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A SCIENTIFIC FOOD POLICY

WAR had brought famine to two of its first victims, China and Spain, before Great Britain took part in it. With the deliberate spoliation by the Nazis, the blockade and the scorched earth policy in the most fertile regions of the U.S.S.R., famine at the end of this War will be far worse than in 1918 and the following years. Some form of international famine relief commission must, perforce, be set up. It may be content to restore the unsatisfactory normal of the years before the War, or it may grow into a permanent organization that will attempt to raise the nutrition of people throughout the world to a satisfactory level—an organization that will differ from the wistful and ineffective League of Nations in having executive powers. If the present determination to make a safer and saner world survives the War, this relief organization will not give up the more ambitious aim.

Of the four freedoms of President Roosevelt, freedom from want, in respect of food at any rate, stands in a class by itself. Such phrases as freedom of speech may have very different meanings in New York and Moscow, in London and in Berlin ; even those to whom the words carry the same meaning, may differ in their estimates of the amount of freedom that should be allowed. But a calorie is a calorie all the world over ; the experts of nine States have agreed on the minimum amounts of various food constituents that freedom from want implies. The requirements are settled. How can the supplies be obtained and how can a fair distribution be ensured ?

We can take it that plans for the reorganization of British agriculture that suited the years before the War will no longer meet our needs. The economic position of Great Britain will have changed fundamentally ; we shall no longer be able to draw food and feeding-stuffs, as tribute, from half the world. Further, as Dr. Platt said at the recent meeting of the Nutrition Society (see p. 318), continued importation of large amounts of feeding-stuffs by Great Britain does not involve a competition for food between different kinds of domestic animals only, or even between men and animals only, but also between men and men ; the food for our animals is taken at the expense of men in other parts of the world. There are huge blocks of human life, in India and China, for example, whose standard of diet is not of the same order as the minimum proposed by the Technical Commission of the League of Nations or as the standard of diet of western Europe. Europe, excluding the U.S.S.R., with a population little more than one third that of Asia, consumes more cereals and six times as much meat. A world of such gross inequalities cannot be stable.

Physiologists have been impressed by the production (over a limited area and for a limited period) of supplies of food in excess of effective demand, and by the deliberate destruction and limitation of productive resources. They have been inclined to believe that there is no physical bar to the satisfaction of their demand for adequate food for all ; that ample is available to order. There is an opposite

view ; in its extreme form it is that human nutrition is a by-product of a cycle—fodder crops, animals, manure—that maintains the fertility of the soil. The exhaustion of the soil, which has reduced fertile land from Saskatchewan to Texas to whirling dust, has made us all realize that the soil cannot supply food in unlimited amounts and kind ; that it is essential to plan the type of food produced so that the quality of the soil will be maintained. If this is not done in the traditional way with animal manure, some other way must be found.

Actually the world, as a whole, has never produced too many calories for human food ; certainly, in the years after this War there will be no excess. It will be necessary to take care of the calories. Now, the largest number of calories for human consumption can be obtained from a given area if crops are grown that can be eaten by human beings. If feeding-stuffs are grown and used to feed animals, the return, in terms of calories, is poor. For example, an acre under potatoes will produce some four million (large or kilo-) calories for human consumption, and some two million if under wheat ; but only one fifth of a million calories if used as grass-land for feeding beef cattle, and two thirds of a million if used to feed milch cows. Animals, like human beings, use up the greater part of their food to supply their daily needs of energy, and store only a small surplus as flesh ; owing to the rapid growth of animals, the return is higher than might have been expected. But, during periods when calories are short, no more animals should be kept than are needed to maintain the fertility of the soil (supposing that no substitute is found) and to meet the special needs of human beings that are not well supplied by vegetables. The conversion factors give a fairly correct estimate of the relation between the amount of energy, for human beings, obtained if crops are used direct as human food and the amounts obtained if the crops are used indirectly for feeding animals which are eaten by human beings ; for a calorie is much the same, whether obtained from animal or vegetable food.

But estimates of the amounts of protein produced by animals from a given amount of protein in feeding-stuffs cannot be used without qualification ; they do not take into account the difficult question of biological value. Meat is of special importance in nutrition because animals pick out the indispensable amino-acids, which we cannot make ourselves from their food, and concentrate them in their flesh. The concept of biological value is unsatisfactory. It appears that wheat protein mixed with a small amount of animal protein may have the same value as an equal weight of animal protein. We cannot calculate the proportion of vegetable food to meat that will give the highest nutritive value per acre until we have a more exact knowledge of the metabolism of amino-acids and of their interplay. However, milk is in a class by itself ; milch cows give a fairly high return, even of calories ; the protein of milk has a high biological value ; cows concentrate calcium and riboflavin in their milk ; they return the carotene of their food mainly as pre-formed vitamin A, which is better absorbed by human beings. Taken all round, milch cows are by far the most efficient converters of vegetable feeding-stuffs into valuable food for human consumption. In times of shortage they are the only animals that should be allowed to compete with human beings for food ; other animals, male calves, for example, should be killed young.

This concentration on vegetable crops, for direct human consumption, and on milk and milk products, gives the diet recommended by Sir John Orr both for war-time and during the reorganization of the world's food supply. So far as our present knowledge goes, it will supply everything that is needed.

At the end of the meeting of the Nutrition Society on February 28, Sir Joseph Barcroft stressed the importance of the flavour and interest of food. But there is no reason why milk products and vegetables should be flavourless or dull. There is a wonderful choice of cheeses, and no two Cheddars even taste quite the same. There is no need to cling to the narrow range of badly cooked vegetables that is traditional in Great Britain. What is wanted is better methods of transporting and storing vegetables, something comparable with the improvement in methods of storing fruit. As it is, however, the diets of many people are so dull that they must enliven them with crude flavourings. The Indian corrodes his stomach with curry and the Englishman spoils his palate and ruins his digestion with pickles and spices. The first edition of 'Blitz' soup, prepared to suit the taste of Londoners, was so fiery that it might have been used externally as a counter-irritant. Further, tastes are changing. British soldiers patronized milk bars, so long as they supplied milk. Experiments on children have been extended to adults eating in canteens ; one can now see sturdy draymen sampling Oslo meals.

Vegetables and milk are best produced on the spot, whereas cereals are well suited for transport. The most effective policy would be one similar to the breadstuffs policy of the War of 1914–18. Peoples, such as those of India and China, who now wring just enough or not enough calories from the soil, might be supplied with cereals from areas such as Canada and the Argentine that can expand production and produce a surplus over their requirements. In this way, land in the over-populated countries could be set free for growing other crops and for feeding animals, with benefit to the health of the people and the fertility of the soil.

If the amount and quality of food is to be raised, agricultural machinery must be supplied. This will involve an increased demand on manufacturers, who will have to meet other demands to supply pressing needs—machinery for transport and building, for example. The Nutrition Society is a valuable meeting-place, in which physiologists can discuss with agriculturists how best their demands can be met. Should there not be a means devised of enabling agriculturists to meet manufacturers, state their requirements and learn the difficulties that may lie in the way of their fulfilment ?

There are political difficulties, too. Small farms cannot use agricultural machinery economically. There must be some form of amalgamation, whether

in State farms, collective farms, co-operatives or large groups of family units under one management. In China some 40 per cent of farms are less than 1⅔ acres; in Japan two thirds are less than 2½ acres. These little plots cannot produce proper food for the farmers' families. Some means must be found by which the density of the agricultural population can be reduced.

The production of sufficient food is only half the battle. The producer must know that his crops will find a market; the consumer must be able to buy the food produced. The whole reorganization must involve fundamental changes of custom and conflict with vested interests. Opposition may be less than it would have been a few years ago. All the world over, people are becoming familiar with food control; in Great Britain they are beginning to realize its possibilities. Also hunger is a strong argument, and hunger is one of the few things of which there is prospect of plenty at the end of the War. An International Famine Relief Commission will wield a convincing weapon—food; if it uses this weapon justly and efficiently it can do much to reconcile people to profound changes. Difficulties are great; they must be studied now. For only those who know clearly what they want and how to get it are likely to achieve anything worth having in the welter of conflicting policies at the end of the War.

