research effort upon local problems, as well as on general principles, which could throw light upon how to make improvements within the present, or likely, cost structure of the industry.

Feeding and management, however, form only part of the problem. As Dr. John Hammond pointed out, the present low numbers of commercial pigs provide an opportune setting for the development of suitable breeding materials and methods, and of definite policies of genetic improvement. The new boar licensing scheme is a move towards restricting the kind of sire which can be used for breeding purposes, but several speakers argued that more positive methods are needed to steer the industry towards higher levels of efficient production. The nature of these positive methods can only be decided from a greater application of investigation and use of appropriate data. At present the data on fertility, weight gain and carcase characters are too sparse to serve as more than indications of what might be done. The records collected are either not used sufficiently by the breeders themselves, or are considered so expensive a luxury that breeders, with their eyes on costs, cannot afford to take them. Score card systems of judging carcase qualities can be applied; but so far are used only on a very limited scale. Yet other countries provide striking examples of the ways in which productivity measures have been successfully used in formulating and giving impetus to development.

The requirements and aims of the commercial breeder and the pedigree breeder should be more closely integrated towards an organization of the industry; whether this organization should be imposed from without, or grow up within the industry, is as yet an open question. However achieved, it should allow for a greater specialization of function within breeds and for commercial production based upon deliberate cross-breeding; for example, those interested in the coloured breeds might specialize in mothering ability, adapted for outdoor methods of husbandry; while those concerned with the Large White breed should pay particular attention to growth-rate and carcase quality.

Even so, the present pedigree system requires close examination. The average size and duration of a pedigree herd are insufficient to allow scope or time for any definite breeding policy. Dr. H. P. Donald showed that an average herd lasts only for three years, while the average number of daughters of a sire in use is two; and a family system of breeding, such as could be genetically useful, exists only in names. Moreover, the industry now relies on relatively few people for the supply of good breeding stock; according to Dr. Hammond, nine tenths of the so-called pedigree breeders are just multipliers of pedigree stock. Whether such a system is adequate or even suitable as a vehicle for real improvement is doubtful. In any event, the question of responsibility remains.

The discussion around this aspect was somewhat diffuse; but the conclusion emerged that just as it is ultimately a State responsibility to encourage the

industry towards progress on a defined cost structure and production aim, so also is it a State responsibility to stimulate the accumulation of the necessary information on performance, and on genetic principles upon which sound breeding and selection policies can be based. J. E. NICHOLS.

RESEARCH IN THE U.S.S.R. ON CONDITIONED REFLEXES

RECENT work on conditioned reflexes from Pavlov's laboratory is published in *Trudy Physiologitcheskikh Laboratorii Pavlov*, **11** (Moscow, 1944). The director of the laboratory is now Prof. P. S. Kupalov, and, in general, work has proceeded along the lines initiated by Pavlov.

Considerable attention is being paid to the different types of 'neural personality' to be found among dogs. Not only is this a major factor in the production of experimental neuroses, but also, as is now realized, it enters into the interpretation of all the ordinary physiological results. The primary distinction is between the 'strong' type of nervous system in which conditioned reflexes are readily and strongly developed, and the 'weak' type in which the reflexes are developed with more difficulty and easily extinguished. Either type may be unstable or 'unbalanced'. V. K. Fedorov finds that neuroses develop more readily in the weak type or in the strong unbalanced type with deficient inhibitions. 'Strength' of the nervous system is reduced by castration and old age. Neurosis affects the whole nervous system, following a definite pattern which is determined by the order of stability of the established neural processes, and is independent of the mode of causation.

L. V. Vassilieva and I. S. Rosental have made an extensive study of tactile discriminations. They have been particularly interested in the discrimination between symmetrically opposite points of the body, which is the most difficult tactile discrimination to establish and varies greatly in the different neural types. They have also succeeded in developing a reflex in which the dog holds out its right paw and left paw alternately; this is probably the most complicated conditioned reflex yet established. The main object of their work was to study the reciprocal relationships between symmetrically opposite areas of the cortex.

V. I. Pavlova finds that when the conditioned stimulus is prolonged into the period of the unconditioned stimulus, the reflex is strengthened in the 'strong' type of dog but weakened in the 'weak' type. V. K. Fedorov, by repeating a conditioned stimulus at successively shorter intervals and measuring the size of the response, found that after any one stimulation the cortical cells took 3–10 min. to recover their full excitability.

V. V. Yakovleva has continued the study of what Pavlov called the 'mobility' of nervous processes, which has to do with the speed and facility of development of excitation and inhibition. It has been shown that the chronaxie of all the voluntary muscles undergoes certain quantitative changes during the development of a conditioned reflex, and E. A. Yakovleva finds that previous removal of various parts of the cortex upsets or abolishes these changes; she concludes that the cortex as a whole, rather than any one particular part of it, is responsible for these changes in peripheral chronaxie.

