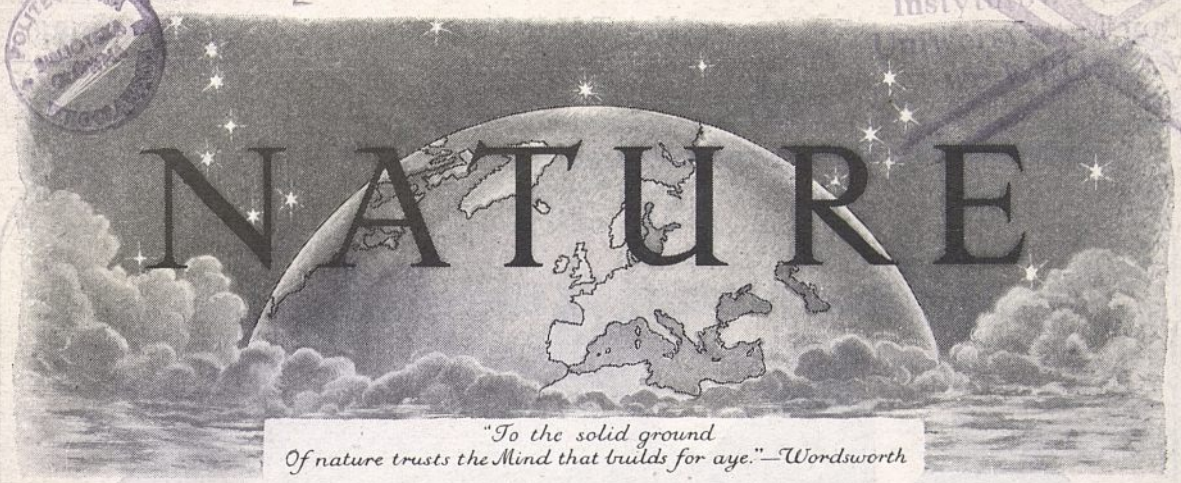

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ECONOMIC WARFARE AND NATIONAL EFFORT

THE dominant conclusion which emerges from the admirable surveys of the work of the Department of Economic Warfare which Mr. Ronald H. Cross has recently given in the House of Commons and in a broadcast talk is that economic warfare is a field which demands very deliberate application of scientific methods if success is to be achieved. Nothing short of a really militant policy, taking full account of the known facts and undeterred by other considerations than its main purpose—that of making it as difficult and as expensive as possible for Germany to obtain her supplies—can be adequate. The task is from the outset more difficult than it was in 1914–18, for Germany now has access by land to the whole of Europe east of France, as well as to the greater part of Asia. We cannot afford to neglect loopholes which might be stopped by more efficient organization or a more scientific policy.

One of the great merits of Mr. Cross's surveys is that they direct the attention of the public not only to what is being done but also to the expansion of that work which is still required. That expansion will demand the co-operation of the public to an extent which will only be possible as a result of a really scientific policy and effective campaign of education. There are many, indeed, in Great Britain who still imagine that we shall win the War without undue disturbance of ourselves. Such easy optimism should at least be shaken by these addresses of Mr. Cross. The discipline already accepted by Germany is not so much a sign of defeat as a challenge that must be taken up by all the democracies. Victory in the great cause for which they contend can only be assured by sacrifices worthy of so great a goal and in no way inferior to those which have been accepted by the enemy.

The accounts which Mr. Cross has given of action taken and projected, however, still afford grounds for the uneasiness with which the Government's attitude in this important matter is regarded in many influential quarters. The concern which has been expressed by Sir William Beveridge and others that the War Cabinet contains no member designated as Minister of Economic Co-ordination or indeed who would appear well fitted for that part, was not dispelled by Lord Stamp's appointment as adviser to a Cabinet Committee on Economic Co-ordination. Recent events, such as the lack of foresight betrayed in a recent debate in the House of Commons on the home production of foodstuffs, have indeed increased it.

Conceived even within the sphere of the Ministry of Economic Warfare, economic warfare is essentially a scientific problem, with all the difficulties involved in conducting operations which bear no relation to normal sound business. So long ago as November an able article contributed to *The Times* argued for an organization on a geographical basis with an economic commander-in-chief, assisted by a small expert economic general staff, corresponding with the organization at the disposal of a military commander-in-chief. Much more is the immense dislocation involved in our transition from a peace-time to a war-time economy a scientific problem which is still incompletely solved. The persistence six months after the outbreak of war of the tragic waste of employment on the scale of a million and a quarter testifies to the absence of

organization to utilize the abundant resources which we possess.

These are among the main considerations which have led to renewed representations for reconstruction of the Cabinet, and administrative machinery on lines which would enable all the activities on the economic front to be co-ordinated as parts of one coherent policy for the vigorous and effective prosecution of the War. Among other speakers, Lord Swinton urged that the Cabinet should include a Minister standing in the same relation to the economic department that the Minister for the Co-ordination of Defence does to Service departments. It is true that Lord Stamp is building up a central staff; he has been assisted from the start by Mr. Henry Clay and Mr. H. D. Henderson. Prof. J. Jewkes has now been summoned from Manchester and Mr. E. A. E. Robinson from Cambridge, and it would be unjust to infer that Lord Stamp and his staff are offering no advice on prices, wages, labour mobilization, exports or finance, because the Government has no apparent policy on these matters.

It would appear to be probable that everything that machinery for interdepartmental co-ordination can achieve is already being done through the committee of permanent heads of departments of which Lord Stamp is chairman, or the Economic Policy Committee of the Cabinet, with Sir John Simon in the chair and Lord Stamp in attendance. What is wanted is central and purposive direction applied not only to inter-departmental matters but also to those that are, formally at least, the concern of one department. Only a Cabinet Minister of Economic Co-ordination can be expected to possess the authority and decision necessary to overcome the obstacles presented by the *laissez-faire* attitude of the Board of Trade in regard to exports or location of industry, the negative views of the Ministry of Labour on its own functions or the inadequate conception of the Ministry of Supply, with its autonomous and secretive controls. The advisability of giving careful consideration to the reconstruction of the Cabinet on the lines recommended by the Machinery of Government Committee of 1918 is more and more apparent as the struggle proceeds.

The administrative problem may be one of scientific management, of bringing into the executive and administrative machinery of government the principles which have been elaborated and tested in large-scale industrial and business organizations and indeed in the Services themselves. The extent to which the whole economic effort of the nation is a problem demanding close scientific analysis is indicated further in an admirable survey of civil needs issued as a broadsheet by P E P (Political and Economic Planning) almost simultaneously with the recent debates on economic warfare in the Houses of Parliament. It reminds us, as did the statements of the Minister of Economic Warfare, of the inexorable demands which war makes on us and the inevitableness of personal sacrifice. It also indicates the chaos and danger which may well result if no guidance is given as to cutting down of unnecessary consumption, and no attempt made to define essential civil needs on a rational basis in relation to the elimination of waste, the conservation of our resources and the most effective implementing of our war effort.

In regard to food, for example, that primary and most essential need, if we are to minimize our large imports of foodstuffs without detriment to standards of nourishment, we must make the best use of the food we consume, by utilizing to the full the discoveries of nutritional science during the last twenty years. Moreover, besides the problem of putting everyone in the position to buy the necessary minimum of foodstuffs, there is the further problem of ensuring that those who can afford enough food are not malnourished through ignorance or physical reasons. Where people are already malnourished to the detriment of their efficiency as workers, an unplanned cut in food consumption would undoubtedly increase this malnutrition and inefficiency. At the same time, a proper use of our knowledge of nutrition might enable us to reduce our gross consumption of foodstuffs without any loss, and perhaps even with an increase, of health and efficiency.

The imposition of rationing without such positive action clearly holds dangers. Both eating and cooking habits may require drastic changes if we are to make the best use of our existing supply of foodstuffs and of the reduced supply which war will inevitably entail. There must be an end to the unbalanced or prejudiced pushing of particular food commodities in the private interests of the seller.

The economic use of the national food supply is largely a scientific question, but it will require firm direction; and national interests must override all other considerations in determining the distribution of such commodities as, for example,

barley, between the farmer or smallholder and the brewer. It will be remembered that in 1916 the Royal Society Food (War) Committee, recommending that feeding-stuffs should be fed only to good 'converters' such as dairy cows, calves and pigs, and the production of cheese instead of butter, recommended also the partial or total prohibition of brewing. Moreover, the dependence of British agriculture itself upon imported feeding stuffs raises other problems in relation to the reduction of imports, from the point of view of saving tonnage or of exchange.

Generally, it requires more shipping tonnage to import food for animals than to import food directly for men and women. A shift in agriculture to good 'producers' as recommended by the Royal Society Food Committee would involve a considerable reorganization of British agriculture. Land formerly used for growing fodder is being turned over to growing food for human consumption. The most effective use of the maximum average which must be the objective of British policy can only be secured by making the fullest use of the scientific knowledge available. Such a utilization, coupled with an effective education campaign, leading us to eat differently, involving sacrifice of some imported foodstuffs, and a measure of reorganization in agriculture, should make it possible to reduce our expenditure on food with real advantage to our war effort.

The housing situation also requires scientific analysis and treatment. If it is probable that the civil need for housing can be satisfied during the War at very little cost, the impact of a large reduction in net expenditure on housing not only on the building industry but also on the public works contracting industry, the furniture-making industry and numerous auxiliary industries requires consideration. The appropriate utilization of displaced workers from these industries is a major problem of social planning which has yet to be tackled. After the War, and during it, if there be large-scale air raids, the building industry will occupy a key position. Careless disposal of the key personnel such as architects, quantity surveyors and skilled workers might have serious consequences.

Similarly, national expenditure on transport demands close and scientific study. The possibilities in the elimination of excessive expenditure on daily journeys, with all the advantages that might accrue in the saving of health and time as well as transport, have yet to be examined. Staggering of hours and holidays may become inevitable as available transport facilities are restricted, and economies in expenditure on private transport should in turn reduce the annual deterioration on the roads. Moreover, the development of alternative sources of power in place of petrol for transport is a further and essentially technical problem.

In many other spheres such as clothing, the use of fuel and water supplies, much could be done to eliminate waste by suitable publicity campaigns. The prevention of atmospheric pollution by more efficient means of utilizing coal in domestic houses and the prevention of riparian pollution are two examples in which the co-operation of scientific workers is important. They could also play their part in directing attention to the preventable waste which occurs through ill-health, the ravages of rabbits, rats, weeds, insect pests or animal pests, through neglect to employ scientific methods of control.

There can be no question as to the seriousness of the economic situation. Direct economic warfare is only one of its facets; equally intense drives are required elsewhere to ensure concerted and intelligent thinking, the elaboration of plans based on adequate scientific knowledge and their translation into immediate and appropriate action. The absence of signs of an adequate plan, of organized thinking and resolute action are disquieting aspects of the situation at the present moment.

We cannot escape, as war proceeds, inroads into our standard of living, and so far the Government has lagged far behind that of France in putting before the people the need for sacrifice. Something more than vague generalities is now required. Should it be decided to adopt the plan of a basic 'iron ration' advocated by Prof. J. R. Hicks, fixing rations of a basic list of necessary commodities, corresponding with basic human needs, at guaranteed prices which would ensure that the whole ration would never cost more than a stated sum within the reach of all, the Government can only win the support of a free people by giving evidence of the most rigorous and impartial examination of the situation, and of its own capacity to take the resolute action demanded. We may well have cause to be grateful if the recent utterances of the Minister for Economic Warfare herald a much closer attention to the economic aspects of the War and a scientific examination of the situation which may give concrete guidance to the call for economy and sacrifice.

COLONIAL DEVELOPMENT AND RESEARCH

WHEN on February 20 the House of Commons turned for a brief space from its preoccupation with the War to listen to Mr. Malcolm MacDonald, H.M. Secretary of State for the Colonies, as he announced the decision of the Government in the matter of the report of the West India Royal Commission, 1938–39, it must have been a source of both pride and gratification to the members that, at a time when every resource is strained in the effort to preserve all for which our society and system of government stand, the loyalty and support which the mother country has received from her colonial dependencies should be met by a no less striking manifestation of solicitude on the part of Great Britain for their inhabitants. As already pointed out (see NATURE, March 2, p. 342), the statement of future policy in relation to the development and welfare of the colonies then made by Mr. MacDonald* not only marks a new departure in the relations, financial and other, of the central and local administrations, but it also extends vastly the field in which the sense of responsibility of the mother country for the well-being of the inhabitants of these territories will be enabled to find effective expression. This interrelation is well defined in the words of the statement itself, that His Majesty's Government, regarding themselves as "trustees for the well-being of the peoples of the Colonial Empire", look upon "the spontaneous and wholehearted support given by the inhabitants of every territory to the common war effort as the best testimony to their appreciation of the way in which that trust is being discharged"; while on the other hand, it is said, "the primary aim of Colonial policy is to protect and advance the interests of the inhabitants of the Colonies (in which term are included . . . Protectorates and Mandated Territories)".

Mr. MacDonald's announcement is the outcome of no hasty and improvised decision. Indeed, it is stated that this further development of Colonial policy was settled in principle some time ago, and final decisions were postponed only pending the result of the West India inquiry. It has been evident for a considerable period that circumstances, aggravated by the economic depression, not only militated against the social and economic well-being of the inhabitants of, for example, the African dependencies under the Colonial Office, but also were rapidly approaching a stage at which drastic remedial measures, beyond the resources of the local administration, would have to be applied. It is now pointed out that while much has already been accomplished, there is room for further active development of the natural resources of the various territories so as to provide their peoples with improved standards of life.

The conclusion at which the Government has arrived, after consideration of the effect of such limited resources derived from agriculture as are available in most of the dependencies, in relation to a policy of steady development, is that many colonies cannot finance out of their own resources the research and survey work, the schemes of major capital enterprise, and the expansion of administrative and technical staffs, which are necessary for their full and vigorous development. The old principle that a colony should have only those services which it can afford to maintain out of its own resources is to go by the board, and in future, assistance will be given not merely for capital expenditure or material development—in the main the objects of the Colonial Development Fund instituted in 1929—but also the money from new sources now to be provided is to be made available for the maintenance of important works or services over a substantial period of years.

For the sake of clearness, it may not be out of place here to recapitulate briefly the financial arrangements now proposed, and the machinery to be instituted for their employment.

The Colonial Development Fund, instituted in 1929 and limited to a maximum of £1,000,000 a year, will be replaced by a new vote in the estimates for assistance to Colonial Governments up to a maximum of £5,000,000 a year for ten years. This assistance will be available not only for schemes involving capital expenditure for colonial development, but also for helping to meet recurrent expenditure on certain services, such as agriculture, education, health and housing.

Bearing in mind the proposals for research made by Lord Hailey in his "African Survey", the Government proposes to make special provision for research. Hitherto, expenditure on various

* Statement of Policy on Colonial Development and Welfare. (Cmd. 6175.) Pp. 8. (London: H.M. Stationery Office, 1940.) 2*d*. net.

forms of Colonial research has received assistance from the Colonial Development Fund. In future, for this purpose a separate sum will be allocated up to a maximum amount of £500,000 a year.

As regards the manner of allocating expenditure from these funds, the Government will enlist the help of a Colonial Development and Welfare Advisory Committee, which will be composed partly of official and partly of unofficial members.

In the province of research, in the past the authorities have had recourse in dealing with questions of Colonial research to the advice of scientific and technical experts in Great Britain ; but they are now anxious to place the system on a wider and more regular basis. It is considered that this object can be best achieved by the establishment of a Colonial Research Advisory Committee. It is not anticipated that the full scale of expenditure will be reached all at once, especially in present conditions ; but so far as possible, steps will be taken immediately to give these proposals effect.

It will be seen that this extension of policy in colonial development represents a very appreciable step in advance. Its most marked effects should be immediately apparent in the removal of the restrictions which virtually, if not in terms, confined previous grants-in-aid to non-recurrent capital expenditure and material development. In no departments of colonial administration have efforts at amelioration been so cramped as in the provision for health services and education—both of paramount importance in raising the standard of well-being among the native populations. By a prolonged course of education alone can the object of the health services really be fully attained.

It is natural that in this much enlarged policy of colonial development the first emphasis should be laid on the improvement of the economic position of the Colonies. Although in any consideration of the amelioration of colonial conditions it has come to be almost a matter of course to consider how and in what way the native population is affected, the interests of the white settler are not to be overlooked. On his shoulders in most instances rests the main burden of the development of the natural resources of the territory ; and anything which contributes to promoting the improvement of economic conditions must be to his advantage as well as a further stage in progress towards self-sufficiency.

At the same time, even in such conditions, as always, the foundation of the social and economic structure is the native population. It is this consideration which weighs the argument when it is urged that whatever delay may be imposed on development by current conditions and the claims of the vigorous prosecution of the War, some part at least, and that the more urgent, of the expenditure on research may be pressed forward as a first and immediate charge. Among subjects of inquiry, a plea must be put forward for intensive study of the forms and constitution of native society. That the claims of this line of investigation should be stressed at this late date may seem a work of supererogation. Yet it is a question whether even yet the essential need of intensive study of native institutions and beliefs, and the implications of its conclusions, have been fully recognized, even though anthropologists have been attached officially to recent survey work, such as the nutritional survey in Rhodesia ; indirect rule itself, prior to its application, requires an investigation of the character of native institutions before it is possible to make use of them in the administration of native affairs. Recent investigations in West Africa, for example, suggest that indirect rule, where it is now in being, may sometimes rest on an uncertain foundation, notwithstanding preliminary inquiry, when dealing with so complex a matter as the seat of authority in an African community. The farther and deeper goes research in the social anthropology of African peoples, the more patent becomes the closely woven nexus of social and religious or quasi-religious relations of the community. It is impossible to touch the part without affecting the whole.

The significance of further and intensive research in social anthropology as a priority condition of the application of measures of colonial development affecting the native should be obvious. There is no measure of amelioration, whether it be in health, nutrition, agriculture, land tenure, education, housing, or social reform generally, which does not necessarily impinge upon, and to some extent modify, some sides of native life. What those sides are, how extensive their ramifications, and to what extent they may introduce further and unanticipated changes in mode of life, to the disadvantage of the community, the anthropologist is better able than anyone else to say. Many mistakes, reacting to the disadvantage of the native population, have been made in the past in default of such expert guidance. The delay which must supervene in the full application of the new policy of development at least gives opportunity for their avoidance from this cause in the future.

THE PLACE OF SCIENCE IN BRITISH AGRICULTURE

Agriculture in the Twentieth Century
Essays on Research, Practice and Organization to be presented to Sir Daniel Hall. Pp. x+440. (Oxford: Clarendon Press; London: Oxford University Press, 1939.) 15*s*. net.

BRITISH agriculture has always had its problems, its vicissitudes, its hopes; and although still buffeted by forces political, economic and social, it keeps its head erect, conscious of its unique importance and maintaining an undying faith in the return of better times. One impression gained by reading these excellent essays, written by leading exponents of scientific agriculture, and most fittingly dedicated to its Nestor, Sir Daniel Hall, is that of the great difficulties confronting statesmen and administrators when they have to adjust their outlook and their policies to meet new situations, which, in the absence of any long-term plan, have come upon them unforeseen. Until Sir Daniel Hall was appointed to the Development Commission in 1909, scientific knowledge and foresight seem to have been conspicuously lacking in administrative circles, and even to-day they have to contend with reactionary forces, represented by vested interests, the ignorance of science, and that one and only static thing in an ever-changing world, the ultra-conservative mind.

Of the fifteen essays included in the book, four deal exclusively with the relations of agriculture to the State or public authorities, and the rest to scientific and technical advances, mainly in the last forty years. The essays adequately cover all branches except that of agricultural engineering. Mr. H. E. Dale, formerly principal assistant secretary to the Ministry of Agriculture and Fisheries, has some interesting things to relate about Civil servants, whose traditional silence keeps the outside world uninformed of their functions and powers. He admits that order and strength, and not flexibility and freedom of personal initiative, are their peculiar virtues, and tells us that they are as averse from official intervention in the business of agriculture as are the farmers themselves. The growth of this intervention has arisen from the urgent need of keeping agricultural producers on their feet. The policy of assisting home producers by supporting prices, or by compensating them for price reductions due to world conditions, has been the dominant note of all recent legislation; unfortunately, as several writers point out, it has not been accompanied by any direct legislation, for example, on distribution costs, to help the consumer. Dr. J. A. Venn shows how the annual cost of supporting agriculture has lately run into a sum of the order of £60 million. Prof. H. H. Ashby contributes a dispassionate digest of agricultural legislation since 1910, but shows his teeth when he writes: "Neither the State nor agriculturists have ever defined the chief aims of agricultural policy, and for the greater part of the time both parties are pursuing conflicting and to some extent mutually destructive aims". Prof. J. A. Hanley recounts the rise and progress of agricultural education since its beginning in 1890, ending on a cheerful, if controversial, note that "the attitude of farmers and farm workers towards education and research has changed completely—their confidence has been won".

Less optimistic is Prof. C. S. Orwin in his account of "The Farmer's Business". He states that "the evolution of the industry has stopped short at a point half-way between peasant production and scientific management". He urges strongly the use of simple accountancy methods by farmers, but has to deplore that "the practice of scientific book-keeping, as the only means to correct the policy and the practice of the farmer, is so rare as to be virtually non-existent".

Prof. J. A. Scott Watson writes more cheerfully, acknowledging fully the many advances made by applying science to practice. He admits, however, that there has been no essential advance in the art of tillage, and states that "the recipe for success in breeding [stock] is still an ounce of science to a pound of intuitive judgement and half a stone of luck".

