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HEALTH AND SOCIAL WELFARE

ALTHOUGH the health of the nation in war has recently been debated in both Houses of Parliament, the attention paid to the subject has scarcely been commensurate with its importance ; indeed it might be held that in this matter Government action is in advance of public opinion. Upon the standard of health depends very largely the volume of production and also the quality of the Fighting Services, yet in the concern over absenteeism, as a report of the Select Committee on National Expenditure indicated, there has been little appreciation of the health factor as the result of excessive hours of work. The precious and vital asset of the good health of the industrial worker is yet to be fully appraised, even if we are more awake to the value of civilian health generally as a result of last winter's experiences.

A further encouraging picture of the nation's health generally has been given by the Chief Medical Officer of the Ministry of Health, while in the recent debate the Minister himself showed that the nation is entitled to congratulate itself on the avoidance of serious epidemics during the second as well as the first year of the War. This second year, moreover, included a period of intense air attack when large sections of the population lived in shelters, often insanitary, and in which material damage coupled with a large re-distribution of the population undoubtedly caused some overcrowding. That the public health has remained so good may well be more a matter of good fortune than of a well-planned policy for the health services, and there can clearly be no relaxation of vigilance. The Minister himself pointed out that good housing is the indispensable foundation of public health, and housing policy is necessarily in suspense.

It should be our first aim, therefore, to utilize this breathing space to adapt our health services to the harder conditions which may lie ahead, and two broadsheets issued by Political and Economic Planning (P E P) are welcome for their contribution to this end. The first of these, on "Health in War-time", points out that the problems of civilian health are potentially far more serious than in the War of 1914–18, mainly because the development of aerial warfare has made the wrecking of civilian community life and services a major objective in the attack on Britain. This is due not merely to the actual damage to public services, such as gas, water, electricity or sewers and consequent deterioration of public hygiene, or to hospitals and clinics, but also to the widespread existence of conditions making for fatigue and loss of satisfactory sleep, and to the indirect effects of the black-out in homes and work-places in reducing the supply of light and air and assisting the spread of air-borne infections.

The two major problems, however, are, as in 1914–18, how to ensure adequate nutrition and how to combat fatigue. The nutrition situation is still much better than in 1917–18, and the measures being taken by the Ministry of Food, of which the new scheme for extending the supply of meals and milk for school-children announced by Lord Woolton is a recent example, encourage the hope it may never deteriorate to the same extent. Confidence in this respect is strengthened by the evidence of co-ordinated policy and close collaboration not merely between the Ministry of Food and the Board of Education but also between the Ministry of Food and the Ministry of Transport, as indicated in a subsequent announcement regarding the rationalization of transport to eliminate avoidable cross-hauls and the control of transport of foodstuffs by the Ministry of Food.

The problem of fatigue is probably much more serious. It is estimated that the average adult has lost one hour's sleep a night, and in the bombed areas his sleep is less satisfying than in peace-time. Moreover, hundreds of thousands miss most of their sleep on a number of nights each month because of Home Guard, fire-watching or other civil defence duties. The ratio of civilian food intake to energy output has so far been reduced more from the output and less from the intake end than in 1914–18. Whether this will in the long run reduce physical resistance so as to lead to outbreaks of infection on a large scale is impossible to say. The situation is clearly fraught with long-term dangers and calls for the utmost vigilance, as well as fully justifying all the attention that Lord Woolton is able to give to the variety of diet and the character of nutrition as well as to its amount.

In such circumstances it is of the utmost importance to avoid any unnecessary taxing of health and strength whether in home life or in industry. For this reason alone the recent report of the Chief Inspector of Factories makes somewhat disquieting reading. The Senior Medical Inspector, it is true, finds no evidence that in general the health of the industrial worker has materially suffered in spite of all the adverse circumstances. Night work in itself is not lowering his physical standard, and the effect of long hours on production has led to some relaxation before it has had any real effect on the general health of the worker. Moreover, there is no evidence pointing to any appreciable number of accidents due to nervousness or jumpiness caused by air raids. The evidence is all the other way of courage and spirit in overcoming intense handicaps.

What is disturbing in this report is the evidence of close vigilance that is still required in respect of hours of work, and the alarming wastage of man-power and woman-power through preventible accidents. The question of long hours recurs throughout the report, and while many managements have learnt the lesson that excessive hours diminish production and that proper breaks and rest days are of great importance from the point of view of output alone, there is far too much evidence that other managements have forgotten or appreciate insufficiently the lessons of the War of 1914–18. The observations of the admirable report of the British Association for Labour Legislation issued last year on welfare and health in relation to hours of work and output in war-time remain pertinent. They are supported by a special report on the subject issued by the Industrial Health Research Board, as well as by evidence in the reports of the Select Committee on National Expenditure.

It is clear that in this matter greater stiffness in enforcing good labour conditions would promote production and efficiency as well as morale and health ; and a like observation applies to the question of accidents. Fatal accidents rose last year by 24 per cent and non-fatal accidents by 20 per cent over 1939, the figures for which were already 17 per cent and 7 per cent, respectively, higher than in 1938. This increase is attributed to relaxation of care, and particularly the neglect of training in accident prevention among the new industrial workers. While inspectors have to meet some criticism that accident prevention is rather an unworthy subject for consideration in war-time, when men in the Forces are taking every kind of risk, the criticism is unsound ; further, as the Chief Inspector points out, the Services are carefully trained not to take unnecessary risks.

What has yet to be realized by management, and sometimes also by workers, is the serious loss of output directly due to accidents caused by lack of reasonable care. This is a matter of increasing importance as the difficulty of replacement of workers and of parts increases. We cannot develop our full man-power and productive capacity until everything that foresight and sound management can suggest has been done to eliminate waste of this character.

This emphasis on the crucial importance of management in regard to health and efficiency is reflected in two other matters bearing on the health of the industrial worker to which reference is made in the same report. The Senior Medical Inspector stresses the need for the extension of a medical service in factories. Much yet remains to be done under the Factories (Medical and Welfare Services) Order of July 1940, and the increasing appointments of medical officers to factories will fail of their full effect without the goodwill and co-operation of both employers and employees. The

services of fully trained nurses have been greatly extended and they are entering industry in increasing numbers, and if the development of a comprehensive medical service in factories is a long-term policy which cannot be fully achieved in war-time, very considerable advances are none the less possible where managements are alive to the possibilities and realize the opportunities which are theirs through the responsibilities imposed in part under the necessity of civil defence.

The second matter which is one of the responsibilities of management is that of the provision of works canteens. To this subject a special section of the report is devoted. Rationing troubles, two- and three-shift working, travelling hardships, billeting, and bombed homes have made the works canteen an essential in war-time. The difficulties in regard to construction and equipment appear now largely to have been overcome, though resort to mobile canteens may be desirable where a policy of dispersal has aggravated the difficulties. Particularly among the smaller employers, conservatism remains an obstacle, and the factory inspectorate sees no alternative but the extension of communal feeding under the local authorities.

The question of canteens indeed illustrates the way in which the health of the industrial worker is linked up with that of the civil population. The extensions of the selective distribution recently announced by the Ministry of Food should in themselves give a direct impetus to the canteen movement, and the policy of redressing the grievances or inequalities which are inseparable in a uniform rationing system in this way is unquestionably sound. Before the end of the year, eighty-five per cent of miners will be receiving supplementary rations served out at the pithead, and the issue to heavy workers of special rations in their canteens or other catering establishments is sound from the health as well as from the production point of view.

These may be described as a short-time programme, but whether they and the long-term programme for the adequate feeding of children will prove effective depends on other factors—continued success in the Battle of the Atlantic, the rigorous elimination of waste, effective administration of the policy itself, and not least the progress of our own efforts to increase food production. The marriage of health and agriculture which is being realized under our eyes is one good thing that has come out of the War, like the fuller utilization of our rapidly advancing knowledge of nutrition. The P E P broadsheet rightly lays stress upon the great asset we possess in this respect compared with 1914, particularly through advances in chemotherapy, in blood transfusion techniques, in radiology, in the understanding of problems of industrial health and fatigue and of the mechanisms of the spread of air-borne infections, and other branches of medical science.

This linking up of nutrition and health with agriculture is a noteworthy example of the way in which provision for war-time needs is serving those of long-term policy or reconstruction after the War. The hospital services themselves provide yet another outstanding example; air warfare has already forced upon us a transformation of our medical services. The admirable analysis of the Emergency Hospital Scheme contained in the second P E P broadsheet, on "Hospitals in War Time", not only reviews the scheme in action, but also makes constructive proposals for the improvement of this highly centralized organization.

The first of these proposals is the development of the Emergency Hospital Scheme into a National Hospital Service. The estimates of expected casualties should be reviewed, but the State should continue to pay full treatment costs for Service cases and air-raid casualties, and also for all children, as well as residual costs for full-time civil defence workers, Home Guards, etc. A direct State subsidy to hospitals to maintain their working efficiency is proposed. Changes in central administration involve transforming the E.H.S. Division of the Ministry of Health into a National Hospital and Medical Services Division, and the Ministry would have to play a more positive part to ensure that hospital services everywhere are brought up to an adequate level for the needs of the whole population.

These proposals involve greater regional autonomy and co-ordination. They can only be carried out if the Ministry's regional staffs are strengthened and greater powers delegated to them. The regional and group officers must be carefully selected for administrative ability and be vigorously backed by the Ministry. Other proposals relate to the further development of services: for example, out-patient departments and specialist clinics at appropriate base hospitals, pædiatric services in all reception areas, regional courses on the structure of the E.H.S. and its experiences in action, on war surgery in general, on blood transfusion, poison gas, rehabilitation of the injured and the nursing of war wounds.

Finally, the broadsheet proposes machinery for the planned use of medical man-power, including the transformation of the Central Medical War Committee into a War Medical Service Committee, representing all the interests involved, to determine priorities, to allocate medical men to the various civilian and military services, and to plan their geographical distribution and full employment. Working through regional committees, incorporating the machinery of the existing local

medical war committees, which register local medical men for national service and recommend how they should be allocated, this proposal might not only facilitate the transference of private practitioners to correspond with the movements of population, but also assist in the use for civilians of medical men in the armed forces who are not fully utilized at present—a question already much discussed by practitioners and social workers and one which may soon become an urgent general question.

Since the broadsheet appeared the Government has announced the broad principles on which its post-war policy will be based. The partnership between the local authorities and the voluntary hospitals is accepted, not merely as the existing basis of the hospital services but as the necessary basis, supplemented by sufficient Government support to ensure that as soon as possible after the War appropriate treatment should be readily available to all in need of it through a comprehensive hospital service. The Government proposes to lay on the major local authorities the duty of securing, in co-operation with the voluntary agencies, the provision of hospital services, and that the service must be designed to serve areas substantially larger than those of individual local authorities, so as to avoid wasteful multiplication of equipment and accommodation. The Government also proposes to secure the provision of the more highly specialized services at teaching hospitals and other selected centres.

These proposals, though less detailed, are clearly in line with the general ideas underlying the recommendations of the P E P broadsheet. Both sets of proposals visualize the construction of the new hospital service on the experience of the past, and the synthesis of traditions and techniques, previously separate, in the service of a wider movement. Nowhere indeed are there wider possibilities in the building of a healthier social order than in this field of public health, if we but utilize aright the new knowledge and experience of nutrition and healing, of regional organization and administration which lie at our command as a result of research and development, in part through the impact of the War. Social habits, both of diet and of occupation, have been broken down, giving us immense opportunities of raising the whole standard of life and health, if we are ready to seize those opportunities after the War. Nor need we wait until after the War. As Lord Horder has reminded us, in this matter of food and fitness, health and education, child welfare and agriculture, we can begin now in the very service of our war effort.

WORLD ECONOMICS AFTER THE WAR

Economic Peace Aims: a Basis for Discussion
By Oswald Dutch. Pp. 280. (London: Edward Arnold and Co., 1941.) 12*s*. 6*d*. net.

MR. DUTCH begins his book with an excellent destructive account of the muddle which was made, especially from the economic point of view, of the settlement of European affairs after the War of 1914–18. This encourages the hope that he will be equally successful in making practical proposals for the settlement after this War. But this hope is disappointed. Mr. Dutch wavers continually between an almost Utopian optimism —as when he proposes that the world shall become practically a free trade area without any barriers in the way of free exchange within about a twelve-month of the conclusion of hostilities—and a contrasting pessimism which causes him to harp on the dangers of over-production and the need for a universal system of quotas, which are somehow mysteriously to be prevented from operating in the same restrictive fashion as capitalist monopolies have by his own admission been operating in recent years. Again, Mr. Dutch is so haunted by the fear of totalitarianism in all its forms that he appears unable to recognize anything of value in the achievements of the Soviet Union, which he continually brackets with Nazi Germany and Fascist Italy as a horrible example of the destruction of every kind of human liberty.

Mr. Dutch is, in effect, an advocate of controlled capitalism as the instrument of post-war reconstruction over all the world. "The primary and most important fundamental for fixing the status of capital in a new economic plan must be that property remains untouched. There must be no capital levy, no expropriation, no breaking up of landed property, and no abolition of hereditary rights." In view of this sweeping statement it is not surprising to find that, in spite of his devotion to the cause of liberty, he has no hesitation in recommending the conscription of labour for the work of reconstruction. "It will be advisable not to demobilise these men [the armed forces, except those who have definite jobs to go back to] but to put them to work in groups, under army discipline but at full rates of pay." I fancy that, in all countries, the returning conscripts will have

something to say about this simple plan, especially if Mr. Dutch's views about the immunity of capital are carried into effect.

The truth is that Mr. Dutch very simply identifies democracy with capitalism. He recognizes that capitalism will need to accept a large element of State planning in the post-war world, but he assumes that ordinary men and women will be quite content to accept a military discipline that will compel them to work for controlled capitalism acting as the agent of public policy. "This work" [the work of reconstruction], he says, "will not of course be carried out by the State directly but by private firms commissioned by the State." Very possibly it will, but the human beings whom the State is to send to work for these private firms' profit will in that case be disposed to ask a good many questions to which Mr. Dutch neither provides nor attempts any answers.

For the rest, Mr. Dutch shares the projector's habit of specious particularity in prescribing measures for the post-war world. He is at home when he is neatly classifying things, and saying categorically that this and that will be done. But sometimes his particularity conceals a real confusion of mind. It is, for example, quite impossible to extract from his various statements any clear notion of the position which he expects Great Britain to occupy in the economic or political structure of post-war Europe. Sometimes it appears that Great Britain is to be an integral part of a unified European system, and at others that Great Britain, linked to the British Empire, is to stand outside, but related to, a Continental system in much the same way as the United States. He recognizes clearly the part which the United States will be called upon to play, not only in the immediate tasks of relief but also in the long-term reconstruction and development of the European continent and of the backward countries of Asia and the rest of the world. But in relation to Great Britain he shows a marked desire both to eat his cake and to have it, by treating Great Britain both as a part of the European system and as a partner with the United States in reconstructing a European system to which she will not completely belong. "Resolutions taken by the Parliament and Government of the Commonwealth will be restricted to Continental affairs and Great Br tain will be excluded from the territorial sovereignty of the Commonwealth Government. Great Britain will have to share in much of the responsibility for Continental affairs, especially in matters of defence, finance, and economic problems. On the other hand, the European Commonwealth will have no responsibility for British affairs." This, and the chapter from which it is taken, seem to me merely muddled. I have no conception of what Mr. Dutch really means.

I do, however, understand what he means when he writes that "the masses of the peoples must be transferred from war to peace work at once without giving them time to organize themselves elsewhere or to carry out any extremist plans". I think Mr. Dutch's conception of democracy is that of a society in which, on one hand, there is "no capital levy, no expropriation, no breaking up of landed property, and no abolition of hereditary rights", and on the other hand, the peoples are compulsorily driven to labour "without giving them time to organize themselves elsewhere or to carry out any extremist plans". This is not my conception of democracy; and I find it, to speak plainly, quite infuriating in one who appeals to his readers in democracy's name. I suppose Mr. Dutch believes himself to be a democrat, and is not pulling his readers' legs. But I sincerely hope no one will take him as a guide to the foundation of our economic peace aims, and at the same time greatly fear that many people will; for he presents just the sort of muddled eclecticism which is calculated to appeal to those who wish to believe that the new world can be at once altogether different from the old and a secure repository of all the ancient values which they personally would like to preserve.

G. D. H. COLE.

A REVIEW OF THE ALGÆ

An Introduction to the Study of Algæ

By V. J. Chapman. Pp. x+387. (Cambridge: At the University Press, 1941.) 18s. net.