INTERNATIONAL ECONOMIC EQUILIBRIUM

THE meetings of the Inter-Allied Council render one signal service in respect of reconstruction—they stress its international aspect. This has to some extent been overlooked in the studies and discussions on reconstruction which have so far been initiated in Great Britain, and for all the attention that has been given to the work of the Leith-Ross Committee and the establishment of the Leith-Ross Bureau to deal with problems involved in the storage of surplus foodstuffs and their distribution after the War to the peoples in enemy-occupied Europe, the economic aims stated in the fourth and fifth points of the Atlantic Charter have not received much emphasis. The political, economic and social aspects of international reconstruction cannot indeed be entirely separated. They are as interlocked as the international and the national or internal aspects of reconstruction, and our hopes of a new and stable world order depend largely on our exploring the situation now so as to lay bare the principles for a constructive policy in readiness for the time of action.

Much of that action must of necessity be deferred until after the War, though in certain matters preliminary action as well as the determination of broad lines of policy are already required. Demobilization, for example, clearly must receive consideration before the fighting ceases. Plans must be in readiness, and the experience of 1918 is with us as a warning that a sudden and unexpected collapse of the enemy should not again find us unprepared. Unpreparedness can as assuredly endanger the winning of the peace as it has hindered the organization of victory.

In the last year or so, the discussions which for the first year of the War were so prominent on Federal Union and the exact form of the organization of a collective security system have rather fallen into the background. It has been recognized that the final form of organization to be adopted is a question to be determined later. On the other hand, there is a wider recognition that forms of co-operation established to serve the common purpose during the War can equally contribute to the final purpose of winning the peace. Even before the United States entered the War, there was unmistakable evidence on both sides of the Atlantic of Anglo-American determination to maintain that co-operation, and the machinery now established will not be recklessly scrapped unless it is proved to be no longer serviceable.

Besides this, attention is being concentrated, not first on the machinery to be established, but rather on the problems to be solved, with the object of elucidating first principles and from them arriving at the methods and organization most likely to provide a solution. In the field of international reconstruction there is, for example, the problem of the relation of Great Britain to Europe. There is the problem of the place of Germany in a new European system. There are the questions of the colonial peoples and of raw materials, and there is the problem of reconstructing world trade.

All these problems are, of course, related and have at least some bearing on the organization of post-war relief in occupied Europe, as well as on the establishment of a new system of collective defence. None the less, they can each serve as the starting-point for an attempt to arrive at first principles and to remove some of the causes of international friction which contributed to the outbreak of the present struggle. This is admirably illustrated in the survey of international economic relations which Prof. J. B. Condliffe has written under the title "The Reconstruction of World Trade"*.

Prof. Condliffe's volume falls naturally into three parts. The first analyses the collapse of the international trading system that was restored, on the pre-war model, after the War of 1914–18. The second, including much the most technical chapters, examines the challenge now presented by the totalitarian methods of bilateral trade. The third surveys the problems that must be faced in any attempt to reconstruct world trade after the War comes to an end. The book is based largely on material drawn from research studies undertaken in preparation for a conference called to meet at Bergen on August 27, 1939, and much of it would normally have formed a report of the International Studies Conference on "Economic Policies in Relation to World Peace". It has, however, lost nothing of its pertinence in the interval, and this lucid exposition could scarcely be bettered as a guide to the discussion of trade policy

* The Reconstruction of World Trade: a Survey of International Economic Relations. By Prof. J. B. Condliffe. (Prometheus Library.) Pp. 427. (London: George Allen and Unwin, Ltd., 1941.) 12*s.* 6*d.* net.

after the War to which Mr. J. G. Winant and Mr. Sumner Welles have recently made such pointed reference.

On the making of policy Prof. Condliffe writes forcefully in his opening chapter. He points out that a Government can rarely lay down in advance, and adhere to, a line of policy which is the result of mature judgment and reflection. Wherever action must be adjusted to an ever-changing set of circumstances largely beyond the control of any individual, group, or government, policy must be in large degree improvised and pragmatic. Moreover, a discussion of the forces that shape national economic policies in the international field cannot be narrowly confined to the field of commercial policy. Prof. Condliffe refers pointedly to the effect of private enterprise, and it follows from what he says that any serious attempt to achieve a balance between freedom and order in the national sphere, as has been suggested by Mr. Geoffrey Crowther, is bound to determine largely the nature of economic policy in the international field.

A further important factor is the passing of power in recent years from the legislative to the administrative side of government. This is widely recognized, but its bearing on economic policy has scarcely been examined, and the searching questions which Prof. Condliffe raises demand careful answer if our reconstruction of world trade is to proceed on sound lines. He stresses the real danger of the progressive withdrawal of day-to-day policy from detailed public scrutiny and criticism. The concentration of power exercised for long periods without the check of public criticism makes individual errors more serious, because errors of policy tend to become cumulative. Moreover, administrative control of policy-making puts a premium upon organized pressure from directly interested individuals or groups of individuals, and lessens the consideration likely to be given to the general public interest, and particularly the unorganized interest of the consumer.

These warnings cannot be lightly disregarded in respect of whatever new measures of commodity control may be developed even for the relief of occupied European countries. The conflict between national regulation and international equilibrium must be recognized, and while we may seek, as Prof. Staley has urged in "World Economy in Transition", to lessen the economic significance of national boundaries, the task of creating effective organs of international co-operation on a regulated basis must not be shirked. Meanwhile Prof. Condliffe's conclusion that the best practical prospect of restoring international equilibrium lies in the re-establishment of known and accepted routine lines of policy, based upon a relatively moderate degree of national planning in the sense of assuring to each national community reasonable minima of security and livelihood, is at least in keeping with the terms of the Atlantic Charter. World economic activity, like world peace, is in fact indivisible.

The relation of freedom of trade to the establishment of social security in the field of nutrition has already been emphasized in such studies as F. L. McDougall's "Food and Welfare", and Prof. Condliffe's book shows how closely it is related to the wider aspects of security. Government policy, not economic or scientific developments, has been responsible for the great decrease in trade in agricultural products, both food and raw materials. The primary responsibility for the breakdown in international trade lies not with economic facts but with economic policy, arising from attempts to place the interest of particular groups before that of the community as a whole and, in particular, to preserve and buttress the unfettered sovereignty of the national State.

International economic equilibrium is not a static but a dynamic concept, and we have yet to develop the appropriate organization and technique now that the technical progress of industry has outgrown national boundaries, as in an earlier age it outgrew the boundaries of city States. Social regression, not security, will follow from any attempt after the War to cling to traditional forms of political organization and put back the clock of scientific knowledge and industrial technique. The dangers inherent in modern tariffs and the complications of tariff bargaining, the administrative obstacles they introduce to trade and the extent to which they represent a reversion to tyrannical methods of government are unmistakable in this analysis. Bilateral treaties negotiated in recent years represent, on the whole, grave restrictions on multilateral trade, and the warm tribute which Prof. Condliffe pays to Mr. Cordell Hull's efforts to promote multilateral trade and breach the high protective wall erected by the Howley-Smart tariff does not disguise the little that had been achieved in removing the obstacles to the restoration of world trade.

It must be recognized therefore that while attempts to preserve past privileges of occupation or ownership may wreck international co-operation in the future as they have done in the past, the absence of any real will-power has been the decisive factor. Policies of independent economic nationalism can never form the basis of co-operation. Their ultimate aim is world domination and their technique is that of conflict. No compromise is possible, in the long run, between States that are organized to serve the purposes of individual citizens and those in which the individual is subordinated to the service of the State.

Prof. Condliffe's thoughtful chapter on new aspects of international organization well illustrates the need for further investigation if we are to formulate a sound policy for the reconstruction of world trade. We have to take account, not merely of the limitation or redefinition of national sovereignty but also of the tendency of business organization and trading relations to become international in scope. The importance of the borderland between business and government with regard to international relations has increased considerably and still presents one of the most significant fields for economic research. Moreover, experience gained with certain of the war-time controls can scarcely fail to prove invaluable for the correction of the weaknesses revealed in some of the pre-war international commodity control schemes and to increase our exact knowledge of their extent and relations with government regulation. If Prof.

Condliffe does not visualize anything like the Raw Materials Union suggested by "Balbus" in "Reconstruction and World Peace" (Democratic Order Pamphlet No. 10) and in the P E P broadsheet, "Commodity Control Schemes", he at least sees the possibility of dealing with the consumer interests more fairly and effectively.