In the essays dealing mainly with scientific and technical developments, some of the authors pursue a rigidly historical sequence, which is apt to make 'heavy' reading, whilst others concentrate on the present position using history as a background. Notable among the latter are Sir John Russell's lucid account of "Soil Science in England", and the valuable essay by Dr. C. Crowther on "Some Problems of Animal Nutrition". Sir George Stapledon's treatise on "Grassland" deserves special attention as coming from the pen of a pioneer, a thinker who has shed his academic blinkers, and—one must add—as a 'feeler', for he confesses: "I am sufficiently unscientific, or possibly sufficiently scientific, to permit feeling to colour my scientific judgements and opinions". Dr. R. N. Salaman has a fascinating tale to tell about the rise and progress of research in plant viruses: and Mr. R. G. Hatton's account of

developments in fruit-growing discloses a remarkable story of scientific achievement which is probably unknown to most of those who do not work in his field.

The technical essays, in particular, will be of great value to students of scientific agriculture (and for this reason the book should have been provided with an index), and if they are read by the humanist, they can scarcely fail to convince him that although progress may often originate with the practical craftsman, it is science alone that can evaluate inventions and discoveries, stabilize them, and use them as a basis for further advance. It is probably true to say that in the last forty years—the period covered by the book—science has been responsible for many more advances than has untutored practice. And by science we mean controlled observation, measurement, and sound reasoning, not (with due respect to Sir George Stapledon) "feeling", although it may play its part in stimulating research and in applying the results to human betterment. Regarded as literary efforts all the essays are well-phrased and lucid. The only criticism that can be advanced is that some of them are rather overburdened with facts ; a little more play of the scientific imagination, a few more generalizations and ideas, and a livelier style of writing would have leavened the whole and increased its general appeal. Nevertheless, the book is in every way a notable one, and a worthy tribute to an exceptionally worthy man.

E. H. TRIPP.

ELECTRON DIFFRACTION

Theory and Practice of Electron Diffraction

By Prof. G. P. Thomson and Dr. W. Cochrane. Pp. xii+334+10 plates. (London : Macmillan and Co., Ltd., 1939.) 18*s*. net.

THE chief interest attached to electron diffraction at the time of its discovery was the abundant support it brought to the new and exciting ideas regarding a wave mechanics of material particles which de Broglie, Schrödinger and others were then applying with such marked success to the remodelling and rationalization of the Bohr atom. The discovery that electrons are diffracted by crystals left no doubt concerning the reality of the waves associated with matter, and the gratifying agreement between observed wavelengths and those calculated from de Broglie's formula afforded welcome evidence of the correctness of the wave model of the atom and of wave mechanical conceptions in general. The waves associated with matter had, so to speak, been brought into the open, and made available for direct examination.

It is not surprising that experimenters and theorists flocked 'in all directions', as the Russians have it, to this new field. Electron diffraction, like other recently discovered effects in these days of high-pressure research, enjoyed a period of intensive, not to say feverish, investigation during which the main facts and implications of the phenomenon were quickly laid bare. The technique of producing and recording patterns was rapidly improved, particularly for electrons of high speed. All diffraction effects observed with X-rays were shortly duplicated with electrons, including diffraction by molecular gases. The first rough checks of the de Broglie formula were confirmed by precision measurements. The first attempts were made to polarize electron waves by reflection. The relative intensities of diffraction beams were used to calculate the structure factors of crystals and form factors of atoms, with results in general accord with expectations based on existing theory. The dynamical theory of electron diffraction was developed along lines paralleling those followed in the theory of X-ray diffraction. Further, what now seems of prime importance, G. P. Thomson made the first applications of electron diffraction to the study of corrosion films on metal surfaces.

These developments were greatly facilitated by the huge store of knowledge and experience which had accrued from more than twelve years of intensive study of X-ray diffraction. The investigators of electron diffraction had at hand not only a model and guide for their work, but also an enormous fund of data regarding crystal structure and constants. There was some feeling at the time indeed that this store was rather more enormous than one might wish. All the 'easy shots' in crystal analysis had already fallen to X-rays ; electron diffraction had arrived only in time for the cheering—or so it seemed. It was recognized that electrons were suited to the study of exceedingly thin films and to surface layers—fields from which X-rays, because they are scattered but feebly by atoms, are excluded—and that here much of importance was to be learned. It is doubtful, however, if anyone realized how extensive and rich a field this is ; if anyone realized that in their respective fields, electrons would, in certain respects, be more useful for the analysis of crystals than X-rays.

The flow of energy in the primary electron beam is much greater ordinarily than that in the primary X-ray beams. The exposure times for electrons are consequently shorter (of the order of one second) and patterns are recorded at a greater rate, in spite of the fact that with electrons a vacuum must be broken and re-established at frequent intervals for changing plates and specimens. The wave-lengths of high-speed electrons are much shorter than those of the characteristic X-radiations, and this also is advantageous as it results in a greater content of information in the diffraction pattern per unit solid angle about the primary beam. Electron patterns which show twenty-five or thirty Debye-Scherrer rings are not uncommon, and patterns have been obtained which show as many as forty.

Even in the matter of diffraction phenomena, electrons have produced effects not observed with X-rays. The so-called cross-grating patterns, produced by the copious scattering of the extremely short electron waves, are of this class, as are also the Kikucki line patterns which reveal the diffraction of electrons elastically scattered in random directions within a crystal.

All these matters and much else beside, Thomson and Cochrane have set forth in a scholarly and pleasing manner in this new and welcome book on electron diffraction—the first of its scope in English. About one third of the book is devoted to theory. A chapter on general considerations of wave phenomena is followed by more particular examination of the concept of material waves, of crystal structures and diffraction effects. Ewald's invaluable conception of the reciprocal lattice is explained and employed throughout in the interpretation of patterns. Bethe's dynamical theory of electron diffraction is explored in considerable detail in a later chapter, and in another Darwin's theory of polarization is briefly reviewed.

The greater part of the book is given over to experimental technique and to a critical examination of results so far obtained in investigations of thin films and surface layers of gross specimens. Separate chapters are devoted to oil and grease films on metal surfaces, to oxide layers, and to the still controversial question of the physical nature of surfaces which have been mechanically polished. A chapter on the diffraction of low-speed electrons serves chiefly to reveal how much is yet to be learned in this important field. Elsewhere, also, one is struck not only by how much has been accomplished but also by the vast amount of work still to be done. The book is not free from errors: What book in its first edition is? But such as have been noted are few, obvious and innocuous.

The authors are to be congratulated on having produced a timely survey and appraisal of our present stock of knowledge regarding the diffraction of electrons. C. J. DAVISSON.

DESIGN IN AIRCRAFT

Aircraft Design

Vol. 1: Aerodynamics. Pp. xii + 215 + 8 plates. 13*s*. 6*d*. net. Vol. 2: Aerostructures. Pp. xiii + 308 + 10 plates. 16*s*. net. By C. H. Latimer Needham. (London: Chapman and Hall, Ltd., 1939.)

IT is difficult to assess the value of these two books without understanding to whom they are addressed. The author's treatment of his subject is more applied than academic, making it appear to be a designer's handbook rather than a student's text-book. Even then "he falls between two stools", giving neither enough facts and figures for the one, nor fundamental proofs for the other. Nevertheless the subject matter, so far as it goes, is useful and logically treated, and the volume should find a place in any library of aeronautical literature.

Vol. 1, "Aerodynamics", could have been better named "Aerodynamic Design"; it treats the subject entirely from this point of view. In this respect the author has made some unfortunate choices in his examples. In the remarks upon the properties of aerofoils, R.A.F. 15 is the one chosen. This has long been of nothing more than academic interest to the designer. The chapter dealing with the variation of the properties of an aerofoil with its shape is an excellent concept, and gives the designer exactly the lead that he so often needs, having to produce an aerofoil to fulfil a certain performance. The discussion of the effect of Reynolds' number on drag is dangerously vague, and no mention is made of the fact that the roughness of the surface is a vital factor when using results comparatively. Also the effect of structural form, biplane or monoplane, and plan form on induced drag seems to be none too clear.

The chapters on variable lift devices and airscrews are good, being more of an applied nature, but a fuller reference to B. M. Jones's classical method of drag analysis would have been valuable.

Vol. 2, "Aerostructures", is much more clearly defined in its presentation, and gives the impression that here the author is more at home with his subject. Again his choice of examples might have been more up to date. His figures for the comparison between a biplane and a monoplane are based on practice of several years ago. There is an excellent chapter on weight distribution and its estimation, a subject which has seldom been treated properly or as fully in other published text-books. Load factors are also dealt with fully, another subject none too clearly treated in other books. Mention should have been made of the possibility of these being varied as our knowledge of the principles of aerodynamics is extended.

When the author reaches the really practical aspects of design in chapters such as wing design, under-carriages, and metal construction, he becomes very sketchy in his treatment. It is, of course, impossible to treat such subjects in any other fashion in so small a compass, and it might have been better to have covered a smaller field more thoroughly. For example, a chapter on testing scarcely comes within the province of "Aircraft Design". The subject-matter in these chapters is accurate and useful so far as it goes. One is tempted to hope that the author will find it possible to extend future editions, and give his readers the benefit of the detailed knowledge of this part of the subject that he obviously possesses.

PROGRESS IN BIOCHEMISTRY

Annual Review of Biochemistry

James Murray Luck, Editor; James H. C. Smith, Associate Editor. Vol. 8. Pp. ix+676. (Stanford University P.O., Calif: Annual Reviews, Inc., 1939.) 5 dollars.

THE editors emphasize the need for critically appraising contributions of major significance rather than attempting a mere catalogue of papers, so that presumably this year's reviews, of which there are twenty-five, have been written from this point of view. Even so, they are mostly so highly specialized as to be too difficult for anyone but the experts.

Under the heading biological oxidations, Mr. Dixon notes the discovery of a new coenzyme-nucleotide and of new catalytic flavoproteins. In point of fact, rapid progress is being made in this group, but it requires a year or two yet before the results can be pulled together and a clear story made out of them.

The enzymes are dealt with in two sections, proteolytic and nonproteolytic. The work is now mainly chemical and slow progress is being made. K. Myrbäck devotes a few pages to the discussion of the various amylases: it is now admitted that they belong to clearly different groups producing from starch either alpha maltose or beta maltose or stable dextrins which vary in nature. It is inferred that the starch molecule cannot be so simple as deduced from the formula of Haworth. What a difficult problem starch presents! It has perhaps the largest literature of any compound and is one of the commonest of substances.

Karl Freudenberg selects lignin for discussion among polysaccharides and has put forward what seems to him the most logical conception of spruce lignin structure. The fundamental type unit, a skeleton containing nine carbon atoms, is a substituted phenyl propane, and it is considered that lignin is composed of a number of similar units connected through an ether linkage between phenol-hydroxyl and the carbinol group of the side chain. The origin of lignin in the plant can only be conjectured. It may come from pectin, but it is more probably derived directly from hexoses. The relation of lignin to the many phenolic glycosides also requires consideration. X-ray studies are doing so much to advance the knowledge of the structure of compounds of biological interest that it is valuable to have a note on this subject from W. T. Astbury.

Chapters follow on fats, proteins, and sulphur compounds and on several branches of metabolism.

There is more work on hormones than ever, particularly in the steroid group relating to sex and adrenocortical hormones. John Freud and two other Dutch workers contribute a very useful summary in which they cite 550 papers and books. The vitamins are distinguished as water-soluble and fat-soluble. There is an interesting note by C. H. Best and J. H. Ridout of Toronto on choline, which acts in the diet to inhibit the accumulation of neutral fat and cholesterol esters in, and accelerates their disappearance from, the liver.

Reference has only been made to half the reviews; it must suffice to show how much work is going on and how valuable these reports are. Messrs. Murray Luck and James Smith have once more earned the thanks of their biochemical colleagues.

PROTECTION OF THE RADIATION WORKER*

BY DR. G. W. C. KAYE, O.B.E., F.R.S.
NATIONAL PHYSICAL LABORATORY

THE basic ideas of protection for radiation workers by the use of remoteness and absorptive shielding are obvious enough: the remarkable thing is the time it took to secure their observance. Naturally, the X-ray tube as evolved by Röntgen and his contemporaries in 1895 onwards was entirely unprotected, but although the explanation was not clear, the dangers of superficial injuries through indiscriminate exposure to the rays had become evident within a few months of their discovery. There were those who attributed the injuries to personal idiosyncrasy, electrical effects, ultra-violet rays, platinum particles from the X-ray tubes, platinocyanides from the fluorescent screens, etc. Among other things, red silk and thin rubber sheet were actually advocated as preventives! Röntgen himself probably escaped hurt for the reason that he conducted his experiments, which were mainly photographic, with the X-ray tubes inside a metal box.

In 1898, a committee appointed by the Röntgen Society collected evidence, much of it confusing, on the harmful effects of the rays. Presently, the principle of absorptive shielding began to emerge, and a distinction was drawn between the effects of 'hard' and 'soft' X-rays. But developments were slow, and so it happened that for many years, protection for most workers continued to be rudimentary or nearly non-existent and, whether owing to apathy or ignorance, injuries and deaths continued to result. The position was aggravated during the War of 1914–18, for many of the X-ray diagnostic sets on which the British army depended were of relatively primitive design. Such outfits, which wholly employed induction coils and gas tubes, were necessarily of restricted output, and exposures, particularly in screen examinations, were often formidable.

BRITISH RECOMMENDATIONS

A series of casualties to a number of prominent X-ray workers during the next few years definitely aroused public opinion. It had become apparent that in addition to general deterioration of health, the signal effects were of three main types: (*a*) injuries to the superficial tissues (usually of the hands) which, with neglect, might become ulcerated or even cancerous; (*b*) prejudicial changes in the blood which might progress to fatal anæmia; and (*c*) derangements of internal organs. More effective protection for the X-ray worker was clearly necessary; but no less important to the X-ray worker was the absolute safeguarding of the patient against accidental over-exposure, particularly in screening and therapy. In 1921 the British X-ray and Radium Protection Committee was formed under the chairmanship of Sir Humphry Rolleston, the members being nominated by various radiological and scientific bodies. It speedily got out a series of protective recommendations which, incidentally, were the first of the kind to be issued by any country, so giving a lead to the world in these matters. These recommendations took cognizance of three primary dangers: (*a*) undue exposure to radiation; (*b*) high-voltage risks from exposed conductors; (*c*) undue exposure to toxic gases produced by coronal discharge. Since 1921, the Committee has revised the recommendations on a number of occasions. In the light of greater knowledge and experience, the recommendations gained in precision and detail, and presently extended their scope to include film storage, electromedical apparatus and ultra-violet therapy.

The attention of the younger workers may be directed to the difficulties with which the British Committee was confronted in its first efforts to specify and standardize protective measures. The need was great, for the conditions in the majority of X-ray departments were thoroughly unsatisfactory in those days. The Committee realized the pitfalls of a biological unit of dosage, but a bigger obstacle was the absence of an accepted physical unit of quantity of radiation. Only a few workers had attempted to make or utilize physical measurements which could be looked upon as significant or trustworthy; and the best the Committee could do was to try to translate into specific recommendations a sort of grand average of the protective measures which could be gleaned from the working conditions of a number of experienced radiologists who had escaped injury and still enjoyed normal health. A committee which attempts to put forward safety recommendations must err, if it errs at all, on the side of caution, and it was perhaps not surprising that at the first onset the recommendations were regarded by

* Substance of the fourth Stanley Melville Memorial Lecture delivered before the Society of Radiographers on February 10.

some as unnecessarily drastic, and that the embryonic efforts of the British industry, which backed the Committee's work loyally and wholeheartedly, to provide adequate protection against stray radiation, was deprecated in some quarters as heavy, clumsy and costly, and too cramping for the work of the radiologist. But presently the heavy lead-protected boxes and the like departed in favour of the self-protected X-ray tube in which the full degree of lead protection laid down by the Committee was incorporated in the tube itself, and so made it possible with lighter weight and better mechanical designs to restore the freedom of action to which the radiologist was accustomed.

Looking backward, it is scarcely possible to over-estimate the progressively beneficial influence of the Committee's recommendations on the well-being of the radiation worker, whether in hospitals or industrial and research establishments, as well as on the development and design of X-ray equipment. The Ministry of Health and the Ministry of Pensions gave the recommendations their support, and the National Physical Laboratory collaborated by inspecting some hundreds of hospitals and equipment from the point of view of the recommendations. Furthermore, thanks chiefly to the activities of an Inter-Services Advisory X-ray Committee, which has functioned since 1926, the three British defence services entered the present war with X-ray departments and equipment of which the general standards of safety conform to the Protection Committee's requirements as fully as those of civilian hospitals.

International Recommendations

In 1928, at the second International Congress of Radiology at Stockholm, the British Committee submitted proposals based on the British recommendations as a basis for international agreement, the outcome being that they were adopted as international recommendations. An International Protection Commission was also formed with representatives from Great Britain, United States, France, Germany, Italy and Sweden, Dr. Melville and Dr. Kaye being elected secretaries. These recommendations have been revised triennially by the Protection Commission on the occasions of the successive international congresses held in Paris, Zurich and Chicago, and would no doubt have come up again in Berlin this year under happier conditions. Meanwhile, the international recommendations have been adopted in principle throughout virtually the civilized world. They have been implemented by more detailed national recommendations drawn up by protection or safety committees in a number of countries.

X-Ray Protection

From the first, the British recommendations stressed the obvious value to both operator and patient of enveloping an X-ray tube as completely as may be with protective material of a thickness adequate for the X-ray voltage concerned. Such thickness is almost invariably stated in terms of lead, since this is the most effective and convenient absorbent readily available at a reasonable cost. The recommended thicknesses gained in precision as two major steps in progress came about. The first step was the adoption at the Stockholm International Congress of the international röntgen as the unit of quantity of X-radiation, based on an air-ionization method of measurement under specified conditions. The second step was the adoption by the International Protection Commission of a maximum 'tolerance dose' of X-rays. While there are a number of uncertain variables which do not lie within the province of physics but are wholly biological, the erythema dose is commonly accepted on broad grounds as an index of biological response for the average individual, the tolerance dose being taken as 1/1,000 of an erythema dose in three working days, under conditions when the whole body is irradiated. Estimates of the X-ray erythema dose depend on the exciting voltage, but, on the average, evaluate it as equivalent to about 600 röntgens (r.), so that the tolerance dose corresponds to 0·2 röntgen in a normal working day of 7 or 8 hours, or 1 röntgen per working week of 5 days, or 10^{-5} röntgen per second. The protective lead thicknesses for primary X-ray beams which are given up to 600 kv. in the latest International and British recommendations are in general harmony with this tolerance figure under average conditions, corresponding in actual fact to an initial dosage rate of about 2 röntgens per minute at the point to be shielded.

When an X-ray equipment is tested, stray radiation may be evaluated either by a convenient form of dose meter or a Geiger counter, or by carrying on the person a portable ionization chamber of small capacity, or a photographic film. In point of fact, such a film test is very sensitive, blackening which is 'just clearly visible' corresponding (with standard development) to about 0·01–0·02 röntgen (that is, about 1/20–1/10 of the daily tolerance dose), in the case of X-rays of qualities associated with, say, 100–200 kv. The corresponding figure for gamma-rays is about 0·1 röntgen (that is, about one half of the daily tolerance dose).

As regards the protection for X-rays from higher voltages, Mr. W. Binks and I have recently shown, on the basis of theoretical and practical data relating to photo-electric, scattering and nuclear

Exciting voltage (pulsating)	Total lead protection required to give the tolerance dosage rate of 10^{-5} r./sec. at 1 metre distance with 1 milliamp. tube-current (X-rays emitted perpendicular to electron beam)	
	Calculated values (Kaye and Binks)	Experimental measurements (Bouwers and van der Tuuk)
400 kv.	18 mm. lead	17 mm. lead
600	40	36
800	60	57
1000	80	79
2000	175	—
5000	290	—

absorption processes, that it is possible to forecast the appropriate protective lead shielding for any voltage. We have somewhat prophetically extended our calculations up to 5,000 kv., though, in practice, 2,000 kv. is roughly the highest voltage at which X-rays have so far been generated. The validity of the calculations, at any rate up to 1,000 kv., is supported by the good agreement with some experimental results since published by Bouwers and van der Tuuk. This is shown in the accompanying table, where it will be noted that the lead protection required for 1 million-volt X-rays is about 3 inches, for 2 million-volt rays 7 inches, and for 5 million-volt rays nearly a foot.

Incidentally, if we may, not unfairly, regard the X-radiation from a 2-million volt tube as comparable in quality with gamma-rays, then at 1 metre distance from such a tube operating at constant potential, the maximum X-ray output, which is of the order of 210 röntgens per minute, corresponds to the gamma-ray emission at a like distance from 16,000 grams of radium, a figure the magnitude of which may be contrasted with the total of 1,000 grams known to be isolated in the world.

Radium Protection

The problems which present themselves in protecting radium workers are more acute and troublesome than with X-rays. A knowledge of the radium contents of radium sources is naturally of service in this connexion. Such measurements were first put on a satisfactory footing when, following the formation at Brussels in 1910 of an International Radium Standards Committee with the late Lord Rutherford as chairman, an International Radium Standard was set up in Paris in 1913, thanks to the skill of the late Mme. Curie and the generosity of the late Sir George Beilby. In the same year, the latter also presented to the National Physical Laboratory the British National Radium Standard, which had been calibrated in terms of the International Standard, and which has since formed the basis of test of nearly 200 grams of radium.

Protection from alpha- and beta-radiations (which are virtually all absorbed in the skin) is fairly readily achieved in the case of most forms of radium manipulation. As regards gamma-radiation, the position is less satisfactory than with X-rays. Progress came when the Fifth International Congress of Radiology in 1937 accepted the röntgen as a unit for measuring gamma-rays as well as X-rays. Furthermore, the International and British Protection Committees were led tentatively to assume, on the evidence available, that the human body is equally susceptible to X-rays and gamma-rays, and adopted the same tolerance dose for both radiations, namely, an average dose over the whole body of 1 röntgen per working week. There is, however, some divergence of opinion on this point, certain workers maintaining that the tolerance dose should be smaller for gamma-rays.