THERE has long been a need for a short general account of the Algæ, for the various works published during recent years are either detailed treatments, often dealing only with certain aspects, or specialized taxonomic works. The book under review aims at supplying this need and endeavours to deal briefly with the study of Algæ from every point of view. The task that the author has set himself is no light one, and for its successful accomplishment both considerable experience and a judicious handling of the subject-matter are requisite. Despite diverse defects, Dr. Chapman's book will undoubtedly prove of value to those wishing to obtain an outline knowledge of the range of form and reproduction and of the manifold roles that Algæ play in Nature. The author has shown great industry in assembling the wide range of

matter that is covered, but one cannot help feeling at the outset that he has detracted seriously from the value of his work by endeavouring to include too much and by the manner of presentation, which lacks continuity. It is difficult at various points to get away from the impression of rather hasty compilation, and diverse sections would have profited from a more carefully considered and balanced treatment.

Rather more than two thirds of the book is taken up by the taxonomic and morphological matter, and here the Chlorophyceæ and Phæophyceæ occupy the bulk of the space. The sections on Cyanophyceæ, Xanthophyceæ and Rhodophyceæ are brief, while all other classes receive little more than mention. In each main section, after a short introduction, a series of 'types' is described. Apart from the question whether such separate consideration of genera is the most suitable method of introducing the reader to an acquaintance with the Algæ, too many examples are often selected. This has the disadvantage of confusing the picture, the more so as individual descriptions are commonly so inadequate that one may doubt the value of their inclusion. As examples, Chordaria, Elachista and Corallina may be mentioned, while the account of Sporochnus gives no conception at all of the structure of this remarkable form, so fully studied by Kuckuck and Sauvageau. The choice of 'types' does not always appear to be very appropriate. Among the true desmids, for example, the only genus considered is Closterium, which is divergent in various respects. It is difficult to understand why Martensia is brought in on p. 230, when the multinucleate character of the tetraspore mother-cell is equally well shown by the British *Nitophyllum punctatum*. Nemalion is referred to at the end of the description of Batrachospermum because of the division of the spermatium-nucleus which is also recorded in the latter, while more important features, such as the fusions in the carpogonial branch of Nemalion, are not mentioned.

The subject-matter is in general up to date, but if the author had delved rather more deeply into the Continental literature, he would have avoided several misstatements or omissions. Thus, the unilocular sporangia of *Ectocarpus virescens* (p. 134) were described by Sauvageau in 1933, and Papenfuss described the gametophytes of Spermatochnus (p. 148) in 1935. Under Sphacelaria prominence is given to the rather inconclusive work of Clint, while that of Papenfuss which, together with that of Schreiber on Cladostephus (1931), sheds considerable light on the nature of the life-cycle in Sphacelariales is afforded a rather casual mention. A perusal of Nienburg's work (1913) would have contributed to a clearer presentation of the development of the conceptacle in Fucales. The account of cell-structure of Cyanophyceæ is scarcely in accord with the present state of our knowledge. A number of erroneous statements, for example, the reference to Phacotus as a colourless form, that relating to the orientation of the flagella in Dinophyceæ, and the development of the cystocarp-wall in Polysiphonia, should have been avoided. There are other inaccuracies. For example, red snow (p. 33) is due to a species of Chlamydomonas and not of Sphærella, as was shown long ago by Wille, the 'trumpet-hyphæ' of Laminariales are almost certainly for the most part neither connecting threads nor hyphæ, while the account of the mature Thalassiophyllum plant accords ill with the familiar figure of Postels and Ruprecht.

Statements are made in various parts of the book that appear to lack any sound foundation; examples are the suggestion of homoplasy between Merismopedia and Prasiola, that the original centre of distribution of Laminariales was in the North Pacific, and that there is an affinity between Trentepohlia and Phæophyceæ. The chapter on reproduction and evolution is in my opinion a definite backward step, and the matter is presented in such a form that the student will find difficulty in following it. A scheme such as that given on p. 261 has no support whatever in fact and is contrary to all modern teaching, while the value of phylogenetic trees like that on p. 262 may be questioned. The final chapters dealing with physiology and ecology contain a considerable amount of useful though not very thoroughly digested matter. The account is, moreover, marred by too much tabular presentation, and the treatment is in part rather one-sided. Why, for example, should a range of salt-marshes be considered, while the account of lake communities is restricted to Windermere? Why should freshwater and marine plankton be almost entirely ignored and yet several pages given to a tabulation of various classifications of life-form among the Algæ?

The brief citations of literature at the end of each chapter are perhaps intentionally rather one-sided, since reference is often made mainly to British and American papers. A considerable number that are included are, however, rather paltry and might with advantage have been omitted to make place for others of greater importance. One is surprised, for example, to find no mention of Killian's paper on Laminariales, of Sauvageau's classical memoir on Sphacelariales, and of Kylin's more recent contributions to Floridean morphology. The copious illustrations occasionally suffer from too much reduction or from crowding.

F. E. FRITSCH.

VEGETABLE PRODUCTION IN THE TROPICS

Vegetable Gardening in Malaya

By J. N. Milsum and D. H. Grist. (Malayan Planting Manual, No. 3.) Pp. xviii+215+52 plates. (Kuala Lumpur: Department of Agriculture, 1941.) 2 dollars.

IN recent years British Colonial policy has been largely directed to matters of nutrition, and the health and well-being of the native inhabitants have been matters of particular concern. In many Colonies the development of export crops had, for long, been the main interest, and such research and experiments as have been undertaken were largely devoted to these crops. Latterly, however, the need for the investigation of the food crops of the people has received increased attention, and new discoveries in the realms of human nutrition have brought to light the unbalanced ration on which so many of the people have had to subsist, and more particularly the need for the increased consumption of those foods containing the so-called 'protective elements'.

The book under review deals with vegetable gardening in Malaya and is a sequel to two previous publications on the same subject published by the Department of Agriculture of the Straits Settlements and Federated Malay States. The senior author of this edition has been associated with all three publications. This one includes and brings up to date much of the information incorporated in the previous volumes.

The present book is a complete compendium of vegetable gardening in Malaya. It includes detailed accounts of the most important of the native vegetables grown, and also some of the newer introductions of foreign origin. So many of the gardening books of the tropics have included the cultivation of fruits and flowers, that they are somewhat unwieldy, and as a result the section devoted to vegetables has often been too scanty. A similar mistake has not been made in this instance where the work is confined strictly to the cultivation of vegetables. Useful chapters describe the methods of preparing the land, and the common insect pests and diseases and ways of controlling them. There is also an account of the vitamin contents of the different kinds of vegetables, written in popular language, which is a novel and welcome addition. The description of the cultivation of European vegetables in the highland area is all too brief and might with advantage have been expanded. These high plateaux in the wet tropics present particular difficulties. The temperature is cool enough to suit vegetables from the temperate regions, but the heavy rainfall and the high humidity make matters difficult, and doubtless special varieties will need to be bred to meet these special conditions. These difficulties appear to have been overcome to some extent in the Cameron Highlands by raising the plants under glass-topped frames. An account is given of this method, which may well be worthy of trial in other similar regions in the tropics, but one is inclined to wonder whether the capital cost of such installations might not prove too heavy.

The chapters on economics are of particular interest. A comparison with the neighbouring island of Java shows that the latter country with a teeming population of more than fifty millions is able not only to supply its own needs, but also to export vegetable products to Malaya to the value of half a million dollars. Malaya is in fact largely dependent on outside sources of supply and obtains large quantities of vegetables from China and India. One of the reasons for this state of affairs is the comparatively infertile nature of the soils. In Java the soils are rich, being derived from rocks of modern volcanic origin, but in Malaya, the underlying strata belong to geologically ancient formations and the soils have been leached of their mineral salts by hundreds of years of tropical rainfall. Another contributing factor is the different character of the population. In Java every person is an agriculturist and skilled in the cultivation of the soil, but in Malaya this is not the case, and the Malay was, until recently, accustomed to seek his livelihood on the sea or in the jungle, and did not take kindly to the settled life of a farmer. It is for this reason that we find that even at the present time nearly all the vegetables produced in Malaya are grown by the Chinese, who have settled in the country in comparatively recent times. The Chinaman is the gardener *par excellence* of the tropics. One may not admire all his methods from the strictly hygienic point of view, but he does produce the goods. Further, as is clearly brought out in this book, he thoroughly understands the art of watering and the necessity for abundant supplies of humus and organic fertilizers. He invariably adopts mixed farming methods to supply these needs, and for this reason he combines the keeping of pigs and poultry with his gardening, and is able to convert most unpromising sites, such as the tailings of a tin mine, into flourishing market

gardens. He imports much of his seed from China, and there is no doubt that the varieties of certain cruciferous, leguminous and salad plants which he grows—and they are numerous—would well repay the critical survey of seedsmen from Western countries. It would be fairly safe to prophecy that such a detailed examination would result in the discovery of additions to our present list of cultivated vegetables, which would be of great value to the plant breeder.

Efforts are now being made by the Department of Agriculture to persuade the Malays to emulate the example set by the Chinese. The latter seem to have the trade for the supply of vegetables in bulk to the towns in their hands, but there is no reason why the Malay cultivator and the estates should not do more towards growing sufficient for their own requirements. The efforts that are being made in this direction are well described, and the drive is being stimulated by existing war-time conditions, which have resulted in a shortage of shipping and thus of imports.

The book is illustrated with photographs of the more typical vegetables and is well worthy of the study of all people interested in tropical gardening.

GEOFFREY EVANS.

THE NEW PHARMACOLOGY

The Pharmacological Basis of Therapeutics

A Textbook of Pharmacology, Toxicology and Therapeutics for Physicians and Medical Students. By Prof. Louis Goodman and Prof. Alfred Gilman. Pp. xiii+1383. (New York: The Macmillan Company, 1941.) 50*s*. net.

IN the past, most important pharmacological discoveries have been made in German universities and German commercial laboratories, but in recent years the work of American pharmacologists has been growing rapidly in importance. "The Pharmacological Basis of Therapeutics", by Profs. Goodman and Gilman of Yale, is a valuable review of this American work.

The authors must be warmly congratulated on this remarkable book. It is written from the clinical point of view; experiments on man are described more fully than experiments on animals, the results of which are given without detailed discussion, so that the book is a work of reference for the intelligent medical practitioner rather than an exposition of the methods which have led to such remarkable advances in pharmacology in recent years. In this respect the book resembles many recent text-books of pharmacology, which have tended to concentrate on the applications of the results to man. This tendency is in many ways a good one, but there is a danger that it may go too far, and that the student may never learn that pharmacology is a living experimental science, which has had great practical effects.

Most medical students will find this book too long, but it will be very valuable for teachers and experimentalists. It contains thousands of references to recent work, a large proportion of them to papers published in 1940. It opens with 100 pages on anæsthetics, and there are 180 pages on cholinergic and adrenergic nerves, more than 100 pages on sulphanilamide and related drugs, 88 pages on hormones and 60 pages on vitamins, with equally complete sections on other branches of pharmacology.

All this wealth of information is apt to have a humiliating effect on anyone who has tried to keep abreast of pharmacological literature, and to stimulate a search for omissions. The clue to success in such a search lies in the fact that the European literature has been less well covered than the American literature. For example, in the section dealing with emetin cathartics, it is stated that the time required for the drugs to traverse the small intestine, and the necessity for a chemical liberation of the active principle, delay the cathartic action, but there is no discussion of the work of Straub, which showed that delay in the small intestine played no part in the time of action of senna, which was not affected by tying the small intestine so that the drug could only act through the blood stream.

The release of histamine in anaphylaxis is dismissed as if it were a dubious speculation rather than a well-proved fact, while the release of histamine by the exposure of sensitive individuals to cold is thought to be established by the isolated observation that an acid gastric juice is secreted.

The section on sympathomimetic drugs contains no mention of perovitin (or methedrine) which has aroused interest in Great Britain because it has been said to have been used to increase the endurance of German parachute troops.

In spite of a few such omissions, the text as a whole is very full and up to date, and gives a very fair account of controversies still raging. It is the kind of work that might have been the fruit of the collaboration of a team of authors, and it is difficult to think how two men did it.

J. H. GADDUM.

The Physical Examination of Metals

By Dr. Bruce Chalmers and Dr. A. G. Quarrell. Vol. 2: Electrical Methods. Pp. viii+280+8 plates. (London: Edward Arnold and Co., 1941.) 20*s*. net.

IN Vol. 1 (reviewed in NATURE, 145, 660; 1940), Dr. Chalmers described optical methods of metallurgical investigation. In the present volume, he unites with Dr. Quarrell, a pioneer in the development of electron diffraction research in metallography, to deal with electrical methods, thus completing a work which will be a boon to the research worker and an indispensable part of students' reading.

The scope of vol. 2 is reviewed in its first chapter. It is logically planned, commencing with magnetic properties and their measurements. Electric measurements and thermo-electric effects are then discussed. X-ray diffraction technique, as applied to metallurgy, is then dealt with and electron diffraction methods follow. The present position of electron microscopy is then examined. The final chapter deals briefly with radiography. Appendixes are devoted to electrolytic polishing and X-ray crystallographic data.

This book successfully combines theoretical treatment with practical outlook. The authors have certainly succeeded in their attempt "to indicate the scope and limitations of the various methods . . . by reference to successful applications". One application, hitherto unpublished, is a very pretty microthermal analysis (p. 108), for which Dr. Chalmers managed to do without any gramophone needles.

Perhaps because it is regarded as engineering rather than metallurgy, stress analysis is not dealt with in the discussion of X-ray diffraction methods.

H. W. G. H.

Modern Assembly Processes

Their Development and Control. By J. L. Miller. Pp. xii+168+28 plates. (London: Chapman and Hall, Ltd., 1941.) 13*s*. 6*d*. net.

IT is possibly strange that engineers have had to wait so long for a book dealing specifically with jointing methods used in the large-scale production of small parts. So far as Great Britain is concerned, it is probable that everybody has waited for Mr. Miller to write it. Those readers who have not the good fortune to know the author personally, will learn from this book that he is a first-class engineer of very long practical experience and gifted with the intelligent curiosity and enthusiasm which most people lose when they gain years of discretion. Those who do know him will enjoy meeting him again in these pages, packed with common sense, and will take particular pleasure in the simple logic with which each point is explained.

The processes dealt with are riveting, soft soldering, hard soldering and brazing, hydrogen furnace brazing, pressure and shrinkage fits, fusion welding by gas and arc methods and electrical resistance welding. The advantages and limitations of each method of jointing are clearly stated and the fundamental principles, on which a choice should be based, are admirably stressed. The chapters on hydrogen furnace brazing and projection welding are unique, since the author has had unique experience in developing and applying these processes; but there are few chapters in which the most up-to-date engineer will not find something useful, and the wisdom of Chapter 14, "Testing, Inspection and Trouble Hunting", is worth every penny of the book's purchase price.

Polynesian Paradise

An Elaborated Travel Journal, based on Ethnological Facts. By Donald Sloan. Pp. 288+15 plates. (London: Robert Hale, Ltd., 1941.) 12*s*. 6*d*. net.

THIS book is a departure from the usual type of story from the South Seas in that it contains quite a lot of information that will interest an anthropologist. The author lived for several months on Manu'au, an isolated group of three volcanic islands inhabited by Polynesians of Samoan stock. These islands are off the usual routes and their isolation has been jealously guarded by the United States of America, to whom they belong, in order to preserve their integrity. This is the more easily done as the Manu'ans themselves are a conservative race and cling to their old ways of life.

By living among them as he did, the author was able to enter freely into their daily life, and he obviously made good use of his opportunities. As a personal guest of the chief he was present, and partook of, all the important feasts and ceremonies, including those for the burial of the chief and the marriage of the village virgin. He gives full accounts of these as well as of the daily life of these unsophisticated people, with whom he was evidently on excellent terms. While there he learned, among other things, to fight with and kill a shark single-handed and armed only with a sharp knife: dealing thus with a seven-foot man-eater provides a truly Homeric contest.

Natives such as these Manu'ans who dwell in isolated parts and live out their lives in the old traditional way are always an interesting study, and although this book is perhaps more adventurous than deeply scientific, it may be none the worse for that as it is likely to interest a wider circle of readers in an extremely important study—that of the unspoilt native peoples.

Introductory Foods

By Osee Hughes. Pp. vii+522. (New York: The Macmillan Company, 1940.) 12*s*. 6*d*. net.

THIS book will be regarded as throwing interesting light on the impact of nutritional science on cookery practice in the United States. It shows how the American housewife has become 'food-conscious' and 'vitamin-conscious', and why she has been diverted from the straight and honest path of Mrs. Glasse and Mrs. Beeton. The author has given quite a good scientific background to the hundred and one cooking problems he discusses. Vitamins, viscosity, surface tension, denaturation, crystal form are only a few of the scientific problems dealt with.

FOOD FROM THE GARDEN

By Dr. H. V. Taylor
Ministry of Agriculture
AND
Dr. J. C. Drummond and Dr. M. Pyke
Ministry of Food

IN peace-time, gardening was merely a hobby to a great many people. In consequence it was common to have a superabundance of vegetables in the summer and insufficient in the winter. Very few people before the War gave any thought to the food value of the crops they grew in their gardens. Nowadays, however, it is essential that vegetables should be produced in a systematic sequence throughout the year and that those vegetables should be grown which will provide in greatest abundance the food constituents most needed in the war-time diet.