CHEMICALLY STABILIZED PAPER CAPACITORS

ACCORDING to an article by D. A. McLean (*Bell Lab. Rec.*, **23**, No. 3; March, 1945), the addition of a small amount of anthraquinone to the impregnant with which the paper is treated has greatly extended the life of paper-insulated capacitors. Among impregnants, chlorinated diphenyl and chlorinated naphthalene have been used extensively. They resist oxidation and thermal decomposition, have high dielectric constant compared with mineral oil, and good electrical properties. At room temperatures, capacitors with paper dielectrics impregnated with these chemicals have a satisfactory life. At high D.C. potentials, however, and at temperatures from 50° to 100° C., rapid deterioration of the dielectric results. There is a number of compounds which substantially increase the life of capacitors on accelerated D.C. tests, when added in small amounts to the chlorinated impregnant. These stabilizers also maintain the leakage current during tests at low and relatively stable values in contrast with the rapidly increasing leakage current in unstabilized capacitors. Among the stabilizers used, the quinones were the most satisfactory, and of them, anthraquinone was chosen for commercial use owing to its high effectiveness, ready availability in pure form, low volatility and lack of toxicity.

Evidence of the diminution of electrode corrosion by anthraquinone was obtained by using capacitors in which the electrodes consisted of thin aluminium films evaporated on kraft paper before the unit was wound. In these capacitors, a small amount of corrosion of the electrodes entirely consumed the aluminium. Capacitors made with this paper were dried and impregnated in the usual manner and subjected to voltage while held at 100° C. The impregnating compound was then extracted and portions of the paper were photographed by transmitted light to show holes produced by the corrosion. The positive electrode was attacked rapidly in the unstabilized capacitors, and eventually even the negative electrode showed deterioration. After testing for 240 hours at 300 volts, the anode was very largely destroyed. The stabilized samples, however, tested under the same conditions, showed no detectable attack of either electrode in 1,000 hours, or in 495 hours at 500 volts.

Suppression of deterioration of the dielectric and corrosion of the electrodes through chemical stabilization with anthraquinone is reflected in longer life and more stable leakage current. When a linen-paper capacitor impregnated with chlorinated naphthalene is subjected to continuous D.C. voltage at 100° C., the leakage current rises rapidly. Within a very few hours a failure develops which completely short-circuits the electrodes at some point. With 0·1 per cent anthraquinone in the impregnant, the current rises less rapidly, and the life is increased by about tenfold. Increasing the amount of stabilizer to the range of one-half to four per cent produces a relatively stable leakage current. The life is then about a hundredfold as great as when no stabilizer is employed. On the basis of these and other results, a minimum of 0·5 per cent is recommended for commercial use. Kraft paper exerts a stabilizing action of its own, and consequently kraft paper capacitors, when fortified with anthraquinone, are superior in performance to stabilized linen-paper capacitors.

FORTHCOMING EVENTS

Monday, October 15

UNITED NATIONS FELLOWSHIP (at 29 Gordon Square, London, W.C.1), at 6.15 p.m.—Prof. N. Bentwich: "The Educational and Cultural Organization of the United Nations".

ASSOCIATION OF AUSTRIAN ENGINEERS, CHEMISTS AND SCIENTIFIC WORKERS IN GREAT BRITAIN (at the new Austrian Centre Swiss Cottage, 69 Greencroft Gardens, London, N.W.6), at 7.30 p.m.—Dr. F. Eirich: "Modern Views of Colloid Science (with special reference to the Ultra-Centrifuge)".

Tuesday, October 16

BRITISH SOCIETY FOR INTERNATIONAL BIBLIOGRAPHY (at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2), at 2.30 p.m.—Dr. S. C. Bradford: "Fifty Years of International Documentation" (Presidential Address); Discussion on "The Technique of making Abstracts of Scientific and Technical Papers" (to be opened by Eng.-Comdr. D. Hassie Smith, R.N.).

EUGENICS SOCIETY (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 5.30 p.m.—Dr. W. Mayer-Gross: "Mental Health Problems in a Rural Area".

SHEFFIELD METALLURGICAL ASSOCIATION (at 198 West Street, Sheffield 1), at 7 p.m.—Mr. J. E. Russell: "The Behaviour of Metals under Stress".

Wednesday, October 17

SOCIETY OF CHEMICAL INDUSTRY, FOOD GROUP (at the Chemical Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Mr. D. W. Steuart: "The Nitrogen Content of Apple Juices and its Importance in Cider Making"; Mr. E. Ball: "The Raw Materials for Cider Making".