It should be noted that X-ray protective lead values do not apply to gamma-rays, materials lighter than lead being normally more effective against gamma-rays than X-rays. The protective thicknesses for gamma-rays may be estimated sufficiently accurately by assuming that the absorption is proportional to the density. Thus, the introduction of tungsten alloys, with a density half as much again as that of lead, has resulted in smaller and more compact radium 'bombs' without sacrifice of protection. Incidentally, the 'safe working distances' for radium bombs, calculated from the tolerance dose, are less than is often imagined; for example, the safe distance for 1 gram of completely unprotected radium is no more than 5 yards, which is reduced to 1 yard or so by enclosure in a lead bomb with 5 cm. walls. By the same token, there is no necessity, apart from questions of air raids, to locate properly designed and protected radium safes at extravagantly large distances from the personnel.

Electrical Precautions

The practice in the pioneer days of Geissler discharge tubes, of using thin copper wire, unprotected except by silk or cotton covering, to connect the high-tension poles of induction coils or electrical machines to the terminals of discharge tubes, was a legacy which persisted with gas X-ray tubes for many years, for although an unexpected electric shock for the personnel was definitely unpleasant, nothing more serious was likely to follow. Many will recall the slack or dangling high-tension leads which carried, usually in the dark, currents at many thousands of volts, sometimes only a matter of inches from the patient or attendant. Heavier high-tension leads followed in due course, but with the advent of larger coils, and particularly of high-tension transformers, with or without condensers, the power developed was such

that greater caution was necessary, and, indeed, fatal accidents began to occur.

The present-day solutions for shock-proofing X-ray outfits take two major forms. One is the shock-proof X-ray tube combined with high-tension cable which, provided with heavy rubber insulation and earthed metallic sheathing, is both shock-proof and sufficiently flexible not to restrict mobility unduly. The other is the complete enclosing of X-ray tube and high-tension transformer in a common earthed metal container filled with a dielectric such as transformer oil or, more recently, 'freon'.

Ventilation and Lighting

Nowadays there are no two opinions about the Protection Committee's advocacy of light schemes of decoration for all rooms (including photographic dark rooms), together with large windows affording good natural lighting and admitting sunshine and fresh air whenever the rooms are not in use. A bigger step was the introduction of artificial ventilation into X-ray departments. The importance to the operator of generous ventilation is now recognized as second only to that of protection, particularly where apparatus is not corona-free, or the control room is not completely isolated from the treatment room. In some countries, notably the United States, elaborate schemes of air-conditioning are employed.

Mention should here be made of the importance of directional ventilation in preventing the inhaling of radioactive dust or radon during the prolonged manipulation of unsealed radium salt, radium ore, etc. ; cases of radium poisoning have occurred for lack of such precautions.

Finally, this is perhaps the most convenient place to make passing reference to the manner in which the problem of fires associated with film storage was solved by the introduction of non-inflammable cellulose acetate film, in place of the highly inflammable nitrate film.

Neutron Protection

The problem of protection for the worker with neutrons seems likely to have a wider interest before long, in view of the invention of the cyclotron by Lawrence and the immense yield of neutrons which can be so obtained. It would appear from recent researches that neutrons can be measured directly in röntgens with reasonable accuracy, and that the biological activity of neutrons may be up to eighty times that of X- or gamma-rays, being probably dependent on the cell structure. In the interests of safety, therefore, it seems well to assume at present that the tolerance dosage rate for neutrons is of the order of 1/100 of that for X- and gamma-rays, that is, about 10^{-7} r./sec.

As regards the protection of personnel against neutrons, the task would be the easier if human tissue were not so effective in absorbing neutrons. Whereas in the case of X- and gamma-rays, the light elements present in tissue are only slightly absorptive, these same elements (or at any rate, the hydrogen) have properties the very reverse where neutrons are concerned. On the other hand, hydrogen-bearing materials such as water or paraffin, if placed around a neutron source, can be turned to account in slowing down and partially absorbing the neutrons before they reach the personnel. In practice, tanks of water or paraffin 50–100 cm. across are used for screening purposes. About 50 cm. of paraffin reduces the total number of neutrons to about 1 per cent, while a few per cent of boric acid in water reduces the slow neutron activity to about one third of that produced by water alone. Having by such means achieved as much absorption of the neutrons as is practicable, further reliance is then placed, as with X- and gamma-rays, on remoteness of the personnel from the neutron source.

International Monument to X-ray and Radium Martyrs

What I have tried to set down in this memorial lecture is largely intended for the younger generation who, equipped as they are, like any modern army, with adequate defensive measures, will, I hope, sometimes spare a thought for those X-ray pioneers who, undaunted by long and sometimes unbearable suffering, which drugs might utterly fail to relieve, and which was perhaps followed by mutilating operations or a cruel death, continued to apply themselves indefatigably to perfect the use of Röntgen's discovery for the benefit of humanity. Their martyrdom prepared the way which rendered the present use of X-rays free from danger.

Such matters have a world appeal, though it was in less troubled days that the German Röntgen Society erected in Hamburg a monument to the X-ray and radium martyrs of all nations. The monument, which was unveiled on April 4, 1936, takes the form of a simple rectangular column of sandstone surmounted by a laurel wreath. The names of radiologists, radiographers, physicists, chemists, laboratory workers and nurses whose deaths were due to work with X-rays and radium are engraved on the sides. The total is 169 names spread over fifteen different nations : though it is probable that the list is now by no means complete, nor does it attempt to take cognizance of the large number of less serious casualties.

FOOD PRODUCTION AND FOOD CONTROL*

BY SIR JOHN BOYD ORR, F.R.S.,
ROWETT RESEARCH INSTITUTE, ABERDEEN

IN anticipation of the War, the Foods (Defence) Plans Committee, working in co-operation with the trades concerned, prepared an elaborate scheme of food control for Great Britain. Excellent though this scheme is in some respects, it is not sufficient to deal with the situation. It does not take account of the fact that, even before the War began, the diet of the poorest third of the population was not up to the standard we now know to be necessary for health. This is the weakest part of the food front. Our food plans should be directed first and foremost to bring the diet of these people up to the standard. If they have sufficient, we need not worry about the rest of the population.

The present system of rationing and price fixing cannot bring about an equal sharing of the available food. Coupons have been issued for 4 oz. of butter and 4 oz. of bacon per week. Even in peace time, when prices were lower, many families could not afford to purchase these amounts. Consequently, we have people with coupons who cannot purchase the rationed amount because they have not the money, and people with plenty of money to purchase the additional amounts they want, but cannot get them because they have not the additional coupons. This fosters an illicit trade in coupons and food which defeats the object of rationing. If the illicit trade does not develop quickly enough, food remains unsold. As the price rises the amount unsold increases until it becomes necessary to increase the rationed amount, so that those with money can purchase more. It is impossible to have two systems, rationing by price and rationing by amount, operating in the same field without creating anomalies. If rationing is to be efficient and to apply to the whole population, the rationed amount must be within the purchasing power of everybody.

Nor does price fixing necessarily benefit the poor. Maximum prices tend to become the minimum. Some commodities have a wide range of prices. Pooling and price fixing will tend to raise the price of the cheapest qualities, which are those that the poor use. Then again, the poor get a less expensive distributive service than the well-to-do. Prices are likely to be fixed on the higher costs of the more expensive service, and the poor may be forced to pay for a service which they cannot afford and indeed will not get.

* The arguments of the present article are set forth at length, with additional data, in a booklet "Feeding the People in War-Time", to appear shortly (London: Macmillan and Co., Ltd.).

It is worth while reconsidering the food policy of Great Britain. We are only at the beginning of what may be a long, grim struggle. The issue will depend as much upon the powers of endurance and the morale of the civilian population as on the efficiency of the fighting forces. Next to having a cause worth fighting for and worth dying for, the most important factor for morale is food. In the War of 1914–18, we sustained serious reverses without any loss of spirit, but there was a grave danger of war-weariness in the food shortage of 1917. Our food policy should be designed to raise to the highest possible level national health and physical fitness, upon which morale and powers of endurance so largely depend. It must, therefore, be based upon nutritional needs.

We should first ascertain the total needs of the population, and then determine how these can best be met, keeping in view the possibilities of increasing home production and the need for using the minimum amount of shipping space and foreign exchange for food imports.

In the first place, we must provide more protective foods to bring consumption among the whole population up to the level among the well-to-do, which is about the level required for health. Then we must provide more energy-yielding foods to meet increased energy expenditure due to the War. Unemployed men and men in sedentary occupations need only about 2,500 calories per day. Many of these will be drawn into industry or the fighting forces. In the former case their needs will increase to between 3,000 and 3,500 calories, and in the latter case to about 4,000 calories. We must make provision for a total increase of probably between 10 and 20 per cent.

We are thus faced with the problem of increasing our total food supplies at a time when we must economize in shipping space and in foreign exchange; and if we plan to have the whole population adequately fed, we have the further problem of adjusting prices to purchasing power at a time when the cost of food is rising.

In normal times, about two thirds of the total food supplies of Great Britain are imported. Including feeding stuffs for animals, this takes nearly 20 million tons of shipping per annum. Home production must be increased to the utmost limit and the increase should consist of essential foods which are costly to import in terms of shipping space or foreign exchange. The potato should come first on the list. It is the most

important crop in war. An acre of potatoes yields twice as much food as an acre of wheat, and it is the safest crop to take out of newly ploughed-up pastures. In the War of 1914–18, the yield of potatoes from old pastures averaged 7·1 tons per acre compared with a pre-War average of 6·2 tons on ordinary potato land. The potato is of special nutritive value ; it is our main source of vitamin C. In Great Britain the average consumption is only about 9 oz. per head per day, though in some families it is as high as 23 oz. In Belgium the average consumption is 19 oz. and in Germany it is 16 oz. We could, with advantage to national health, increase consumption by at least 50 per cent.

The allotment campaign will lead to an increased consumption of vegetables. It is estimated there are about 3½ million gardens in Great Britain, and the number of allotments is likely to be brought up to nearly 1½ million. Out of a total of between 10 and 12 million households in the country, there will thus be nearly 5 million wholly or partially self-supporting in vegetables. If our canning factories are running to full capacity in the summer and autumn, building up a store of preserved vegetables for winter use, and if the distribution of farm-grown vegetables be better organized to reduce the gulf between what the producer gets and the consumer pays, it should be possible to bring consumption of nearly the whole population up to about 6 oz. per head per day, the level among the well-to-do.

Milk is the most important protective food. There is already sufficient milk in Great Britain to bring consumption among the poor, at present less than a quarter of a pint per head per day, up to nearly two thirds of a pint. There should be no great difficulty in making milk, which is at present surplus to the liquid market, available on a cash and carry basis at a price within the reach of working-class families with children.

Milk, vegetables and potatoes between them contain all the food constituents necessary for health. If everybody has sufficient of these, there need be no malnutrition. If we have the right agricultural policy we can produce sufficient for the needs of the whole population, without reducing the pre-War output of other foods.

With sufficient of these three protective foods, we could, if we were forced by lack of shipping space or foreign exchange, limit imports to the cheap, easily carried, energy-yielding foods. The following table shows the estimated storage space, energy value, and price of some of the main foods we import.

The import policy of Great Britain is, of course, affected by trade and other considerations. Thus, for example, we shall import food from eastern Europe, not so much because we need it as to keep it out of the hands of the enemy. Considering only nutritional needs, however, priority in imports should be given to bread and fat, until we have a reserve which puts us beyond the danger of a shortage. In 1914–18 we tried to get a reserve of thirteen weeks' supply, but could not maintain it at that level. With the uncertainty of the present War, we should have at least a six months' reserve of wheat and fat. Of the other foods, sugar is the cheapest energy supplier in terms both of money and shipping space, and would probably be put next to wheat and fat in the list.

	Approx. shipping space (cu. ft. per ton)	Approx. energy value (1,000 cal. per cu. ft. shipping space)	Cost of 100,000 cal.
Sugar ..	45	83	4*s.* 6*d.*
Wheat ..	50	56	5*s.* 6*d.*
Fats & tallow	80	118	8*s.* 6*d.*
Dried fruits ..	50	55	21*s.*
Cheese ..	60	56	39*s.*
Frozen beef ..	95	26	40*s.*
Eggs in shell ..	120	12	75*s.*

If we had sufficient of these energy-yielding foods, together with sufficient milk, vegetables and potatoes, we might be reduced to a spartan diet, but there would never be any need for us to capitulate owing to food shortage. A sufficient amount of the energy-yielding foods could be imported with less than a third of the pre-War shipping space devoted to food and feeding stuffs.

Though these three protective foods and three energy-yielding foods might well form the basis of a national dietary in war-time, it is not suggested that the diet of any part of the population should be reduced to these. Even if shipping space were reduced to a minimum, we would have, in addition to these, all the other foods we can produce at home, and it is exceedingly unlikely that the shipping position will ever be so bad that we cannot continue to import other foods.

The most difficult problem is not the maintaining of supplies to meet nutritional needs ; it is, as it was in peace time, one of bringing a sufficient amount of the right kind of food within the purchasing power of working-class families with children. It has already been decided to subsidize food. It might be advisable to confine the subsidies to the absolutely essential foods and to make it sufficient to bring the price of these within the purchasing power of every family.

To provide for the different physiological needs and for different likes and dislikes, it would be necessary to leave a margin of money for the purchase of other foods. Thus, for example, if milk, vegetables and potatoes, bread, fat (butter or margarine) and sugar are chosen as the essential foods to be subsidized, and, if it were found that,

say 4*s*. 6*d*. a week was the amount available for food among the poorest 10 per cent of the population, the price of these basic foods should be fixed so that a sufficient amount of them can be bought for, say, 3*s*., leaving 1*s*. 6*d*. for the purchase of other foods, such as beef, mutton, fish, fruit, and tea and other beverages.

With such a policy it is doubtful whether it would be worth while maintaining a costly and elaborate organization for the detailed control of food. The Government is the wholesale purchaser. It can fix wholesale prices at a level estimated to have the retail price within the purchasing power of everybody. If the wholesale prices are known and wholesale distribution equitable, competition between merchants and shopkeepers, who are dependent upon the goodwill of their customers, will probably be sufficient to prevent any profiteering. Indeed, it has never been suggested that there was any gross profiteering amongst shopkeepers. Speculation and profiteering, in so far as it existed at all, was in large wholesale dealing, which is now under Government control.

The policy would provide a flexible system for adjusting the national dietary to what we can afford in money or in shipping space. The few essential foods chosen to be subsidized and to be provided in such abundance as there would be no need for rationing, would be regarded as the rock-bottom diet below which we cannot go with safety. Consumption of the other foods could be controlled by price. If we wish to economize in shipping and foreign exchange, we can limit consumption by increasing the price. On the other hand, if supplies of some other foods were sufficient, they could be added to the list of 'essential' subsidized foods and so brought within the reach of everybody. It is most probable that at the present time some other foods such as cheese and dried fruits could be added to the list. If the Government controls the wholesale trade, which is the bottle neck of our food supply, it can regulate consumption as seems desirable by regulating wholesale prices.

In the same way, home production can be regulated by price. The farmer produces for profit. He increases or decreases his output of different foods according to the price he thinks he will get. The farmer should be given a guaranteed minimum price calculated to call forth the additional food we need. The guaranteed prices of the different foods should be adjusted to each other in such proportion that the foods would be produced in the proportion we want. The control of production by the regulation of the price offered would enable farmers to devote their land to the crops for which they are most suited. This would utilize the land of Great Britain to better advantage and give a greater increase in production than a system of compulsory ploughing-up according to a fixed ratio, without any guidance as to what additional foods should be grown.

THE SEVERE WINTER OF 1939-40

THE frost which began on December 27, 1939, and continued with few intermissions until about February 18, 1940, was the most severe in Great Britain since 1895. December 1939 was cold on the whole, the average temperature of 37·8° F. at Kew being nearly 4° F. below the normal; but apart from a short spell of frost about December 22 it did not approach in severity the latter part of the winter. At the end of the month the minimum at Kew fell to 19° F., but comparatively mild conditions returned during the first week in January. The main period of frost came between January 10 and 24, when the mean temperature at Kew was continuously below freezing except for January 12 and fell to 22° F. on January 20. Some very low minima were recorded in all parts of England and Scotland: — 5° F. in the screen at Dalwhinnie, — 6° F. at Bodiam in south-east England and Ambleside in the north-west, and — 10° F. at Rhayader, all between January 17 and 21. At Greenwich the lowest minimum was 12° F., identical with the lowest minimum there in February 1929 and 5° higher than in February 1895. After a short break the month ended with another cold spell, and the mean temperature at Kew was as low as 31·3° F., compared with a normal of 40·5°. February began cold, but severe weather was not encountered until February 10, when another week of frost began, with very low temperatures about February 14.

There was not a great deal of snow in Britain, except in the north, but an even more disastrous phenomenon, glazed frost, occurred over the South and West of England on January 27–28. All through the Saturday night and most of Sunday, fine rain fell through a layer of air which was just below 32° F. The raindrops were cooled below freezing point, but remained liquid until they struck the ground or exposed objects, when they froze instantly into hard clear ice. Twigs and branches of trees, telephone wires and railway tracks were coated several inches thick; one length of telegraph wire in Gloucestershire carried a cylinder of ice 2·4 in. in diameter, and weighing

130 times as much as the wire alone. Mr. C. J. P. Cave calculated that in Hampshire there was a weight of 85–90 lb. of ice on a single wire between adjacent posts. Under the strain, wires and posts gave way, blocking roads and disorganizing the telephone service. Trees were split or brought down by the weight of ice on their branches, and added to the confusion, while the frozen road and rail surfaces caused an almost complete breakdown of transport. The weather continued very cold, and it was some days before conditions approached normal; there was even a second, though less severe, glazed frost on the morning of February 3.

The difference of eleven years between 1929 and 1940 at once suggests the influence of the sunspot cycle, especially when it is remembered that February 1917 also produced a severe frost, while that of 1895 came 22–23 years earlier. All these occurred about one year after a sunspot maximum. There was, however, no similar frost in 1906 or 1907 and the eleven-year recurrence is completely absent before 1895, so that the succession 1917–1929–1940 must be regarded as most probably a coincidence. D. Brunt, in his study "Periodicities in European Weather" (*Phil. Trans. Roy. Soc., Lond.*, A, 225, 247–302), finds no trace of a periodicity of eleven years in the temperatures of London, Stockholm, Paris or Vienna. The cycle of eleven years is the largest periodic element in the temperature of Edinburgh, and shows a minimum about 1938–39; but the double sunspot cycle of 22–23 years is almost equally prominent and is now near its maximum. For London this 22–23 year cycle is the largest component and is likewise near its maximum. In any event the amplitude of these periodic terms is small in comparison with the departures from normal temperature during a severe winter.

The other well-known cycle, Brückner's of thirty-five years, also fails to appear in Brunt's tables for London and Edinburgh, though he found it at Paris and Berlin. It happens that the interval between the last two great frosts, 1895 and 1929, was thirty-four years, but the Brückner cycle is of no help on this occasion, for the winter of 1904–5 was not particularly cold. Nor was 1840, in spite of the supposed grand cycle of a hundred years. Cycles are useless for forecasting severe winters.

On the other hand, although really severe winters may come at irregular intervals, they do present a considerable regularity in the course of events which constitutes them. The greatest intensity of cold rarely occurs until some time in January and quite frequently not until February, and in Great Britain it tends to come in waves of ten or fifteen days separated by brief intervals of milder weather. In a prolonged severe winter, central Europe is occupied by a persistent stream of very cold air coming from the east and north-east, with a temperature sometimes many degrees below 0° F., but over the Atlantic the normal south-westerly winds still prevail. For most of the time the cold winds succeed in crossing the North Sea or English Channel, though sometimes by devious routes, but now and again they give place to the mild south-westerlies. Even the brief passage over the North Sea warms the cold air appreciably, and temperatures in Britain do not fall so low as those on the Continent. Minimum temperatures are not yet available; but at 7h., temperatures only a degree or two above 0° F. were recorded at Copenhagen on January 17 and at Paris on January 23–25. Farther east much lower figures were recorded, down to — 26° F. at Dorpat on January 17. The whole period from about January 1 until January 25 appears to have been generally cold in Europe.

Another cold wave began about February 9, and on February 12, when Copenhagen recorded — 4° F. at 7h., the Baltic between Denmark and Sweden was firmly frozen and, according to reports in the Press, was crossed on foot for the first time in centuries.

OBITUARIES

Colonel R. E. B. Crompton, C.B., F.R.S.

WE deeply regret to record the death on February 15 at ninety-four years of age of Colonel R. E. B. Crompton. He was one of the greatest pioneers both in mechanical road traction and in electrical engineering.

Rookes Evelyn Bell Crompton was born at Sion Hill, Yorkshire, on May 31, 1845. In 1871, he married Elizabeth Gertrude, daughter of George Clarke of Tanfield House, Ripon, and had two sons and three daughters. He was educated at Harrow and served as a naval cadet in the Crimean War (medal and Sebastopol clasp); in the Rifle Brigade (1864–76); in South Africa, 1900 (despatches, Queen's medal with three clasps, C.B.). He was founder of Crompton and Co.; twice president of the Institution of Electrical Engineers; president of the Institution of Automobile Engineers; founder member of the Royal Automobile Club.

Colonel Crompton had a most varied and interesting life and career, and had numerous friends all over

the world. Luckily for us, in 1928 he wrote a volume of "Reminiscences" which he dedicated to his wife; "during almost sixty years my courageous fellow-worker and devoted companion". She died on November 27 last, to the great grief of her husband. They had nearly reached the seventieth anniversary of their wedding day.

The Hon. Sir Arthur Stanley, treasurer of St. Thomas's Hospital, London, in an introduction he wrote to Crompton's "Reminiscences", says: "to write the preface to an autobiography is never a very easy task, but when it is the self-told life story of a man of 83, every minute of which has been made to do the work of two, the task becomes well-nigh impossible". One who remembered Lord Alvanley, the celebrated wit, and could speak of the Great Exhibition in Hyde Park as if it were a thing of yesterday, who was a cadet in the Royal Navy at the age of eleven; who, at that early age, went out and received the Crimean War Medal and Sebastopol clasp before reaching the age of twelve, was undoubtedly making a remarkable beginning to a wonderful career.