The method of cropping described in 1939 by the Ministry of Agriculture in Bulletin No. 1, "Food from the Garden", was designed to fulfil these requirements. The Bulletin contained a cropping plan of the area to be devoted to each crop, the time of sowing and the period of use of each crop. Gardens and allotments were planted in this way during 1940 in most towns of England and Wales. Ninety-eight gardens and allotments, each of ten perches in size, planted in this way were selected and records were made daily of the weight of the crops and the time of gathering. From the complete records set out in the accompanying tables it will be seen that the yield averaged for all these gardens for the year was 411 lb. of potatoes and 1,085 lb. of other vegetables.

Although potatoes and some other vegetables can be stored for considerable periods, it is essential for any plan to be satisfactory in war-time that it ensures a continuous supply of fresh vegetables throughout the year and especially during the winter period. In each of the four quarters of the year at least a dozen different vegetables were available from the planned allotments. In the summer period, for example, there were broad beans, runner beans and dwarf beans, cauliflowers, carrots, peas, lettuce, spinach and turnips. The weekly supply of vegetables other than potatoes during each season was approximately that shown as follows :

	Gross weight lb.	Edible weight lb.
Summer	19	12·4
Autumn	19	14·8
Winter	26	19·7
Spring	17	11·2

From these figures it can be seen that not only has the continuous weekly supply throughout the year been achieved, but also that an increased supply is available during the winter when it is most needed.

When the Ministry of Agriculture cropping plan was devised it was known that the field supplies of potatoes would be more than sufficient. In consequence the garden and allotment crop was planned only to provide the household with potatoes until Christmas. In actual fact the gardens from which records were taken gave 82 lb. during the summer period and 330 lb. during the autumn months. This represented a weekly supply of 6 lb. of new potatoes during July – September and 24 lb. a week of main crop potatoes during October – Christmas.

According to Orr and Lubbock[1] the amount of vegetables eaten per week during the period 1937–1939 was 4·2 lb. of potatoes and 1·66 lb. of other vegetables. These authors recommended that the desirable consumption during war-time of veget-

TABLE 1.
CROPS IN SEASON FROM GARDENS AND ALLOTMENTS 300 SQ. YARDS IN SIZE.

Vegetable.	Weight in lb.				Total Crop
	Summer	Autumn	Winter	Spring	
Broccoli, sprouting				23	23
Brussels sprouts		18	25		43
Cabbage	5	50	50	53	158
Kale			23		23
Lettuce	27	9		18	54
Savoys			58		58
Spinach	10	10		10	30
Turnip Tops				6	6
Beans, Broad	21				21
Beans, Dwarf	20				20
Beans, Runner	34				34
Beans, Haricot		1½	1½		3
Peas	25			25	50
Potatoes, New	82				82
Potatoes, Old	55	137	137		329
Beet	19	19	19		57
Carrots, Young				17	17
Carrots, Old	27	27	27	10	91
Parsnip		27	40		67
Radish				12	12
Swedes		8	27		35
Turnips		27	27		54
Leeks			12	24	36
Onions, Spring				9	9
Onions	15	15	15	15	60
Shallots	1½	1½	1½	1½	6
Marrow	17	17	17		51
Cauliflower	15	16			31
Celery	6	7			13
Tomato	10	5			15
Parsley & Herbs	1	1	1	1	4
Rhubarb				4	4
Total Crop	390½	396	481	228½	1,496
Totals, less Potatoes	253½	259	342	228½	
No. of persons at 2·6 lb. vegetables per week	7·5	7·7	10·1	6·7	

ables other than potatoes should be 2·6 lb. a week. On this basis the vegetable supply from each of the ninety-eight gardens was sufficient for a family of five people for the whole year and in each season of the year.

Nutritive Values

Although potatoes supply a substantial proportion of carbohydrates, and thus of calories, to the diet and they and other vegetables provide a certain amount of protein, vegetables are primarily of importance for their 'protective' value, that is to say, the vitamins and mineral salts contained in them.

For an adult a good daily allowance of vitamin A is about 5,000 international units and of vitamin C about 50 mgm. These are the two vitamins which vegetables can primarily supply. Vitamin B_1 is derived from wheatmeal bread and other cereals and to a less degree from potatoes, pork and meat, although green vegetables make some contribution.

It will be seen from the accompanying tables that the vegetables produced according to the Ministry of Agriculture cropping scheme provide the full dietary needs of vitamin C throughout the year for from 8 to 12 people. Considerable losses due to wastage, cooking and other causes may be expected, so that it would be conservative to consider this equivalent to the true requirement of a family of 4 or 5 people. This is a most valuable contribution to the national diet and one which can only be achieved by planning vegetable production with a clear appreciation of the object in view. This contribution of vitamin C made to the diet by vegetables is particularly noteworthy at a time when fruit is difficult to obtain. The amount of vitamin A provided in the form of carotenoid precursors, mainly β-carotene, while not so ample as that of vitamin C, is nevertheless a most substantial proportion of the family requirement. The loss of vitamin A in cooking is very much less than that of vitamin C.

Examination of Table 2 in detail shows the contribution made by each vegetable. For example, carrots, which are available throughout the year, provide the major proportion of vitamin A. It would therefore be inadmissible to substitute any other crop for them. Similarly, savoys, which are available in the period January–March, maintain the supply of vitamin C at that time. The amounts of such minor crops as beets, shallots or turnips may be varied to some extent according to taste, but alteration in the quantities of winter greens, for example, and particularly carrots, will weaken considerably the whole plan of a continuous supply of 'protective' nutrients.

Beside their primary role in the diet as sources

Table 2.

Quantities of Vitamins A and C in Crops.

Crop	Average Vit. A. (I.U. per 100g.)*	Average Vit. C. (mgm. per 100 g.)	Summer		Autumn		Winter		Spring	
			Vit. A. I.U.	Vit. C. mgm.	Vit. A. I.U.	Vit. C. mgm.	Vit. A. I.U.	Vit. C. mgm.	Vit. A. I.U.	Vit. C. mgm.
Broccoli, Sprouting	300	65							31,000	6,700
Brussels Sprouts	300	65			24,000	5,200	34,000	7,200		
Spring Cabbage	300	65							71,000	15,400
Winter Cabbage	300	65	7,000	1,500	67,000	14,600	67,000	14,600		
Kale	300	65					31,000	6,700		
Lettuce	300	65	36,000	7,600	12,000	2,600			24,000	5,200
Savoys	300	65					78,000	16,800		
Spinach	300	65	13,000	2,900	13,000	2,900			13,000	2,900
Turnip Tops	300	65							8,000	1,700
Broad Beans	0	0								
Dwarf Beans	0	0								
Runner Beans	300	65	46,000	9,900						
Haricot	0	0								
Peas	300	65	33,000	7,200					33,000	7,200
Potatoes, New	0	12		4,400						
Potatoes, Old	0	6		1,500		3,700		3,700		
Beet	0	15		1,300		1,300		1,300		
Carrots, Young	6,700	4							570,000	300
Carrots, Main	6,700	4	810,000	500	810,000	500	810,000	500	300,000	200
Parsnip	0	15				1,800		2,700		
Radish	0	15								800
Swedes	0	15				500		1,800		
Turnips	0	15				1,800		1,800		
Leeks	0	16						900		1,800
Onions, Spring	300	16							12,000	600
Onions, Bulb	0	16		1,100		1,100		1,100		1,100
Shallots	300	16	2,000	100	2,000	100	2,000	100	2,000	100
Marrow	0	4		300		300		300		
Cauliflower	0	65		4,400		4,600				
Celery	0	15		400		500				
Tomato	1,000	25	45,000	1,100	23,000	600				
Parsley	300	65	1,000	300	1,000	300	1,000	300	1,000	300
Rhubarb	0									
Others	0									
Quarterly Total			993,000	44,500	952,000	42,400	1.023,000	59,800	1,065,000	44,300
Number of people for which this is the *full* daily requirement			2	9	2	8	2	12	2	9

* Figures based on carotene analyses of vegetable groups.

of vitamins A and C, the vegetables produced from an allotment provide a useful percentage of the mineral elements in which war-time food is likely to be deficient. Calcium particularly, which is important for growth and the structure of the bones in children and for adult well-being, is present in substantial amounts in green vegetables such as kale, sprouting broccoli and turnip tops, and in appreciable quantities in many other vegetables.

CONCLUSION

The results of a critical assessment of the produce grown during 1940 on ninety-eight gardens and allotments show that, under the system of cropping recommended by the Ministry of Agriculture, a fairly even supply of vegetables is secured, with the larger quantities being available during the winter months. These vegetables can probably supply the vitamin C requirements and a substantial proportion of the needs for vitamin A for a family of five people throughout the year, taking into consideration losses due to cooking and other causes. In addition, they provide substantial contributions of other vitamins and of minerals, particularly calcium and iron. The importance of cropping gardens and allotments in this way cannot, therefore, be stressed too strongly.

[1] "Feeding the People in War-Time", by Sir John Orr and David Lubbock, Macmillan (1940).

APPLICATIONS OF PARTICLE SIZE ANALYSIS

By DR. E. G. RICHARDSON
KING'S COLLEGE, NEWCASTLE-UPON-TYNE

MANY methods are available for the delineation of the size-frequency curve of a substance in amorphous form, but most of those in current use are adaptations of the microscope or of sedimentation technique. Each of these has certain disadvantages. The microscope—whether it employs a beam of light or a beam of electrons—demands the careful selection of a representative sample, and much tedious measurement of the cross-section of individuals, setting aside problems of optical resolution and distortion. Rather similar criticism applies to the X-ray method, though this seems only to have been applied to a system having particles of nearly equal size. A method in which the powder is allowed to settle in a suitable fluid medium, either in a gravitational or centrifugal field, or alternatively is held stationary or driven against such a field by a suitable upward fluid current, on the other hand, demands an assumption of Stokes' Law or one of its recent modifications, and also requires that the powder is not so concentrated in suspension that neighbouring particles interfere with each other's movements, and that temperature gradients may not give rise to convection currents. It is also necessary to see that the estimation of the 'weight of a sample'—using the words in a statistical and not in a literary sense—which is taken from time to time as the powder settles does not spoil the course of the sedimentation. Probably, the 'photo-extinction method', in which the weight of a sample is estimated by casting a beam of light athwart the settling tank to fall on a photo-electric cell, is the most accurate as well as the most convenient of these, particularly as it will work with quite small amounts of the powder.

It is not, however, the purpose of this article to discuss the methods themselves[1], but rather to direct attention to the increasing number of applications of the technique in the spheres of applied physics and chemistry.

APPLICATIONS TO POWDERS

One of the difficulties that trouble the employer of this technique is to ensure that the degree of dispersion which exists in the sample chosen for analysis persists during the examination itself. For example, if particle-size analysis is chosen as one of the fundamental physical factors in describing soil properties, as it undoubtedly should be, how can the state of aggregation and relative positions of the grains be preserved during their transfer to the microscope or sedimentation tank? Indeed, since in either apparatus the particles must be separated or diluted to a certain extent, the purist would say that the analysis ought only to be done *in situ*, which in the present state of the technique is impossible.

For some materials, sedimentation at low concentration is favoured, with the addition of a reagent like ethylene glycol to the liquid, into which the powder is vigorously stirred, short of causing actual abrasion. If it is intended to study the effect of such deflocculating agents on the results as well as to obtain a set of results representative of the original sample, the unfortunate operator has indeed been set a difficult problem.

It is evident that each industry must work out its own dispersion technique in international collaboration if results in different laboratories are to be comparable, though the agreed results may still not represent the powder in its natural state.

Particle-size analysis is constantly being used to determine the efficiency of grinding and milling processes and to estimate to what extent equality of fineness may be produced in similar mills when used by different operatives or in different factories. The problem presents itself as that of deciding how a certain property depends on the granularity of the powder or material in which it is incorporated, and then of finding to what extent a specified degree of fineness can be reproduced in practice.

Thus in the baking industry, particle size is one of the chief features which discriminate those flours which are suitable for cake-making from those which will form a good bread dough. In the accompanying table are shown the results of some analyses of different types of commercial flour. It will be noticed that there is not much difference in the two commercial bakers' flours, but the flour made from the Irish wheat, being softer to the touch, has a greater percentage of fine particles. On the other hand, the strong imported flour from Canada tends in the other direction and has more large grains than the British-milled commercial flour. The speciality cake flours are all finely ground, but there are differences between them, those with the maximum of fine particles being found most useful for special cake processes[2].

PARTICLE-SIZE ANALYSES OF COMMERCIAL FLOURS.

Sample	Percentage corresponding to size group (in microns)								
	105–95	95–85	85–75	75–65	65–55	55–45	45–35	35–25	25–15
Commercial bakers' flour	3	6	9	10	12	12	11	18	19
Irish flour	5	4	4	3	4	6	10	19	45
Imported Canadian flour	3	7	11	10	11	12	12	18	16
Cake flour (milled in England)	3	3	4	5	4	4	11	19	47
Cake flour (milled in Canada)	0	0	0	0	2	6	12	25	55

Occasionally, there seems to be a critical size which is most effective in a given process. A specific size is often mentioned in connexion with the dust problem in mines, whether as causing explosions or in diagnosing the cause of miners' silicosis. Pigment colours reach a maximum brilliance for a certain grain size probably associated with the wave-length of the light absorbed or reflected. On the other hand, certain light-influencing factors such as the brilliance of fluorescence in phosphor powders continuously increase as the particles causing it get smaller, apparently because on a given covered area the total surface of the exposed grains increases as they get smaller[3].

In those cases where the physical property which it is desired to influence depends on pore space, the size of the units which make up the texture of the material is equally a determining factor. The insulating plasters used as acoustic absorbents form an example. For a given total volume of grains in contact, the most open structure is obtained by securing that they are of uniform size. On the other hand, the concrete industry looks for a polydisperse mix to get a better conglomerate. These two extreme types of distribution curve are readily resolved in a sedimentation apparatus.

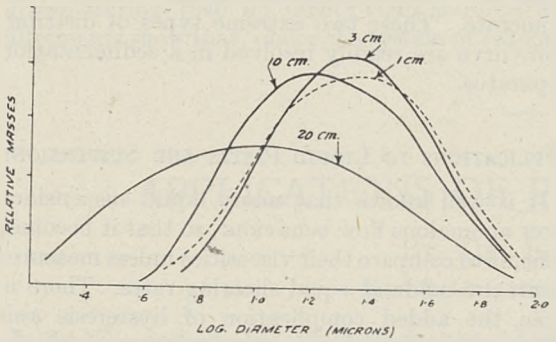
Applications to Liquid Pastes and Suspensions

It is well known that many liquid suspensions show anomalous flow behaviour, so that it becomes difficult to compare their viscosities unless measurements are made at equal shearing rates. There is often the added complication of hysteresis and other memorials of the previous history of the suspension. Nevertheless, it is generally found that viscosity rises as the aggregates break down. In monodisperse systems certainly, fine particles in themselves promote high viscosity, but many factors may obscure this effect, since the addition of coarser grains and the noted effects of thixotropy —reversible sol-gel transformation—and electrokinetic potentials on the state of aggregation may influence the flow behaviour of the suspension. When the grains are in the main large but are interspersed with very small, albeit, colloidal particles, the colloidal filling seems to act as an effective lubricant. In this way a stubborn soil becomes easy to plough and an erstwhile firm sand is turned into a quicksand. Such suspensions form valuable muds for oiling the drilling tool during the excavation of a bore hole. The phenomenon is usually explained by saying that the colloidal adulterant confers thixotropic properties on the specimen, whereby it is easily made to flow under a sufficient pressure, but partially 'sets' when the pressure is released.

By a similar process, fine particles confer cohesion on a modelling clay, and allow a cast to fit the mould more perfectly while not preventing it from being shaped under manual pressure.

Pigments in a liquid medium present similar light-dispersing characteristics in the paste form to those in the dry state. In addition, the manufacture of a liquid paint involves considerations of brushing and wetting properties which are again largely a question of granularity. The paints with finer pigments have better covering

power, which means that less paint will be required per square inch of that colour which has the greater specific surface. It has also been suggested that one could discriminate in this fashion between a medium which is a wetting agent—one that lowers the surface tension of water without altering the state of aggregation—and a true dispersoid which not only increases the number of fine particles at the expense of the aggregates but also imparts resistance to flocculation, an important factor in the conferment of good brushing or spraying properties in paints[4,5].



An interesting case in which two desiderata require size-frequency curves having peaks at opposite ends of the granularity range is to be found in the spinning of rayon. To control lustre the manufacturer adds titanium oxide in amorphous form to the cellulose acetate before it is spun. If this powder is too coarse, the jets from which the mixture is squirted become choked. On the other hand, the presence of fine particles raises the viscosity (*vide supra*) and involves greater pressure to force the rayon through the spinnerets.