INSTITUTION OF ELECTRICAL ENGINEERS, TRANSMISSION SECTION (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Mr. E. T. Norris: Inaugural Address as Chairman.

INSTITUTE OF FUEL (at the Royal Geographical Society, Kensington Gore, London, S.W.7), at 6 p.m.—Prof. C. H. Lander: Melchett Lecture.

INSTITUTE OF WELDING, WEST SCOTLAND BRANCH (at the Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow), at 6.30 p.m.—Mr. J. S. Blair: "Some Technical Problems in the Execution of 'Pluto'".

Thursday, October 18

INSTITUTION OF ELECTRICAL ENGINEERS (joint meeting with the ROYAL METEOROLOGICAL SOCIETY) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Discussion on "Weather and Electric Power Systems" (to be opened by Mr. J. S. Forrest, Mr. H. W. Grimmitt, Mr. A. J. Drummond and Wing-Comdr. R. M. Poulter).

ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE (at Manson House, 26 Portland Place, London, W.1), at 8 p.m.—Dr. C. M. Wenyon, F.R.S.: "Tropical Medicine in War and Peace".

Friday, October 19

PHYSICAL SOCIETY (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 5 p.m.—Prof. Bengt Edlén: "The Spectral Structure of the Inert Gases". (Fellows of the Royal Astronomical Society are invited.)

INSTITUTION OF MECHANICAL ENGINEERS (at Storey's Gate, St. James's Park, London, S.W.1), at 5.30 p.m.—Prof. Andrew Robertson, F.R.S. (Presidential Address).

INSTITUTE OF PHYSICS, SCOTTISH BRANCH (joint meeting with the INDUSTRIAL RADIOLOGY GROUP) (at the Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow), at 6.30 p.m.—Mr. E. Thomas: "The Radiography of Welds in High Pressure Steam Pipes".

Saturday, October 20

ROYAL INSTITUTE OF CHEMISTRY, LONDON AND SOUTH-EASTERN COUNTIES BRANCH (at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1), at 2.30 p.m.—Discussion on "The Publicity of Science, with particular reference to Chemistry" (Dr. O. J. R. Howarth, O.B.E., Mr. O. F. Brown, Mr. G. A. Jones, and others).

INSTITUTION OF MECHANICAL ENGINEERS, GRADUATES' SECTION (at Storey's Gate, St. James's Park, London, S.W.1), at 3.30 p.m.—Mr. R. Gore: "A System of Production Control".

APPOINTMENTS VACANT

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

LECTURER IN CHEMISTRY at the Widnes Municipal Technical College—The Clerk to the Governors (Oct. 15).

TECHNICAL LABORATORY ASSISTANT in the Chemistry Department, University College of South Wales and Monmouthshire, Cathays Park, Cardiff—The Registrar (Oct. 16).

SENIOR LECTURER IN CIVIL ENGINEERING—The Principal and Clerk to the Governing Body, Wigan and District Mining and Technical College, Wigan (Oct. 18).

JUNIOR ASSISTANT PHYSICIST (temporary) in the London County Council's Hospitals Service—The Medical Officer of Health (S.D.6), London County Council, County Hall, London, S.E.1 (Oct. 19).

LECTURERS IN MECHANICAL ENGINEERING, PRODUCTION ENGINEERING, and PHYSICS in the Chance Technical College—The Chief Education Officer, 215 High Street, Smethwick (Oct. 20).

LECTURER IN MECHANICAL ENGINEERING at the Brighton Technical College—The Education Officer, 54 Old Steine, Brighton 1 (Oct. 20).

ASSISTANT LECTURER IN THE MATHEMATICS DEPARTMENT—The Clerk and Treasurer, Technical College, Bell Street, Dundee (Oct. 22).

TWO HIGHWAY ENGINEERS (Ref. No. E.1988.A), and RAILWAY ENGINEER (Ref. No. 1989.A), for service in China with the United Nations Relief and Rehabilitation Administration—The Ministry of Labour and National Service, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2 (Oct. 22).

LABORATORY TECHNICIAN (Public Health Department) with a knowledge of Public Health Bacteriology (including milk examinations) and/or Clinical Pathology, and a TECHNICAL ASSISTANT (Borough Engineer's Department) for work on repairs to war-damaged houses—The Town Clerk, Finsbury Town Hall, Rosebery Avenue, London, E.C.1 (Oct. 23).

GRADUATE IN CHEMISTRY in the Senior Science Department of the Southport Technical College—The Chief Education Officer, 1 Eastbank Street, Southport (Oct. 25).

PRINCIPAL OF THE COUNTY TECHNICAL COLLEGE, Guildford—The Chief Education Officer, County Hall, Kingston-upon-Thames (Oct. 26).