Then comes a period which is similar to the ordinary life of a lively English boy. When Crompton returned to England he left the Navy, and towards the end of 1856 was sent to school at Elstree to prepare for Harrow. He left Harrow in 1860 and entered the Rifle Brigade three years later. He went to India in the following year, and after serving for a time with his regiment was seconded for special service as superintendent of the Government Steam Train Department. In 1865, when the summer was exceptionally hot, he caught a particularly noxious form of malaria, which troubled him intermittently for many years. He was sent by his doctors to the Murree Hills to convalesce, and made friends with several great sportsmen.

Shortly after this, Crompton received a staff appointment at the Umballa Durbar, and got into touch with several influential men at headquarters. He was invited by the commander-in-chief to the aides-de-camp quarters at Simla, and he was successful in interesting them in his project of substituting mechanical transport for the bullock trains which at that time were generally employed for army purposes. He was appointed an extra aide-de-camp to the commander-in-chief, and in this capacity was often asked to accompany Lord Mayo, the Viceroy, on his rides. His own road engine (the *Blue Bell*), which he had practically completed before he left for India and which travelled at an average speed of four miles per hour, had been left in the hands of R. W. Thomson of Edinburgh, to develop. Through the good services of the Director-General of the Post Office, who controlled the bullock train service in India, the first *Blue Bell* 6 h.p. road vehicle was ordered and Crompton received the official appointment as "Superintendent of the Government Steam Train", so as to take charge of the experiments. He was temporarily withdrawn from the army in order that this could be done. After many difficulties and adventures with the *Blue Bell* in India, his return to London was of an unusual kind, as the Franco-Prussian War was on and Paris was invested. Eventually the German military authorities gave them permission to proceed, provided they put on uniforms and wore their swords to show that they were officers.

At this time, mechanical road transport in England was limited to the agricultural traction engines, which were allowed, as a favour, to clank along the high roads at the speed of the man who walked in front with a red flag, and even at those low speeds their hauling capacity was very poor. Thomson, by his invention of rubber tyres of great cross-section which flattened themselves under the weight of the engine, at once doubled the hauling power and allowed his engines to be run at speeds up to ten miles an hour whenever the Red Flag Act permitted it.

From 1878 until 1882, Crompton carried on a business as an electrical manufacturer, confining himself to the manufacture of electrical arc plant. The firm sold and installed Gramme generators and Bürgin dynamo machines, for the latter of which it acquired the sole right of manufacture. These machines could supply from six to eight arc lamps in series, and so the firm could undertake the lighting of railway stations, goods yards, docks and other open places in which work has to be carried on at night; and for such purposes the firm found a ready market. An order to light St. Enoch Station, Glasgow, with arc lamps was obtained, and the interest taken in this work by Sir William Thomson (Lord Kelvin) cemented a friendship between them which was helpful to both.

Willans the engine-builder, about this time (1879–1880), was a frequent visitor at Crompton's house in Porchester Gardens. They were both interested in electrical development and were able to discuss together and help one another in their respective difficulties. They agreed that the generator sets of the future must consist of a high-speed engine coupled direct to a direct current dynamo. During 1879, Cromptons designed many portable sets of electric lighting plant. Combined with this set, the first Willans high-speed compound engine gave such remarkably economical results that it attracted great attention from the engineering world. About Christmas, 1879, Crompton lighted up his own house in Porchester Gardens. At first he used primary cells, but they were not a success, so he brought in one of his portable sets into the mews at the back of his house and gave special parties, using small arc lights fixed in his drawing-room and dining-room. This was probably the first instance of effective electric lighting in a private house, although there had previously been exhibitions of arc lighting at the Royal Institution and elsewhere.

Early in the year 1880, a messenger from Messrs. Mawson and Swan, the well-known chemists of Newcastle, to whom Crompton had supplied arc lighting plant, called on him to say that Mr. Swan urgently desired to see him. He went to Newcastle, where Swan took him to his laboratory and showed him twenty small incandescent lamps, which burned very

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brightly and steadily, each having a carbon filament enclosed in a globe, exhausted to a very perfect vacuum, and claimed that he had solved the problem of electric light for internal illumination. Crompton agreed with him. Later in the same year (1881), the great German physicist Helmholtz lectured at University College, London, and for the illustration of his experimental work Crompton supplied him with one of his portable sets of generating plant. For the International Exposition of Electric Lighting held in Paris in the summer and autumn of 1881 in the Palais de l'Industrie, Cromptons sent over a fine exhibit, and were awarded the first gold medal ever given for electric lighting plant.

The great fire which in 1883 destroyed the Ring Theatre of Vienna with great loss of life so impressed on the Emperor Francis Joseph the dangers of gas that he asked the Imperial and Continental Gas Company, which then supplied gas for the lighting of Vienna, whether it could not arrange for the lighting of the Opera House and the other Imperial theatres by electricity as being a safer and better illuminant. The Gas Company, advised by Prof. Monnier of the École Centrale in Paris, suggested that Crompton should be called in for consultation, and so in June 1885 he went with Prof. Monnier to Vienna and spent some weeks in considering the Emperor's question. At this time a small central station had been started in Berlin in the Friedrichstrasse. In London, the original Edison Company had done the same at a point near the Holborn Viaduct, and the Grosvenor Gallery scheme was in its initial stage. At this time the Swan Company had succeeded in turning out satisfactorily 100-volt lamps. At Vienna the company designed from its central station in the Schenkenstrasse 440-volt generators and laid twin conductors to carry this pressure up to the Opera House. Babcock and Wilcox boilers were some of those used. Part of the Vienna plant was delivered in the spring of 1886, and when more plant was required, Crompton went to Witcowitz in Moravia to give instructions for the boiler work.

The old Emperor Francis Joseph showed great interest in the electrical work when in progress, and very frequently came to watch the workmen, generally accompanied by his son, the Crown Prince. He paid Crompton the high compliment of saying that he wished his son Rudolph to be a good deal with them as a sort of pupil.

As soon as new scenic effects were made possible by electric lighting, Crompton had to spend a good deal of his time on the stage of the Grand Opera. This threw him into the society of Richter, who had already made his name as the great conductor of opera in London and was then endeavouring to reconcile old-time opera with the Wagnerism that was then just commencing. At that time there were two directors of the Grand Opera, Richter, who stood rather for the old school, and Jahn, who was all for Wagner and the Wagner school. They used to have great arguments and ask Crompton for his opinion on musical points. Crompton disclaimed all pretence of being an authority on music, although his mother had known Mendelssohn well at the time of his apogee and was acquainted with very many of the musical world at that time.

In 1896, Dr. John Hopkinson, who had succeeded Colonel Crompton as president of the Institution of Electrical Engineers, discussed the possibility of forming a corps of electrical engineers. This was accepted by the War Office, and Hopkinson took command with the rank of major in the Royal Engineers, Crompton being the senior captain. Four or five men well known in the electrical profession, including Hopkinson's eldest son Bertie, also joined the corps as officers. After training at Alum Bay in the Isle of Wight, Dr. Hopkinson left the corps to join his family in Switzerland. But a few weeks later the sad news arrived that he and two members of his family had been killed when climbing on the Alps, and so the whole work of training and organization of the corps fell on Crompton's shoulders.

Throughout the years which followed his return from the Boer War until 1914, Crompton never ceased from his efforts to persuade the War Office to interest itself in the introduction of mechanical transport, not only for war material, but also for the haulage into position of guns of greater power than had been hitherto used.

In an epilogue to his book of reminiscences Crompton says, quoting from an address he delivered to the borough authorities of Chelmsford in 1900, at the time when that town received its first cheap electrical supply :

"England in future, instead of being spoilt by densely populated industrial centres, might be covered with cottages extending for miles over the present almost uninhabited rural districts, so that the population would be more evenly spread over the kingdom. The factory hands, instead of having to work under the shafting in factories, should be able by the electrical transmission of power to carry on industrial pursuits in their own cottage homes. That is the future which lies before electrical engineers if they have the pluck and energy to force their views upon the public to a sufficient extent. The thing has been done in Switzerland, in Sweden and elsewhere on the Continent, and if I can live to see it accomplished in our own country, I shall be proud to have contributed in some degree to the solution of all the greatest problems of distribution."

ALEXANDER RUSSELL.

Prof. Ludwig Hopf

THE death of Prof. Ludwig Hopf occurred on December 21 at Dublin, only a few months after he had been appointed lecturer in applied mathematics at Trinity College, Dublin. Dr. Hopf went as a refugee to Cambridge in April 1939, after having lost his position as professor of applied mathematics at the Technische Hochschule, Aachen, on racial grounds soon after the Nazis came into power. He had been on the staff of the Hochschule since 1914 and had become one of its most popular teachers.

As one of the first pupils of Sommerfeld at Munich, Hopf graduated in 1909 with a thesis on the problem of turbulent flow in a river. He worked in particular on the influence of the roughness of the walls of a canal on the transition from laminary to turbulent flow. This work brought him into contact with the Mittlere Isar water regulation and drainage scheme, to which he was scientific adviser for several years. During the War of 1914–18, Hopf did valuable work on problems of stability of aeroplanes, and his collaboration with R. Fuchs led to their well-known monograph on aerodynamics. In the second edition (1934) the book was divided into three volumes, Hopf being responsible for the first, which dealt with general principles. This is still being used as the chief text-book for aeroplane designers in Germany.

In the early days of relativity and of quantum theory, Hopf collaborated with Einstein (1910–11). Several papers on radiation dating from that time, and a recent well-written popular account of matter and radiation (Springer, 1936) bear witness to his interest in this subject. More recently, Hopf studied the methods of solving linear differential equations in separate domains with the view of finding the relation between the corresponding solutions. A first paper appeared in 1935, and important applications to physical problems were to follow. The many friends of this genial and kind-hearted mathematician will deeply regret the loss they have suffered.

Prince Ginori-Conti

WHEN Prince Piero Ginori-Conti died on December 9, Italy lost one of her most energetic industrial personalities and international science a devoted supporter. His name will always be associated with the industrial utilization of the volcanic springs in the Lardarello district of Tuscany. Thanks to his 'drive' and business acumen, these waters were made to generate electric current for transmission to Florence and Pisa, and to yield boric acid, carbon dioxide, etc., for industrial use. In the chemical works connected with this great undertaking, he was much helped by Prof. R. Nasini, and on the engineering side his son, Dr. Giovanni, one of the three children by his first wife, was of great assistance. An article on the Lardarello development appeared in NATURE of January 14, 1928, p. 59.

Ginori-Conti was born in 1865 as a scion of two ancient Italian families, Ginori and Conti, and on the latter side he claimed relationship with the Scottish Mackenzies. His title of Prince of Trevignano was inherited; that of Senator was granted him later in life. His first wife was the daughter of the Count of Lardarel, the owner of the springs, and his second wife was a French lady. A charming personality, Prince Ginori-Conti came frequently to London where, as a member of the executive committee of the Union Internationale de la Chimie, and as an honorary member of the Society of Chemical Industry, his visits were much appreciated by numerous friends.

Prof. Alexandru Slatineanu

PROF. ALEXANDRU SLATINEANU, a leading Rumanian bacteriologist and hygienist, who died on November 27, 1939, was born at Bucharest on January 5, 1873. He studied medicine in Paris under Berger, Dejerine, Babinski and Metchnikoff, in whose laboratory at the Pasteur Institute he made the acquaintance of his compatriot Prof. Cantacuzène, with whom he was closely associated henceforth. He qualified in 1901 with a thesis on experimental *Bacillus pfeiffer septicœmia*, for which he received the university medal awarded for theses of outstanding merit.

From 1902 until 1912, when he was appointed professor of bacteriology at Jassy, Slatineanu acted as chief assistant to Cantacuzène at Bucharest in his work on experimental medicine and the reorganization of the Rumanian health services. At Jassy he founded an institute of hygiene of which he was made director, and also organized an isolation hospital for infectious diseases. In 1917 he took an active part in the campaign against typhus fever which was then very prevalent in Moldavia. In 1931 he was appointed general secretary of the Rumanian Ministry of Health under Prof. Cantacuzène, who was the minister of that office. He was the author of numerous articles on infectious diseases which were published in French in the *Comptes rendus de la Société de Biologie*, *Bulletin de la Société de Pathologie Exotique*, *Archives roumains de Pathologie*, or in Rumanian in the *Revista Stintelor Medicale*.

J. D. ROLLESTON.

Dr. E. M. Mikkola

DR. ERKKI MIKAEL MIKKOLA, geologist of the Geological Commission of Finland, was killed at Taipale on February 13. Mikkola, who was born in 1907, had become a leading authority in Pre-Cambrian geology, possessing an intuitive faculty of seeing through a geological formation, and picturing it correctly in space and time. His scientific studies led him from botany to geography, quaternary geology, tectonics and petrology. His three Lapland maps are given a foremost place among Pre-Cambrian sheets of the Finnish Geological Survey. Their description in English is a monograph of fundamental value.

When the Russian attack developed on November 30, Mikkola, as a lieutenant in the reserve, went to join his company, leaving the Geological Survey at Helsinki just one hour before it was destroyed during a bombing raid. Thereafter he spent all his time, two and a half months, in the front lines, taking a full share in the dangers of the heroic defence.

WE regret to announce the following deaths:

Prof. C. D. Marx, emeritus professor of civil engineering in Stanford University, on December 31, aged eighty-two years.

Mr. H. C. Newton, first chairman of Messrs. Newton and Wright, Ltd., London, manufacturers of X-ray equipment, on February 19, aged eighty years.

NEWS AND VIEWS

Lord Halifax and International Affairs

MANY speeches dealing with the present crisis have been made since the War began six months ago. That of Lord Halifax at Oxford on February 27 surpassed them all not only in the clarity with which the fundamental issues at stake were set forth, but also in the eloquent and moving enunciation of their relation to a philosophy of life which looks beyond the individual ideal to an aim worthy of the pursuit of mankind at large. Addressing his audience, as he said, with the dual personality of Chancellor of the University and H.M. Secretary of State for Foreign Affairs, Lord Halifax made no attempt to gloss over the facts, unpleasing as they may be, or to ignore the grave dangers for the future of civilization which they imply. The one fact by which above all he is appalled is that this "waste land" we live in, as the present state of European civilization has been called, has been brought about not by the mistakes, the pride, and the selfishness of an older generation, but by that of youth, deprived of the elements of true judgment, which has been the driving force behind the Nazi movement. But, if on one side force is an instrument of aggression, on the other, youth will fight to break down the barrier which must be broken down, if the youth of Europe is to avoid living always in this "waste land".

The antagonisms which have brought about the present conflict in Europe are by now familiar in terms to all; but as formulated by Lord Halifax before an audience composed largely of those whose task will be to ensure that right prevails, they are seen to penetrate to the very fundamentals of human associations. On one side is an all-embracing and overpowering system—a system based on the conception of the so-called economic man—and over against it the ideal which has made as its end the perfection of the individual "in the conviction that here, too, lay the secret of life for all society". It must be remembered that "the substance of any conventional code . . . must derive from the depreciation by society of the principles of its own survival" and, he went on to say, "If we are to recapture the secret of order for international society . . . we must as individuals strive to erect or maintain standards that will bring true freedom through the way of discipline". If any good thing can come out of so great an evil, it is that the outbreak of War has constrained the British peoples to reason with themselves upon the nature and aims of the societies in which they live. If there still be those in whose minds there lingers a doubt, they cannot fail now to see the issues clearly in the light of what Lord Halifax has said.

Universities in War-time

DR. RAYMOND PRIESTLEY, vice-chancellor of the University of Birmingham, devoted his address at the annual meeting of the Court of Governors of the University to a discussion of war conditions. He said that the university, until now, has fared very well. Numbers are almost up to normal and on the science and applied science side the great majority of students will remain until they have graduated. "Reservation is not intended to prevent, and will not prevent, university-trained youth from playing its part in the country's war effort. Their advent is merely deferred until they are fully prepared to pull their weight." In this way fully trained men will become available at the end of each academic year, and there will be a proportion able to play their part in the reconstruction that must follow the end of the War if European civilization is to make up leeway and resume its advance. Dr. Priestley went on to say that he believed it is not necessarily bad for young university men to pass through the Army, the Navy, or the Air Force on the way to their normal work in the world. He quoted his own experience of the War of 1914–18: "I came out of it a better man—more humane and better able to deal with situations and with men". When the War ends, the universities and university men will have a more important part to play even than in war-time, and it would be fatal if a false impression got abroad that university personnel claims to be set apart from the generality of citizens.

The recognition by the Government that the work of the universities of Great Britain is part of the national cause in the War has provoked criticism. Dr. Priestley believes this to be unfair. Indeed, he thinks that there can never have been an occasion when, in similar circumstances of national strain, a Government has been more far-sighted in this particular respect. In the War of 1914–18, education almost closed down. By the decision to refrain from enlisting the youth of the nation before the age of twenty, the Government has given technical and university education a chance to continue their task. For this purpose the universities require adequate finance. "They provide the technical experts on whom the servicing of the post-War world will depend. They provide the teachers who must tune to concert pitch the bodies and minds of succeeding generations. They ought to produce a large proportion of the enlightened leaders for the new era. Certainly if they do not, leadership, though it may be powerful, will not be enlightened." He also referred to the universities as "the chief repositories, exponents, and defenders of that freedom of thought that has been quenched in the totalitarian State".

Evacuation of Schoolchildren

THE Government Evacuation Scheme is reviewed in a Circular (No. 1965) to county councils and local authorities and an accompanying memorandum (Memo. Ev. 8. (London: H.M. Stationery Office. 4*d*. net)), which explain in detail the scheme recently announced by the President of the Board of Education. More than 400,000 evacuated schoolchildren remain in the reception areas, and the Government is of the opinion that dispersal of children from the evacuating areas is as desirable now as it was at the outbreak of the War. The first objective of policy is therefore to ensure that there is no further drift back of those children to the evacuation areas. To secure an equitable distribution of the burden of private billeting, householders in reception areas are to be invited to place their names on a roll, one of the primary objects of which will be to secure a list of persons willing to share with their neighbours in the care of children who have been billeted since the outbreak of war. Local authorities also have compulsory powers if the voluntary response is insufficient. At the same time, the billeting allowance has been increased to 10*s*. 6*d*. a week for all schoolchildren of fourteen years and over as from March 2.

The further plans to be made for evacuation are for schoolchildren only, and will only be operated if air raids develop on a scale involving serious and continuing perils to civilian population. Evacuation will remain on a voluntary basis, but parents registering their children will be asked to sign undertakings that they will send them with the school party if evacuation is ordered and that they intend to leave them in the reception area until the party returns. The areas to be evacuated will be the same as those evacuated in September 1939, but the decision to evacuate any area will be taken in the light of prevailing conditions. Not less than 36 hours notice will be given to any particular area, and specified parties will be taken as far as possible to specified destinations. Children found to be suffering from infection or disease or serious uncleanliness are not to be billeted on householders in that condition. While the fullest possible use is to be made of the camps provided by the Government, the contribution from this source is limited. To supplement this, each receiving authority is being asked to provide hostels available for about 5 per cent of the children to be received, utilizing for this purpose a certain number of empty houses.

Institute of Chemistry

IN submitting the annual report of the Council at the sixty-second annual general meeting of the Institute of Chemistry, Sir Robert Pickard, senior vice-president, who presided, owing to the death of the president, Mr. W. A. S. Calder, early in January, said that the Institute, as the professional organization of chemists, has assisted the Government in supplying its needs in technical personnel for industries essential in war-time. The roll of the Institute continues to increase and now numbers more than 7,550, more than five times as many members as were registered in 1914. Those who could remember the position forty years ago, and recall the difficulty at that time of making any headway in the profession of chemistry, have watched the astonishing increase in the number of chemists, their growing influence, the increasing applications of science and the steady absorption of chemical talent in industry and commerce, in Government and municipal service, and in the affairs of everyday life. The profession of chemistry now stands high in the public esteem as a very essential service.

The report of the honorary treasurer of the Institute shows that the Institute is financially in a sound condition. Referring to the burden of publication expenses, he expressed the hope that the fund which had been raised by the Chemical Council, from industry as well as from chemists themselves, will help to put the affairs of the publishing societies—the Chemical Society and the Society of Chemical Industry—on a sounder financial basis. The officers and council for the ensuing session were elected, the new president being Dr. J. J. Fox, Government Chemist.

Relics of Ancient Egyptian Royalty

THE black granite sarcophagus of Pharaoh Psusennes, discovered at San el Hagar, the ancient Tanis, by Prof. Montet of the University of Strasbourg (see NATURE, February 24, p. 300), was opened in the presence of King Farouk on February 28. Inside, it is reported (*The Times*, February 29), was a silver sarcophagus, about 7 ft. long, in the likeness of King Psusennes. On the head were the royal insignia, and in the hands, which were folded across the chest, were a sceptre and a flail. The state of preservation and the exquisite carving are said to combine in making this one of the most beautiful objects discovered in recent years. The silver sarcophagus was in two pieces. Inside it was another sarcophagus, of which the top was a silver-gilt body-covering and a gold mask, also a likeness of the king. On the chest are long inscriptions, apparently religious texts. The lower half of the coffin had been of some metal, which had completely disappeared owing to the damp that had seeped in between cracks. In consequence, the mummy also had disappeared, only a mass of mud being left, in which were a few bones.

On the removal of the sarcophagi, a mass of fine jewellery was found in the granite case. Twenty-one gold bracelets, ten from the right arm and eleven from the left arm of Psusennes, all bear inscriptions which trace the king's genealogical tree and give details which will be of importance for the history of a period obscure in its dynastic relationships. Inscriptions giving the names of the king's mother and uncles, pointing to a possible connexion with Thebes, have already been deciphered. Many gold necklaces, some adorned with rubies and scarabs, were found, as well as finger and toe cases of gold. Photographs of the site, sarcophagi, and some of the finds appeared in *The Times* of February 29.