The extension or development of international commodity schemes is a difficult problem. There is no very satisfactory half-way house between a free trading system based on *laisser-faire* and one in which national production is co-ordinated in a system of international planning. Moreover, Prof. Condliffe has misgivings about the international planning of policy, for reasons already indicated, and while he considers there are wide areas of economic activity over which government control could with advantage be extended, such control should be limited to regulation rather than operation, and for this new types of international political and economic institutions must be invented. Indeed, the possibilities of international economic co-operation in the immediate future will largely depend on the way in which governments use such powerful new instruments as credit regulation.

While the necessities and disillusions which follow a great war may be powerful factors of constructive co-operation, that only holds if they are used in that direction. Peace is a dynamic process, the other name for which is co-operation, and only a world which is prepared to make the continuous effort of re-creating peace, like freedom, year by year, can establish and maintain a new international system of economic co-operation and social security. The most hopeful feature of that Anglo-American co-operation which has developed during the last fifteen months has been the frank indication on both sides of the intention to see it to completion.

Prof. Condliffe recognizes the paramount influence of the United States on any international system which can be established, and that it must be based on Anglo-American co-operation. He touches on those other problems of the position of Britain in Europe which also affect the ultimate solution, and stresses that the choice before us is broadly one between entering a European confederation or joining with the United States in an effort to re-establish a world trading system. But it is less for the outline of a suggested solution of the problem than for its clear analysis of principles, its firm warnings of the dangers that cumber the way, its challenge to searching inquiry and constructive thought that Prof. Condliffe's book is an outstanding contribution to the discussions which Mr. Winant, Mr. Cordell Hull, Mr. Sumner Welles and others have already initiated.

The guarded language which Lord Cranborne necessarily used in November in replying to a question in the House of Lords regarding the methods by which the Government proposes to give effect to Article V of the Atlantic Charter and to secure the fullest collaboration between all nations in the economic field should not be taken as indicating that the Government is not alive to the importance of this subject and anxious to secure the improved labour standards, economic advancement and social security implied therein. Practical plans of economic co-operation already engage its attention, and the growing ties between the two great democracies should ensure that they will face together now, and not merely after the War, the broad changes of policy involved in the inevitable internal and external reconstruction. Moreover, in approaching and studying these problems it must be remembered that by the adhesion of the Soviet Union and of the Allied Governments now in London, the Atlantic Charter has become a multilateral pact. The co-operation of twenty-six nations in fighting aggression is already pledged thereby to continue after victory is won to ensure that the world shall gather its fruits in peace and in security.

The immediate task in regard to world trade is of course to create the international machinery for co-operation after the War to enable people to live, to find the means of livelihood, and to exchange their products with one another, and to arrive at common understanding as to the principles on which such machinery shall operate in the conditions likely to obtain at the end of the War. The impartial examination of practical problems in a new setting, without regard to theories or dogmas framed to meet other conditions, should be able to evolve plans for preventing a repetition of the chaos which followed 1918. The four freedoms will only be established by planning and co-operation and an immense amount of hard work, in which the reconstruction of world trade is one of the first steps to the establishment of that freedom from want, which in Mr. Winant's view should be one of our first objectives after the War. There should be no lack of response in Great Britain to the efforts already being made in the United States in the study of these problems, so as to extend the present co-operation after the War into the organization of the exchange of goods on co-operative instead of on narrowly competitive lines.

WEATHER ANALYSIS AND FORECASTING

Weather Analysis and Forecasting

A Textbook on Synoptic Meteorology. By Prof. Sverre Petterssen. Pp. xvi+505. (New York and London: McGraw-Hill Book Co., Inc., 1940.) 35*s*.

FOR twenty years the Norwegian school of meteorology has led the world in the development of methods of forecasting. The appearance of a treatise on weather analysis and forecasting by a distinguished member of the school is therefore an important event. Prof. Sverre Petterssen was for many years on the staff of the Geophysical Institute at Bergen and recently succeeded Prof. C. G. Rossby as professor of meteorology at the Massachusetts Institute of Technology. His book developed from courses of lectures delivered during the years 1935–40 at various places in America and Norway.

Long before the influence of the Norwegian school was felt, meteorologists realized that the weather was influenced largely by the interplay of currents of air

from different parts of the globe. Occasionally, when contrasts of temperature were great, boundaries were drawn on a series of maps and the progress of such boundaries, which were frequently marked by line-squalls, was traced from map to map. The new school introduced the practice of drawing these boundaries or 'fronts' between different 'air masses' on every working chart. It was soon manifest that the charts gave much more vivid pictures of the weather over large areas than had ever been obtained before. A striking development was the recognition of the fact that the isobars, when carefully drawn, are kinked where they cross fronts. When once the eye is trained to look for these kinks, one wonders how the meteorologists of yesterday could have drawn smooth isobars through the areas where the wind distribution cried out for sharp bends. Modern forecasting depends largely on the study of the movements of fronts.

In the rules for forecasting developed by Petterssen, great stress is laid on arithmetical calculation. He is not content to notice that a front or any other feature of the weather map is moving towards the east. He works out the speed at which the feature has been moving and finds that, if all goes well, the feature will have travelled so far in the next twenty-four hours. The rules which are propounded are simple enough. They could have been introduced as soon as the practice of reporting the barometric tendency (the change of pressure in three hours) was initiated in the weather reports from telegraphic stations. The general rule is that any well-marked feature of the weather map will probably continue for several hours to move as it has been moving. The rule is reduced in each case to an appropriate numerical formula, which justifies the author's bold quotation, on the flyleaf facing his title-page, of Lord Kelvin's dictum:

"When you can measure what you are speaking about and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre, unsatisfactory kind."

In the main, the processes developed by Petterssen are purely kinematical, the map is regarded merely as the representation of a moving, changing pattern, but use is made of the idea of the gradient wind in four of the thirty-one rules that are set out.

The individual forecasts which are quoted are remarkably accurate. While the forecasts of the movements of systems are purely kinematic, depending solely on the first law of motion, the deductions as to the resulting weather are made with an intimate appreciation of the effects of the varying structure of air masses with different histories.

It might have been expected that the upper air observations available to the forecaster would have been brought into these numerical forecasts. Actually, in Petterssen's own scheme the information available serves rather to give the structure of the atmosphere in the several air masses and in defining the positions of the fronts. However, that is not the end of the matter. It is an important question to the forecaster this, how to make the best use of the upper air observations which are obtained by special aeroplane ascents and, in the most modern technique, by radio soundings. The system adopted in the United States, where such observations are now well distributed, is to map temperature and humidity corresponding with an isentropic surface, that is, a surface on which the potential temperature of air (the temperature to which it would be brought by adiabatic compression to the standard pressure 1000 mb.) has a constant value, such as 26° C. This way of representing the conditions in the upper air was first suggested by Sir Napier Shaw. It has the advantage that a single set of lines represents the distribution of temperature, pressure and density. Further, so long as the air is not affected appreciably by radiation, conduction and turbulence, it must move on an isentropic surface. Rossby, who developed the practice of using isentropic charts, found it useful to show humidity by the proportion of water vapour in the air. The way in which the vapour is conveyed from region to region across the continent is portrayed most vividly. The valuable chapter on this subject is contributed to the book under notice by Mr. James Namias, who was Rossby's collaborator at the Massachusetts Institute of Technology. The method is also illustrated in the last of the forecasting studies in the work.

It would be presumptuous for a reviewer with no practical experience of forecasting to assess the value of the book to the working forecaster. It may be said, however, without fear of contradiction, that to the layman who has already some familiarity with meteorological charts, the book is most acceptable for the insight it gives into the principles on which modern forecasting is based.

F. J. W. WHIPPLE.

PRESERVATION OF ORNAMENTAL TREES

Maintenance of Shade and Ornamental Trees

By Prof. P. P. Pirone. Pp. xvii+422. (New York and London: Oxford University Press, 1941.) 25*s*. 6*d*. net.

So much can be done with trees to clothe the nakedness of arterial roads and to screen from view the hasty work of the builder in new 'development' schemes that a book designed to assist in establishing and protecting trees is welcome. There are districts where it is impossible to restore the 'rustic scene' but where, given time, avenues, say, of horsechestnut, or groups by the roadside of such trees as beech, birch or Norway maple, compensate to some extent for lost amenity. As for trees in urban areas there is the example of New York City, quoted by the author, where nearly a million trees are maintained along some five thousand miles of streets.