RECORDS OFFICER to the Nuffield Health and Sickness Records Bureau, for the supervision of collection and analysis of information concerning morbidity in the West of Scotland—Mr. R. Morrison Smith, 135 Buchanan Street, Glasgow, C.1 (Oct. 27).

LECTURER IN CHEMISTRY, with qualifications in Inorganic Chemistry and Metallurgy—The Principal, Heriot-Watt College, Edinburgh (Oct. 29).

ASSISTANT CHIEF OF RESEARCH by firm in N.W. England engaged in a highly technical form of manufacture on a large scale—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, York House, Kingsway, London, W.C.2, quoting F.4367.XA (Oct. 29).

INORGANIC CHEMIST (qualified) to supervise chemical control of Middlesex factory manufacturing cast plaster panels—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting F.4964.XA (Oct. 31).

ASSISTANT TO HEAD OF TECHNICAL ENGINEERING DEPARTMENT of large Iron and Steel Works—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting C.2683XA. (Oct. 31).

TECHNICAL ASSISTANT IN THE DEPARTMENT OF CHEMISTRY—The Registrar, The University, Bristol 8 (Oct. 31).

BIOLOGIST and a PHYSICIST at the North-Eastern Forensic Science Laboratory at Wakefield—The Establishment Officer, (Room 321), Home Office, Whitehall, London, S.W.1 (Nov. 6).

ENGINEERS for development, indoctrination, and contact work in lubricants field: (a) A.M.I.Mech.E., and preferably with University degree, also experience with automobile firm (Reference No. C.2785.XA), (b) A.M.I.Mech.E., and preferably with University degree, also experience in oil engine design and operation (Reference No. C.2786.XA), (c) A.M.I.Mech.E., and preferably with University degree, also experience with steam power plant and general industrial engineering (Reference No. C.2784.XA), (d) A.M.I.Mar.E., and preferably with University degree, also experience with marine diesel manufacture (Reference No. C.2783.XA)—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting appropriate Reference No. (Nov. 12).

RESEARCH OFFICER, DAIRY RESEARCH SECTION, Council for Scientific and Industrial Research, Melbourne—The Secretary, Australian Scientific Research Liaison Office, Australia House, Strand, London, W.C.2 (Nov. 12).

SENIOR LECTURER IN GENERAL SCIENCE AND SCIENTIFIC METHOD in the University of Melbourne—The Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1 (Nov. 15).

PROFESSOR OF PHYSICS—The Registrar, University College, Singleton Park, Swansea (Nov. 17).

HACKETT PROFESSOR OF AGRICULTURE in the University of Western Australia—The Agent-General for Western Australia, Savoy House, 115 Strand, London, W.C.2 (Nov. 30).

COUNTY SURVEYOR to the Devon County Council—The Clerk to the Council, The Castle, Exeter, endorsed "Appointment of County Surveyor" (Dec. 31).

LECTURER IN THE DEPARTMENT OF PHYSIOLOGY—The Secretary, The University, Aberdeen (Jan. 15).

PROFESSOR OF GEOLOGY, and a PROFESSOR OF INDUSTRIAL CHEMISTRY, in the Farouk I University, Alexandria—The British Council (Appointments Department), 3 Hanover Street, London, W.1.

TWO ASSISTANTS IN AGRICULTURAL ENTOMOLOGY in the Advisory Entomological Department, School of Agriculture, Cambridge—F. R. Petherbridge.

OFFICERS (2) for the INTELLIGENCE SECTION OF THE MINERAL RESOURCES DEPARTMENT, Imperial Institute—The Establishment Officer, Imperial Institute, South Kensington, London, S.W.7.

Trained TECHNICIAN IN THE PHYSIOLOGY DEPARTMENT, and DEMONSTRATORS (temporary) IN PHYSICS, BIOLOGY and CHEMISTRY—The Vice-Dean, St. Bartholomew's Hospital, at Queen's College, Cambridge.

LECTURER IN BACTERIOLOGY in the University of Queensland—The Agent-General for Queensland, 409 Strand, London, W.C.2, and the Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1.

TEACHER OF PHYSICS AND CHEMISTRY to first M.B. and Intermediate Science standard—The Principal, Technical Institute, Folkestone.

LECTURERS IN THE SCHOOL OF ENGINEERING for Mechanical Engineering and Electrical Engineering—The Principal, Leicester College of Technology and Commerce, Leicester.

QUALIFIED PRODUCTION ENGINEER, and a TEACHER (man or woman) OF BIOLOGY—The Clerk to the Governors, Wolverhampton and Staffordshire Technical College, Wolverhampton.

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