University of Birmingham

AT the annual meeting of the Court of Governors, the Pro-Chancellor, Mr. E. P. Beale, welcomed, with relief, the announcement that the Treasury grant to the universities is not to be reduced. He also announced with gratification that contributions from the Birmingham City Council and the surrounding local authorities showed a substantial increase, due mainly to the grant of an additional £750 from the Warwickshire County Council. He regretted that it had been necessary, owing to lack of financial support, to close the Department of Industrial Hygiene and Medicine; he hoped the setback would be only temporary. He also referred to the endowment of a chair of theology by Dr. Edward Cadbury. The endowment fund (£32,000) is the largest individual benefaction received by the University in 1939.

The Nuffield Physics Laboratory is now occupied. The magnet of the large cyclotron has been erected free of charge by Messrs. Horsley Bridge and Thomas Piggott, Ltd., of Tipton, the steel for its construction having been supplied on most generous terms by Messrs. Colvilles, Ltd., of Glasgow. Prof. S. Zuckerman, who was appointed to the chair of anatomy to succeed Prof. R. D. Lockhart, is engaged on work of national importance and it has been agreed that, in consequence, he shall postpone taking up duty at Birmingham. Dr. C. F. V. Smout is continuing to act as temporary head of the department.

Higher Education in Palestine

THE Friends of the Hebrew University of Jerusalem have just published their annual report, 1938–39 (199 Piccadilly, London). This University is an important centre of culture in a distracted country and continues, we are glad to see, constructive effort, though faced with financial uncertainty. A new Medical Centre was opened last year, including a fine hospital with three hundred beds and first-rate equipment. For the present it will be mainly devoted to medical research and post-graduate courses. Progress has been made with agriculture and education, for which eight diplomas were awarded last year. The University is enterprising enough to broadcast popular talks on its work, and its friends are busy in Great Britain seeking to make up for losses due to the War. It is hoped that some special donations may help a large number of students who, coming from countries under German domination, can no longer receive the money on which they formerly relied. It is estimated that £6,000 will be needed for urgent cases.

The Hebrew Technical Institute, Haifa, has altogether more than seven hundred students and a staff augmented by some distinguished refugees. A Nautical School was started in 1938 and has its own training ship. The Daniel Sieff Research Institute has been experimenting, for the benefit of the orange industry, on peels and other waste products. Difficulties of transport will keep much of the present crop at home. Johnson used orange peel for indigestion, but it is scarcely likely to survive to-day as a remedy.

The Blind Spot

HELMHOLTZ, in his "Handbuch der physiologischen Optik" (1867), stated that the demonstration of the blind spot of the eye, the discovery of which was communicated by the Abbé Edme Mariotte to the Royal Academy of Sciences in France in the winter of 1667–68, was given before the King of England in 1668. Dr. J. Bröns, of Copenhagen, in a monograph on "The Blind Spot of Mariotte" (London: H. K. Lewis and Co., Ltd., 1939. 12*s*. net), proves that this statement is erroneous, and brings forward strong evidence of the manner in which it arose. In 1776, Georg Simon Klügel, professor of mathematics in the University of Helmstädt, published a translation of Joseph Priestley's "The History and present state of Discoveries relating to Vision, Light and Colours" (London, 1772). On p. 144 of the translation there is a footnote as follows: "(a) Smith's Opticks, Remarks, p. 6 (d. d. Ausg. S. 367). Oeuvres de Mariotte, p. 496. (Der Versuch ist 1668 vor dem Könige von England gemacht. Birch, T. 2, p. 281. Haller's Phys., T. 5, p. 470, K.)" The reference to Birch shows that the communication to the Royal Society was made by Oldenburg, and not by Mariotte, and there is good evidence that the king was not present at that, or indeed any other, meeting. The reference to Albrecht von Haller, also a footnote, is in his "Elementa physiolgiæ corporis humani" (Lausanæ, 1763), also contained in his "Anfangsgründe der Physiologie", S, p. 470, Berlin-Leipzig, 1772. This reads as follows: "Factum ann. 1668 coram S. Reg. Maj. T. Birch, T.II, p. 281. Exstat oper. Mariot, p. 496, Ed. Holl.". Dr. Bröns thinks that Klügel expanded the footnote to "Factum anno 1668 coram *Sua* Regia Majestate", adding his translation "Der Versuch ist 1668 vor dem Könige von England gemacht", whereas it should read "Factum anno 1668 coram *Societate* Regiæ Majestatis"—"the experiment was shown before the Royal Society".

Progress at the British Museum

IT is strange to read in the recently published annual report of the British Museum of events like the special Thomas Cromwell exhibition and, in the Natural History Museum, the retirement of Dr. Tate Regan and succession of Dr. C. Foster-Cooper, which seem to be matters of ancient history, but perhaps that is inevitable when H.M. Stationery Office issues the Museum's Annual Report for 1938 at the end of 1939. The interest of the public in museums has been undoubtedly on the up-grade in recent years, and this is reflected in an increased attendance (7,720) at the Natural History Museum. It is more difficult to account for the serious fall of more than 80,000 in the number of visitors at the British Museum, where the total, still exceeding one million, was the lowest since 1926. Perhaps the decrease was a reflection of the international disturbances in the autumn of 1938, for the work involved in air raid precautions, in training the staff in anti-gas measures, and planning for the safety of the invaluable contents of these institutions obviously interfered with normal working in the departments. Yet in these museums

good progress was made, both in the development of the exhibited collections and in the less spectacular research conducted in the laboratories. That this work should now have been brought almost to a stop is regrettable, if inevitable. The announcement recently made that certain galleries are to be reopened to the public, and that special exhibits of current interest are being arranged, will be widely welcomed.

Biology in Schools

THE latest report of the Joint Committee of the Four Secondary Associations shows useful and, indeed, necessary work for education in the way of criticism, protest and suggestion. Complacency about the success of evacuation is now being reduced. Authorities who commandeer schools for officials and leave school buildings in a defective state have much to answer for. Such unwise economy is strange, after reckless expenditure elsewhere. A subsidiary subject syllabus is printed which a sub-committee of biologists has suggested for a London Higher School Certificate, since separate syllabuses for botany and zoology are regarded as unsatisfactory. This scheme for biology includes six important subjects, from histology to heredity and ecology, though the last-named is reduced to the study of fauna and flora in a restricted area. A practical examination and a written paper, each for three hours, are proposed, but the former, if ill-done, will not mean failure in the subject as a whole. The wide ground is well covered but, as the average teaching time for the whole of the syllabus, including practical work, is three hours a week, is there not too much to get through? Ambitious programmes tend to produce shallow knowledge which is soon lost.

Cave Man in Colorado

EXCAVATION of a cave near Durango, Colorado, it is anticipated, may afford evidence for an approximate early dating of basket-maker culture in the southwestern States. The investigation was carried out on behalf of the Carnegie Institution of Washington by Earl H. Morris. Evidence of occupation, according to a report circulated by Science Service of Washington, D.C., was found below three feet of accumulated debris. There were indications that the inhabitants had lived in one-room structures, with mud-coated floors and fire-pits, though how these constructions were built was not detected. Corn and pumpkins were grown, but the principal mode of subsistence apparently was by hunting.

The most significant find, however, consisted of charcoal, from which tree-ring sequences have been constructed each covering a period of at least one hundred years. These are not only independent of one another, but also of any known Indian tree-ring datings. As these last have now been carried back to about A.D. 150, unless, as Dr. A. V. Kidder has suggested, conditions in this area were entirely different from the normal for northern Colorado, this constitutes valid evidence for Basket-maker occupation of the cave at not less than approximately two thousand years ago.

A Preparation for the Control of Bleeding

A FAT-SOLUBLE vitamin, known as vitamin K, is indirectly concerned with blood coagulation, will reduce the clotting time of blood in cases of prothrombin deficiency, and will check certain forms of hæmorrhage, such as occur in obstructive jaundice and occasionally in new-born babies. Vitamin K is found naturally in alfalfa and hog's liver fat, it has been isolated and its chemical composition determined. Several related but simpler compounds are known possessing a physiological action similar to the natural vitamin K, and one of these—a methylnaphthaquinone—has been introduced for use in medicine by Glaxo Laboratories, Ltd., Greenford, Middlesex, under the name "Kapilon". Kapilon has been found to be a valuable agent for reducing bleeding in obstructive jaundice and in neo-natal hæmorrhage.

Institution of Electrical Engineers: Scholarships

THE following scholarships are open for award by the Institution of Electrical Engineers during 1940: *Duddell Scholarship* (value £150 per annum, tenable for three years), open to British subjects less than nineteen years of age on July 1, for a whole-time day course in electrical engineering; *Ferranti Scholarship* (value £250 per annum, tenable for two years), open to British subjects less than twenty-six years of age on July 1, who are students or graduates of the Institution, for whole-time research or post-graduate work of an electrical engineering nature; *Swan Memorial Scholarship* (value £120, for one year), open to British subjects less than twenty-seven years of age on July 1, for whole-time research or post-graduate work of an electrical engineering nature; *Silvanus Thompson Scholarship* (value £100 per annum and tuition fees, tenable for two years), for works' employees who are the sons of parents of limited means, open to British subjects less than twenty-two years of age on July 1, for a whole-time day course in electrical engineering at an approved university or technical college; *William Beedie Esson Scholarship* (value £120 per annum, tenable for two years, renewable in approved cases for a third year), for works' employees who are the sons of parents of limited means, open to British subjects less than twenty-two years of age on July 1, for a whole-time day course in electrical engineering at an approved university or technical college. Further information can be obtained from the Secretary, Institution of Electrical Engineers, Savoy Place, London, W.C.2.

Royal Society of Edinburgh: New Fellows

THE following have been elected fellows of the Royal Society of Edinburgh: Mr. E. B. Ball, president of the Institution of Mechanical Engineers; Mr. J. Bowman, City water engineer, Edinburgh; Mr. B. S. Bramwell, advocate, London; Mr. J. Brough, lecturer in vertebrate zoology, University of Edinburgh; Dr. A. F. Buchan, teacher of mathematics, James Gillespie's School, Edinburgh; Mr. J. M. Caie, deputy secretary, Department of Agriculture for

Scotland; Mr. J. Cameron, formerly head of the Pharmaceutical Department, Peiping Union Medical College; Prof. J. W. Cook, Department of Chemistry, University of Glasgow; Dr. J. Coutts, lecturer in pharmaceutics and demonstrator in practical pharmacy, St. Bartholomew's Hospital Medical College, London; Mr. Satchidinanda Datta, veterinary research officer, Imperial Veterinary Research Institute, Calcutta; Dr. T. Elder Dickson, art master, George Watson's Ladies College, Edinburgh; Dr. A. T. J. Dollar, assistant in the Department of Geology, University of Glasgow; Dr. H. I. Drever, assistant in the Department of Geology, University of St. Andrews; Mr. W. McC. Harrowes, medical director, New Saughton Hall Private Mental Hospital, Polton, Midlothian; Mr. T. Hart, collector of the Trades House of Glasgow; Prof. C. F. W. Illingworth, Department of Surgery, University of Glasgow; Mr. J. G. Kyd, registrar-general for Scotland; Mr. P. R. Laird, secretary to Department of Agriculture for Scotland; Dr. Robert McAdam, lecturer in mining and surveying, Heriot-Watt College, Edinburgh; Dr. J. A. Macdonald, lecturer in botany, University of St. Andrews; Dr. A. E. W. McLachlan, clinical medical officer, Newcastle General Hospital, Newcastle-upon-Tyne; Dr. A. MacNiven, physician superintendent, Royal Mental Hospital, Glasgow; Prof. G. F. Marrian, Department of Chemistry in relation to Medicine, University of Edinburgh; Dr. E. R. A. Merewether, H.M. medical inspector of factories, Birmingham; Mr. R. M. Neill, senior lecturer in zoology, University of Aberdeen; Dr. H. B. Nisbet, lecturer in chemistry, Heriot-Watt College, Edinburgh; Mr. J. S. C. Reid, solicitor-general for Scotland; Mr. H. Riley, founder and headmaster of Strathallan School, Forgandenny, Perthshire; Mr. J. Thomson, distiller, London; Dr. H. M. Traquair, president of the Royal College of Surgeons of Edinburgh, lecturer on diseases of the eye, University of Edinburgh.

Announcements

THE council of the Royal Society of Edinburgh has awarded the Keith Prize for the period 1937–39 to Prof. F. A. E. Crew, for his papers and joint papers in the *Proceedings* of the Society within the period of the award, and in recognition of his valuable contributions to animal genetics; and the Neill Prize to Mr. James Wright, for his important paper on "The Scottish Carboniferous Crinoidea", published in the *Transactions* of the Society within the period of the award.

THE Senatus of the University of Edinburgh has awarded the Cameron Prize to Prof. E. C. Dodds, Courtauld professor of biochemistry in the University of London, for his work on synthetic œstrogens.

THE Masters Memorial Lectures of the Royal Horticultural Society will be delivered in the lecture room of the Society's New Hall in Greycoat Street, Westminster, on April 2 and 16, at 3 p.m., by Prof. F. E. Weiss, on "Graft Hybrids and Chimaeras".

PROF. MAX BORN, Tait professor of natural philosophy in the University of Edinburgh, will give the distinguished visitor's address before the Royal College of Science Mathematical and Physical Society at the College on March 11 at 5.15. Prof. Born's address will be entitled "On Melting".

MR. T. T. PATERSON, curator of the University Museum of Archæology and Ethnology, Cambridge, will deliver the Swiney lectures on geology in the rooms of the Linnean Society on Fridays and Mondays, at 3 p.m., from March 29 until May 10 (April 19 excepted). The subject of the lectures, to which admission is free, will be "Geology and Early Man".

THE Committee on the Chemistry of Proteins of the Division of Chemistry and Chemical Technology of the National Research Council has been granted 3,600 dollars by Mr. Eli Lilly of Indianapolis, for the establishment of a National Research Council fellowship in protein chemistry. The fellowship has been awarded to Dr. I. Fankuchen, who will carry on X-ray research on proteins in the laboratory of Prof. B. E. Warren at the Massachusetts Institute of Technology.

THE twelfth International Congress of Psychology, which was planned to take place at Edinburgh in July 1940, has been postponed, though not abandoned. The invitation of the City and University of Edinburgh is not withdrawn, and the Local Organization Committee hopes that the Congress may still meet in Edinburgh when circumstances permit the continuation and completion of the preparations.

THE annual meeting of the Swiss Society of Internal Medicine will be held in Bern during May 18-19, when the following subjects will be discussed: the chemistry of vitamins and some enzymes, introduced by Prof. P. Karrer of Zurich; the hypovitaminoses in medical practice, introduced by Prof. Bickel of Geneva. Further information can be obtained from the president, Dr. Otto Roth, Kantonspital, Winterthur.

AN Argentine Society of Social Medicine has recently been founded at Buenos Aires.

A MONUMENT has been erected at Chateauroux, France, of Stanislas Limousine, the chemist, who invented wafers for unpleasant drugs and pipettes for counting drops, introduced coloured bottles for poisons, organized the first public laboratory, and first injected quinine hypodermically.

ACCORDING to an investigation carried out in Calcutta, more than 96 per cent of 887 maternal deaths were due to an avoidable factor. Puerperal sepsis accounted for 32 per cent, eclampsia for 18 per cent, hæmorrhage for 11 per cent, anæmia for 24 per cent, and septic abortion for 5 per cent. The chief cause of death from diseases associated with child-bearing was pulmonary tuberculosis, which accounted for 40 per cent.

LETTERS TO THE EDITORS

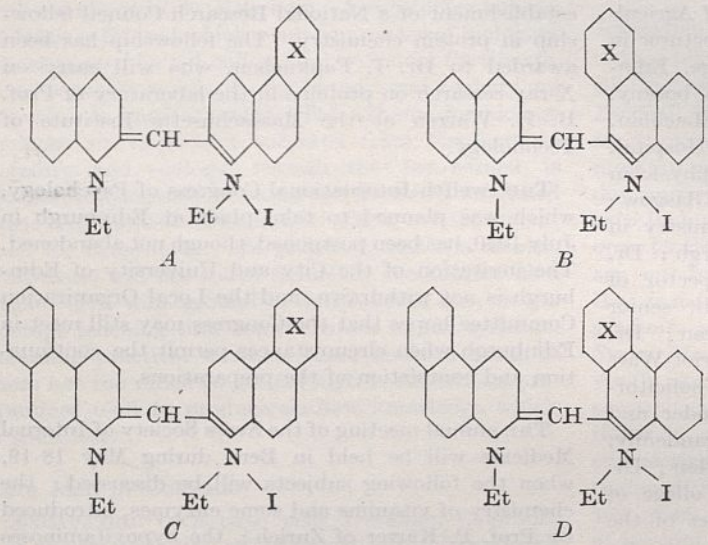
The Editors do not hold themselves responsible for opinions expressed by their correspondents. They cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

IN THE PRESENT CIRCUMSTANCES, PROOFS OF "LETTERS" WILL NOT BE SUBMITTED TO CORRESPONDENTS OUTSIDE GREAT BRITAIN.

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 391. CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Steric Influence in Optically Sensitizing Dyes

IN a paper by L. G. S. Brooker and C. H. Keyes[1], the preparation is described of certain isomeric cyanine dyes having the following formulæ :



A *B*

C *D*

Brooker and Keyes noted that dyes *A* and *C* were strong sensitizers, while *B* and *D* did not sensitize. These substances were investigated later by J. A. Leermakers, B. H. Carroll and C. J. Staud[2], who confirmed the sensitizing results. But in addition they observed strong adsorption to gelatino-silver bromide grams of *all* the isomers, and "pronounced absorption maxima (by reflection)".

In recent work on these compounds we have observed, first, that the *rate* of adsorption to silver bromide from aqueous gelatin solution of dyes *B* and *D* is very much lower than for dyes *A* and *C*, although much the same adsorption densities (in molecules per unit area) were ultimately obtained. While this might account to some extent for lack of sensitizing (because of insufficient time of treatment), it does not appear an entirely sufficient explanation. A further complication was encountered in the form of a strong tendency of isomers *B* and *D* to bleach or fade, even in alcoholic solutions, probably by autoxidation.

On constructing the formulæ for these isomers, using correct bond angles and interatomic distances, it can be seen that complete coplanarity of the molecule is not possible in case *B* without bringing the 3,4-benzo-radicle within a distance of *ca.* 1·7 A. of the opposite quinoline group, and in case *D*, of the opposite β-naphtho-quinoline. This condition is not improved by 180° rotation of a nuclear group about a $=CH-CH<$ linkage to an alternate coplanar stereoisomer. The same condition obtains for 1, 1′-diethyl-3′, 4′-dibenzo-2, 2′-carbocyanineiodide (having three methines between two phenanthridine nuclei), which was found also not to sensitize, but does not for 1,1′-diethyl-5,6,5′,6′-dibenzo-2,2′-carbocyanine iodide (having three methines between two β-naphtho-quinoline nuclei), which sensitizes strongly, and also not for 1,1′-diethyl-3,4,5′,6′-dibenzo-2,2′-carbocyanine iodide (having three methine groups between one β-naphtho-quinoline and one phenanthridine nucleus), and which definitely sensitizes.

On examining the absorption spectra (in alcoholic solution) of the non-coplanar isomers, it was observed that the half-width of the absorption band of maximum wave-length was much greater for the non-coplanar isomers than for their isomers, and the molecular extinction coefficients at $\lambda_{max.}$ were much less. There is also evidence that the yields are considerably lower than in synthesis of similar dyes which can readily assume a coplanar form of the fully extended (*trans-trans*) molecule.

It was suggested by Leermakers, Carroll and Staud[2] that "the phenyl group (*X*) in dyes *B* and *D* interferes with the proper exchange of energy between dye and silver halide, because of some steric effect in the molecule". The steric effect we believe to be the inhibition of coplanarity (cf. for analogous cases C. J. B. Clewes and K. Lonsdale[3], also J. M. Robertson[4]) of the dye molecule, and consequent interference with its resonance. In a fuller account the relation of coplanarity to adsorption (cf. Sheppard, Lambert and Walker)[5] will be discussed, as well as the temperature influence. The steric factor here indicated is of far-reaching importance in regard to the effects of substituents in the polymethine dyes.

S. E. SHEPPARD.
R. H. LAMBERT.
R. D. WALKER.

Research Laboratories,
Eastman Kodak Company,
Rochester, N.Y.
Feb. 2.

[1] *J. Amer. Chem. Soc.*, **58**, 659 (1936).
[2] *J. Chem. Phys.*, **5**, 878 (1937).
[3] *Proc. Roy. Soc.*, A, **161**, 493 (1937).
[4] *J. Chem. Soc.*, 232 (February 1939).
[5] *J. Chem. Phys.*, **7**, 256 (1939).

Gattermann Synthesis of Aldehydes

THE observation was made recently that hydrogen cyanide promotes the growth of certain fungi[1], which indicates the increased activity of the enzymes present in such circumstances. Earlier findings, on the other hand, had had some bearing on the mechanism of the mixed Cannizzaro reaction[2]. Investigations are now being carried out in this laboratory, in an attempt to contribute toward the elucidation of the mechanism of the Gattermann synthesis of aldehydes[3].

These experiments involve an adaptation of the original technique, using aluminium chloride, sodium cyanide (both chemically pure and "Aero Brand"), a solvent belonging to one of several series of hydrocarbons, and dry hydrogen chloride. They have already proved the practicability of this method[4]. The yields thus far obtained are evidenced by some data presented in the table below.

At the same time, the use of solvents belonging to homologous series has already outlined the basis of a rule relating the position of a given solvent in such a series to the yields obtained. The table, illustrating the results of an average series of trials, will serve to exemplify the latter point :

Formula of solvent	Name	C-atoms in side chain	Average yield %
PhH	Benzene	0	11
$PhCH_3$	Toluene	1	20
$PhCH_2CH_3$	Ethylbenzene	2	38
$PhCH(CH_3)_2$	Cumene	3	24
$PhCH(CH_3)(C_2H_5)$	sec.-Butylbenzene	4	3·5
$PhC(CH_3)_2(C_2H_5)$	tert.-Amylbenzene	5	7·5

Further investigations are in progress along several lines (including the influence of directive substituents), with a view toward clarifying some of the less evident features of the Gattermann synthesis.