In the years which immediately preceded the War there was an awakening of the public conscience to the æsthetic value of trees, and societies such as the Council for the Preservation of Rural England and the Roads Beautifying Association did much to direct attention to the subject. Numerous books have appeared dealing with ornamental trees and a few have confined their attention to 'tree surgery', still there is room for Dr. Pirone's volume on 'maintenance'.

The author addresses himself specifically to the eastern and mid-western States of America, but readers will find plenty of suggestions applicable to conditions in Great Britain.

The author wastes no time in preliminary discussion; after a brief preface and an introductory note by Dr. L. H. Bailey, he plunges straightway into a concise description of the structure of a tree

and the functions performed by the various parts. The relation of soil to tree growth is then approached, particularly as regards the soil's physical state and chemical composition, but not forgetting the biological aspect. Emphasis is laid on the importance of the degree of soil acidity or alkalinity, as the case may be, in determining the choice of species. In this connexion a list is given of the *p*H range suitable for the commoner trees and shrubs. If due weight be attached to the other factors, such as elevation, exposure, rainfall, etc., the relative *p*H value will be found to be a useful guide. It is pointed out that most trees prefer soils with a slightly acid reaction, but requirements vary a great deal from the lime-loving to the peat-loving species.

As regards the planting of trees, the author remarks that the methods employed too often resemble an experiment to see how much the tree will stand. Instead of this, of course, the effort should be to reduce so far as possible the shock of removal and to give the transplanted tree a good start. It may be that very few planters will be able fully to follow the author's somewhat elaborate prescriptions, especially in war-time, but it is well to be reminded of the care that should be taken, particularly when trees of large size are being transplanted.

Pruning and the treatment of wounds naturally claim considerable space in this book, for the number of wrong ways of proceeding is remarkable. In Great Britain the section will command the greater attention owing to the unusual amount of damage caused in recent winters by ice and snow. Most of the damage, unfortunately, has perforce been neglected, and wood-attacking fungi will undoubtedly gain a footing if pruning is much longer delayed. To rid trees of their lower branches and produce straight, clean stems is another and quite distinct problem for the pruner which the author discusses, but he makes no mention of 'natural' pruning so familiar and so useful to the forester. It may have been considered outside the province of the 'arborist'. But is it ? In parks, at least, trees can be grown in groups just as easily as singly, and even if individual trees are eventually isolated, the good effects of early massing will be observable in better shape, health and vigour.

Neglected bark-wounds and the removal of large branches so often lead to decay that a description of the methods of repair forms a fitting sequel to the chapter on pruning. The notes on various matters concerning this kind of surgery include specifications for the antiseptic dressing of tree wounds and are distinctly helpful. As for the treatment of cavities in tree trunks, however, it appears doubtful if it is not better, in most cases, to let well alone rather than to plaster the holes with incongruous stuff such as cement, bricks, clay, mortar and asphalt. Generally speaking, these attempts at arresting decay are futile and the unsightly patchwork strikes a jarring note.

Readers who turn to the section headed "Trees suitable for Streets and Roadsides" will be disappointed to find that only about fifteen species are dealt with and some of these are dismissed in half a dozen lines. Many beautiful trees quite well adapted for the purpose, such as birch, hornbeam, whitebeam, flowering cherries, hawthorns, Nothofagus, Pyrus, Gleditschia, etc., are omitted altogether, or mentioned elsewhere in the book only in connexion with the ailments which occasionally afflict them. Small and medium-sized trees are in many cases more desirable than larger trees for bordering motor roads as their finer leaves decompose more readily and do not cause a skiddy surface.

Passing on to the diseases and insect enemies of trees, we find a somewhat undue proportion (half) of the book is occupied with their discussion. It is to be hoped that would-be planters will not be discouraged by the number and variety of pests, because, apart from a few diseases, for example, chestnut blight and the Dutch elm disease, single trees (as distinct from trees in massed formation) are fairly free from serious infestation. The list of possible dangers—parasitic, non-parasitic and climatic—has an alarming appearance rather out of proportion to the actual risk. Still, if not taken too seriously, there is always the biological interest of diagnosing ailments, studying the pathological symptoms and occasionally endeavouring to treat the complaint. These matters are dealt with helpfully in the text and excellent photographs assist identification.

The book is handsomely turned out, being well printed, well bound, fully illustrated, and provided with a good index and an extensive bibliography. It deserves a good reception from all who have anything to do with the planting and preservation of park, street and roadside trees. Its perusal should correct any tendency to haphazard planting and lead to the better maintenance of the beautiful trees which already adorn the English countryside. FRASER STORY.

AN INDIVIDUALIST'S PHILOSOPHY

Brought Out in Evidence

An Autobiographical Summing-Up. By William Bowyer. Pp. 424. (London: Faber and Faber, Ltd., 1941.) 15*s*. net.

THIS book is at once a presentation of the author's beliefs about the universe and the record of his own life. Save in the opening chapter, entitled "The Horizon", where he garners the ripe fruits of his spiritual pilgrimage, the philosophy is, with rare artistry, interwoven with the autobiography. Mr. Bowyer could scarcely have done otherwise ; for his speculative outlook is intensely personal. Born in a Battersea slum, into a house clouded by dissension and poverty, where religion meant little but the crude and jealous fundamentalism of Plymouth Brethren and of Strict and Open Baptists ; educated (*sic*) in the elementary and grammar schools of the locality ; harnessed while still a lad to the drudgery of a subordinate post in the General Post Office—such an upbringing was bound to leave an enduring mark on a nature shy, awkward and inarticulate, and at the same time richly gifted and responsive to every stimulus that crossed its path. He hungered for the friendship of those who 'cared' for the things nearest his heart.

Mr. Bowyer is too much of the artist in temperament to rank as a philosopher. His creed is avowedly intuitional, a matter of faith rather than of reasoned evidence. Like D. H. Lawrence, for whose mind he confesses "an awed admiration", he profoundly distrusts the analytic method of the sciences, a distaste probably not lessened by the suspicion that he offers an appetizing bait to the psycho-analyst. No wonder that he early swung free of materialism and scientific determinism, as later on from Socialist and Communist orthodoxies. But the pessimism of his childhood remains unshaken. The marvel indeed is that

so sensitive and self-centred a nature should have escaped shipwreck. The thought of suicide, as is evident from the measured discussion in the closing pages of this book, cannot often have been out of mind. It is largely his strong sense of the reality of suffering and evil that makes this biography so arresting and impressive.

Liberation came to him, partly through friendships, still more through his own tough courage—a "Cornish tenacity" inherited through his father—but most of all through conversance with the arts. The effects on his mind of music, painting, sculpture, the Russian ballet, poetry, are traced in full detail in the fourth chapter ("Assimilation and Growth"), the longest and the most illuminating in the book. Mr. Bowyer's views on art are less coloured by emotional bias than many of his other reflections—the unbalanced diatribe against feminism, for example, in Chapter 6 or the extravagant denunciations, scattered up and down the volume, of educational and religious institutions. Yet even where he is most intolerant, there is something engaging in his candour. One of the most interesting passages is on his ideal of political and social reform, where he advocates an original type of State-Socialism, to be applied in the field of economic and material interests, with sedulous precautions against its intrusion into that of spiritual values.

The more philosophical portions of the book are, for the reason already stated, less satisfactory. They state speculative problems rather than answer them. The decisive influence on Mr. Bowyer's mind was that of Bergson, with whose doctrine of intuition he is naturally in sympathy, while dissenting from the narrow role allowed to intellect. His final verdict is for a dualism, naked and unashamed, between matter and spirit, the former being regarded as the source of evil, the latter as creative of eternal values, truth, beauty and goodness, "the greatest of which is Charity". Like T. H. Huxley, he sees the cosmic process in irreconcilable enmity to the moral. But can Nature be branded as immoral without a lapse on our part into the 'pathetic fallacy' ? The point, however, in Mr. Bowyer's dualism that most provokes questioning concerns the relationship of the good and evil principles. Reality, he tells us, lies in this relationship ; beauty, for example, belongs "to the very flow and creative movement of reality". Is this because the spiritual values have their source in the human mind ? If so, since man is integral to Nature, it looks as though the cosmic process generated, not merely its own condemnation, but also the means of its own redemption. Yet we are told that charity, the supreme value, is "in some way an ultimate principle of eternal reality", with a "worth independent of time and place", and as such presumably independent of all temporal process. If this be so, must not the final word lie with the absolute values, and not with the relative and transitory forces of evil ? Mr. Bowyer's noble faith in charity, and also in a Universal Mind with which the human mind is absorbed at death, seem to point the way towards a religious *Weltanschauung*, within which Nature as a principle of evil appears as an abstraction. Having gone thus far, Mr. Bowyer, whose whole life-history is a revolt against the abstract, has set himself a problem, the solution of which can only be reached by going still farther.