Applications in Natural Phenomena

Recently, useful information has been acquired from measurements of the granularity of sediments put down by natural agencies such as winds and rivers. Sometimes these studies are made during the actual process of silt transport and deposition in rivers in spate or during desert storms[6,7], a field in which much still remains to be done in correlating the scale of turbulence to the silt-carrying propensities of the flow, which varies with the mean size of grain involved and the size-frequency distribution in a way not properly understood.

In fluid motions over a rough surface, it is the size of the rugosities which determine the character of the flow. This has been brought out by experiments in which a uniform sand has been glued to a smooth board set edgewise to the stream while its hydrodynamic resistance is determined. If, however, the sand is free to move, it will be transported whenever the velocity gradient at the boundary exceeds a critical value and redeposited at a lower critical value, which can be determined for each grain size. In mixed sands, these critical values are less certain, but their significance from the point of view of natural phenomena like the raising of desert storms or of the silting up of river estuaries is obvious.

Some preliminary work has been done on the analysis of cores drawn from lake beds, using an apparatus described in an earlier issue of NATURE[8]. These cores consist of recent deposits of semi-liquid mud overlying more compact stratified layers of clay in which fine and coarse particles often alternate, representing successive climatic stages in the history of the lake.

The accompanying figure represents analyses into size-frequency curves of the upper layers of the bed of Esthwaite Water, Lancs, in which only recent depositions are represented in the graphs for various depths. The whole extract is loosely compact and semi-fluid. The shifting of the mean towards finer particle size as the depth of sampling increases may be the result of chemical and bacteriological action breaking down the aggregates, which are formed of silt and organic detritus deposited on the lake bed in the absence of circulating currents, or it may mean no more than that the fine grains during the natural process of sedimentation penetrate through the interstices between the larger crumbs in the ooze until brought to a standstill lower down. The change in mean size goes rapidly at first with depth and then more slowly; in fact, a good straight line is obtained by plotting the logarithm of the most frequent size in the curves shown on the figure against the depth. A similar law is not, however, found for the hardened cores representing historical deposits. Bands of colour in the core and sudden changes in size-frequency distribution probably represent geological catastrophes in the bed formation or of the seasonal inflow of silt from rivers in spate.

It must be appreciated that many of the applications here outlined are in the early stages of their development, but it is hoped that sufficient examples have been given to show that the accurate measurement of granularity will be increasingly used to supply data without which the exploration of many phenomena, both in the laboratory and in the field, will be incomplete.

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The Department includes day and evening classes of all grades up to Degree standard.

Burnham Scale salary will be paid, with up to ten increments for recognized research or teaching experience.

Forms of application, which may be obtained from the undersigned on receipt of a stamped addressed foolscap envelope, must be returned by December 19, 1941.

F. HERBERT TOYNE, B.A.,
Education Officer.

54 Old Steine,
Brighton, 1.

Wanted: Bulletin of Entomological Research—Vols. 25-30, 1934-39. Review of Applied Entomology (A)—Vols. 25-27. Review of Applied Entomology (B)—Vols. 24-27. Will anyone willing to dispose of any of the sets quoted above, please communicate with The Librarian, The University, Edgbaston, Birmingham, 15, stating price required.

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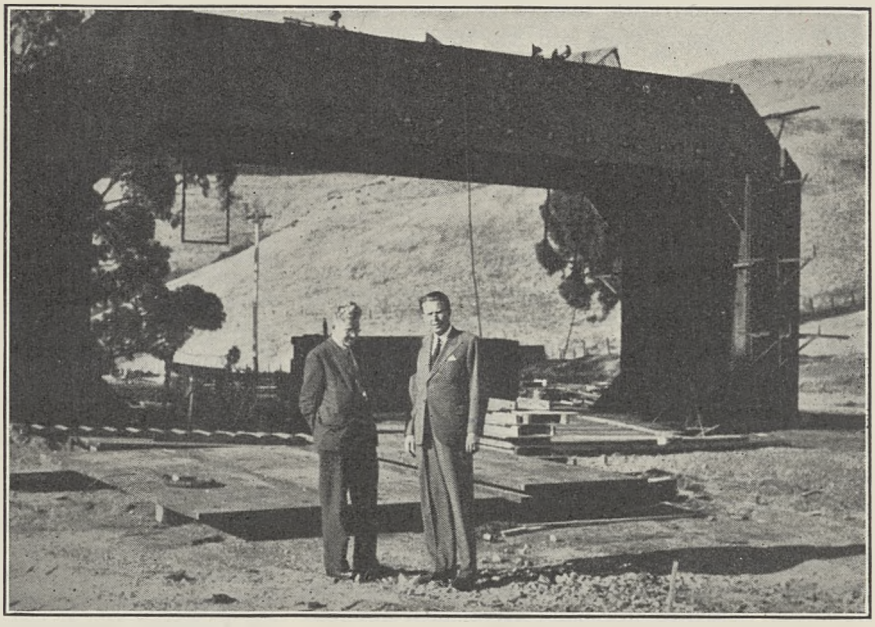
THE 184-IN. CYCLOTRON AT BERKELEY, CALIFORNIA

By Prof. M. L. Oliphant, F.R.S.

DURING a recent trip to the United States in an official capacity, I was fortunate to be able to repeat for a few hours a visit I made first in 1938 to the Radiation Laboratory in Berkeley, California. The earlier visit was made with the object of obtaining information which would enable me to build in Birmingham a large cyclotron. The 60-in. monster in the Crocker Laboratory was almost complete, and Lawrence had already begun to think of trying to push the cyclotron technique to its limit. We discussed in detail the difficulties of such a scheme, but these proved small obstacles in the path of Lawrence and his great band of co-workers. The theory of the cyclotron had recently been worked out, and it had been shown by the 'prophets' that existing apparatus which delivered 8–10 million volt deuterons was in fact the largest which could be made to work, owing to loss of resonance between the particles and the electric field due to relativistic change of mass. The Berkeley group under Lawrence promptly increased greatly the voltage applied to the electrodes of the new 60-in. cyclotron and showed that no such limit need in fact exist.



MAGNET OF THE 184-IN. CYCLOTRON UNDER CONSTRUCTION AT BERKELEY, CALIFORNIA. In the foreground are Prof. E. O. Lawrence (right) and Prof. M. L. Oliphant (left). Photograph by Dr. Donald Cooksey, assistant director of the Radiation Laboratory.

In the realms of nuclear physics the cyclotron is by far the most powerful tool which we possess, and in its present form in Berkeley it provides curies of activity of artificially radioactive elements and weighable quantities of transmuted elements. The possibilities for medical and chemical investigation are only now being realized, and the chemistry of carbon itself in complex organic and biochemical changes is being studied by use of the short-lived active carbon isotope now available in large quantities. Elements as heavy as bismuth can be transmuted by bombardment with the existing apparatus.

The giant cyclotron now under construction contains enough steel and copper to build two large destroyers, and is designed to push the cyclotron technique to the extreme limit. It will be capable of providing particles with energies approaching those of cosmic rays, and we can expect with confidence that these will open up fresh fields in atomic physics. The Rockefeller Foundation and the United States are to be congratulated on the vision displayed in enabling the inventor of the most remarkable apparatus used in scientific investigations the opportunity himself to direct the building of this great machine. Lawrence is assisted by a brilliant team of workers who have been associated with his work in the past. With Lawrence himself, many of these men are now doing work of more immediate national importance, but the project itself is proceeding under the guidance of Dr. Donald Cooksey, Lawrence's enthusiastic lieutenant.

It is certain that, when completed, the giant cyclotron will attract physicists from the whole world, and Lawrence expresses himself as the director of a piece of apparatus which will in happier times be shared by all who have the wish and the ability to do so. In front are the blue waters of San Francisco Bay; and behind, the warm hills scented by groves of eucalyptus trees. A physical centre of such importance in so beautiful

a part of the earth will draw scientific workers from every country. In Berkeley with Lawrence there is much of the spirit of the Cavendish, and in Lawrence there is one who, like Rutherford, can gather round him a team of men and inspire them to do great things.

Dr. Donald Cooksey, who has forwarded the photograph reproduced herewith, showing Prof. Ernest O. Lawrence (right) and Prof. M. L. Oliphant (left), has sent the following particulars of the cyclotron and the laboratory which is being built to house it.

The magnet is 56 ft. long, 30 ft. high and 184 in. wide. It rests on 1,200 tons of concrete, contains 3,700 short tons of steel and 300 tons of copper. The pole diameter will be 184 in., and the gap between the poles 40 in. The steel construction is complete except for the upper core and the pole tips.

The laboratory enclosing this magnet, which is about to be erected, will be a 24-sided building, on a spur overlooking the Berkeley campus and the whole of San Francisco Bay; in fact, it is directly opposite the Golden Gate, the elevation above sea-level being 881 ft. The views involved probably make it the most spectacular site for any physics laboratory in the world. The construction work has now been under way for about a year, and it is estimated that approximately two more years will be required for its completion. This cyclotron is being designed to give 100 million electron-volt deuterons.

OBITUARIES

Mr. H. M. Wallis

HENRY MARRIAGE WALLIS died on November 10 at the age of eighty-seven in Reading, where he had resided since 1872. He was a member of a well-known Quaker family from Ipswich. He had travelled widely in Europe and North Africa, spending each winter in and around the Mediterranean. He was 'father' of the Reading Museum and Art Gallery, with which institute he had been associated for half a century as the honorary curator of vertebrates.

As the result of a deep passion for, and love of, Nature, Wallis became known for his multitude of observations, especially on birds and mammals. His knowledge (based on first-hand experience) was profound and was passed on to his fellows by contributions to a number of scientific and other journals and to the Press and by lectures—the latter covering many branches of science and history.

Wallis corresponded with Darwin on the subject of the hair upon the ears of new-born babies. Wallis also did research work on ancient breeds of pigs, having been stimulated by those he saw in Bulgaria and those depicted on Greek coins.

He was responsible for the acquisition of specimens of the British deer—red, fallow and roe (male, female and young of each)—from the herd of the late King George V at Windsor, which now make the magnificent groups in Reading Museum. The birds of prey of the Pyrenees were a special study of his, and I am indebted to him for minute guidance to the avi-fauna of that region. Besides his study of local birds and mammals, Wallis took a leading part in the experiment in 1930 of introducing a colony of large copper butterflies in the Kennet valley.

He was a founder member of the Reading and District Natural History Society and was president during 1891–93. He was also a member of the British Ornithological Union, the British Trust for Ornithology.

H. M. Wallis was a lovable and humble man and will be sadly missed by a multitude of friends, both personal and scientific. W. A. SMALLCOMBE.

Mr. Richard T. Baker

WE regret to record the recent death in Australia of Mr. Richard T. Baker. For thirty years Baker was curator of the Technological Museum, Sydney, and for thirteen years lecturer in forestry at the University of Sydney. He is perhaps best known to botanists for his comprehensive work on the Coniferæ of Australia, published in 1910, in which he was assisted by Mr. H. G. Smith, assistant curator and economic chemist at the Technological Museum, Sydney. Mr. Smith also collaborated with him in his valuable researches on the genus Eucalyptus, especially with reference to their essential oil, and the results were published in 1902. The conifers were profusely illustrated by numerous photographs of the trees *in situ* and of herbarium specimens, as well as photomicrographs showing anatomical structure, some of them in the colours with which they had been stained.

Baker also published a large number of small papers on various Australian economic plants, and these are scattered through the volumes of the *Journal and Proceedings of the Linnean Society of New South Wales*. Nearly all of them are accompanied by first-rate black-and-white drawings by the author, with full details of the structure of the flowers and fruit.

Baker was a fellow of the Linnean Society of New South Wales and served on the Council during 1897–1922. In 1922 he was awarded the Clarke Medal of the Royal Society of New South Wales, of which he was elected a fellow in 1894.

NEWS AND VIEWS

The World at War

IT is one of the conditions of the existence of a group of individuals as a society that certain rules for the guidance of the individual be obeyed. This applies as much to nations in their association with other nations as to individuals. A fundamental rule in international relations is that no nation should carry out an act of war against another without giving notice of its intentions. In spite of all the facilities of modern means of communication, Japan has thought fit to ignore this elementary procedure in its attack on the United States, thereby aligning its foreign policy even more emphatically with those of Germany and Italy in its total disregard of international law. It is yet another demonstration of the Nazi 'new order' of the supremacy of armed force, and of the worthlessness of any pretensions on the part of the totalitarian nations of conceding any rights or liberties to other nations. Japan is a relatively young nation which choose deliberately to model its future on that of the Western world. She has chosen bad mentors, and it must be a source of grief and despair to those Japanese men of science of international reputation like Honda and Yukawa, as it would have been to those of the older generation such as Kitasato, Noguchi, Omori, and Jogi Sakurai, that the nation should have allowed itself to be carried away by the machinations of the military party.

With the extension of war to the Pacific, Japan's so-called "China incident" becomes now a part of a vast conflagration which has girdled the earth. The greater part of Europe, Africa, Canada and the United States, most of the States of South America, the myriad isles of the Pacific in the hands of the United States, Great Britain, Australia and New Zealand, the eastern sea-board of Asia from Siberia to Singapore, the Dutch East Indies, Australia and New Zealand—all are directly involved; and it is safe to add that no nation or people at present at peace is unaffected. When the totalitarian powers have been finally broken, the Allies, who are pledged to democracy and freedom, must go forward with a world programme for reconstruction, the fundamentals of which will be based on the Atlantic Charter. President Roosevelt put the position bluntly in his radio address on December 9: he said that Americans "must begin by abandoning once and for all the illusion that we can ever again isolate ourselves from the rest of humanity . . . there is no such thing as security for any nation, or any individual, in a world ruled by the principles of gangsterism. . . . We are now in the midst of a war not for conquest, not for vengeance, but for a world in which this nation and all this nation represents will be safe for our children. . . . We are going to win the war, and we are going to win the peace that follows."

Dr. V. K. Zworykin: Rumford Medallist

THE American Academy of Arts and Science has awarded the Rumford Gold and Silver Medals to Dr. V. K. Zworykin for his invention of the iconoscope and other television devices. Dr. Zworykin was born in Russia, and educated in Petrograd, Paris and Pittsburg. Since 1929 he has been connected with the Radio Corporation of America and has been associate director of the research laboratories of that Corporation since 1934. Zworykin's name is world-renowned for his far-reaching researches in electronics and photo-electric cells, culminating in his invention and development, with a group of associate workers, of the iconoscope or 'electric eye', which forms the basis of the television system adopted in Great Britain and still in active development in the United States.

The iconoscope is a special form of cathode ray tube in which the fluorescent screen is formed of a mosaic of tiny photo-electric cells, on which is focused the television picture to be transmitted. The electron beam of the tube is caused to scan this screen, and the resulting fluctuations of potential, depending upon the relative illumination of different parts of the screen, are used as the source of the picture modulation signals for the television radio transmitter. Zworykin's work has also led to the electron-multiplier, for amplifying the signals produced by a photo-electric cell, and to other devices used in television transmission and reception. All this work is described in a number of papers by him and his co-workers published principally in the *Proceedings of the Institute of Radio Engineers*, New York, and in the *Journal of the Institution of Electrical Engineers*, London.

Training of the Disabled

AN interim scheme for the training and re-settlement of disabled persons, which is for the benefit of women and girls as well as of men and boys, is described in a leaflet issued by the Ministry of Labour and National Service. In addition to members of the Fighting Services, the Merchant Navy and the Civil Defence Services disabled on war service, the scheme is intended to cover civilians injured through air raids, factory accidents or in other ways, and is open to all persons above the age of sixteen. Some degree of preference may be given to those whose disablement is due to war service or to enemy action, but foreigners who have been disabled since the beginning of the War are also eligible. Training will be given in occupations connected with munitions work such as draughtsmanship, fitting, instrument making, machine operating, welding, inspecting and viewing, and for this purpose the courses of training will be similar to those in the existing schemes of the Ministry, but modified to suit disabled persons or particular types of disablement. It also will be given in other

occupations specially authorized for the scheme. The training will be provided at certain Government training centres administered by the Ministry of Labour, at special centres with experience in training disabled persons for industry, at technical colleges and similar institutions and at works. A maximum period of twenty-six weeks training will probably be sufficient. Throughout the training, in addition to proper medical supervision, weekly allowances varying from 42*s*. to 17*s*. for men and boys and 33*s*. to 15*s*. for women and girls will be paid, and each trainee will also receive a dinner meal or 5*s*. per week in lieu, daily travelling expenses, when necessary, and dependants' allowances. These allowances will be independent of any pension or other payment the trainee may receive in respect of his or her disability.