A. G. MISTRETTA.
F. F. NORD.

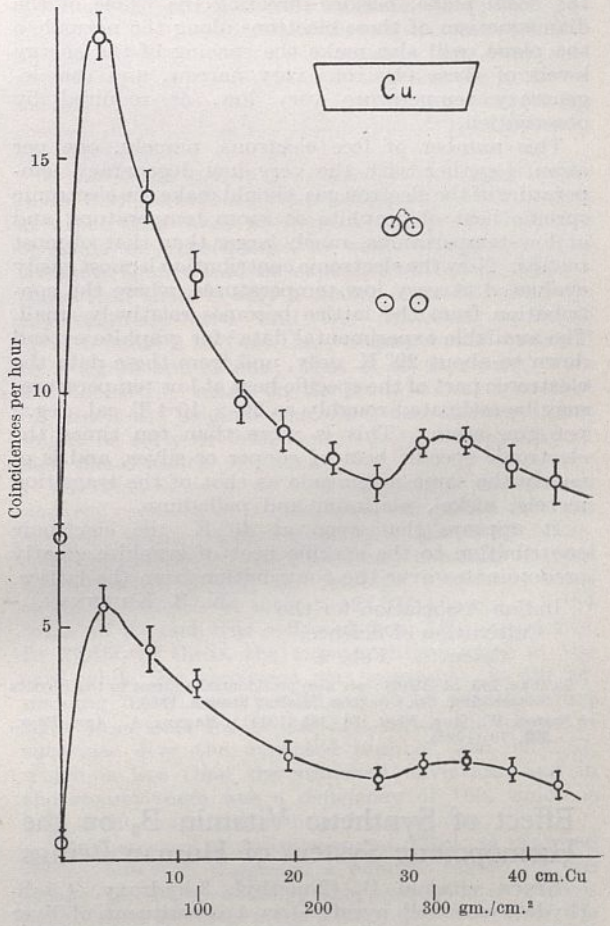
Department of Organic Chemistry,
Fordham University,
New York.
Dec. 26.

[1] Dammann, E., Rotini, O. T., and Nord, F. F., *Biochem. Z.*, **297** 192 (1938). *Ergebn. Enzymforschg.*, **8**, 179 (1939).
[2] Nord, F. F., *Beiträge z. Physiol.*, **2**, 301 (1924); *Chem. Rev.*, **3**, 65 (1926).
[3] Gattermann, L., *Ber. deut. chem. Ges.*, **31**, 1149 (1898).
[4] cf., however, Montgomery, E., and Adams, R., *J. Amer. Chem. Soc.*, **46**, 1518 (1924).

The Second Maximum in the Rossi Transition Curve for Copper

K. SCHMEISER and W. Bothe found a pronounced second maximum in the transition curve for cosmic ray secondaries from large thicknesses of lead. This maximum became the more pronounced the smaller the angle subtended by the counters at the absorber. W. Morgan and K. Nielson, on the other hand, found no indications of a second maximum for a counter arrangement similar to that employed by Schmeiser and Bothe, with the exception that the two upper counters were not joined together, while a rather similar curve to that of Schmeiser and Bothe was obtained when the upper counters were linked together. In this case the background rate was very much increased. This appears to show that the relatively high count under large thicknesses is connected with a high background rate.

In view of the fact that these two experiments are not in harmony, it was considered worth while to investigate the small-angle showers under large thicknesses of material, both when the upper counters are joined and when they count separately. The absorber used was copper, the angle subtended by the counter system at the absorber 6°. The curves obtained in the two cases are shown in the accompanying graph. When the upper counters were connected the background rate was certainly increased very much, but the characteristics of the curves remained essentially the same at large thicknesses. Both show a marked second maximum.



In the case where the upper counters work separately, and fourfold coincidences are counted, the number of counts without copper is very small, that is, the background rate is very small. Threefold coincidences, with the upper counters joined, show, on the other hand, a large background rate. The conclusion is that it is not the background rate which is responsible for the relatively high count at large thicknesses, but the secondaries from the material placed above the counters.

P. J. G. DE VOS.

Department of Physics,
University of Stellenbosch.
Jan. 6.

Electronic Specific Heat of Graphite

IN a previous communication[1] it was shown that the observed large diamagnetism of graphite along its hexagonal axis is that of its 'free' electrons, and is of the Landau type. At high temperatures it conforms to the Curie law $K = -n\mu^2/(3\ kT)$, and at low temperatures it tends to the temperature-independent value $K = -n\mu^2/(2\ kT_0)$, where n, the number of free electrons, is found to be just one per carbon atom, and T_0, the degeneracy temperature, is found to be about 520° K.; μ is the Bohr magneton.

These results fit well with the known electronic structure of graphite. From structural considerations we should expect one electron per carbon atom to be free, and its freedom of movement to be confined to the basal plane. This restriction of the freedom to the basal plane, besides directing the whole of the diamagnetism of these electrons along the normal to the plane, will also make the spacing of the energy levels of these electrons very narrow, and the degeneracy temperature very low, as required by observation.

This number of free electrons, namely, one per atom, together with the very low degeneracy temperature of the electron gas, should make the electronic specific heat of graphite at room temperature, and at low temperatures, much larger than that of most metals. Now the electronic contribution is most easily evaluated at very low temperatures, where the contribution from the lattice becomes relatively small. The available experimental data[2] for graphite extend down to about 29° K. only, and from these data the electronic part of the specific heat at low temperatures may be estimated roughly as 20×10^{-4} T. cal. deg.$^{-1}$ per gm. atom. This is more than ten times the electronic specific heat of copper or silver, and is of nearly the same magnitude as that of the transition metals, nickel, platinum and palladium.

It appears that even at 40° K. the electronic contribution to the specific heat of graphite greatly predominates over the contribution from the lattice.

K. S. KRISHNAN.

Indian Association for the Cultivation of Science, Calcutta. Feb. 9.

[1] NATURE, **145**, 31 (1940); see also presidential address to the Physics Section, Ind. Sci. Congress, Madras Session, 1940.

[2] Nernst, W., *Ann. Phys.*, **36**, 395 (1911); Magnus, A., *Ann. Phys.*, **303**, 70 (1923).

Effect of Synthetic Vitamin B_6 on the Hæmopoietic System of Human Beings

SINCE vitamin B_6 (2-methyl, 3-hydroxy, 4,5-di-[hydroxymethyl] pyridine) is a constituent of liver and yeast, both of which relieve some of the symptoms of pellagra and pernicious anæmia in relapse, it was decided to give large amounts of this synthetic vitamin to pellagrins with macrocytic anæmia and to patients with classical pernicious anæmia. The observations of Fouts, Helmer, Lepkovsky and Jukes[1] show that dogs with a deficiency of vitamin B_6 in the diet develop a hypochromic anæmia which is not relieved by iron. These results have been confirmed and extended by McKibbon, Madden, Black and Elvehjem[2] in puppies. We have searched in vain to date for patients with hypochromic anæmia which did not respond to large amounts of iron. The vitamin B_6 used throughout this study was furnished by Merck and Company, Rahway, New Jersey.

The present report is concerned with the effect of the intravenous administration of from 50 to 100 milligrams of crystalline vitamin B_6 in sterile physiological solution of sodium chloride, each day for a period of ten days, to three pellagrins with macrocytic anæmia and to two patients with pernicious anæmia. Within forty-eight hours, the patients with pellagra and pernicious anæmia experienced considerable increase in sense of well-being and strength. On the fifth, sixth, seventh and eighth days of the study, in every instance, a slight but definite reticulocytosis appeared. The reticulocytes did not rise above five per cent, but the white cell count, which was extremely low in the two patients with pernicious anæmia, increased strikingly during the period of reticulocytosis. This increase was principally in the polymorphonuclear leucocyte series. One hundred milligrams of vitamin B_6, incubated with 100 c.c. of normal fasting human gastric juice, was given orally to one of the patients with pernicious anæmia after reticulocytes and white blood cells had reverted to the original low level, with a response identical to that observed following the administration of vitamin B_6, intravenously.

These findings suggest that vitamin B_6, when administered in large amounts, has a definite effect upon the hæmopoietic system of human beings who have macrocytic anæmia of pellagra or pernicious anæmia in relapse. This substance does not, however, in our opinion, act specifically either as the true anti-pernicious anæmia factor or as the extrinsic factor of Castle.

This study, an account of which was read before the Academy of Medicine of Cleveland, December 15, 1939, was aided by grants from the John and Mary R. Markle Foundation and Anheuser-Busch, Inc.

R. W. VILTER.
H. S. SCHIRO.
T. D. SPIES.

Department of Internal Medicine,
University of Cincinnati
College of Medicine,
and the
Cincinnati General Hospital.

[1] Fouts, P. J., Helmer, O. M., Lepkovsky, S., and Jukes, T. H., "Production of Microcytic Hypochromic Anemia in Puppies on Synthetic Diet Deficient in Rat Antidermatitis Factor (Vitamin B_6)", *J. Nutrition*, **16**, 197 (Aug. 10, 1938).

[2] McKibbon, J. M., Madden, R. J., Black, S., and Elvehjem, C. A., "The Importance of Vitamin B_6 and Factor W in the Nutrition of Dogs", *Amer. J. Physiol.*, **123**, 102 (1939).

Effect of Stilbœstrol on the Ovaries of Hypophysectomized Rats

VARIOUS authors have reported that small doses of œstrogen injected in the intact adult rat cause an increase in ovarian weight, generally attributed to an increase in the secretion of luteinizing hormone from the pituitary[1].

Comparatively large œstrogen dosage causes a decrease in ovarian weight in the intact animals. The available evidence strongly suggests that this is due to a depression of hypophyseal activity[2]. So far as can be ascertained, however, little work has been done on the action of œstrogens on the ovaries of the immature hypophysectomized rat, though such a preparation should give valuable information about the direct action of œstrogens on the ovary. Accordingly, immature (40–50 gm.) female rats were

hypophysectomized and a solid tablet of œstrogen was implanted subcutaneously two days after operation. The œstrogen used was the synthetic compound diethylstilbœstrol[3]. Two important effects were observed: first, that the œstrogen tablet prevented or greatly retarded the atrophy of the ovary that normally occurs after hypophysectomy, and secondly, that the response of the ovaries to the injection of pregnant mare serum was markedly increased with more pronounced luteinization of the membrana granulosa. Pregnant mare serum is mainly follicle-stimulating in action and has a much greater gonadotrophic action in intact immature rats than in hypophysectomized rats[4]. The tests on this substance were carried out as previously described[4], the animals being killed fifteen days after operation. The results are summarized in the accompanying table.

Condition of rat and treatment	Without œstrogen		With œstrogen	
	Mean wt. of ovaries (mgm.)	No. of rats	Mean wt. of ovaries (mgm.)	No. of rats
Normal	11·6 (10-13)	5		
Hypophysectomized 10–15 days post-operative	3·6 (2–7)	13	9·0 (6–15)	9
10 mgm. *PMS* 10	42 (27–59)	4	112 (79–168)	3
20 mgm. *PMS* 10	71 (57–95)	5	202 (106–250)	3
2·5 ml. *PMS* 11	35 (24–46)	5	81 (52–97)	3

PMS 10 is a concentrated extract of pregnant mare serum diluted with lactose, *PMS* 11 is a sample of pure serum diluted five times.

While it would be premature to speculate on the wider implications of these results, it is obvious that no action on the pituitary gland can be involved nor can the maintenance of corpora lutea play any part, since they are absent in the immature rat ovary. It is also clear that the role taken by the pituitary in the greater response of normal rats to gonadotrophic stimulation compared with the response in hypophysectomized rats will have to be reconsidered. It should be emphasized that the dose of stilbœstrol absorbed (as measured by weighing the tablets before implantation and at autopsy) was large, being 150–200 μgm. per day. This dose is much larger than any previously used in this connexion[5]. It is interesting to note that even these large doses did not produce any increase in the ovarian weight for normal animals of this size, so that œstrogen cannot be regarded as strictly gonadotrophic in the usual sense of the term.

Experiments are in progress to give more detailed information regarding the quantitative relations and histological changes of the œstrogen effect, and to test the reaction with other gonadotrophins.

P. C. WILLIAMS.

Courtauld Institute of Biochemistry,
Middlesex Hospital,
London, W.1.
Feb. 14.

[1] See "Sex and Internal Secretions", ed. E. Allen, pp. 505, 987–992. (London: Baillière, Tindall and Cox, 1939.)
[2] See Deanesly, R., *J. Endocrinol.*, 1, 36 (1939).
[3] Dodds, E. C., Golberg, L., Lawson, W., and Robinson, R., NATURE, **141**, 247 (1938).
[4] Noble, R. L., Rowlands, I. W., Warwick, M. H., and Williams, P. C., *J. Endocrinol.*, 1, 22 (1939).
[5] Fevold, H. L., Hisaw, F. L., and Greep, R. O., *Amer. J. Physiol.*, **114**, 508 (1936).

Experiments in Non-Sensory Cognition

Two independent researches in this field have recently yielded mutually supporting results of considerable interest.

One of us (W. W. C.) used simple drawings as test material. In order to exclude processes of rational inference, and coincidental thinking, the subjects for these were selected by a random method immediately before each trial. Fifty such 'originals' were used, in five experiments of ten originals each. About 250 percipients took part, of whom none was ever in the same room as an original during a trial. In nearly all cases the original was put up in the experimenter's study and the percipients recorded their impressions, mainly by drawing, in their own homes. The whole of the material thus obtained (about 2,200 drawings) was marked against all fifty originals by a judge who had not been concerned in the experiment and did not know which original was which. Thus there was no possibility of the percipients inferring the probable nature of the original, or of their knowing it by sensory means, or of the judge's predilections biasing the outcome.

It was found (*a*) that percipients scored significantly more 'hits' (resemblances) on originals of experiments in which they were working, as compared with the originals of experiments in which they were not working, than would be expected on the null hypothesis that there is only a chance connexion between the originals used and the drawings produced ($P < 0{\cdot}0001$); and (*b*) that 'displacement' occurred to a significant extent; that is to say, 'hits' were not necessarily made on the same occasion as that on which the original concerned was displayed, but might be early or late, though most frequent on or near the occasion of display.

The other of us (S. G. S.) used specially randomized packs of cards, of which each bore one of five different symbols which percipients were required to name, under experimental conditions very carefully devised to exclude completely the 'leakage' of sensory clues to the percipient. A total of 128,350 guesses in 5,134 'runs' of 25 each was collected from 160 percipients. In 57,450 of these, the experimenter looked at the card while the percipient was guessing; in the remaining 70,900 cases he did not. The results at first sight were null, for in the first series the excess of successes over the expected number was only 51, which is less than the standard deviation, and in the second there was a deficiency of 160, which is only 1·50 times the standard deviation.

The discovery of a displacement effect, as recorded above, however, suggested a possible reason for the failure to score, namely, that percipients' guesses might refer to cards a few places before or after the one at which they were aimed. It was accordingly decided to examine the number of hits made on cards 1, 2, 3, etc., places before and after the guess.

As a start, two percipients, one of whom had done 2,000 guesses and the other 800, were scored in this way up to a displacement of eight positions in each direction. In the first case, the three central positions show an excess of 178 hits over expectation, equivalent to 5·82 times the standard deviation, giving $P < 10^{-8}$; in the other, the excess is 86·8, or 4·49 times the standard deviation, giving $P < 10^{-5}$. Either of these gives a highly significant result, even if taken as the best sample of the whole material.

Thus the results of the card-guessing experiments confirm the displacement effect discovered in the

experiments with drawings; and these have led to a type of effect in the card-guessing being brought to light which might otherwise have escaped notice.

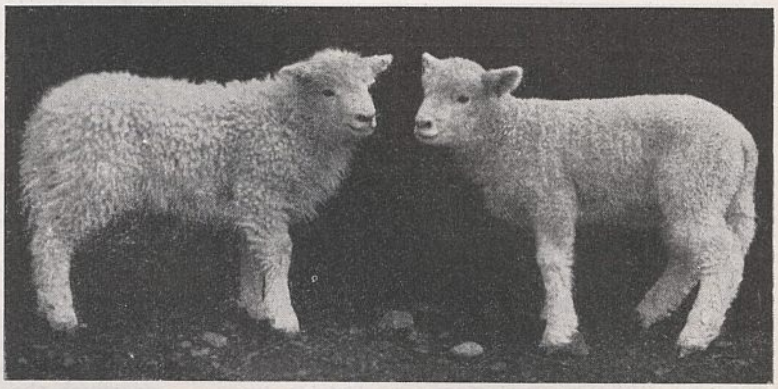
Full substantiatory details of both investigations will be published shortly.

W. WHATELY CARINGTON.
Cambridge. S. G. SOAL.
Feb. 4.

A Mendelian Situation in the Birthcoat of the New Zealand Romney Lamb

IN our work on the inheritance of the abundance of halo-hairs in the birthcoat of the New Zealand Romney lamb, interest has become centred in a genetic situation which we find ourselves a little surprised to encounter in a character of a marketable product of livestock other than colour. While complexities are not lacking, it is plain that we are dealing with something more clear-cut than the usual multifactorial flock of factors defying genetic analysis.

Lambs with gross abundance of halo-hairs on the main area of the body, as well as on the extremities, are reported by breeders to make their appearance from time to time. It is safe to say, however, that they are not very common. These 'gross' lambs we call *N*-type, *N* being the initial letter of the name of the breeder, Mr. N. P. Nielsen of Tiakitahuna, who gave us our first ram of the type in question. In several *N*-type lambs born in various experimental matings, it is concluded from their ancestry and/or breeding performance, that the genetic basis is multifactorial, but in most *N*-type lambs born at the College the genetic basis is manifestly relatively simple. This is a summary of our findings from experiments in which well over a hundred *N*-type lambs have been produced.



LEFT: *N*-TYPE; RIGHT: NOT-*N*-TYPE. THE LATTER HAD NO HALO HAIRS ON THE MAIN AREA, BUT MANY NOT-*N* LAMBS HAVE SOME HALO-HAIRS THERE, EVEN LARGE NUMBERS, BUT CHARACTERISTICALLY FEWER THAN *N*-TYPE. THESE LAMBS ARE TWINS. THE FATHER WAS *N*-TYPE, THE MOTHER NOT-*N*, WITH NO HALO-HAIRS. THE SIRE OF THE FATHER WAS *N*-TYPE, THE DAM OF THE FATHER HAD NO HALO-HAIRS.

(1) Breeding results from two *N*-type rams, not related to one another, together with results from rather numerous *N*-type descendants of theirs, make it look as if this kind of coat were conditioned by a single dominant factor linked with the sex-influenced factor for horns, with crossing-over occurring about once in ten or twelve times.

(2) Some attention has been paid to horns by one of us (J. A. S.). It happens that horns have been rather plentiful in non-*N* experimental stock. On the average the horns are decidedly bigger in *N*-type than in non-*N* rams.

(3) Several pieces of evidence indicate that this *N* factor (or possibly *N* complex) sometimes comes to incomplete expression, so that the lambs fall a little short of the abundance of halo-hairs regarded as properly gross. It may suffice to mention the following two points:

(*a*) In back-crosses of horned *N*-type rams deemed double heterozygotes, most of the near-*N* male offspring have horns.

(*b*) Most of the ewes chosen for back-crosses had few or no halo-hairs on the back. The lambs could be separated almost sharply into two groups, those of the *N*-type and near-*N*-type and those with few or no halo-hairs on the back. There were very few with intermediate abundance of halo-hairs.

(4) In back-crosses of heterozygous *N*-type (so regarded from their parentage) to not-*N*, some ratios are almost exactly 1 : 1, but in the offspring of some tested rams there is a deficiency of *N*-type, that is, an excess of lambs definitely not-*N*. Whether this deficiency of *N*-type is significant, and how it is to be interpreted if it is real, are matters calling for further experiment.

(5) One *N*-type ram, with all his parents and grandparents not-*N*, was mated with not-*N* ewes with no, or few, halo-hairs on the back. He sired 3 *N*-type, 1 near-*N*, and 60 not-*N*. So far he has been mated with only four of his own daughters (all not-*N*), getting one of the *N*-type lambs and the near-*N* lamb just mentioned, and 2 not-*N*. One of the other *N*-type lambs was from a daughter of one of our original *N*-type rams.

(6) (*a*) A not-*N* ram sired by the original Nielsen ram was mated with not-*N* ewes sired by the same ram. He gave 10 lambs, all not-*N*.

(*b*) A not-*N* ram (without any halo-hairs on the back), the son of an *N*-type son of the original Nielsen ram, was mated with not-*N* ewes (with no or few halo-hairs on the back), daughters of the original ram or of one or other of his *N*-type sons. The result was 2 typical *N*-type, 9 not-*N* with halo-hairs absent or of low abundance on the back.

We are able to suggest more than one somewhat elaborate explanation of our list of facts. Two linked complementary factors for *N*-type are favoured by one of us (P. R. McM.), while a dominigene is the pivot of another hypothesis. We are reminded of the recent work on another domestic animal by Kurzbauer and Marchlewski, who find that "two yellow dogs may produce black offspring and two black ones may produce yellow"[1].

F. W. DRY.
P. R. MCMAHON.
J. A. SUTHERLAND.
Massey Agricultural College,
Palmerston North,
New Zealand.
Dec. 11.

[1] *Animal Breeding Abstracts*, 7, 2 (1939).

Air Transport, Insects and Disease

I HAVE read with much interest Dr. A. D. Imms's review (in NATURE, January 13, p. 76) of Mr. Sarel Whitfield's paper entitled "Air Transport, Insects and Disease", and agree with both the author and the reviewer that the present position of this problem is still unsatisfactory.

In Dr. Imms's opinion, "no adequate and reliable control of insects in aircraft has been discovered", which is true of insects in general, but is scarcely so of the class of insects to which he especially refers, namely, the carriers of malaria and yellow-fever. The evidence brought forward in our paper[1], supported as it was by the opinion of reliable observers, shows that adequate control of mosquitoes in aircraft can be effected if the measures devised by us, and by Dr. Park Ross, are carried out.