The author shows himself throughout intensely alive to the cultural influence, not only of his contemporaries, but also of the past. We note, however, a few errors, which do not seriously impair the value of his book. Has any Christian theologian ever thought of the Second Person of the Trinity as "existing before and after as well as during His incarnation, in the same human shape" (p. 33) ? Calvin was not a Swiss (p. 80), but a native of Picardy. The Church Catechism does not suggest that everyone should be kept "in the state of life to which it had pleased God to call him" (p. 114) ; it says "shall please", which is very different. Nor is it true to say (p. 220) that Aquinas's philosophy was based "upon first principles about God", which were "merely affirmed". St. Thomas held that the knowledge of God's existence and of certain of His attributes was demonstrable by natural reason. Finally (*note*, p. 123) it was surely Lord Randolph Churchill, not Lord Palmerston, who "could never understand those damned dots".

W. G. DE BURGH.

MAN'S PRESENT AND FUTURE

The Outlook for Homo Sapiens

An Unemotional Statement of the Things that are Happening to him Now, and of the Immediate Possibilities Confronting Him. By H. G. Wells. (An amalgamation and modernization of two books—"The Fate of Homo Sapiens" and "The New World Order", published severally in 1939 and 1940. Pp. 287. (London : Secker and Warburg, Ltd., 1942.) 8*s*. 6*d*. net.

THE present volume is an amalgamation of two earlier books, "The Fate of Homo Sapiens" (1939) and "The New World Order" (1940). It will be remembered that in the earlier book Mr. Wells stressed the need for some contemporary movement similar to that of the French Encyclopædists of the eighteenth century, so that the human species, now dangerously out of harmony with its environment, might be enabled to make the necessary mental readjustments. He wants a campaign for "a reinvigorated and modernised education", primarily scientific in character.

"The scientific vision of life in the universe and no other has to be his vision of the universe. Any other leads ultimately to disaster. And since the existing educational organisation of the world does not provide anything like that vision nor establish the necessary conceptions of right conduct that arise out of it, it needs to be recast quite as much and even more than the political framework. This will almost certainly involve such a kultur-kampf as the world has never seen before."

This new education will not stand by itself but will be part of a new organization of human life involving "outright world-socialism scientifically planned and directed, *plus* a sustained insistence upon law, law based on a fuller, more jealously conceived restatement of the personal Rights of Man". Summarizing his programme, Mr. Wells speaks of "the triangle of collectivisation, law and knowledge".

Mr. Wells makes short work of current ideologies and religions. "There is no creed, no way of living left in the world at all, that really meets the needs of the time." He even seems somewhat dubious about the Division for the Social and International Relations of Science recently created by the British Association, and says that two divergent tendencies display themselves in it.

"One is plainly to organise and implement the common creative impulse in the scientific mind so

as to make it a vital factor in public opinion; the other is to restrain any such development of an authoritative and perhaps embarrassing criticism of the conduct of public affairs and to keep the man of science modestly to his present subordination."

Mr. Wells is of the opinion that great possibilities await scientific research if his new and stirring education increased the numbers of workers available. "I throw out the suggestion that in our present-day world, of all the brains capable of great and masterful contributions to 'scientific' thought and achievement, not one in a thousand, not one in a score of thousands, ever gets born into such conditions as to realise its opportunities. And of the millions who would make good, useful, eager secondary research workers and explorers, not one in a million is utilised."

Mr. Wells writes with a strong sense of urgency. For the better part of his life this prolific and ingenious writer has been one of the foremost of our propagandists for an outlook which is at the same time scientific and humane. It has now become a question how far the scientific outlook is *necessarily* bound up with humane and liberal ideals, and perhaps Mr. Wells is too ready to take such a connexion for granted. For this reason it is perhaps a pity that Mr. Wells is so impatient of the traditional religions, for though in the past they may have been, and may sometimes still be, obstacles to progress, yet they too are capable of leading men to make "mental readjustments" of a desirable kind. To take one example. According to the Hindu view of life, when a man has reached a certain age and fulfilled certain responsibilities, he should retire from active life and devote himself to the contemplation of the ultimate mysteries. Mr. Wells might consider this a waste of time; but by banishing all the men of sixty from active life it would ease the situation of those surplus and frustrated young men whose existence Mr. Wells regards as the chief cause of wars.

J. C. HARDWICK.

GENETICS APPLIED

New Paths in Genetics

By Prof. J. B. S. Haldane. Pp. 206. (London: George Allen and Unwin, Ltd., 1941.) 7*s*. 6*d*. net.

IN the thirty-three years that have elapsed since Bateson wrote his "Principles", two kinds of activity have developed from that book. The one has been concerned with digging the foundations of genetics deeper and the other with building a superstructure of more immediate utility. One has led to an integration with the physiology and mechanics of the chromosomes and of the cell; the other is leading, by a more laborious process, to an integration with plant breeding in general and with special problems in embryology, biochemistry and medicine.

So far as plant breeding goes, the first attempts to build on the Batesonian foundation were partly disappointing. That was bound to be so because in the formal genetics of Bateson the chromosomes are treated as symbols obeying deductively the established laws of the subject. Unfortunately, the easiest achievements as well as the greatest difficulties in plant breeding depend on the chromosomes disobeying these laws. Moreover, the statistical instruments for handling plant breeding, even so far as the laws held, were not at first available, and have not yet been systematically applied.

In other directions, however, Bateson's formulæ hold well enough for practical purposes, and it has been possible ever since 1909 to go ahead with elucidating their applications to the problems which other branches of biology are continually putting in our way. In this work Prof. Haldane has played a foremost part. Nor could anyone else have played a similar part. He has been responsible for bringing together the organic chemist and the geneticist in the work of discovering how the genes co-operate in producing plant pigments. He has likewise brought together genetic analysis and the study of abnormal development. He has also, with Fisher, developed a statistical instrument not only for making good the experimental shortcomings of human breeding but also for establishing medical genetics as a discipline of independent value and validity.

This work Haldane has briefly summarized in the present volume. The paths he maps are inevitably far apart from one another, and few readers will be equally interested in the different techniques he describes. Perhaps he might have done more to spread the interest by sparing or explaining his words. For they are, I imagine, the most impressive in strength and variety ever brought together in a volume of this size. But the general reader need not be deterred by these technical expressions, for they can mostly be replaced by symbols without loss to the argument; and in their present context the mathematical equations can be taken as a decoration.

Some readers may feel that if Haldane is approaching his problems in terms of formal genetics he is thereby missing important possibilities of deeper analysis. I do not think he is missing much. A danger lies merely in formal concepts being supposed to have an analytical finality. Two examples of possible misconception may be taken from this book. In *Drosophila melanogaster* and *Zea Mays* it is said "almost every gene has been located" (p. 17). By this is meant analytically "every gene-difference so far detected by experiment". The method of experimental breeding cannot be said to have located every gene since every gene has not necessarily mutated and some genes are not individually detectable. Again (p. 108) it is inferred that "the normal allelomorphs of *W* and *f* control different unit processes", since the abnormal allelomorphs upset the control of these processes. This does not necessarily follow. It is a possibility. In the case of his amorphs, hypomorphs and hypermorphs, Muller has proved that the possibility may be realized. But in the case of other types of mutation he has equally proved that it is not and cannot be realized; which is *a priori* fairly obvious. The gene indeed as it exists in Nature is physiologically a somewhat informal body capable of breaking most physiological rules. The possibilities of rule-breaking that it is not likely to take advantage of are the mechanical ones such as those envisaged by Haldane (p. 110), of its running loose in the cytoplasm. That would be an offence against Nature since the reproductive cycle of the nuclear gene is naturally conditioned by its nuclear environment.