Evaluation of Individual Adjustment

"AN Evaluation of Adjustment based upon the Concept of Security" by Mary D. Salter has been published in the University of Toronto Studies (Child Development Series No. 18. Toronto: University of Toronto Press; London: Oxford University Press, 1940. 3*s*. net) as the first part of a larger study designed to provide an evaluation of important aspects of an individual's adjustment by means of a series of scales based upon the common concept of security. The technique used in this investigation utilizes the principle of internal consistency to construct an extra-familial and a familial scale of security designed to throw light on relations outside and inside the family, respectively. The results indicate that social insecurity appears most frequently with those who are dependently secure in the family and with those who are insecure and independent in the family. Tolerance is much more frequent with independence than it is with dependence, both for the socially insecure and the socially secure groups. Those who are socially secure and dependent tend to intolerance and familial insecurity.

Familial security in the early stages is of a dependent type and forms a basis from which the individual can work out gradually, forming new skills and interests in other fields. In its absence the individual is handicapped by the lack of a secure base from which to work, and at the college age such insecurity is at least partly due to friction on the issue of emancipation. Independence of the family is true independent security if the individual has formed requisite skills and dependencies outside the family without being involved in conflict with the family. Continued dependence on the family may make for inadequate adjustment if it seriously interferes with the development of skills in other fields. Extra-familial security is based partly upon social skills and partly upon dependencies on friends, both apparently being necessary and interrelated. Insecurity is due to a lack of skills or of friends or of both. Intolerance is a common form of compensation which may contribute to social security during the acquisition of skills, and is most effective if the individual has dependent security also or at least a fairly satisfactory basis of skills already formed. Lacking both these, compensation either becomes ineffective resulting in insecurity, or must be exaggerated to avoid insecurity, leading to the unusual forms of behaviour which characterize serious maladjustment.

University Staffs in the British Empire

THE "Yearbook of the Universities of the Empire" is an invaluable reference book, the last issue of which is dated 1940. In view of the numerous changes, probably mostly due directly to the War, which have occurred during the past eighteen months or so in the staffs of universities, this issue quickly lost much of its value. When, however, the Universities Bureau had to consider the preparation of the issue for 1941, it was found that, on account of the destruction of the Bureau's premises, the delays in obtaining information from overseas and the shortage of paper, it was possible to prepare only a Supplement to the existing volume (Supplement to the Yearbook of the Universities of the Empire, 1940. Published for the Universities Bureau of the British Empire. Pp. xxxi+255. London: G. Bell and Sons, Ltd., 1941. 3*s*. 6*d*. net). In this book, which is of the same format as the well-known Yearbook, the officers are given for each university followed by a list of changes of staff. The list is carefully set out to facilitate easy reference, and there is an index of names at the end of the volume. The Yearbook for 1940, with the Supplement, provide as up-to-date a record of university staffs in the British Empire as is feasible in these times. The Bureau is to be congratulated on its enterprise.

Tar Oil Washes

THE introduction of tar oil washes in Great Britain about 1921 resulted in the greatest advance in the control of fruit pests that has been made during the present century. With extension in their use came the demand for their standardization, as differences in source and process of manufacture had led to uncertainty in their performance. After a study of the insecticidal properties of the various components of the washes and their behaviour under different conditions had been made both at the research stations and the research departments of insecticide manufacturers, a small joint committee of representatives of the Association of British Insecticide Manufacturers and the Ministry of Agriculture was set up to consider the available information, and, if possible, to prepare specifications. After still further investigation, specifications and methods of analysis for both the miscible oil (black fluid) type and the stock emulsion (mayonnaise) type were successfully drawn up, which have been accepted by the Association and the Ministry, with the concurrence of the Government Chemist. The full data are available in Bulletin 122 of the Ministry of Agriculture (H.M. Stationery Office, 6*d*.). Members of the Association and most of the manufacturers of tar oil washes have agreed that their products shall conform to these standards, and purchasers are strongly advised to take advantage of this by requiring that any washes they obtain shall comply with the specifications.

Public Health Education in Mexico

THE August issue of the *Boletin de la Oficina Sanitaria Panamericana* contains an instructive article by Dr. Angel de la Garza Brito, director of the School of Hygiene of Mexico, on the present and future of education in hygiene in his country. The old preparatory school in public health which was reorganized in April 1938 gave instruction to 130 medical men, 184 nurses and 70 health officers, as well as to an auxiliary staff consisting of statisticians, laboratory assistants and social workers for venereal diseases. In 1941 the first regular course for medical officers of health was opened. Difficulties which have been encountered are due to an almost complete lack of modern text-books and special literature on preventive medicine and public health, the scarcity of full-time teachers and the absence of basic training in preventive medicine and hygiene. These defects have been partly remedied by the preparation of synopses on each subject, and by encouraging the study of foreign languages, especially English. It has also been suggested that hospital instruction should be supplemented by a sociological approach.

Urea Formaldehyde Glue for Plywood

PLYWOOD is made to one of two specifications, either D.T.D.427 or B.S.S.5.V.3, requiring resistance to three hours immersion in water at 60° C. (140° F.) and 100° C. (212° F.) respectively. At present urea formaldehyde resins are used for D.T.D.427 plywood, and Tego film (paper impregnated with a phenol formaldehyde resin and used in a dry state) for the 5.V.3 plywood. Although modified urea formaldehyde glues meet the requirements of B.S.S.5.V.3, they cannot be used in the manufacture of very thin plywood because of the swelling caused in the thin veneers by the wet glue, and because of the penetration that takes place after pressing. The phenol formaldehyde film type of glue is, of course, immune from these troubles.

To meet this difficulty, and to reduce costs, Messrs. Aero Research, Ltd., of Duxford, Cambridge, have introduced a foamed modified urea formaldehyde glue. The amount of glue applied by any ordinary means (glue spreaders or brushes) is in excess of the optimum amount; by using the glue in the form of a foam an extremely thin uniform spread is obtained in terms of pounds of glue per square foot, although the glue layer has an appreciable thickness. Actually the volume of the glue is about doubled by a special beater machine before it is poured into the glue spreader. Under ordinary factory conditions it is possible to get a spread of 1·35 lb. of glue per 100 square feet. This foamed-up glue, known as Aerolite F.67, gives plywood meeting the requirements of specification 5.V.3. Because of the nature of the foam, it can be used with thin veneers. The press temperature required is 90° C., so that steam-heated presses are unnecessary and the older type of press common in Great Britain, with hot-water heating, can be used; the use of pressing temperatures below 100° C. obviates any risk of over-heating of the wood with its attendant troubles. Messrs. J. M. Steel and Co., Ltd., of Kern House, 36–38, Kingsway, London, E.C.2, are the distributors of Aerolite glue, and all inquiries should be addressed to them.

Forests of British Honduras

THE annual report of the Forest Department of British Honduras for the year ending December 31, 1940, is an illustration of the failure on the part of responsible administrators to understand the principles of a true forestry management. Mahogany has been exported from the country for a couple of centuries and more. The report commences with the statement that "British Honduras is essentially a producer of raw materials for export, of which in the last eighteen years an average of 79·6 per cent has been derived from the forests. In 1940 there was continued improvement in the export trade, and particularly so for forest produce, in spite of war conditions." There was but slight disruption of communications with North America to which a considerable proportion of these productions goes and the United Kingdom Timber Control Department purchased the whole of the lumber output. The Conservator writes: "the work of the Department in 1940 was concentrated on the most important aims of the forest policy." This policy is apparently to develop the forest estate by the maintenance of the chief export, mahogany, and chicle, etc. This is not forestry. A timber merchant can do this; nor can it be termed a 'forest policy'. The exploitation of the forests is apparently done entirely by licensees who set up their own mills.

That the forests so worked and the amounts of valuable timber they contain is to a great extent unknown is obvious from the statement in the report that "shortage of staff has, for years, made it impossible to do much exploration in advance of exploitation"; there appears to be an idea that by giving longer terms to the licences issued, licensees will plan their work economically. In the history of forest lumbering this hope has ever remained a dead letter. The superior staff of this Department consists of a conservator and two assistant conservators. Both these latter were absent for a greater part of the year; and yet we are told that 79·6 per cent of the raw material exported from the Colony comes from its forests. It would have been interesting had the report told us the direction in which the sums obtained from this produce went. Do they go into the exchequer of the Colony and are they spent in the improvement of the conditions of the people? If the answer is in the affirmative, how long will the forests stand the drain upon them in the absence of the introduction of a true conservative management which could solely be enacted and maintained by an adequate forest staff? According to the report, the latter can only be considered to be present in name.

British Association Seismological Committee

THE report of the British Association Seismological Committee for 1941 has just been received. It shows that some progress is being made in spite of

war conditions. The new-type electrically driven recording drums for the Milne-Shaw seismographs are proving satisfactory in India. The rotation of the drum is particularly uniform and there is no 'backlash'. This result has been achieved by pivoting the electric motor eccentrically on a spindle, and permitting it to fall by gravity into mesh with the gear attached to the drum. It may be described as a 'floating' contact in place of the usual fixed centres. Difficulties in connexion with the International Seismological Summary are being successfully overcome at Oxford. Jeffreys has investigated the deep earthquake of June 29, 1934, and has obtained from it helpful readings of the receding (*DE*) branch of *PKP*. The table of *PKP* has thus been improved and a table also constructed for *sP*. Stoneley makes some very helpful and pertinent remarks concerning the integration of seismograms in connexion with the long-wave phase of earthquakes. There need now be no hesitation in accepting the usual identification of the early part of the long-wave phase (apparent velocities 4·4–4·0 km./sec.) as Love waves.

Compounding in Locomotive Design

MR. W. A. STANIER delivered the presidential address to the Institution of Mechanical Engineers on October 24, when he discussed "The Position of the Locomotive in Mechanical Engineering". Although a standard feature of marine reciprocating design, compounding has not found extensive favour in Europe except in France. In England it has been the subject of repeated trials—no less than 12 per cent of the papers ever read before the Institution are on compounding—and in theory it has obvious advantages over simple expansion. These advantages are specially marked at working pressures higher than 300 lb. per sq. in. Attempts in Great Britain have contained defects, condensation causing serious loss, and lack of understanding of the principles of steam flow have often rendered the engines more sluggish than their simple expansion contemporaries. Superheating, which brought fresh life to the compound engine on the Continent, has only been applied to any scale to one British type, the 'Midland' compound; within the limits of its size, good work has been done and is still being done by this class. It has, however, never been modernized as regards its cylinder and valve-gear design, so its actual efficiency is below that of the present-day simple expansion engine. It is also possible to understand now why the French De Glehn compounds, imported by the Great Western Railway in 1903 and 1905, did not give results superior to the simple-expansion designs of Churchward. It is impracticable to combine within the British loading gauge, however, both the large low-pressure cylinders required, and the bearing and crank dimensions required by compound locomotives.

Northern Ecological Association

THE Northern Ecological Association was founded by the late Mr. R. J. Flintoft, of Goathland, Yorks, who organized workers in various fields of natural science in their own localities in the north of England. Valuable work had been done in this way, and it was felt that the organization should not be allowed to lapse, but should be placed on a permanent basis. Accordingly a special meeting of the Association was held at York on November 23, and it was decided to re-enact the existing constitution and to adopt the existing name. The officers of the Association are as follows: *president*, Dr. W. Collinge; *secretary and treasurer*, Mr. J. L. Forrest, Eversfield, Goathland, Yorks; *editor*, M. Dallman.

Dr. E. N. Miles Thomas

DR. E. M. DELF, Department of Botany, Westfield College, London (at St. Peter's Hall, Oxford) writes: "Dr. E. N. Miles Thomas, who is widely known amongst botanists for her contributions to the study of seedling anatomy, retired from her position as head of the Department of Biology at University College, Leicester, in 1937. Thereafter she occupied a research room at Westfield College (University of London), and for a time continued her many professional activities. Her health, however, was already seriously impaired. The evacuation of the College to Oxford and other difficulties in connexion with the War situation probably added greatly to the overstrain from which she was suffering. Early in 1940 she was found to have lost almost completely her power of memory, a condition which is now unfortunately regarded as permanent, although her general health has somewhat improved. Her research effects are housed at the Jodrell Laboratory, Kew."

Recent Earthquakes

IN addition to being recorded on all the seismograms at Kew Observatory, the earthquake of November 25 was recorded on the electrometer record of the rain electrograph. This earthquake, which affected Lisbon, gave very large amplitudes at Kew. The real ground amplitude caused by *P* (18h. 08m. 22s. U.T.) exceeded 300 μ, the amplitude caused by *S* (18h. 13m. 45s. U.T.) exceeded 800 μ and the maximum may have exceeded 2 mm. A tentative interpretation of the records shows a compression from the south-west (azimuth 233°) and an epicentral distance near 3,600 km. The epicentre may thus have been near 28° N., 29° W., in the Atlantic Ocean south of the Azores. On December 4 an earthquake of considerable severity was felt at Rangoon though no damage is reported. On December 6 earthquakes were reported from Santiago and from San José in Costa Rica. Considerable damage was reported though full details are not yet available.

The United States Coast and Geodetic Survey, in co-operation with Science Service and the Jesuit Seismological Association, has found the epicentres of the earthquakes of October 3 and October 5. The earthquake of October 3 at 16h. 13·2m. U.T. had its epicentre near lat. 40·6°N., long. 124·6°W., which is in northern California in the neighbourhood of Cape Mendocino. On the basis of instrumental reports from seven seismograph stations, the epicentre of the earthquake of October 5 at 10h. 11·2m. has been calculated to be lat. 15° S., long. 173° W., which is in the Pacific Ocean between the Islands of Samoa and the Fiji Islands. All interpretations and calculations are tentative.

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.*

Linkage of Physico-Chemical Processes in Biological Systems

IT is a truism of general physiology that living organisms are *actively* co-ordinated systems, that is, systems in which there is co-ordination of action as well as of structure. It would be no exaggeration to say that the discovery of the *quantitative* correlation of processes is the major task of modern general physiology, a correlation which, in the present state of science, can be exactly expressed only in terms of the existing concepts of physics and chemistry. Failure to recognize the linkage of intracellular *chemical* processes with *physical* diffusion processes involving unequal distributions of ions between the living cell and its fluid environment has often given rise to misunderstanding. The following simple example will serve to illustrate the point.

In Fig. 1, (I) represents the interior of the cell,

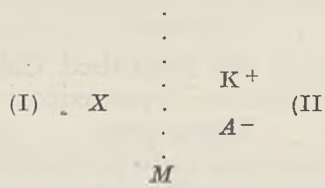


Fig. 1.

(II) the fluid environment, M the semipermeable cell-membrane. Within the cell is a dissolved *impermeable* neutral substance X, while in the extracellular fluid there is the ionized salt K^+A^-, where (for example) K^+ denotes the potassium ion and A^- a certain univalent negative ion, the membrane M being freely permeable to both. Fig. 1 represents an *initial* state.

We now make the supposition that the *practically irreversible* chemical reaction

$$X + A^- \longrightarrow Y^-, \quad . \quad . \quad . \quad . \quad . \quad (1)$$

occurs within the cell, where Y^- denotes an *impermeable* 'complex' ion (using the word 'complex' in its widest sense). The chemical reaction (1) may involve the elimination of one or more water molecules and the active co-operation of an enzymatic system, but the simple formulation given in (1) suffices for the present purpose. The final state of the system is represented by Fig. 2, where we assume that there has been present in the system more than sufficient A^- to convert practically all the X originally present into Y^-.

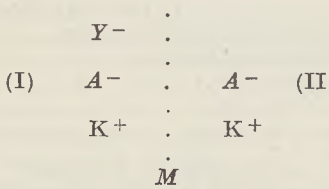


Fig. 2.

For simplicity (that is, for the sake of illustrating the ideas involved), we now assume (*a*) complete ionization of the salts KA and KY, and (*b*) applicability of the laws of very dilute ideal solutions. We have then the following relations (where C denotes molar concentration):

$$C_K = C_A + C_Y, \quad . \quad . \quad . \quad . \quad . \quad (2)$$
$$C_K C_A = C'_K C'_A, \quad . \quad . \quad . \quad . \quad . \quad (3)$$
$$C'_K = C'_A; \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

whence follows:

$$C_K = \tfrac{1}{2}\,(C_Y + \sqrt{C_Y^2 + 4\,C'^2_K}) \quad . \quad . \quad . \quad (5)$$

(the accented letters denote quantities referring to (II)).

Equation (5) shows that at equilibrium $C_K > C'_K$, and gives a quantitative expression for 'the accumulation of potassium ions in the cell against a concentration gradient'. In the present case such an accumulation is rendered possible by the occurrence of the reaction (1). This reaction involves *per se* a decrease of free energy, but this decrease of free energy is not directly and quantitatively correlated with any diffusion of potassium ions against a concentration gradient (and across an electrical potential difference). There is no mysterious 'energy-pump' at work, 'pumping' the potassium ions against a concentration gradient. The situation is simply such that the occurrence of the intracellular chemical reaction (1) produces a *down* concentration-gradient of A^- ions from (II) to (I), and the free-energy changes associated with the *down-gradient* diffusion of A^- offset (when necessary) those associated with the simultaneous, linked, and equivalent *up-gradient* diffusion of K^+. If the reaction (1) be sufficiently rapid, we may divide the process of passage of K^+ and A^- from (II) to (I), into two phases; the first is complete when the reaction (1) is (practically) complete and (I) contains only the salt K^+Y^-, while further diffusion of K^+ and A^- from (II) to (I) occurs in the second phase and completes the equilibrium.