The reason why these measures have not been generally adopted is, first, because the provisions of the International Sanitary Convention on Aerial Navigation place the responsibility for insect destruction on the ground sanitary authorities of the various countries through which the aircraft passes; and secondly, because these local Governments are averse to delegating their responsibility under the Convention to aircraft companies, with the result that a variety of different insecticides is still being used, and the manner of their application is equally varied.

Dr. Imms's criticism is valid when applied to some other arthropods, and we have had correspondence recently regarding the possible carriage in aircraft of the cotton boll worm and of the Japanese beetle. We realize that the procedure devised for mosquitoes would be entirely ineffectual when applied to such parasites, and eminent entomologists, both at home and abroad, have been asked to advise us regarding a substance lethal to these arthropods and yet of practical application in a passenger-carrying aeroplane.

Until such a preparation has been found, it is obviously impossible for aircraft companies to proceed in the matter. We consider that we have a method, adequate and trustworthy, against mosquitoes; but until the biochemical side of the problem has been extended, we cannot take measures to destroy the more resistant parasites which may carry veterinary or agricultural disease.

If Mr. Whitfield's valuable monograph, and Dr. Imms's review of it, serve to direct attention to the nature of the problem awaiting solution, they will have done a great service to aerial transport.

F. P. MACKIE.
(Chief Medical Officer.)
Imperial Airways Limited.

[1] Mackie, F. P., and Crabtree, H. S., "Destruction of Mosquitoes in Aircraft", *Lancet*, 447 (August 20, 1938).

Points from Foregoing Letters

THE presence of steric inhibition of coplanarity in certain polymethine (cyanine) sensitizing dyes is discussed by S. E. Sheppard, R. H. Lambert and R. D. Walker. It is adduced as a cause of modified spectral absorption and inefficiency of optical sensitizing of silver halides.

A. G. Mistretta and F. F. Nord describe experiments and give indications of a rule with regard to the relation between solvent and yield in the Gattermann synthesis using sodium cyanide.

P. J. G. de Vos finds a second maximum in the curve for cosmic ray secondaries from copper similar to that observed by other workers using lead.

In view of the large number of 'free' electrons present in graphite, namely, one per carbon atom, and the very low degeneracy temperature of the electron gas, indicated by the magnetic data, it is pointed out by K. S. Krishnan that the electronic specific heat in graphite should be much larger than in most metals. The available experimental data support this conclusion.

It is known that both liver and yeast relieve some of the symptoms of pellagra and pernicious anæmia, and also that both contain vitamin B_6. R. W. Vilter, H. S. Schiro and T. D. Spies have administered heavy doses of this vitamin, intravenously and orally, to patients suffering from pellagra and pernicious anæmia, with beneficial results.

P. C. Williams states that the atrophy of the ovaries that follows hypophysectomy may be prevented, in the immature rat, by the implantation of a tablet of the synthetic œstrogen stilbœstrol two days after the operation. The ovaries thus maintained respond to the injection of pregnant mare serum, both quantitatively and qualitatively, much more like the ovaries of intact rats than like those of untreated hypophysectomized rats.

W. W. Carington and S. G. Soal, working with simple drawings and with special cards respectively, under the most rigorous possible conditions, find significant cognitive relationships between the test material and the guesses made. In the first case, percipients score more hits on the drawings used in the experiment in which they were concerned than on those of other experiments; in the second, two sample percipients have been found to score heavily above expectation on the three cards preceding, coinciding with and following the guess, taken as a group.

Certain lambs of the New Zealand Romney breed are born with great abundance of so-called halo hairs in the fleece. F. W. Dry, P. R. McMahon and J. A. Sutherland have examined this condition genetically. Mendelian inheritance of the character is indicated, but no agreement has been reached as to the factors and mechanism concerned.

The Chief Medical Officer of Imperial Airways, Ltd., writes to confirm a comment made by Dr. A. D. Imms that the present position with regard to air transport in its relation to the transmission of disease by insects is unsatisfactory. He states that satisfactory measures against mosquitoes have been devised, but are not generally adopted because the responsibility for taking action is in the hands of the ground sanitary authorities instead of the aircraft companies. Measures against insects other than the mosquito are being sought.

RESEARCH ITEMS

Mangarevan Archæology

IN the course of the expedition to the Mangarevan Islands of the Bernice P. Bishop Museum, Honolulu, under Dr. Peter H. Buck in 1934, an archæological survey of sites on Mangareva itself as well as of stone structures on neighbouring atolls was made by Kenneth P. Emory (*Bull.* 163, Bernice P. Bishop Mus. 1939). Owing to the use of the stone for building by missionaries all important structures in the Mangarevan group have now disappeared; but fortunately the stone structures left by the Mangarevan inhabitants of Temoe atoll, 25 miles to the south-east, are intact. Here the largest structure is a platform 21 feet wide and 58 ft. long. It has an unenclosed court on the inland side extending 30 feet from the face of the platform. Across the court face are two high steps. The largest structures in Temoe had burials in small vaults at the top. In two maraes, open vaults at ground level are larger and more carefully constructed than the vaults containing burials. These, it has been reported, were considered the dwelling-place of the god of the marae. The nearest parallels to the Mangarevan maraes are certain image *ahu* of Easter Island, in which the platform is stepped on the court side, and at the top of which burials were made. The Easter Islanders added images of stone along the back of the platform. Probably the features shared by the Mangarevan and Easter Island structures had a common origin, possibly original features of Marquesan culture with which both Mangareva and Easter Island exhibit affinities, but which evidently have been modified in the Marquesan, where sacred structures are not uniform, nor of the type of Mangarevan and Easter Island sanctuaries. However, like the Easter Islanders the Marquesans set up large images on their sacred structures; but the Mangarevans lacked both the timber and the tuff which would have permitted the making of such images.

Toxicity of Snake's Venom

IT is the general impression, and has been definitely stated by workers in America and Australia, that snakes in captivity from which venom is repeatedly extracted gradually yield smaller quantities, and that the venom decreases in potency. These statements are not confirmed by the observations of N. O'Connor Wolff and Thomas S. Githens made upon a group of twenty-one water moccasins (*Agkistrodon piscivorus*), used for venom extraction over a period of two years (*Copeia*, 234; 1939). The 'milking' took place at irregular intervals, the longest time between extractions being six months and the shortest three weeks. The venom having been collected was measured, centrifuged to remove epithelial scales, and then dried either by gentle heat or in a desiccator under vacuum. Toxicity was determined by intravenous injection into pigeons of a solution of the dried venom to determine the minimum lethal dose. A table is given recording complete data regarding the extractions over the two-year period. At the earliest extractions the average amount of venom per snake on the first three occasions was 0·500, 0·486 and 0·517 c.c., while on the last three extractions the averages were 0·550, 0·777, and 0·722 c.c. Similarly the first minimum lethal doses averaged 2,000, 1,300 and 1,577 per snake, while the last three averaged 2,520, 1,970 and 2,500. The table shows a considerable range of fluctuation throughout the period, but seems to establish the contention of its authors that neither quantity nor toxicity decreased owing to repeated extractions.

Marquesan Insects

THE Pacific Entomological Survey, dealing in the main with the fauna of the Marquesas Islands, is a project organized and directed by institutions in Hawaii. As the result of expeditions sent out under its auspices a large addition to knowledge of the insects, and related arthropods, of the area concerned has been made. Under the title of "Marquesan Insects—III" published in 1939 as *Bulletin* 142 of the Bernice P. Bishop Museum, Honolulu, the latest contribution on the work of the Survey has come to hand and it marks the end of the present programme. The longer articles in the *Bulletin* are concerned with Crustacea (Talitridæ), Spiders, Acarina and Chelonethida. Among the insects themselves, the article on Scolytidæ by C. F. C. Beeson is of interest since it records the first known bark beetles from the Marquesas; more than two hundred specimens, representative of five genera and twenty-one species, were dealt with. Two new genera of Hydrometridæ, or water-bugs, are described by H. B. Hungerford, and a new Blastophaga from the indigenous Ficus of the Marquesas is dealt with by G. Grandi. Other papers on the Insecta include contributions by H. H. Knight on new species of the hemipterous family Miridæ.

Experimental Taxonomy

J. W. GREGOR (*New Phyt.*, **38**, 293–322; 1939) has continued his analysis of wild populations by examining the differentiation of North American and European plantains. He shows that *Plantago maritima*, *P. alpina*, *P. carinata*, *P. juncoides*, and *P. oliganthus* of North America, Greenland, and Europe form an inter-fertile group which is diploid, while Alpine tetraploids form another group. He points out that variations within one sub-region overlap with those of another, but that the means of measurable characters within a population may differ from the mean of another population. Thus bracts and sepals of North American plantains are broader in proportion to length than those of northern Europe. The mean values of the sub-regions regarding this index and that of the ratio scape length to spike length show a gradient from low values in western America, rising in eastern America, Iceland, Faroes, Britain to a maximum in Sweden, and falling again in southern Germany. Data regarding various other measurable characters show similar geographical gradients, but it is important to note that irregularities in small localities sometimes occur. The author points out that classification founded upon the complex of characters in an individual is not so useful in experimental taxonomy as that of the average of characters in a population. The data illustrate the fact that growth and physiological characters behave in a similar manner to qualitative or morphological characteristics.

Diamond Deposits of Tanganyika Territory

ALTHOUGH diamonds have been worked in Tanganyika for sixteen years, no comprehensive publication covering the geological and economic aspects of the industry has appeared until now. *Bulletin* 12 of the Geological Division, T.T., by G. J. Williams, comes at an opportune time, just as the original finds are reaching the end of their productivity, since it gives an account of most of the country in which kimberlite (the home of the diamond) is known to occur, and provides a useful guide to prospectors in other areas. The kimberlite occurrences are mainly in the central granite batholith of Tanganyika. The individual pipes tend to be localized at or near geological contacts (for example, against dolerite dykes or remnants of basement rocks) or fracture zones. There are, however, groups of pipes without visible connexion with pre-existing structures, owing—at least in part—to the existence of thick covers of superficial deposits. Here the search for such minerals as ilmenite, garnet and zircon in the subsoil is most likely to lead to the body of kimberlite from which they were derived. Areas likely to repay prospecting are suggested. From evidence in Tanganyika alone, the age of the kimberlite masses cannot be determined exactly. They are, however, pre-Pleistocene and post-early Jurassic; a time-range within which falls the late Cretaceous age established for the South African pipes. The *Bulletin* contains a map of the kimberlite province of Tanganyika and also a map showing the distribution of kimberlite pipes and fissures throughout Central and Southern Africa.

The Quetta Earthquake of 1935

THIS earthquake has been studied in some detail by K. R. Ramanathan and S. M. Mukherji of the Colaba Observatory, Bombay (*Rec. Geol. Surv. India*, 73, Pt. 4, 483–513; 1938). It will be recalled that damage was caused by this earthquake along a tract of land extending from Baleli just north of Quetta, through Dingar and Mastung to Mand-i-Haji, and including the Shirinab Valley to the west of the Mastung–Kalat Road. It is an area about 68 miles long and 16 miles wide. The surface crack extended from about 30·3° N., 66·9° E., to 29·1° N., 66·5° E., the centre of the region of maximum disturbance being 29·7° N., 66·7° E. The seismological data used for the present study were the seismograms from Bombay, Agra, Calcutta, Hyderabad and Kodaikanal in India, together with fifteen seismograms from foreign observatories. Miss Bellamy, of Oxford, supplied readings from 142 observatories. From these data the authors concluded that the best position for the epicentre was 29·6° N., 66·5° E., slightly to the south-west of the permanent maximum displacement but well within the region of maximum macroseismic effects. The origin time of the earthquake was May 30d. 21h. 32m. 58·5s. G.M.T. Among the prominent features of the seismograms were the gradual increase of amplitude interrupted by larger and larger impulses, and the large amplitudes of the long waves compared with those of the preliminary phases, suggesting block movement and a shallow depth of focus (less than 10 km.). This was also deduced on other grounds. The energy of the earthquake was estimated to have been about 10^{21} ergs. or 1/2,000 that of the Great Assam earthquake of 1897. A list of aftershocks recorded at Agra is given.

Viscosities near Absolute Zero

WITH financial aid from the Smithsonian Institution, Prof. W. H. Keesom and G. E. Macwood have determined the viscosities of liquid helium and hydrogen and of hydrogen vapour at temperatures near the absolute zero (*Leyden Comm.*, No. 254). Their method is that of the oscillating disk, which is 5 cm. in diameter and is suspended by a phosphor bronze wire of 0·05 mm. diameter and 25 cm. long in a cylindrical box of a little greater diameter, the top and bottom plates of which can be placed at various distances from the disk. The decay of the torsional oscillations of the disk were observed by the mirror, telescope and scale method. The apparatus was standardized by using in it helium gas of known viscosity. The viscosity of hydrogen is normal in both states. For the liquid it decreases from 210 micro-poise at 15° K. linearly to a little more than 150 at 18° K., then more slowly to 140 at 20° K. For the vapour it increases from a little less than 10 micro-poise at 14·5° K. to 13 at 21° K. linearly, and is independent of pressure. The viscosity of liquid helium is abnormal. It increases from 1·8 micro-poise at 1·3° K. at first slowly, then rapidly to 17·5 at 2·1° K., where there is some uncertainty. From this point it increases to 25 at 3° K. and to 29 micro-poise at 4° K.

Observations of the Zodiacal Light

MOHD. A. R. KHAN, Begumpet, Deccan, has sent a description of his observations of the zodiacal light on December 17, 1939, at 5.30 a.m., Standard Indian Time. The phenomenon produced the impression of two cones, one within the other, the inner cone being the brighter of the two. The apex of the inner cone rested on γ Virginis, and ξ Virginis, β Libræ and μ Serpentis lay approximately on its northern boundary. On the southern boundary were 76 Virginis, 20 Libræ, and φ^1 and φ^2 Lupi. The apex of the outer cone appeared to extend to ρ Leonis, and 109 Virginis and π Hydræ were on its northern and southern boundaries, respectively. The light thus presented the appearance of a tall double cone, broad at the base near the horizon, and getting quickly narrower and narrower towards the apex. A similar configuration was observed on December 12 at 5 a.m.

Structures of Sulphuryl and Thiophosphoryl Fluorides

As the relations between bond length and bond character are not well understood for molecules containing semipolar double bonds, the investigation of SO_2F_2 and PSF_3 by the electron diffraction method (D. P. Stevenson and H. Russell, *J. Amer. Chem. Soc.*, 61, 3264; 1939) is of interest. The distances predicted by the standard covalent radii are P–F 1·74 A., P=S 1·95 A., whilst those found are 1·51 and 1·85, indicating resonance with a larger proportion of ionic structures than for the corresponding chlorine compound, and due to a considerable triple bond character made possible by the large electronegativity of fluorine and the small difference in electro-negativity between phosphorus and sulphur. The relatively small angle 99·5° F–P–F is not interpreted for lack of data. The S–F distance in SO_2F_2 is 1·56 A., which is less than the single bond distance calculated from the standard covalent radii, but the shortening is not so great as is found with the fluorine derivatives of phosphorus. Although there is much more shortening in the S–Hal bond in SO_2F_2 than in SO_2Cl_2, the S–O distance 1·43 A. in SO_2F_2 is the same as that in SO_2, SO_3 and SO_2Cl_2.

PREHISTORIC PEOPLES IN SOUTH AFRICA

DR. ROBERT BROOM'S recent discoveries in the Transvaal of important evidence bearing upon the origin and descent of man have tended to overshadow another field of anthropological investigation in South Africa which, though more localized in its application, ranks in African ethnology as scarcely of lesser significance for studies of the evolution and distribution of prehistoric racial types. The problem in question arises from the recognition by Dr. A. Galloway* in the skeletal material from the remarkable prehistoric sites of Mapungubwe and Bambadyanalo, recently excavated, of a new race, the Bush-Boskopoid, associated with and apparently responsible for the mining operations which figure conspicuously among the activities of the prehistoric inhabitants of Rhodesia. The physical characters of the race of miners, their relation to the Bantu-speaking peoples who later came to form the predominant population, and how far the Bush-Boskopoid of Mapungubwe constitutes the type, are discussed in a series of communications made recently to the Rhodesia Scientific Association (*Transactions*, **37**; 1939).

In reference to certain human remains found in excavations at various times since 1934, which are recorded in detail by A. E. Phaup, the evidence of the prehistoric skeletal material as a whole from Rhodesia is summarized and discussed by Prof. M. R. Drennan.

By way of preface it is remarked that the remains, both male and female, appear to be those of indigenous natives living under tribal conditions, and using metals. They differ from the present Negroes of South, East and West Africa in that their skulls were longer and narrower than the average, their faces were more prognathous and their brains smaller. They were also shorter. They resemble the "Bush-Boskop" race of Mapungubwe and Bambadyanalo, and are similar to the more modern "Hottentot" type, seeming intermediate between Bush and Bantu, with some of the characteristics of both. They also show affinities to the Cro-magnon race of Europe. They buried their dead in caves and the ancient workings of prehistoric gold mines. The bodies were probably clothed or covered, and personal ornaments and small utensils were left on or near the body.

The remains were found in different conditions throughout Southern Rhodesia as follows:

Penhalonga. On the Umtali Mission Farm among a group of granite blocks and under the largest was a natural wedge-shaped cavity 50 ft. long and 20 ft. wide, which had been walled in. The floor was covered with bones and scattered groups of small beads of blue glass and ostrich-shell. Four skulls, three male and one female, were available for examination and were pronounced in a report by Dr. Drennan at the time to be "a good sample of some native group, . . . quite comparable to the existing groups of natives".

Makoni District. From a large limestone cave on Romsley extension farm came a human skull and tibia, animal bones, clay pots, grinding stones, a copper bangle and a spear-head. Dr. Drennan pronounced the skull to be female and "typically Bantu", closely resembling two Mashona skulls.

Carolina Claims, Mazoe. An almost complete female skeleton was collected by the late T. H. Wilson, of the Geological Survey, from the Carolina gold claims, about a mile south of Jumbo siding, in workings in a small hill of banded ironstone. The skeleton was found in reopening one of the old shafts. With it were eight rusty iron rings. Dr. Drennan's report states that the remains are those of a young female of native type aged about twenty years. The skull is comparable with that from Penhalonga, and "definitely negroid in every respect".

Eureka Mine, Sipolilo. Two fossilized fragments of a human femur were found in an ancient working of the gold mine. They show extreme degrees of platymeria and pilastering, features practically never occurring in this degree in Europeans, moderate in Bantu, but a marked feature of Bushman and Hottentot. A fragmentary skeleton of an infant found later, while indeterminate owing to age, is as regards the cranium typically 'negroid', while the mandible is definitely 'Bush-Boskop'.

Inyanga. Fragments of a skull from the Van Niekerk ruins, found lying under a large granite slab, apparently belong to a young female of about fifteen years of age. The measurements are very similar to those of the female from Penhalonga.

In his further review of the skeletal material from Southern Rhodesia as a whole supplementary to the report to which reference is made above, Dr. Drennan states that his interest in the ancient gold miners and other prehistoric inhabitants of Southern Rhodesia was first aroused by the skull from the Gwalo mine presented to the South African Museum by Sir Clarkson Tredgold in 1917. In this skull the features of Bushman, Hottentot and Bantu types are curiously and strikingly blended. Next came the skull from the Planet Mine, Bulawayo, which, while showing certain Bantu characters, is predominantly Bushman, and with reservation might be assigned to the Bush-Boskop group.

The material described by Mr. Phaup, though all legitimately prehistoric Rhodesian, falls into two groups—those with, and those without, a definite association with mining activities. In the mining group fall the Mazoe, the Eureka, and the Van Niekerk specimens; they all belong to the same physical type and are all women or children. The Makoni skull also belongs to the same physical group; but the group from Penhalonga seem to approximate more to the modern type.

While Dr. Drennan finds a considerable measure of agreement with Mapungubwe, there are also significant differences. The material from Mapungubwe and Bambadyanalo, to which Galloway applies the term Bush-Boskop, is not homogeneous, but includes three or four different elements. In the present series, however, there is no instance of the absolute long-headedness or big-brainedness of the Boskop race, so prevalent at Mapungubwe and Bambadyanalo, nor is their relative long-headedness to be accounted for as a mixture of Bushman and Boskop strains. For this we must look to a pre-negro strain. The pronounced prognathism of the present group emphasizes their negro character; but it is absent at Bambadyanalo.

It is thus impossible to reconcile the two findings at present; but it may turn out eventually that it is a difference between the exploiters of gold on one hand,

* Galloway, A., "The Skeletal Remains from Mapungubwe in 'Mapungubwe: Ancient Bantu Civilization on the Limpopo'". Edited by Leo Fouché. Cambridge, 1937.

who show a preponderance of Bush-Boskop character typical of the southern prehistoric peoples, and of the actual miners on the other hand, who show more negroid character inherited from northern pre-negro types such as Elmenteita man.

Upper jaws of a Boskop type attracted the attention of Prof. Raymond Dart in 1938 to the Cornucopia site at Rusape, Umtali, on which Mr. Barnes Pope had been engaged in trenching with the view of discovering the nature of the material there, which had attracted the ancient industrialists responsible for the workings of which evidence had been discovered. The appearance of a Boskop type was unanticipated as all previous skeletons from ancient workings in Rhodesia had been described as Bantu (Keith, 1931) or Bush (Drennan, 1930).

Mr. Barnes Pope, excavating in depressed areas with a luxuriant growth of trees and herbage, which had been disturbed on a grand scale at some past period of time, revealed consistently four layers: (1) the vegetation layer, (2) the gravel or barren layer, (3) the fertile layer, (4) the bed-rock layer.

The bed-rock layer consisted of granite boulders and the disintegrated granite which forms the basis of the area in which the ancient miners worked. The material which attracted them was either the rich brownish-black iron oxide grains, to be used either as a cosmetic or as a source of metallic iron, or alternatively the tin, which though not now found in paying quantities, may originally have been rich. This layer varies from three to forty-five feet.