These objections like the others are no hindrance to Haldane's underlying argument. That argument is, in brief, that genetical analysis provides the key to problems in other fields which will baffle the wits and waste the labour of those who attempt to get along without it.

C. D. DARLINGTON.

FOOD PRODUCTION AND NUTRITION

By N. W. PIRIE
Rothamsted Experimental Station

UNDER the general title "Food Production and Distribution in Relation to Nutritional Needs", the recently established Nutrition Society held a meeting on February 28. Papers were read by Sir John Orr on "The Agricultural Implications of a Food Policy based on Nutritional Needs", by Dr. N. C. Wright on "Rival Claims of Animals and Man for Food", by Mr. E. T. Halnan on "Animals as Food Converters" and by Sir John Russell on "Planning for Agricultural Production". Each paper was followed by discussion, but the subjects of the papers were so closely interlocked that there was considerable overlapping of the points made by the twenty-five contributors to the discussion.

After two and a half years of war there is no evidence of a worsening in our nutritional state. Sir John Orr pointed out that, although there are differences between the feeding standards adopted in different countries and by different authorities, these are differences in detail and, broadly speaking, there is now unanimity. At the outbreak of war, both in Great Britain and in the United States, one third of the population fell below this standard; a decade before that the proportion had been one half. This improvement gives us some cause for satisfaction, but it is clear that in planning post-war nutrition it is insufficient to aim merely at the restoration of the pre-war state. The consumption of foods such as milk might well be increased by 100 per cent in Great Britain, and our agriculture should concentrate on the production of perishable protective foods. In many parts of the Empire, for example India, the need is not confined to special foods, for the nutritional condition is appalling, and more of almost every sort of food is needed.

Both during the War and after it is not sufficient merely to consider which crops should be grown; research is needed on the more efficient utilization of existing crops and on their improvement. Sir John mentioned, as an example of the former, the possibility of extracting edible protein from grass, "an idea started two or three thousand years ago under royal patronage", and as examples of the latter the production of vegetables richer than usual in minerals and of oats and wheat with an enhanced vitamin B_1 content. The main point brought out in the discussion was the need to ensure that the vitamins originally present in foods such as vegetables are not lost because of the delays in retailing or because of carelessness in cooking. Dr. S. W. Swindells spoke of the "planned destruction of vitamin C in canteen cooking" and referred to cases in which incipient scurvy, caused by this cooking, had been mistaken for pyorrhea.

Dr. Wright showed, in a number of different ways, that in pre-war farming in Great Britain animals were predominant; for example, the population weighs approximately two million tons and the livestock five, three million acres were devoted to the direct production of human food and twenty-seven to the production of food for animals, besides which the latter ate two thirds of the imports. This state of affairs has come about because most people prefer the flavour and small bulk of foods derived from animals, and in peace-time there is no real competition between man and animals; for we get the better parts of the foodstuffs, whether imported or home-grown, and the animals use up the rest. In war-time this luxury cannot be afforded, for animals rarely have an overall efficiency of more than 25 per cent in the conversion of feeding-stuffs into human food.

The productivity of land devoted to the grazing animal is also low: an acre will yield six million calories in the form of potatoes, or three million in the form of wheat but only one million as milk and 200,000 as meat. The ploughing up of three million acres of grass, 15 per cent of the total, must therefore be accepted as a wise policy and it should be remembered that it amounts only to restoring the agricultural balance that existed in Great Britain sixty years ago. The best land was generally ploughed; the policy therefore led to the loss of about a quarter of the stock-feed produced by grassland. This, together with the restricted importation of feeding-stuffs, has reduced the available fodder to one half. In these circumstances Dr. Wright has argued that it would be unwise to divert any more cattle food into human feeding by increasing the percentage extraction of flour. The raising of the extraction rate from 70 to 75 per cent has reduced the supply of wheat by-products by 400,000 tons and a further rise to 85 per cent will reduce it by 1,000,000. This fascinating, controversial and extremely complicated subject was not, however, argued in any detail at this meeting.

The question of efficiency of conversion of feeding-stuffs into human food was discussed by Mr. E. T. Halnan, Mr. A. N. Duckham, Dr. D. J. Ewing, Dr. J. Hammond, Prof. J. R. Marrack and Prof. D. M. S. Watson. A simple percentage efficiency rarely expresses the matter adequately because many animals can use feeding-stuffs that could, in no circumstances, be used by man. Even when efficiency is considered in terms of protein only, it should be borne in mind that animal proteins are of higher biological value than some of the plant proteins from which they are made. Young pigs and poultry are the only converters that need a type of food substantially similar to that needed by man. Egg production is as efficient as, or more efficient than, milk production and some of the concentrates at present reserved for the dairy cow might well be released for poultry feeding so long as this food is used primarily for eggs and not for table birds. In the allocation of feeding-stuffs more attention should be paid to individual variations between animals. In general, the young animal is a more efficient retainer of protein and the old a more efficient retainer of calories, laid down in the form of fat. Since protein is the primary deficiency in the war-time diet, this would suggest that animals should be slaughtered young, but it can be argued on the other side that the adult pig or ox may be eating food for which there is otherwise no use. So long, therefore, as they are not allowed to compete with men or with the, at first sight, younger and more efficient producers, there is no objection to their retention as producers of fat.

Having considered, at some length, the question of the animal's efficiency, the meeting turned to a brief consideration of our own. Dr. Marrack criticized the inefficient distribution of milk and pointed out that there are fines for selling milk of low fat content but not for selling milk rich in bacteria or low in vitamin A. The lack of any preventive medicine on

the farm and the great losses of feeding-stuffs, caused by the prevalence of mastitis and contagious abortion, were stressed by Dr. W. R. Wooldridge. Individual farmers in the same area may get widely different yields with the same crop. Dr. W. K. Slater asked how great the increase in our productivity would be if every farmer were as skilful as the best farmers, but no one was prepared to answer the question.

The various conflicting interests that have conditioned agricultural policy in the past were considered by Sir John Russell. In the first place the cheapest type of farming in Great Britain would be extensive ranching with few workers and much processing; for, except on a strip up the east coast, our best crops are grass and trees. The essence of planning is that we should decide what is wanted and then guarantee the farmer a market for that crop, otherwise he naturally tends to play for safety and farm in the cheapest way possible. Mr. Halnan had said earlier that the conversion of Great Britain into a "dormitory and exercise ground for animals" is sound economics when imported fodder is cheap, and Dr. F. Yates had explained how a labour shortage tends to encourage stock-feeding. Under planned agriculture half our food should be home-grown, but this does not mean that half of each particular food should be; there should be a great extension in milk and vegetable production. This would mean a decline in home production of wheat, butter and other commodities that keep well and so can be easily transported from abroad. It was noteworthy that the policy of increasing the wheat acreage, except as a purely war-time measure, found no support from any speaker at the meeting; instead there was substantial unanimity that Great Britain should adopt a policy somewhat similar to the peace-time policy of Denmark.

In summing up the results of the meeting, Sir Joseph Barcroft pointed out that, whereas a Government committee consists of men who have been carefully selected for reasons not always connected with their scientific attainment, it was open to anyone with knowledge to have his views heard at meetings such as this. He suggested that a channel should be established through which any agreed plan of action could be brought to the attention of the Government. The speakers who had urged on those responsible for the planning of diet the need for making that diet appetizing had his wholehearted agreement. The Society presumably claims no particular originality for this point of view, an earlier authority having remarked:

> Now, good digestion wait on appetite,
> And health on both!

UNITED STATES ANTARCTIC EXPEDITION, 1939–41

A SYMPOSIUM on the scientific results obtained by the United States Antarctic Expedition, 1939–41, was arranged by the American Philosophical Society at Philadelphia on November 21 last.

Prof. F. Alton Wade, professor of geology, Miami University, and senior scientist of the U.S. Antarctic Service, gave an introductory paper, in which he stated that one of the primary purposes of the Expedition was to carry on a comprehensive programme of scientific observations and research. A great portion of the programme was carried to completion by the twenty-one members of the scientific staff; due to an unexpected termination of the expedition, some phases were only partially completed. Detailed observations were made and programmes of research were conducted in the following fields: auroral phenomena, bacteriology, botany, cosmic rays, glaciology, magnetism, medicine, meteorology, micropalæontology, ornithology, petrography and petrology, physiography, physiology, radio, seismology, structural geology and zoology. Among the reports in preparation are the following: observations and height determinations of the aurora australis; the physiographical features of the Ross Shelf ice; the geology of the Weddell coast of Palmer Peninsula south of 68° S.; the geological features and formations in the vicinity of East Base; the sedimentary rocks of the Edsel Ford Mountains; the petrography and structure of the Rockefeller Mountains; ornithology report, which will include observations of bird life at both bases, at the Melchior Islands and along the ships' routes; the petrography and structure of the Melchior Islands; a correlation of radio receiving and transmitting conditions with magnetic phenomena and auroral displays.