Although not necessary for the preceding argument, it may be noted that at equilibrium we have also the osmotic pressure equation (ignoring for the present purpose all constituents in (I) and (II) except those already considered):

$$P_{\mathrm{I}} - P_{\mathrm{II}} = RT\,\{C_K + C_A + C_Y - (C'_K + C'_A)\}$$
$$= 2RT\,(C_K - C'_K) \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

where P_{I} and P_{II} denote the hydrostatic pressures in (I) and (II) respectively.

Generally, we may suppose that, as the cell grows, fresh X is constantly being produced and as constantly converted into Y^-, there being always a sufficiency of KA in the fluid environment.

The foregoing simple example, though somewhat different, has been suggested by the recently published remarkable work of P. J. Boyle and E. J. Conway[1] on potassium accumulation in muscle and associated changes. It must be stated, however, that the highly simplified considerations of the present note

touch only the fringe of the ideas involved in the extensive investigation of the authors mentioned. Nevertheless, the present brief communication will serve a useful purpose if it directs attention to an important investigation which throws much valuable light on the difficult problem of the quantitative correlation of linked physico-chemical processes in a living system.

F. G. DONNAN.

Athenæum,
London.
Nov. 15.

[1] *J. Physiol.*, **100**, 1 (1941).

Role of Potassium in Yeast

IN our previous communication[1] it was described how ammonia could entirely replace potassium in yeast under suitable conditions. It became then a question of interest as to how the 'ammonia yeast' functioned compared with the normal or 'potassium yeast' when both were maintained under strictly similar conditions, except that the ammonium ion replaced potassium. The rate of fermentation of glucose, the reproduction in suitable media and the resting metabolism were examined.

Preparation of the yeast for examination. Two 5-gm. samples of the same baker's pressed yeast were taken, one immersed in Ringer-Barkan fluid (as described in ref. 1) containing $N/5$ NH_4Cl and no potassium, and the other in a similar solution, K being replaced by NH_4 ions. The mixture was bubbled with 3 per cent carbon dioxide and 97 per cent oxygen, the medium being changed every twenty-four hours. After four days there was no measurable amount of potassium left.

The 'potassium yeast' after centrifuging contained 205 m.eq. K/kilo moist yeast and no appreciable amount of ammonia, and the 'ammonia yeast' contained 248 m.eqs./NH_3–N and no potassium.

Fermentation. 1-gm. samples of the centrifuged yeasts were suspended in 10 c.c. of water and allowed to act on an equal volume of 6 per cent glucose. It was found that the mean rate of carbon dioxide production by the 'ammonia yeast' was 40 per cent of that for the 'potassium yeast'—this latter being 0·26 m.eq./hr./c.c. yeast suspension.

Growth and reproduction. Small platinum inoculations were made into 100 c.c. of sterile medium containing 2·5 gm. glucose, 0·5 gm. K (or NH_4) acid phosphate, 0·1 gm. $MgSO_4$, and 20 ml. of boiled 1/5 water extract of 'potassium (or ammonia) yeast'. A curious difference appears between the two yeasts. The 'potassium yeast' grows much faster at first, but reaches an upper limit after twenty-four hours. The 'ammonia yeast' is considerably slower at first, but after two to three days exceeds the 'potassium yeast' and passes on to a far higher level (about four times the number of cells). The early upper level of the 'potassium yeast' is not due to an exhaustion of the glucose by fermentation, as shown by the use of higher glucose concentrations leaving much unfermented sugar after twenty-four hours, but no appreciable change in the number of yeast cells. It appears to be related to an exhaustion of some substance in the yeast extract added.

Resting metabolism. The oxygen uptake at 30° C. was examined in the Warburg apparatus, 3 ml. being taken of a 1/100 suspension in a medium consisting of 0·095 gm. Na_2HPO_4, 0·080 gm. NaH_2PO_4 and 0·60 gm. NaCl made up to 100 ml. (pH = 6·7). The Q_{O_2} for 'potassium yeast' was found to be −5·35 and that for the 'ammonia yeast' was −6·36. Thus the resting metabolism of the 'ammonia yeast' is *higher* than that of the 'potassium yeast'.

Experiments such as described in the previous letter and in other communications[2,3] show that potassium exists in cells in the ionized form, and it would appear that the main biological reason for the accumulation of potassium in cells (at least those with distensile membranes) is a necessary process for the accumulation of appreciable non-diffusible material or such as the cell can retain[4]. At the same time, the potassium ion even in one-celled organisms, such as yeast, may exert some specific ionic effects, though the above experiments indicate only a difference between the ammonium and potassium ion without it being possible to say which, if any, plays a merely passive role. They show, none the less, that potassium (at least over 0·1–1·0 mgm./100 gm.) is not essential for fermentation, growth or resting metabolism of the living yeast cell.

EDWARD J. CONWAY.
JOHN BREEN.

University College,
Dublin.
Oct. 3.

[1] [NATURE, **148**, 662 (1941).]
[2] Boyle, P. J., and Conway, E. J., *J. Physiol.*, **100**, 1 (1941).
[3] Conway, E. J., and Boyle, P. J., NATURE, **144**, 709 (1939).
[4] Conway, E. J., NATURE, **147**, 574 (1941).

Nature of the Disturbed Calcium Metabolism in Thyrotoxicosis and Myxœdema

VARIOUS theories have been put forward to explain the excessive calcium output in thyrotoxicosis including an increased metabolism *per se*[1], neutralization of acid products[2], direct stimulating catabolic action of thyroxin on bone, and a co-existing hyperparathyroidism[3]. For reasons to be given later, all these theories are unsatisfactory. As a result of direct experiments and observations[4] on normal subjects and cases of thyrotoxicosis, myxœdema and parathyroid tetany, a new theory has been formulated. It is believed that in thyrotoxicosis, an excessive secretion of thyroxin acts directly on the kidneys, stimulating them to increase their output of calcium. This may be achieved either as a result of the increased metabolism *per se* or by lowering the renal threshold for calcium.

As Aub *et al.*[1] have shown that an increased metabolism *per se* does not increase the calcium output, the excessive calcium loss would appear to be due to a lowering of the renal threshold for calcium. This leads to a fall in the serum calcium, and as a result there is an increased mobilization of calcium from the bones. In other words, the decalcification in thyrotoxicosis is due to a *vis à fronte*. In myxœdema there is the converse picture, where a diminished thyroxin secretion raises the renal threshold for calcium and causes the calcium output to fall.

J. DOUGLAS ROBERTSON.

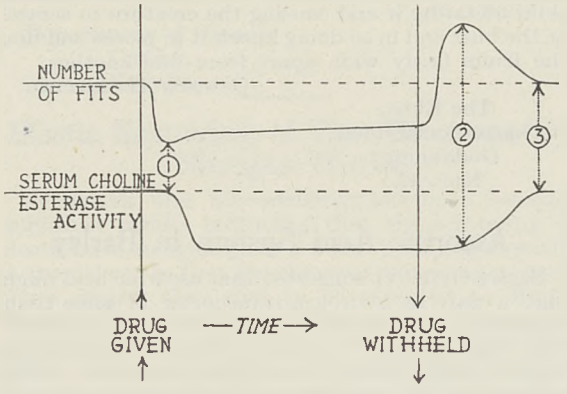
Courtauld Institute of Biochemistry,
The Middlesex Hospital,
London, W.1.
Nov. 19.

[1] Aub, J. C., Bauer, W., Heath, C., and Ropes, M., *J. Clin. Invest.*, **7**, 97 (1929).
[2] Hoennicke, E., *Biol. klin. Woch.*, **41**, 1154 (1904).
[3] Hansman, F. S., and Wilson, F. H., *Med. J. Austr.*, **1**, 37 (1934).
[4] Robertson, J. D., *Lancet*, **1**, 97, 129, 156, 216 (1941).

Mechanism of Drug Addiction and Drug Tolerance

IT has been found that prolonged administration of 'luminal' (and other barbiturates) to human beings (for example, epileptics) and animals greatly reduces the cholinesterase activity of the serum, so that it reaches 10–20 per cent of what it was before the treatment with the drug. No change in cholinesterase activity was found, however, when the drug was added to serum *in vitro* (2·5 mgm./c.c.). It appears that the barbiturate does not act directly on the enzyme as in the case of eserine and other anticholinesterase substances. The pronounced decrease in cholinesterase activity which was found *in vivo* might be interpreted as a counter-adaptation, the activity of the cholinergic system being reduced by the narcotic, reducing thereby the demand for cholinesterase, which, consequently, slowly decreases.

It is known that when the drug is withheld from epileptic patients to whom it has been given for many months the number of epileptic fits rises sharply. They become much more frequent than they were during the drug treatment and before the treatment was started. After some time, however, the fits appear with very much the same frequency as before the treatment. In the accompanying figure both cholinesterase activity and frequency of fits have been plotted against time.



The peak in the number of fits when the drug is withheld may be compared with the great demand for drug when withheld in cases of drug addiction. The number of fits, however, is a conveniently more measurable quantity than the expressed desire for the drug in the latter case. It is suggested that the increased number of fits (at 2) is due to the fact that the narcotic effect of the drug, which diminishes the fits, wears off more rapidly than the counter-adaptation, namely the reduction of the cholinesterase activity. It should be noted that when the fits reach their maximum (at 2) the cholinesterase activity was still low. The fits, however, return to their 'normal' number at about the same time that the cholinesterase activity reaches its former level (at 3). Accordingly the optimal effect of the drug (greatest reduction of fits as at 1) is observed when the direct narcotic effect of the drug, as indicated by the number of fits, has already taken place, and the counter-adaptation (reduction of cholinesterase activity) has not yet adjusted itself. The best effect of the drug is thus observed when an apparent strong narcotic effect (few fits) is combined with a high cholinesterase activity (at 1). At 2 there is little or no narcotic effect (many fits) combined with a low cholinesterase activity.

These observations, apart from suggesting that the cholinesterase should have a therapeutic effect on the number of epileptic fits, might also explain the development of drug tolerance.

In the case of barbiturates one may therefore distinguish between a direct (D) and an indirect effect or counter-adaptation (C). In our case both could be estimated, D from the number of fits, C from the reduction of the cholinesterase activity. The velocity with which these two effects develop and wear off respectively is greatly different. If in other cases a drug should prove to produce two such similar effects, the condition for an increased demand for a drug after it is withheld (addiction), or that higher doses are gradually needed to obtain the same effect (tolerance), might generally be expressed thus: $\frac{dD}{dt} > \frac{dC}{dt}$, where t is time, and both $\frac{dD}{dt}$ and $\frac{dC}{dt}$ are positive in drug addiction, immediately after the drug is withheld, and negative in drug tolerance, immediately after drug is given.

F. SCHÜTZ.

The Medical School,
University of Birmingham.
Nov. 19.

Drug Prophylaxis against Acute Anoxia

IN the course of some oxygen-lack experiments, an opportunity occurred to test the prophylactic effect of ethylene-diamine theophyllin ('Cardophylin') against acute anoxia.

Mixture breathed	Time	Tension in mm. mercury of alveolar carbon dioxide	Tension in mm. mercury of alveolar oxygen	Minute volume in litres.
Air	11.48	41·1	95·3	6·8
11·4 per cent oxygen	12.00	29·1	56·1	9·0
	12.05	0·4 gm. of 'Cardophylin' taken orally.		
Air	12.35	36·9	98·9	6·7
11·4 per cent oxygen	12.49	22·3	60·9	16·0

In the above table are given the results of one test. In this case 0·4 gm. of the drug was given orally. The pulmonary ventilation was much greater when breathing the low oxygen mixture after the administration of the drug.

The above effect was demonstrated in the minority of the small number of subjects investigated.

IAN F. S. MACKAY.

Dept. of Physiology,
University of Manchester,
Manchester 13.
Nov. 14.

Cobalt Manuring and Pining in Stock

IT is well established from experiments carried out in New Zealand[1] and elsewhere that certain forms of pining in stock can be prevented or cured by the addition of cobalt to the soil. The cobalt content of the herbage is thereby increased to a value above that at which pining due to cobalt deficiency occurs. We[2] have demonstrated this in experiments in eastern Ross-shire.

Spectrographic examination of the herbage grown on soil which has undergone cobalt treatment has shown, in some instances, a marked increase in the molybdenum uptake, the content approaching that of teart herbages reported by Ferguson, Lewis and

Watson[3]. Data for two soils are appended. On soil *A* pining in sheep has definitely been both prevented and cured by the application of 2 lb. cobalt chloride per acre, and, although the molybdenum content of the herbage increases as a result of cobalt treatment, even 10 lb. per acre, a dressing considerably greater than any likely to be used in practice, does not increase the molybdenum content to a dangerous extent. Soil *B*, where a form of pining in cattle has been reported, but not definitely attributed to cobalt deficiency, carries a herbage which is initially quite high in molybdenum. Even 2 lb. cobalt chloride per acre causes a considerable increase in the molybdenum content of the herbage, and a content at which teart is liable to occur appears to be approached. It may be that the pining reported on this soil is a combined cobalt deficiency : molybdenum excess effect, and the addition of cobalt to the soil as a remedial treatment may have deleterious results. It appears from the work of Ferguson, Lewis and Watson that the uptake of molybdenum decreases with increasing soil acidity : the use of a cobalt-rich lime, as has been suggested in New Zealand, may therefore be dangerous.

In cases of cobalt-deficiency pining such as that occurring on soil *A*, the application of a cobalt-rich fertilizer is a simple and effective means of counteracting the disease, but it is evident from the foregoing that caution must be exercised in the general use of cobalt-rich fertilizers. More detailed investigation of the inter-relationships of cobalt, molybdenum and other trace constituents which appear to enter into the nutritional balance of the plant and the animal is necessary, and work on these lines is continuing.

COBALT AND MOLYBDENUM CONTENTS OF HERBAGE, FIFTEEN MONTHS AFTER COBALT TREATMENT, AS PARTS PER MILLION OF DRY MATTER.

$CoCl_2,6H_2O$ added lb./acre	Herbage from Soil *A*		Herbage from Soil *B*	
	Co	Mo	Co	Mo
0	0·08	1·7	0·07	6·3
2	0·22	2·2	0·20	9·2
10	0·63	2·4	0·89	10·0
80	3·20	7·5	2·75	14·2

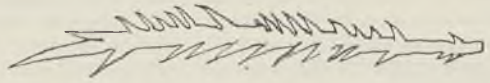
R. L. MITCHELL.
R. O. SCOTT.
A. B. STEWART.
Macaulay Institute for Soil Research,
Aberdeen.

JAMES STEWART.
Animal Diseases Research Association,
Gilmerton, Midlothian.
Nov. 21.

[1] Askew, H. O., and Dixon, J. K., *N.Z. J. Sci. Tech.*, 19, 317 (1937).
[2] Stewart, J., Mitchell, R. L., and Stewart, A. B., *Emp. J. Expt. Agric.*, 9, 145 (1941).
[3] Jealott's Hill Res. Bull., No. 1 (March 1940).

A Factor in the Dispersal of Burdock (*Arctium Lappa*, Linn.)

THE hooks on the involucral bracts of burdock, by clinging to passing animals, secure the removal to a greater or less distance of the fruits from the parent plant ; but they do not secure the scattering from one another of the fruits contained in the burr itself. A chance incident that occurred some years ago, but which I have only recently investigated, enables me to suggest the means by which this desideratum is probably achieved. One of the boys in a class with which I was studying hooked fruits happened, after pulling to pieces a burdock burr, to lean his cheek on his hand : within a few minutes he complained of intense irritation in the skin of his cheek, and soon there appeared on his face a rash like that caused by the hairs of some caterpillars. Some of the copious yellow dust that falls readily out of the ripe burr of this species had adhered to his hands, so I attributed the discomfort to this substance ; but only now have I examined it microscopically.



The microscope shows that the dust is composed of very fine and stiff bristles varying in length from approximately 1 mm. to 2 mm. and in breadth from 0·04 mm. to 0·06 mm. ; their distal ends are sharply pointed, and their sides armed with numerous short spikes, as illustrated. These bristles form a dense tuft (pappus) on the summit of each fruit, and their attachment to the ovary is so brittle when ripe that the slightest jar causes them to snap off and so lie free in the mouth of the burr. Their many needle-like points are certainly likely to irritate animal skin acutely.

I suggest that these pappus bristles are instrumental in bringing about the break up of the burr and the scattering of its fruits apart from one another. When a burr has become attached to the coat of an animal many of the bristles are certainly shaken out, and some, probably many, will reach the animal's skin, irritating it and causing the creature to scratch at the burr and in so doing knock it in pieces and fling the fruits fairly wide apart from one another.