The fertile layer, from which all objects found underground have come, varies from three inches to several feet in thickness but usually is only twelve inches in height. Here are crude potsherds, skeletal remains, beads, slag, a button of melted tin, etc. Curious arrangements of objects have been discovered. Under a flat stone were thirteen stone phalli. Here there were no bones; but in another place a skull was found accompanied by fifteen phalli. A second skull was found at a depth of fifteen feet, but without accompanying objects.

It may be inferred that two forms of burial were practised: (*a*) simple and sometimes phalli accompanied burials at the mining face, probably burials of miners; and (*b*) cylindrical stone monument burials in the 'mine-filling', probably burials of important individuals.

The 'mine-filling' process can be separated into two distinct phases represented by the sterile layer, composed mainly of earth displaced by the miners, and the vegetational stratum-humus, twelve to eighteen inches in thickness, representing the flux of a considerable period of time—certainly several hundreds and it may be even thousands of years. At Zuurberg the humid period represented by the black soil over the former land surface is dated tentatively at 1800 B.C.

This date, which applies to the earliest levels in which occur 'Bushman' burials on the Zuurberg site, is correlated by Wells with the "classical rainfall maximum" of C. E. P. Brooks (1922), dated at a period extending from 1800 B.C. to A.D. 500. The assessment of rate of deposition in South Africa, however, is notoriously difficult and uncertain. The period under investigation was one of aridity and erosion, rather than of precipitation. The rate of deposition of earthy vegetable layers at the present day in South Africa has not been determined; but while it would be rash to jump to the conclusion that the 12–18 in. earthy vegetable layer is referable to the same period as the Zuurberg material, the tentative suggestion of "even thousands of years" may be no exaggeration.

At the same time, cultural evidence from certain sources which have been under review may point to the later limits, for which an approximate dating might be suggested. While weapons and implements of iron are very similar to those collected on ancient ruins of medieval date, or even to those of the modern iron-worker, certain assemblages of beads are comparable to those of the Great Zimbabwe acropolies, that is, of the ninth to tenth centuries of our era, though here again allowance must be made for survival in fashion.

Turning to the skeletal material found on the Cornucopia site, L. H. Wells, in describing the two skulls, stresses their great length and relative narrowness. Thus the more complete of the two measures 201 mm. at its maximum length, while the maximum breadth is only 130 mm., giving a cephalic index of 65·0. The corresponding figures for the second skull are estimated at: maximum length, 190 mm.; maximum parietal breadth, 127 mm.; cephalic index, 66·5 approximately. The cranial capacities, respectively, are 1,425–1,500 c.c. and 1,300–1,350 c.c. In both, the bones are thick and massive and slightly mineralized.

The feature, however, which is singled out as especially noteworthy is the remarkable size of the palate and the teeth. In the first skull, the longitudinal and transverse diameters fall just within the maximum recorded for the South African Negro while the height of the palatal vault above the grinding surfaces of the teeth is greater than in any Negro. Moreover, the form is different, the incisors forming an almost straight line between the canines. The palate is thus quadrilateral rather than horseshoe-shaped. Except that it is much higher in the vault, this palate agrees with the Boskop type.

Both skulls agree in presenting very few negro features, while of their non-negro features, the majority are proper to the Boskop type.

Yet although these skulls recall the Boskop type, they also diverge widely from it. The significance of these findings becomes apparent on reviewing the skulls previously found in similar circumstances. The number found in Rhodesia is small. Skulls examined by Shrubsall and Keith were classified as of negro type, but probably these conclusions call for revision in the light of further knowledge. Galloway has recognized both Bush and Boskop features from Penhalonga. The Cornucopia find has revealed the association with an ancient occupation site of skeletal remains which are predominantly of non-negro type. They represent a type which there is good reason to believe preceded the Bantu-speaking Negro. Such a strongly marked Boskopoid type is already well known in the southern portions of Africa. The same elongated and low-vaulted skull has been found among the Hottentots and, it has been shown, can arise from the mixture of large-headed Boskop and small-headed Bush types. The most remarkable development of the last few years in South African anthropology has been the demonstration by Galloway (1937) that "a homogeneous Boskop-Bush population physically akin to the post-Boskop inhabitants of the coastal caves" was associated with the Iron Age civilization of Mapungubwe. It is concluded that the Cornucopia people, if not identical with the Mapungubwe type, are very similar in most respects.

A SLIDING RATE ELECTRICAL METER

IN a paper published in the *Journal of the Institution of Electrical Engineers* of January, Dr. Unz of the Iraq Petroleum Co., Ltd., has suggested a new type of electrical meter, to replace the existing maximum-demand indicators. The object of the maximum-demand indicators is to enable the supply station to charge its consumers not only in accordance with the number of electric units consumed, but also in proportion with the demand on the station at the time during which they were consumed. In the early days of the use of this system, the meter bill consisted of two components, the first being at a constant rate for all demands not greater than a certain minimum rate, and the second component being charged at a higher rate when the demand exceeded this rate. The object was to influence consumers to be economical with their lighting when they were consuming at the higher rate. Economy at these times is most important to the supply company, which is otherwise forced to buy large quantities of expensive reserve plant, used only for a short time every day when the demand is excessive.

Improvements to the demand-charging system have been effected by means of peak-load meters, load-levelling relays and time-switches, as well as by various refinements of the tariffs, but these are of limited application. A meter is required which would automatically fix the price level of each consumed unit as a function of the power at which it is applied, and integrate such prices to a total amount. The consumer would know that the price of a unit consumed at half load would be much lower than that consumed at double full load. He could therefore endeavour to reduce his electricity bill by improving the load factor to the utmost, but need never be afraid of being penalized for exceeding his usual demands. The supply undertaking, on the other hand, would have the full benefit of a rational and simple charging system, without the necessity of providing duplicate measuring instruments and wiring.

An integrating watt-hour meter having a curve for the speed characteristic instead of a straight line would serve the purpose. The meter readings would then not be in kilowatt-hours but in what might be termed 'key-units'. These readings would be proportional to the amounts of money due, as in load-rate prepayment meters or in double-tariff meters with a single counter train.

The speeding-up effect described above can be obtained in a meter either by making the driving torque proportional to a power of the load higher than the first, or by reducing the retarding torque of the brake. Dr. Unz states that the latter method is constructionally easier, and in addition it has the advantage that the existing driving elements with all their compensating devices can be left untouched. The constructional details of the proposed braking element are shown, its equivalent electric circuit is considered, and its performance discussed. The reconstruction of the meter characteristic is outlined, and the errors and compensation methods briefly discussed.

The device offers new facilities in the application of demand charges. It works on the same principle as a standard watt-hour meter, and deviates from the latter only in regard to its speed 'characteristic'.

THE MUSICAL PITCH OF ORCHESTRAS

IN the English edition of the second quarterly bulletin of the "Centro Volpi di Elettrologia" published in Venice last year, there is an interesting article by G. B. Madella surveying investigations which have been recently made on the frequency of the reference note of an orchestra. The history of this problem was discussed in an article in NATURE of November 5, 1938 (p. 820), by Dr. G. W. C. Kaye, who also described the proceedings of the international congress which made recommendations in 1939 (see NATURE, May 27, 1939, p. 905).

Madella describes a series of measurements made during a period of a month in the Electro-acoustic Department of the Istituto Elettrotecnico Galileo Ferraris in Turin at the request of the Italian Committee on Acoustics. Some of the results obtained are given below. A standard frequency of 400 was obtained from that of the institution standard, which operates at 1,000. This gives an accuracy quite sufficient for the purpose. The two tensions thus obtained having the unknown frequency and the frequency of 400 are then applied to a copper oxide modulator. The frequency beat obtained in this way is applied to the plates of an oscillograph and then registered by means of a photographic recording machine. The accuracy obtainable varies according to the time-length of the note studied; as a rule, it is about a tenth of a cycle. Attempts to apply stroboscopic methods were unsuccessful as these methods tire the eye of the observer and are therefore not suitable for systematic measurements.

The tuning frequency, on the average, was found to be above 435; during the transmissions of operas and symphonic concerts, values of the order of 441 were observed.

During the transmission of piano performances or of performances comprising pianos and vocal or string instrument groups, lower frequencies were nearly always observed, often in the neighbourhood of 435, with differences of less than 0·5 cycle. At a violin and piano concert the frequency most often heard was 437·1, but at a symphonic concert the frequency most frequently noted was 442, the maximum being 444·8 and the minimum 439·7.

The results are partly explained by remembering that when a piano is accurately tuned, the tuning is maintained without variations of practical importance. Wind instruments, even if well tuned at the

beginning, have a tendency after a time to increase the frequency of the emitted note because of the heating produced by the breath of the player. Finally, string instruments allow the player within certain limits to follow the tune of other instruments, and the same is the case with singers.

No evidence was found to confirm the generally stated order of variation in which the mean tuning frequency tends to increase during the execution of selections by an orchestra. The frequency of the pitch which is observed during the tuning of instruments before starting the performance tends to be maintained as a mean value during the whole performance. As few tests of this have been made, it would be advisable to make further investigations; if confirmed, it would be of importance in relation to the choice of the steps apt to modify the tuning frequency.

TEMPORARY PRESERVATION OF ANIMAL SPECIMENS

MR. J. R. NORMAN, of the British Museum (Natural History), has abstracted and translated the following from a letter he has recently received from Dr. Paul Chabanaud, of the Museum National d'Histoire Naturelle, Paris:

On learning the news of the sensational discovery of *Latimeria chalumnae*[1], there can be, I imagine, few naturalists who were not seriously perturbed by the thought that it was only by the merest chance that this extraordinary living fossil was not irretrievably lost. Indeed, our congratulations are due to all those who have succeeded in saving this priceless specimen, although we must deplore the fact that its final state of preservation is so far from satisfactory.

Even if fishermen do not often find a representative of the Mesozoic fauna in their nets, how very few of the interesting specimens captured by them daily throughout the world find their way to our museums or laboratories. Even in the case of the species well-known to science, the larger individuals are rarely, if ever, preserved, and our knowledge of the size attained by certain animals (for example, the halibut—*Hippoglossus hippoglossus* (L.); some of the Siluroids; and very many Elasmobranchs) rests largely upon hearsay, or upon the examination of fragments (for example, the 'saws' of *Pristis*).

Naturalists travelling abroad are compelled to forgo the collection of individuals exceeding a certain size (except in the form of skins), solely because their preservation by ordinary methods (alcohol or formalin) necessitates the use of containers so large that their transport is quite impracticable.

There is, however, an extremely simple and quite inexpensive method of preserving animals, both large and small, and in particular fishes: this is by the use of sodium chloride or sea salt. I speak with some knowledge on this subject, as I have used the method myself on many occasions.

All that is necessary is to place the animal in a basin or dish, or preferably on a board or something of a like nature, and to cover it with a heap of salt, being careful to introduce as much of the salt as possible into the mouth and gills, as well as into the abdominal cavity through an incision previously made in one side of the body. The effect of the salt, of course, is to absorb the fluids from the organism. After some hours, that is to say, on the next day at the latest, the specimen should be turned over, drained, and the diluted salt replaced by fresh.

If the animal is of small or moderate size no further treatment is usually required, but if of considerable volume it may be necessary to repeat the operation several times, care being taken to turn the body over each time. Naturally, the hygrometric state of the surrounding atmosphere will tend to accelerate or retard the process as the case may be.

The desiccation of the specimen must be made as complete as possible, since, of course, the sodium chloride does not fix the tissues, and its preserving powers depend entirely upon its strong hydrophilism, the organic tissues treated by the salt being dehydrated and at the same time rendered unsuitable for the proliferation of destructive organisms such as bacteria, moulds, etc.

Thus, it is absolutely indispensable, especially in warm and humid climates, to obtain this dehydration as rapidly as possible, the animal being, in fact, converted into a 'stock-fish', which can be readily packed in any sort of box or crate, with no other packing than the salt itself.

By using this method I have been able to obtain very large specimens of fishes (for example, *Psettodes belcheri* Bennett, a flatfish from the north-west coasts of Africa, and enormous heads of halibut from Newfoundland), which would have been extremely difficult, if not impossible, to procure otherwise.

When the specimen reaches the museum or laboratory it should be soaked in fresh water for just long enough for it to resume its natural form; after this, it can be finally immersed in alcohol or formalin. The complete elimination of the salt is quite unnecessary, since its presence does not harm the final preservation.

I have never experimented myself with a mixture of sodium chloride and sodium sulphate, although I understand that this has given excellent results.

Clearly, this method of salting does not represent the ideal treatment for histological examination, but I can assure you that, not only the external morphology, but even the macroscopic anatomy, is perfectly clear; external characters, bones, viscera, muscles and nerves can all be easily studied. Obviously, the same cannot be said with regard to the blood-vessels or the brain, since special treatment is usually required before undertaking research on these organs.

I do not pretend that the external shape of a salted fish will always compare favourably with that of one which has been placed while fresh in alcohol or formalin. The colours are altered; frequently the scales are displaced. Admittedly the salt is only a makeshift, but how very much better than putrefaction and complete ruin?

I have dealt only with fishes, but there is nothing to prevent the use of salt for the preservation of any kind of vertebrate, provided that such necessary precautions as cutting open the peritoneum and the stomach, etc., are taken.

[1] NATURE, **143**, 455 (1939).

SEVENTY YEARS AGO

NATURE, vol. 1, March 10, 1870

Science Education in Germany

PROF. H. E. (afterwards Sir Henry) Roscoe, F.R.S., contributed a second article on this subject. The earlier article, dealing with the universities, appeared in NATURE of December 9, 1869; the present article deals with the "Polytechnic Schools".

"The 'Polytechnicum' is an institution peculiar to Modern Germany. It has for its object the teaching of all branches of the sciences of experiment and observation, not only in their principles, but in their applications to the industrial arts; these applications not being merely treated as illustrations of science, but regarded as the main subjects for instruction, for the sake of the understanding of which systematic courses on theoretic science are given."

The article points out that the polytechnics are quite independent of the science departments of the universities, although both are State institutions and there are often working arrangements between them. The professors rank somewhat below those of the universities. Entrance is normally at seventeen years of age, that is, one year earlier than to the universities.

The continued separation of the universities from the polytechnics is harmful in that it encourages the tendency in the polytechnics "to neglect the *educational* aspects of science in considering its practical applications".

A Probable Cause of Malaria

J. GAGLIARDI, writing under this title, refers to the work of Count Castracane on diatoms, described before the Academy of the Lincei. In this work, according to Gagliardi, he discovered that "nothing is so fatal to the life of marine or even brackish water diatoms as a sprinkling of pure fresh water. . . . From this fact he comes to the very probable conclusion that the sudden dying away of myriads of diatoms, besides, perhaps, myriads of other living creatures, during the rainy season might be, if not the only, at least one of the most efficient causes of *malaria*".

Natural Science Schools at Rugby

AN article appears, by the Rev. T. N. Hutchinson, on these new 'schools', which is accompanied by a plan and an engraving of a general view of the laboratory. The laboratory is 35 ft. × 22 ft., and intended to accommodate thirty boys. The benches are divided into compartments each of which includes a cupboard and two drawers, two shelves, two gas taps, sink and water supply. A room is provided for the lecturer, and the chemical lecture theatre seats fifty. The physics lecture theatre seats sixty.

M. DELAUNEY is the new director of the Paris Observatory. [See also NATURE, February 10, p. 235.]

PROF. UNGER, of Vienna, a well-known botanist, whose death we reported last week, was, it is now stated, found murdered in his bed at Graz; and no trace of the murderer has as yet been discovered. A priest has taken this opportunity to assert from the pulpit at Cilly, Styria, that the body of the late philosopher had probably been destroyed by the devil himself, who had just claims upon his soul!

APPOINTMENTS VACANT

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

A MISTRESS OF METHOD for the Manchester Training College of Domestic Economy—The Director of Education, Education Offices, Deansgate, Manchester 3 (March 15).

LECTURER IN METALLURGY in the Technical College, Bradford—The Director of Education, Town Hall, Bradford (March 16).

HEADMASTER of the Skipton School of Art and the Skipton Technical Institute—The Secretary to the Managers, School of Science and Art, Skipton, Yorks (March 18).

WATERWORKS ENGINEER AND MANAGER—The Town Clerk, Municipal Buildings, Poole (March 20).

DIRECTOR OF EDUCATION—The Director of Education, Education Department, Newarke Street, Leicester (March 27).

DIRECTOR OF THE GEOLOGICAL SURVEY—The Secretary, Civil Service Commission, 45 Upper O'Connell Street, Dublin (April 12).

ASSISTANTS III for duty on Resident Technical Officer Staffs at Aircraft Construction Works—The Under-Secretary of State, Air Ministry (B.127), Department ZA, Harrogate, Yorks (quoting B.381).

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Ministry of Health. Memo. Ev. 8: Government Evacuation Scheme. Pp. 24. (London: H.M. Stationery Office.) 4*d*. net. [152

Falmouth Observatory. Report of the Observatory Committee to the Royal Cornwall Polytechnic Society and the Falmouth Town Council, by H. Dent Gardner; with Meteorological Notes and Tables for the Year 1939 with Mean Values for 65 Years (1871–1935), by W. Tregoning Hooper. Pp. 12. (Falmouth: Falmouth Observatory). [202

Committee of the Privy Council for Medical Research. Report of the Medical Research Council for the Year 1938–1939. (Cmd. 6163.) Pp. 171. (London: H.M. Stationery Office.) 3*s*. net. [212

Development Commission. Twenty-ninth Report of the Development Commissioners, being for the Year ended the 31st March 1939. Pp. 133. (London: H.M. Stationery Office.) 2*s*. net. [212

The One Hundred and Sixth Annual Report of the Royal Cornwall Polytechnic Society. New Series, Vol. 9, Part 3, 1939. Pp. 102. (Falmouth: Royal Cornwall Polytechnic Society.) [222

The South-Eastern Naturalist and Antiquary: being the Forty-fourth Volume of Transactions of the South-Eastern Union of Scientific Societies, including the Proceedings at the Forty-fourth Annual Congress held at St. Albans, 1939. Pp. lxvi+76. (London: South-Eastern Union of Scientific Societies.) 5*s*. net. [222

Other Countries

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OFFICIAL ANNOUNCEMENTS

THE INSTITUTE of CHEMISTRY of GT. BRITAIN & IRELAND

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

APPOINTMENTS REGISTER

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

Particulars of the Regulations and Examinations of the Institute can be obtained (free), on application to the Registrar.

All communications to be addressed to The Registrar, the Institute of Chemistry, 30 Russell Square, London, W.C.1.

COIMISIÚN NA STÁT-SHEIRBHÍSE

POSITION VACANT:
DIRECTOR OF THE GEOLOGICAL SURVEY

Application forms for and full particulars of a vacancy in the Department of Industry and Commerce for a Director of the Geological Survey may be obtained free from the Secretary, Civil Service Commission, 45 Upper O'Connell Street, Dublin.

Age limits: 35-48 years, with extension of two years for established Civil Servants.

Salary: Man: £500—£20—£700 a year, plus cost-of-living bonus; woman: £400—£15—£600 a year, plus cost-of-living bonus. At present the bonus on £400 is £179 2s. and on £500 is £208 10s.

Essential qualifications: (*a*) Degree in Science, Geology being one of the subjects taken in the University Course, or an equivalent to such degree; (*b*) considerable experience of geological work in the field.

Latest date for receiving completed application forms: April 12, 1940.

THE MAYNARD GANGA RAM PRIZE

Applications are invited for the award of the Maynard Ganga Ram Prize of Rs. 2,000/- for the two years ending December 31, 1940, for a discovery or an invention or a new practical method which will tend to increase agricultural production in the Punjab on a paying basis. Competition for the prize is restricted to non-officials only, irrespective of caste, creed or nationality. Government servants are not eligible on this occasion. Essays and theses are not accepted. The prize will be awarded for something practically achieved as a result of work done after the prize was founded in 1925. Competitors in their applications must give a clear account of the history of their invention or discovery and must produce clear evidence that it is the result of their own work. In the case of an improved crop details of parentage, evolution and history and a botanical description are necessary.

The Managing Committee reserves to itself the right of withholding or postponing the prize if no satisfactory achievement is reported to it.

Entries should reach The Director of Agriculture, Punjab, Lahore, not later than December 31, 1940.

THE RESEARCH ASSOCIATION OF BRITISH RUBBER MANUFACTURERS

The Board of Management invites applications for appointment to the post of Director of Research, vacant by the death of Mr. B. D. Porritt.

Candidates must possess first-class scientific qualifications and research experience. It is desirable that candidates should have spent some time in the rubber manufacturing industry. In addition, ability for organization and co-operation with the industry is regarded as important.

The salary will be of the order of £1,200 per annum, according to qualifications, with superannuation provision under the F.S.S.U. Scheme.

Applications should be addressed to The Secretary, The Research Association of British Rubber Manufacturers, 105/107 Lansdowne Road, Croydon, and be received not later than April 6, 1940.

Lewkowitsch Bibliographical Bureau (Director: J. Lewkowitsch, B.Sc., A.R.C.S.), Barn House, Barn Hill, Wembley Park, Mddx. (ARN 3956). Abstracts of papers, summaries of literature, bibliographies. Periodical reports of current literature. Bibliographical researches. Chemistry, Biochemistry, Physics, Geology, Botany, Biology. Any language. Accuracy and completeness. Moderate Terms.

BRADFORD EDUCATION COMMITTEE TECHNICAL COLLEGE, BRADFORD

Applications are invited for appointment as Lecturer in Metallurgy in the College.

Salary according to the Burnham Award, which in the case of graduates is up to £528 per annum. Commencing salary according to qualifications and experience.

Further particulars of the appointment and forms of application may be obtained from The Director of Education, Town Hall, Bradford, and completed forms should be returned to the Principal of the College not later than March 16, 1940.

THOS. BOYCE,
Director of Education.

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