Paul A. Siple, of the U.S. Antarctic Service, said that geographical exploration was carried on from West Base in 1940 by means of five reconnaissance field parties and two aircraft. The routes used followed but extended considerably beyond those opened first by the Byrd Expeditions of 1929 and 1934. The field parties' operations were limited to the hinter-coastal mountains east of Little America from long. 164° W. to long. 136° W. The parties were occupied mainly with surveying, geology, biology and meteorology. Aerial reconnaissance and surveying extended eastward to long. 120° W., including the major land features to nearly 200 miles south of the coast. This was accomplished by six flights, making more than a thousand usable aerial survey photographs available of the area.

Exploration to the west of Little America included three major flights over previously explored portions of the Ross Ice Shelf, crossing in each case into meridians of east longitude in the vicinity of lat. 78° 30′; 79° 20′; 81°; 83°; and 84°. Four newly discovered areas of internal disturbance were studied and fifteen bays and inlets were photographed in the continuous aerial survey of about four hundred miles of Barrier face from an altitude of 7,000 ft.

Southern exploratory operations were confined mainly to filling in the gap of mountains in the Austral Cordillera between Beardmore and Live Glaciers. However, the character of land formations east of the 120th meridian west indicated that there is no sea-level connexion between the Ross and Weddell Seas.

Other geographical accomplishments included glacial studies of the formation and physiography of shelf ice, problems of human adaptation to the climate of Antarctica, and studies of the cooling power of the wind.

An account of the geology of the large ranges around Little America was given by Lawrence A. Warner, of Johns Hopkins University.

The physical aspects of shelf ice were described by Prof. Alton Wade. The first detailed investigations of shelf ice were made at West Base during 1940. Included in the programme were the following: the variation of the density of the firn with depth, sub-

surface temperature measurements to a depth of 41 m., variations in the snow surface-level over a period of eleven months, horizontal and vertical movements within the firn, variations in the size of the constituent grains in various zones, stratification and horizontal banding. The results, presented in tabular and graphic forms, were compared with those obtained from investigations of the physical aspects of other types of glaciers; namely, valley glaciers and the Greenland Ice Cap. The lack of summer melt-water in the Ross Shelf ice eliminates what had been considered the most important factor in the process of firnification. However, without the aid of melt-water, the process does proceed with much the same results. An explanation of the firnification process in regions where the air temperature seldom rises above freezing was advanced.

Herbert G. Dorsey, jun., of the U.S. Weather Bureau, described some of the meteorological work. The programme at the East Base included the establishment of a completely equipped weather outpost more than a mile above sea-level on the plateau of Palmer Peninsula, Antarctica. Early in August 1940 a sledging party from East Base found a route to the plateau, making an ascent which previous explorers considered inaccessible to dog teams, and indicating the possibility of erecting a mountain weather station. Late in October, nearly 1½ tons of equipment were transported by four dog teams to the proposed meteorological outpost, located at 68° 7′ S., 66° 30′ W. on a plateau knoll about 12 miles east of the main base. Lester Lherke and Robert Palmer occupied the plateau weather station during November and December.

Despite prevailing north-easterly storms of drifting snow, Messrs. Lherke and Palmer spent their time between living quarters in a sturdy tent and a meteorological 'office' in a snow cave. For the first time in south polar regions, detailed high-level weather data were obtained in a form suitable for comparison with nearby sea-level observations.

Six-hourly check readings on all data were taken concurrently with those at East Base, in addition to the continuous autographic records of wind, pressure and temperature. Snow accretion and ablation were measured. Pilot balloon observations of the winds aloft were especially valuable when there was a low overcast below the plateau.

The mountain station was in contact with the base twice daily by low-power radio, sending coded weather reports which were included in the East Base weather transmissions to South America. These data, and frequent special reports, were helpful in forecasting for aviation operations at East Base and provide interesting material for future research on the meteorological phenomena of Palmer Peninsula.

A preliminary report on the magnetic and seismic programme was given by Roy G. Fitzsimmons, of the U.S. Antarctic Service and the Carnegie Institution of Washington. During the period April 27, 1940–January 21, 1941, a LaCour insensitive magnetograph was in operation at Little America. Variations of the declination and the horizontal and vertical components of the earth's magnetic field were recorded. Control observations were made with a magnetometer and a dip circle. A general description of the magnetic observatory and the method of observation as well as a report on the preliminary magnetic results were given. During the period November 17–December 28, 1940, a McComb-Romberg seismograph was in operation at the Rockefeller Mountains. A report of the earthquakes recorded and analyses of them were given.

Prof. S. A. Korff, assistant professor of physics, New York University, discussed the cosmic ray programme, which was planned with the view of throwing further light on the connexions between cosmic rays and meteorology, and also on the effects produced by such high-energy rays passing through matter. The first part of the programme involved the operation of two meters at West Base throughout the antarctic winter and a correlation of the records obtained there with temperature, pressure and other effects such as magnetic variation; and also the operation of the instrument on board ship to obtain further data regarding the temperature coefficient and the latitude-variation. Finally, aeroplane flights to high altitudes were carried out, which were to be studied in connexion with *radio sonde* data. The second part, namely, studying the effects produced by the radiation, involved (*a*) operating a cosmic ray counter on shipboard for comparison with the electroscope data, (*b*) the operation of a neutron counter, and (*c*) measurement of all bursts in the cosmic ray intensity on the long-term records.

With respect to the first part, a pressure coefficient was determined from the data at West Base for each 15-day period of operation. It was found that the least-square solutions of the correlation between pressure and cosmic ray intensity gave a slope (pressure coefficient) and an intercept (the extrapolation of the cosmic ray intensity to zero pressure) both of which varied over somewhat wider limits than were anticipated. Further analysis showed that this variation was associated with changes in the height of the mesotron-producing layer, but that contrary to the usual procedure in temperature latitudes, this could not be represented as an external temperature effect. This was found to be due to the fact that the surface temperature was not a good indicator of the distribution of the atmosphere in the column of air above the instrument. Using the *radio sonde* data, a new dependence upon upper atmosphere conditions was computed, and better agreement was obtained. This was checked by the runs made on shipboard in zones of different surface temperatures. The reduction of the observations was partly supported by a grant from the Penrose Fund of the American Philosophical Society.

A report by Arnold Court, of the U.S. Weather Bureau, dealt with the complete disappearance of the tropopause during the antarctic winter. This was revealed by the 190 *radio sonde* observations made during April 25, 1940–January 15, 1941, as part of the U.S. Weather Bureau's share in the scientific programme of the Expedition.

Summer-time observations show a definite and rather warm (−50° C.) tropopause around 9 km., above which the stratosphere is −40° C. or warmer. Spring and autumn soundings clearly show the transition from the winter type, with no clearly defined stratosphere, and with temperatures to −80° C., to the summer condition. This hitherto unsuspected behaviour of the upper air apparently is due to seasonal differences in radiation, but no indications of such conditions have so far been reported in the northern hemisphere, despite daily soundings at Barrow, Nome, Fairbanks, and other Alaskan stations, and intensive work in the U.S.S.R. and Scandinavia. None of these stations, however, is so close to the pole as Little America III (800 miles).

Another phase of the meteorological programme,

the making of 230 pilot balloon ascents, revealed the prevailing summer-time wind at high levels to be south-west or west-south-west, not north-west as had previously been assumed. On the surface, observations covering an entire year were obtained, eleven months of them on a complete 4-a-day basis. Barograms were obtained in duplicate for the entire time, and thermograms except when winter cold stopped clocks. Complete wind records minute by minute were obtained from April 10 to camp abandonment on February 1.