OSWALD H. LATTER.
The Elms,
Charterhouse Road,
Godalming.
Nov. 22.

Ascorbic Acid System in Barley

SZENT-GYÖRGYI suggested that ascorbic acid might play a part as hydrogen-transporter in some tissue respirations comparable with the role of cytochrome. This was supported by the discovery of an active ascorbic oxidase in a number of plant tissues. A difficulty which has hitherto retarded acceptance of Szent-Györgyi's suggestion has been the failure to discover any cellular reducing system, other than glutathione, capable of regenerating ascorbic acid from its oxidized form.

Though barley tissues do not yield any striking reaction for glutathione, they are well known to contain ascorbic acid and they also contain a reducing system which we found would readily reduce methylene blue. By manometric methods we were able to show the presence of an active ascorbic oxidase, freely soluble in diluted barley sap or phosphate buffer at *p*H 6. It was completely inhibited by *M*/1,000 cyanide and had other characteristics similar to the ascorbic oxidase previously extracted from other plants.

In searching for a hydrogen-donator which would maintain the activity of the system, we found that addition of $M/100 \rightarrow M/20$ lactic acid greatly increased oxygen consumption, although in barley sap without addition of ascorbic acid it had no effect. Titration with 2, 6 dichlorophenolindophenol showed that the presence of the lactic acid maintained the ascorbic acid in the reduced form. At the end of

the reaction, pyruvic acid was isolated as 2, 4 dinitrophenylhydrazone, confirming the removal of hydrogen from the lactic acid. Other hydroxyacids, namely, glycollic and tartaric, behaved similarly though less vigorously. Malic acid gave irregular results, and in this connexion it is noteworthy that we added no co-enzyme to the diluted saps. Hydroxyl groups were not oxidized in a number of other substances tried, including β-hydroxybutyric acid and catechol. Succinic and pyruvic acids were also found inactive. There is thus good reason to presume the existence in barley tissues of the system :

$$CH_3\,CHOH\,COOH + \text{Ascorbic Acid} + O_2$$

(lactic dehydrogenase: $H_2 \rightarrow$; ascorbic oxidase: $H_2 \rightarrow$)

Lactic and pyruvic acids have been reported in barley tissues and we have no reason for believing this system unable to play a part in barley respiration. Mr. C. R. C. Heard, working in this laboratory, has found that addition of ascorbic acid accelerated the decomposition of hexosediphosphate by barley saps. A fuller discussion of the status of this system is being presented elsewhere ; but it may be remarked that it seems to us improbable that any one mechanism is solely responsible for the respiratory oxidations. It is, perhaps, significant that although catechol oxidase is absent from barley, we have been able to satisfy ourselves of the presence of small quantities of cytochrome.

W. O. JAMES.
J. M. CRAGG.

Department of Botany,
Oxford.
Nov. 24.

Elastic Scattering of Fast Electrons by Nitrogen Nuclei

SCHERRER and his collaborators[1] have recently published results indicating that the scattering of electrons of energies up to 3·5 Mv. by nitrogen nuclei is anomalous, in that the observed scattering is many times greater than that to be expected on Mott's theory[2]. In particular, they apply a correction amounting to nearly 400 per cent for the geometry of the expansion chamber. This correction is necessitated by the rigid criteria adopted for the selection of tracks for measurement, and they suggest that the agreement between my results and theory, in the region 0·4–1·1 Mv., might be due to the omission of such considerations. In my measurements, however, examination of the tracks was made, not by stereoscopic reprojection, but by microscopic examination of the images on the camera plates in the manner so successfully introduced by Blackett for α-ray collisions. Tracks which after collision are only a few millimetres long are then easily measured as regards general direction. Even with the stereoscopic method such as I used in later work, large-angle collisions are quite easily detected, although they cannot be measured very accurately.

As I have often stressed, the adoption of rigorous criteria in track selection is of great importance in securing reliable results, and with ample data available, Scherrer's angular limitation criterion is highly desirable. In common practice, however, the experimenter is usually faced with the unpleasant alternative of strict selection criteria plus large statistical fluctuation, or less rigid criteria accompanied by less statistical fluctuation.

In my work, a total of 201 collisions was considered in an energy range 0·4–1·1 Mv., whereas Scherrer observed only about eighty collisions in the same energy range. For scattering between 20° and 60° his results are, *in this energy range*, not in appreciable disagreement with theory when statistical fluctuations are considered. For angles greater than 60°, reference to my own results shows that the scattering rises somewhat above the theoretical values, although statistical fluctuations would not allow a comparison to within ± 50 per cent. From Scherrer's more limited data, however, he deduces an excess above the theoretical value by a factor of 10. In view of the fact that he finds an excess of about five times the theoretical value for energies so low as 0·15 Mv., whereas Neher[2], using a Faraday cylinder arrangement, found an excess of only 30 per cent at this energy for the light element aluminium, it seems possible that Scherrer's result may be a considerable over-estimation. Combined with Stepanowa's[2] results, however, the evidence is now strong that nitrogen exhibits marked excess scattering of electrons at energies greater than 1 Mv.

F. C. CHAMPION.

King's College, London.
Nov. 12.

[1] *Helv. Phys. Acta*, 85, 14 (1941).
[2] *Rep. Phys. Soc.*, 1938.

Origin of the Automatic Microtome

IN his very sympathetic obituary notice on W. H. Caldwell in NATURE of Nov. 8, p. 557, Dr. G. P. Bidder asks all biologists to remember that they owe to Caldwell the ribbon method of cutting paraffin sections. In this connexion I would like to direct attention to a short account of the invention of the microtome for cutting continuous ribbons of paraffin sections written by the late Sir Richard Threlfall, in *Biological Reviews*, 5, 357 (1930). Caldwell and Threlfall were contemporaries and friends at Caius ; both were then scholars and later on fellows of the College. In a characteristically personal manner, Threlfall recounts in his article how when he was still an undergraduate he discussed with Caldwell their joint invention, and he tells the part that he himself played in making the new type of microtome which was to become an essential tool of zoologists. Threlfall's article includes a photograph of a copy of the original instrument; this copy is now in the Science Museum, London. The original instrument is in the Zoology Department, Cambridge.

H. MUNRO FOX.

Gonville and Caius College,
Cambridge.

Distribution of Energy among the Cathode Rays of a Glow Discharge

EXPERIMENTS have been carried out to determine the energy distribution among electrons originating in the cathode dark space of the glow discharge through gases. Two methods have been employed : a method of retarding potential applied to electrons which escape through a hole in the anode into a low-pressure region behind it, and a method employing electrostatic focusing and deflexion of the same issuing beam. The following general conclusions have been drawn from the experimental study :

(*a*) At low pressures and high voltages where the discharge is strongly abnormal, the issuing electrons

are substantially homogeneous in energy. This energy corresponds approximately to the potential difference across the discharge. This is the region where the discharge forms a useful source of electrons of homogeneous velocity for use in high-speed cathode-ray tubes and electron diffraction cameras.

(*b*) At higher pressures and lower voltages, the electron beam possesses a wide range of energies. The general form of this energy distribution is independent of current and voltage. The maximum of the distribution curve occurs always at the maximum energy, and this in turn corresponds closely with the potential across the cathode region of the discharge. In general, at constant pressure the greater the current the greater is the proportion of electrons which possess the full energy. As the pressure is increased, the relative number of electrons in the lower energy regions increases while the fraction of the current carried by electrons decreases. It would appear that in all cases the greater number of electrons originates at the surface of the cathode itself. Except at the highest pressures, there is no support for the conclusion of J. J. Thomson that ionization is uniform throughout the cathode dark space, an assumption which has been accepted generally as necessary to explain the observed potential distribution.

A detailed account of these experiments will be published elsewhere at a later date.

R. M. CHAUDHRI.

Muslim University,
Aligarh.

Early Logarithmic Works

READERS of J. Henderson's bibliography of logarithmic tables ("Tracts for Computers", No. 13, Cambridge, 1926) will be aware of the interest attached to Ezechiel de Decker's "Tweede Deel vande Nieuwe Tel-konst" (Gouda, 1627), in which was first published the important de Decker-Vlacq table of 10-decimal logarithms of numbers from 1 to 100,000. After the existence of this work had been doubted by many authorities, a complete copy was found at Utrecht by van Haaften in 1920.

In September of this year my attention was directed by Mr. H. G. Ward, of the Harold Cohen Library of the University of Liverpool, to the existence of a copy of Vlacq's "Arithmetique Logaritmetique" (Gouda, 1628) among a collection of books bequeathed to the University by T. G. Rylands in 1900, and now housed in the Harold Cohen Library. On examining the volume, I found, bound in at the end, pages 1–36 (a–d^4, e^2) of the "Tweede Deel", forming a treatise on the use of logarithms in arithmetic. Title-page and foreword (both reproduced in facsimile in Henderson's tract) are wanting, so that neither the name de Decker nor the date of publication occurs. The logarithmic table, which is known to have been published in both de Decker 1627 and Vlacq 1628, is wanting as a part of de Decker's work, since the Liverpool copy of the table has the French (not the Dutch) sub-title, and belongs to Vlacq's work, as a part of which it is collated.

There is nothing obviously incomplete about the Liverpool copy of the introductory treatise; rather the reverse, in view of the final half-section e^2. It may well prove to be complete, when it becomes possible to obtain detailed information about the Utrecht copy. In the meantime, it seems desirable to put on record the existence of a copy in Liverpool.

Also bound in the same volume is a copy of the rare extra section of 12 pages of Briggs's "Arithmetica Logarithmica" (London, 1624), containing 14-decimal logarithms of numbers from 100,001 to 101,000, and 11-decimal square roots of numbers from 1 to 200, with first differences in each case. I mention this now because the section has also been described by De Morgan and by Glaisher (see Henderson's tract, p. 41), and in respect of the table of square roots their descriptions differ from one another and from the above.

A. FLETCHER.

Dept. of Applied Mathematics,
University of Liverpool.
Nov. 18.

John Mayow, 1641–79

ACCORDING to numerous histories of science and similar works, John Mayow was born in London of Cornish descent. The writers of these works give the date of his birth variously as 1640, 1643, 1644 or 1645, with a preference for 1645. This preference is presumably due to a statement made by Anthony à Wood that Mayow was "descended from a gentile family of his name living at *Bree* in *Cornwall*, was born in the parish of S. *Dunstan in the West* in *Fleet-street, London*, admitted Scholar of *Wadham* Coll. 27. *Sept.* 1661 aged 16 years"[1].

In some recent researches, which are too long to describe here and which will shortly be detailed elsewhere, I have been able to show that Wood's statement is wrong. As it now appears that the present month of December is as near as can be ascertained to the tercentenary of Mayow's birth, we may here briefly summarize this new evidence that he was born in Cornwall in 1641.

C. S. Gilbert describes Mayow as "a descendant from the ancient and genteel family of his name, living at Bray, in the parish of Morval"[2]. The manor of Bray was acquired by the Mayows in 1564 when Phillip Mayow of East Looe bought it from Christopher Copplestone[3]. Wood's "Bree" is, therefore, the manor of Bray in the parish of Morval near Looe in Cornwall. A search in the parish registers of Morval, by the courtesy and with the assistance of the Rev. E. A. Saunders, vicar of Morval, showed that John Mayow, the second son and third child of Phillip Mayow and his wife, Frances Stukeley, was baptized in Morval Church on December 21, 1641. As confirmatory evidence we may quote here, with the kind permission of the Warden of Wadham College, Oxford, the following extract from the records of the College: "John Mayow (Mayouwe), matriculated 2 July 1658, received as commoner, but admitted scholar 23 Sept. 1659, said to be of Bree, Cornwall and aged 17". Thus the John Mayow of Wadham College is also the John Mayow of Bray in Cornwall, who, being aged seventeen in September of 1659 (he would have been eighteen in December), or possibly said to be of that age in July of 1658 (he would have been seventeen in December of that year), was baptized in Morval Church on December 21, 1641.

DOUGLAS MCKIE.

History of Science Department,
University College,
London.

[1] "Athenæ Oxonienses", 1st ed., 2, 474 (London, 2 vols., 1691–2); 2nd ed., 2, 637 (London, 2 vols., 1721). Italics occur in original.
[2] "Historical Survey of the County of Cornwall" etc., 1, 140 (Plymouth-Dock and London, 2 vols. in 3, 1817–20).
[3] *ibid.*, 2, 197.

GLASS FURNACE PROBLEMS

THERE has been little advance in glass furnace design since the invention of the Siemens regenerative furnace in the sixties. Such improvements as have taken place have been largely in the resistance of the various refractories to the temperature of which this type of furnace is capable, and even yet a producer-gas fired furnace can be run at a substantially higher temperature than the refractories themselves will withstand for long periods. The Society of Glass Technology, in co-operation with the Department of Glass Technology at the University of Sheffield, has given continuous thought to the problem of furnace design during the twenty-five years of its existence, and it was therefore appropriate that the twenty-fifth anniversary meeting which was held at Sheffield on November 19 should take the form of a symposium on glass furnace problems.

The morning session was devoted to two papers dealing with the fundamental aspects of heat transmission, of which one, by Prof. D. T. A. Townend and his associates in the Department of Fuel at the University of Leeds, referred to radiation from flames and furnace linings, and the other, by Mr. J. B. Wagstaff, of Messrs. Hadfields, Ltd., had particular reference to the use of heat-resisting steels in recuperators. The second session, in the afternoon, dealt with the problem (of more immediate importance to the manufacturer) of the possibility of determining figures which would represent the performance of glass tank-furnaces, and provided a summary of the work which has been carried out by the Furnace Sub-Committee of the Department of Glass Technology during the last few years.

In discussing the question of metal recuperators, it was pointed out that the conditions for heat exchange in gases are fundamentally different from those for liquids, in that there is a high temperature difference between ingoing and outgoing gases, and the large volume of gases to be considered travel necessarily at a low velocity. For temperatures below 600° C., cast iron is reasonably satisfactory, and from that to 900° C. alloy steels meet the case. Even the best alloy steels are unsatisfactory at temperatures in excess of about 900° C., and the high nickel steels have the additional disadvantage that they are readily attacked by sulphur compounds. A metal recuperator, owing to the possibility of welding, can be made leak-proof, but the ordinary refractory recuperator, while standing up to the temperature and corrosion conditions, usually leaks so badly as to diminish its efficiency to a serious extent.

Mr. Wagstaff dealt in considerable detail with the fundamentals of the design of metal recuperators, and a point of considerable practical importance is the way in which the efficiency diminishes with a deposit of slag or dirt on the recuperator tubes. This was stated to be due to the increase in thermal resistance through the tube itself rather than to any change in the transfer of heat from the flame through the recuperator due to variations in the emissivity of the surface. In the course of the discussion it became clear that while some metal recuperators have failed in the course of as short a time as forty-eight hours, others have been found satisfactory for periods up to ten years; the main point that was emphasized being the necessity for selecting the metal appropriately to the particular conditions of the problem.

Prof. Townend provided a masterly summary of the fundamentals of heat transfer by radiation, and sketched in outline the theories that have been advanced to explain the radiation from water and carbon dioxide in the near infra-red. There is growing evidence of the existence of what he described as "over-activated molecules of relatively long life", which are, however, capable of giving up extra energy almost instantaneously on collision with the appropriate molecule or surface. Some of the facts which have led towards this conclusion are that silica-coated thermocouples record much lower temperatures than plain metallic thermocouples in the same gas stream, showing the effect of the surface on the rate of transfer. It has been shown also that most of the radiation from the Bunsen burner comes from the outer surface or the hot cone, indicating that all the energy is not instantaneously released on combustion. It is known that the addition of a small quantity of hydrogen to a carbon monoxide flame decreases the radiation disproportionately, but that the time of combustion increases. This was offered as a partial explanation of the known 'cutting' heat of a water-gas flame versus the 'soaking' heat of producer gas. In the flame spectrum of carbon monoxide there are bands superimposed on the continuous spectrum which are believed to be due to the over-activated molecules referred to above.

The effect of luminosity in the gas flame on the transfer of heat by radiation was then discussed by Prof. Townend. It has been shown that the radiation is greater than in the case of non-luminous flames but falls short of that emitted by a black body at the same temperature. Important factors in the rate of transfer in furnaces are the calorific value of the fuel as this affects the flame temperature, good mixing of the air and gas, and, related to this, the turbulence of flow. The point that is sometimes overlooked by the practical man is that the flame must always be considerably hotter than the walls of the closure.

Prof. Townend's colleague, Dr. A. L. Roberts, discussed the question of the radiation from solids, and pointed out that most refractory materials are initially selective radiators, and showed diagrams indicating how the purity of the refractory material affects the flame and its emissivity curve. Contamination of the surface of refractories in use tends to make them less selective, whereas the most hopeful lines of research would appear to be to make the walls radiate selectively so that the energy would be mostly radiated in the region where it could be most easily absorbed by the substance to be melted. The texture of the surface also has an important bearing on the effective emissivity. Rough surfaces have higher effective values although they, again, tend to render the radiation less selective. There are, therefore, two contradictory facts, and only experience can show which of them has the most important bearing on flame transfer efficiency.

The afternoon papers were, as stated earlier, more largely of direct interest to the glass manufacturer. Mr. W. A. Moorshead summarized the principles involved in the calculation of furnace performances

with particular reference to the effect of changes in regenerator efficiency on the thermal balance sheet. Dr. W. M. Hampton put forward a proposal for a performance figure for glass tank furnaces. While the accurate determination of a thermal balance sheet provides all the information necessary, it involves so much time and work that some simplified method of calculation is anxiously required. It has been the custom in the glass industry to consider the simple ratio glass made/coal used, but it was pointed out that the amount of glass produced in a furnace bears no necessary relation to the amount of glass such a furnace is capable of melting, as commercial considerations frequently come into operation. It is clear that the fuel consumption of a furnace increases with the throughput of glass, and after considering many alternative bases for comparison, it has now been agreed by the Furnace Committee that the fuel consumptions of different furnaces should be compared on the 'no load' basis, that is, the amount of coal needed to maintain the furnace at a given temperature when it is not actually producing any glass. Since the fuel consumption also varies with the temperature at which the furnace is run, Dr. Hampton proposed—and curves were provided to enable the transformation to be carried out simply—that the fuel consumption should be calculated as at a standard temperature of 1400° C.

It has also now been agreed by the Furnace Committee that the input to the furnace should be reckoned in heat units instead of in terms of various fuels, and the proposed performance figure suggested as the area of the furnace per unit input of heat which can be maintained at a temperature of 1400° C. when no glass is being produced. Using the information collected by the Department of Glass Technology over the last four years on glass tank furnaces in various parts of Great Britain, it was shown that there is a definite correlation between the size of the furnace and its performance figure, and also that the most important factor in improving the performance is adequate insulation. Differences in design are apparently of minor importance.

The general impression left by the meeting and discussion was that the glass industry is fully alive to the necessity for fundamental research, and that by the use of some agreed basis it should be possible to compare the performance of tank furnaces employed in making very widely different types of glass. Such comparisons should enable the effect of variations in design or materials on the performance of furnaces to be estimated, and so lead to substantial improvements in fuel economy. W. M. HAMPTON.

CIVILIZATIONS IN TRANSITION

ALTHOUGH cultural penetrations usually follow predictable lines in accordance with proximity, degree of difference between the civilizations involved, and their relative prestige values, notable exceptions indicate the wide variability of human reactions.

In the symposium on "Civilizations in Transition", held on September 25 as part of the celebration of the fiftieth anniversary of the University of Chicago, Prof. Robert H. Lowie, professor of anthropology in the University of California, and Prof. Michael I. Rostovtzeff, professor of ancient history in Yale University, discussed phases of cultural infiltration.

Prof. Rostovtzeff, speaking on "The Destinies of Hellenism in the Near East", described the trends toward hegemony and toward subordination which existed simultaneously in the case of the Greek settlers in Egypt. At first the Greeks, bearers of a high culture, were an *élite*, organizing a complex bureaucracy which virtually undermined the royal power and which milked the native population of its wealth. Later, Prof. Rostovtzeff said, the tendencies towards cultural acclimatization began to take effect, and by the time of the rise of Roman power, the Greek creative force in Egypt had been exhausted.

After the death of Alexander the Great, a wave of Greek emigrants swept into Egypt.

Since the status of the Greeks was that of a privileged class, the higher strata of the native population naturally tried to acquire for themselves this status. The prerequisite for it was Greek education and participation in Greek life. Thus a certain part of the native population became gradually 'Hellenized' and some of them received from the king the status of Hellenes.

Prof. Lowie discussed numerous examples of primitive groups in which cultural transfer depended on such obvious factors as the conqueror-conquered relationship and geographical proximity, but also listed situations in which these factors were outweighed by customs and other cultural phenomena which prevented transfer of traits of civilization when other circumstances were apparently favourable. Speaking on "The Transition of Civilizations in Primitive Societies", he also pointed to societies in which culture spread from the conquered to the conqueror and across apparently insuperable geographical barriers.

Although contact between two cultures usually results in an exchange of cultural traits, it does not always have this result. Dr. Lowie cited as an example four tribes in the Nilgiri Hills of southern India all of which live within easy walking distance of one another. The Toda are buffalo-breeders; the Badaga raise millet; the Kota serve as smiths and musicians; the food-gathering Kurumba practise magic. Transference of traits among the tribes is inhibited by the intense caste sentiment that prevails. When a few Kota attempted to wear turbans, after the fashion of the Badaga, they were at once beaten up by their outraged neighbours. Geographically there is an ideal set-up for a levelling of cultural differences, but any such process is frustrated by the prevailing ideology.

Class consciousness hinders the free spread of ideas by checking one of its most natural promoters, intermarriage; and it is equally potent when material advantages are reserved to a dominant people.

In Ankole, an East African country, the subject Bairu cannot turn into independent stock-breeders so long as their Bahima overlords claim the right to own all productive cows. Another factor preventing exchange of traits is the emotional revulsion to a novelty which, however useful, flouts accepted

standards, as when Buddhistic scruples prevent the Buddhist from raising silkworms.

Although the raising of edible plants usually spreads rapidly from one culture to another, it is not difficult to find exceptions. Why did rice fail to penetrate Oceania? Why do the contemporary Tahitians, with the example of the Chinese colonist before them, disdain to raise it ? Why did potato cultivation remain confined to Andean cultures in pre-Columbian times even though wild species occurred to the north ? Why did the tomato, a native of South America, reach the Ijca of northern Colombia only in recent times ?

Though not all such instances are explainable, Dr. Lowie considers that a partial explanation is that borrowing of cultural traits is not likely to occur when the potential recipient possesses an adequate counterpart.

In discussing the influence of borrowed traits upon culture, Dr. Lowie pointed out that borrowed traits, because of their extreme novelty, seldom are acceptable to the religious aspects of a culture. He cited as examples the reluctance of American Indian tribes to accept horses and guns into their religious ritual and worship, long after both horses and firearms had been widely used by the tribe. The horse remained of little religious importance. Even though it was an object constantly prayed for, we rarely, if ever, hear of a supernatural horse on a par with the bear, eagle, beaver, or other animal spirits. One Crow band had a horse dance, but the celebrants believed that they derived their power from an eagle.

The principle that novelties are religiously inferior holds true for weapons as well. In 1805 the Crow, obliged to obtain firearms and ammunition from the village tribes of the upper Missouri, were still poor shots with the gun. The deficiency was soon overcome, and, what is more, the wresting of a gun in a hand-to-hand fight came to be recognized as an honorific exploit equivalent to the older bow-snatching. Yet in the preparations for the sacred sun dance it was explicitly ordained to shoot a bull without the use of a gun.

Dr. Lowie also referred to the Crow practice of beginning a war expedition on foot, out of respect for the ancient method of fighting, even though the warriors later mounted horses.

Prof. Rostovtzeff stated that while 'Hellenization' was effected among the well-to-do natives, it did not touch the masses of the population of the two monarchies, the peasants of the country and the artisans of the cities, towns, and villages.

In time, the Greeks became privileged servants of the king and soon a powerful bureaucracy grew up dominated by the Greek administrators. From the point of view of the masses, the Greeks were their oppressors. They extracted from them ever heavier taxes, they supervised their compulsory labour, they acted as agents of the Government in exercising an ever stricter control over their economic life. The native working classes complained to their protector, the king, but they soon found out that the kings were helpless to relieve their sufferings. The powerfully organized bureaucracy was stronger than the royal will. No wonder then from time to time the natives rose in revolt.

As the Greeks began to intermarry with Egyptians, Dr. Rostovtzeff declared, they became more and more influenced by Egyptian culture, and soon an 'Orientalized' type of Greek came into existence. The Greeks were gradually absorbed by their Oriental surroundings. Climate, food, environment had their natural effects. A new type was in formation. We know little of this type, but its existence is certain.

It is significant, for example, how rapidly the Greeks became 'Orientalized' in religion. From the very beginning they worshipped in Egypt the new 'Hellenized' god Sarapis, a blend of the Egyptian Osiris and certain Greek gods. They became more and more devoted to this god as time went on, and especially to his divine consort the mighty Isis, long familiar to the Greeks. There was also the growing devotion of the Egyptian Greeks to the various animal gods such as the great crocodile god, and to the pseudo-science of astrology.

Another symptom of 'Orientalization' was the gradual change in the spirit of the Greeks. The buoyant energy of the pioneers of the third century B.C., their creative force, gradually subsided. Creation was replaced by routine, the Greek tempo of work was followed by Oriental passivity.

By the time of the rise of Roman power, Dr. Rostovtzeff said, the Greek creative force in Egypt had been exhausted and Egypt and the entire Greek world became incorporated into the Roman Empire.

THE QATTARA DEPRESSION

By M. G. BEADNELL

THE account in NATURE of November 1 of the career of the late Dr. John Ball, technical adviser to the Geological Survey Department of Egypt, brings vividly before me his enthusiasm on the subject of the Qattara Depression Scheme, with which his name was so closely associated in Egypt.

Roughly speaking, the depression is shaped like an elongated mutton-cutlet, and has a total superficial area of 19,500 sq. km., two thirds of which are more than 50 metres below sea-level, and the remainder reaching a minimum of −134 m. at a point south-east of the tiny enclosed Oasis of Qara. Its greatest length, from west to east, is 298 km., and greatest breadth, from north to south, 145 km. The depression extends from nearly 80 km. from Siwa on the west to within 205 km. of Cairo on the east, and its most northerly boundary is only 56 km. from the Mediterranean.

Nearly a third of the floor consists of a damp mixture of sand, clays and salts, known as "Sabakha", an Arabic term applied to deposits having a fertilizing value. (This area is so enormous that a proposal was put forward at the time by a Cairo newspaper that the depression should be exploited for its economic value, as a parallel to that of the Dead Sea, but this was never undertaken.)

The existence of this low-lying tract was discovered only in 1917, and quite fortuitously. The

commander of a military patrol going through that part of Northern Libya was requested by the Survey of Egypt to take aneroid readings, and the result was so surprising that at the earliest opportunity a scientific surveying party was sent there to confirm the data obtained. This led to a visit to the region by Hussein Sirry Bey (now Prime Minister), at that time director-general of the Survey Department, accompanied by Dr. Ball, director of the Desert Surveys branch.

There and then was conceived the huge project of bringing the water of the Mediterranean to the depression through a 60-km. aqueduct, part canal and part tunnel, and utilizing its fall from the exit —about 250 m. below the summit of the escarpment— for the generation of electric power on an enormous scale. They calculated that evaporation would effectively prevent the resulting lake from rising to the level of the site of the power-station.

This scheme appealed immensely to the people of Egypt—always worshippers of everything on a grand scale—for they immediately saw a navigable canal connecting the sea with a vast lake over which they might sail almost to Siwa, as well as a natural and inexhaustible electrical supply of 250–350,000 kw., providing cheap power and light for the towns and villages of the Delta.

After some experimental outlay on ascertaining the nature of the strata to be excavated, the idea was entirely abandoned, as its cost would have been prohibitive and exhausted the exchequer before any returns could reasonably be expected.

A point of considerable interest is that in the Miocene and later beds of the 300-metre escarpment of Qattara, a discovery was made of fossil bones of prehistoric animals, descendants of the Eocene *Arsinoitherium Zittelli* and contemporary ancestors of the elephant, excavated nearly forty years ago in the Fayum Province of Egypt. Owing to stress of work, this find could not be investigated, and is known only to the finder.

Qattara is the starting-point of many of the sand-dune belts of the Libyan Desert. Wind-erosion is persistently disintegrating the clays, sandstones and limestones out-cropping on the face of the escarpment, the grains being unceasingly swept away and blown southwards to add to the ever-increasing volume of these dunes, the most deadly obstacles to the domination of the desert yet encountered by man.

FORTHCOMING EVENTS

MONDAY, DECEMBER 15

ROYAL GEOGRAPHICAL SOCIETY (at Kensington Gore, London, S.W.7), at 3 p.m.—Mr. J. W. Crowfoot: "Syria".

TUESDAY, DECEMBER 16

ROYAL SOCIETY OF ARTS (DOMINIONS AND COLONIES SECTION) (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Dr. Maurice Ashby: "British Empire Drugs Production".

ROYAL INSTITUTION OF GREAT BRITAIN (at 21 Albemarle Street, London, W.1), at 2.30 p.m.—Prof. J. C. Drummond: "Recent Advances in the Science of Nutrition and their Significance in War-Time".

THURSDAY, DECEMBER 18

ROYAL INSTITUTION OF GREAT BRITAIN (at 21 Albemarle Street, London, W.1), at 2.30 p.m.—Sir John Russell, F.R.S.: "Collective Farming in Russia and the Ukraine".

INSTITUTION OF ELECTRICAL ENGINEERS (at Savoy Place, Victoria Embankment, London, W.C.2), at 5 p.m.—Dr. W. G. Radley and Mr. E. P. G. Wright: "Voice-Frequency Signalling and Dialling in Long-Distance Telephony".

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Éire: Roinn Talmhaidheachta (Department of Agriculture): Brainse Iascaigh (Fisheries Branch). Report on the Sea and Inland Fisheries for the Year 1939. (P. No. 4657.) Pp. 30. (Dublin: Stationery Office.) 6*d*. [1111

Proceedings of the Royal Irish Academy. Vol. 47, Section B, No. 6: Salmon of the Owenduff (Ballycroy) River. By Arthur E. J. Went. Pp. 161–178. (Dublin: Hodges, Figgis and Co., Ltd.: London: Williams and Norgate, Ltd.) 1*s*. [1311

Other Countries

Canada: Department of Mines and Resources, Mines and Geology Branch: Bureau of Geology and Topography, Geological Survey. Memoir 226: Palæozoic Geology of the Brantford Area, Ontario. By J. F. Caley. (No. 2458.) Pp. iv+176. 50 cents. Memoir 227: Jacquet River and Tetagouche River Map Areas, New Brunswick. By F. J. Alcock. (No. 2459.) Pp. iv+46. 25 cents. Memoir 230: Mineral Industry of the Northwest Territories. By C. S. Lord. (No. 2462.) Pp. vi+136. 50 cents. Paper 40–18: Report and Preliminary Map, Houston Map-Area, British Columbia. By A. H. Lang. Pp. iii+18+map. 10 cents. Paper 41–5: Preliminary Map, Manson Creek, British Columbia. By A. H. Lang. 10 cents. Paper 41–6: Vassan-Dubuisson Map Area, Abitiki County, Quebec (Summary Account). By G. W. H. Norman. Pp. iii+9+map. 10 cents. Paper 41–7: Northeast Part, Beauchastel Township, Temiscamingue County, Quebec (Summary Account). By E. D. Kindle. Pp. iii+5+map. 10 cents. Paper 41–8: Preliminary Map, Morley, Alberta. By G. S. Hume and H. H. Beach. 10 cents. Paper 41–9: Preliminary Map, Bighorn River, Alberta. By B. R. Mackay. 10 cents. Paper 41–11: Preliminary Map, Redcliff, Alberta. By J. S. Stewart. 10 cents. (Ottawa: King's Printer.) [1011

U.S. Department of the Interior: Geological Survey. Bulletin 908: Geology of Area between Green and Colorado Rivers, Grand and San Juan Counties, Utah. By Edwin F. McKnight. Pp. v+147+13 plates. 1.50 dollars. Bulletin 910-C: Fineness of Gold from Alaska Placers. By Philip S. Smith. (Mineral Resources of Alaska, 1937.) Pp. vi+147–272+plate 3. 30 cents. Bulletin 911: Ore Deposits in the Vicinity of the London Fault of Colorado. By Quentin D. Singewald and B. S. Butler. Pp. vi+74+21 plates. 1.50 dollars. Water-Supply Paper 848: Ground Water in Keith County, Nebraska. By Leland K. Wenzel and Herbert A. Waite; with Sections on Platte Valley Public Power and Irrigation District, Sutherland Project, by E. E. Halmos, and Central Nebraska Public Power and Irrigation District, Tri-County Project, by G. E. Johnson. Pp. iv+68+8 plates. 70 cents. Water-Supply Paper 869: Flood of August 1935 in the Muskingum River Basin, Ohio. By C. V. Youngquist and W. B. Langbein; with Sections on the Associated Meteorology and Hydrology, by Waldo E. Smith and A. K. Showalter. Pp. vi+118+8 plates. 40 cents. Water-Supply Paper 885: Surface Water Supply of Hawaii, July 1, 1938, to June 30, 1939. Pp. v+142. 20 cents. (Washington, D.C.: Government Printing Office.) [1311

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