Ernest E. Lockhart, of the Massachusetts Institute of Technology, described physiological investigations which were undertaken. An attack on the problem of acclimatization by white men in the antarctic was made by studying the effect of sudden changes in temperature on blood pressure, heart-rate and respiration-rate. This work was extended with data on 'normal' body temperature, blood pressure, heart- and respiration-rates and metabolism under basal conditions. A study of blood sugar levels was also made. Although pulse pressure is not effected significantly, systolic and diastolic pressures increase 25–35 per cent when a sudden change in temperature is the stimulus. Both the respiration-rate and the heart-rate are decreased somewhat. Under 'normal' basal conditions, pulse and respiration-rates, blood pressure and body temperature are slightly lower than normals recorded in temperate climates. Basal metabolism averages 10–15 per cent lower than that reported for temperate climates. Blood sugar levels, on the other hand, are slightly above the normal limit of 120 mgm. per cent.

Although the results presented should be extended, those now at hand indicate that acclimatization does take place in white men when subjected to the extreme conditions prevalent in the antarctic. It is suggested that the acclimatization process is begun by the continual pressor action of the low temperature. This primary stimulus, when repeated frequently, as is this case, induces hypo-effects in the several endocrine systems principally involved in metabolism.

Other papers were by Herwil F. Bryant, of the National Research Laboratory, Anacosita Station, Washington, D.C., on biological problems at East Base, J. E. Perkins, of the U.S. Biological Survey, on the biology of the West Base region, and Richard H. Black, of the U.S. Department of the Interior, on operations in Palmer Land.

CRYSTALLOGRAPHY AND PLANT VIRUSES

By F. C. BAWDEN

Rothamsted Experimental Station

OF the many techniques introduced into research on viruses during recent years, none has aroused more interest than those of the crystallographer. The value of these techniques in such work is amply shown by three recent papers* by Prof. J. D. Bernal and Dr. I. Fankuchen. The authors describe these papers as "only a preliminary and rough survey" and state that "many more years of work will be needed before exact and reliable interpretations can be expected". No doubt this is true. Nevertheless, what has already been done has greatly widened our understanding of viruses, in addition to bringing to light unsuspected properties of colloidal aggregates.

Before 1936 it was tacitly assumed that all viruses were incompressible spheres, and all calculations of their sizes were made on this basis. A cursory examination of the optical properties of purified preparations of tobacco mosaic virus was sufficient to show that this assumption was invalid and that the virus particles were anisodimensional. X-ray analysis soon showed that they were rods at least ten times as long as they were wide. Their width was found to be 152 A., but their length was too great to be measured by X-rays, although by means of specially designed cameras, spacings greater than 1000 A. were measured. Later work on sedimentation and diffusion constants, viscosity and with the electron miscroscope have all confirmed the size and shape first indicated by crystallographic studies.

One of the most interesting properties of solutions of tobacco mosaic virus of sufficient purity and concentration is their separation into two liquid layers, the separation occurring at increased dilutions with increasing purity. The denser phase is also the more pure. It is formed by the fusion of tactoids, and the suggestion offered by Prof. Bernal and Dr. Fankuchen that the cusps of the tactoids are occupied by particles of impurities explains many of the observed phenomena.

X-ray measurements have been made on dried preparations of tobacco mosaic virus and on solutions of varying concentrations. The pattern obtained falls into two parts: one of large spacings obtained with cameras working at very low angles, and the other of smaller spacings obtained with high-angle photographs. The first part of the pattern varies, the spacings depending on the *p*H and concentration. At the same *p*H, the spacings increase with increasing dilution, and at a constant concentration they decrease as the *p*H approaches the iso-electric point. Variations in the amount of water separating the virus particles are clearly responsible for these differences.

These patterns give us information on the effective size of the virus particles and also reveal previously unsuspected regularities in the structure of solutions. They show that the distance between the rods is inversely proportional to the square root of the concentration by volume, and that the particles are distributed in a hexagonal array so as to fill the available space as uniformly as possible. This regularity of packing of the long virus particles is typical of all orientated purified preparations, whether as fluid, gels or as the crystal-like needles produced by precipitation with acid or salts. In all states the particles are equidistant and parallel, but there is no evidence of any regular arrangement in the direction of the length of the rods. This is in striking contrast with the condition inside the infected plant, where true crystals with a three-dimensional regularity occur, and confirms other evidence that the processes of purification alter the viruses, probably by causing them to aggregate end-to-end.

The high-angle photographs give us our main information on the internal structure of the virus particles; surprisingly enough, the clearest have been given by orientated solutions of tobacco mosaic virus. The patterns from these photographs show that the particles have an internal regularity similar

* 1. "Introduction and Preparation of Specimens"; 2. "Modes of Aggregation of the Virus Particles"; 3. "X-Ray and Crystallographic Studies of Plant Virus Preparations", *J. Gen. Physiol.*, **25**, 111–65 (1941).

to that of crystals. Thus the virus preparations are in a sense doubly crystalline, for the components of the particles, in addition to the particles themselves, are regularly arranged. Their structure is more complicated than the anisotropic protein myosin but less so than pepsin. There is a spacing along the length of the particle of 11 A., and the virus seems to be composed of piles of sub-molecules with dimensions of 11 A. cubes. The spacings in the high-angle photographs are independent of the water content of the preparation, showing that even in solution the particles contain no appreciable amount of water. It is their internal regularity, lack of water and chemical simplicity that separate the viruses most sharply from the simplest recognized organisms.

Most of the work has been done with tobacco mosaic or closely related viruses, but some photographs have been taken of potato virus *X* and tomato bushy stunt virus. The last has spherical particles and crystallizes as rhombic dodecahedra, from which patterns were obtained with both high- and low-angle photographs. Each virus gives its own distinct pattern, and differences were even detected between related strains of the same virus, but the different viruses resemble each other more than any other type of proteins yet examined by X-rays. The differences found are of the order to be expected from a knowledge of the chemical, serological and physico-chemical properties of the viruses examined.

It is obvious that this work has opened up a field of research that promises to be extremely fertile. In virus research these techniques will be limited in their application by the difficulties of preparing most viruses, because of their small concentration in the host and their instability, in a form suitable for crystallographic studies. But with the extension of X-ray analysis to spacings as great as 1000 A. and the improvements in the electron microscope, particles of all sizes from bacteria to atoms become capable of direct examination, and a serious gap in our techniques for the examination of colloidal particles has been filled.

OBITUARIES

Captain T. A. Joyce, O.B.E.

THOMAS ATHOL JOYCE, who died at Hoveton, Norfolk, on January 3, was born in 1878, and was the eldest son of Thomas Heath Joyce, editor of the *Graphic* and the *Daily Graphic*. He was educated at Dulwich and Hertford College, Oxford, where he took his degree in 1901 and then studied Egyptology. He entered the British Museum as an assistant keeper in the Department of British and Medieval Antiquities and Ethnography under the keepership of Mr. (later Sir) C. Hercules Read. From the first he specialized in anthropology and was the first Museum officer to give his full time to the Ethnographical Collections including the American antiquities. He introduced considerable rearrangements in the Ethnographical Gallery, and prepared the greater part of the first "Handbook to the Ethnographical Collections", published in 1910 (second edition, 1925), which was essentially a condensed text-book of ethnology, liberally illustrated by specimens in the Museum. Thus he may be said to have laid the foundations of an Ethnographical Department as a distinct entity, destined, one may hope, to take ultimate shape as an independent Museum.

Joyce's attention was at first devoted principally to Africa, and by collaborating with the late Mr. Emil Torday, he secured for the Museum a splendid and well-documented collection from certain tribes of the Belgian Congo, principally the Bushongo, which surpasses both in quantity and quality any other single collection from the African continent in the Museum. Together with Torday he prepared two important monographs of these tribes, "Les Bushongo" (1910) and "Les Basonge, etc." (1922), published in the *Annals* of the Musée du Congo Belge. Afterwards his chief interest shifted to the archæology of Central and South America, where it remained for the rest of his life. These studies were stimulated by his friendship with Sir Clements Markham and Dr. Alfred P. Maudslay, and resulted in a series of authoritative text-books: "South American Archæology", "Mexican Archæology", and "Central American Archæology", which appeared in quick succession in 1912, 1914 and 1916. These were pioneer books, which for the first time presented to the student and general reader in a handy and condensed form a great mass of archæological data, hitherto scattered in a variety of monographs in different languages and not easily accessible. Although no longer wholly up to date, they remain standard works of reference, and have not been superseded.

During the War of 1914–18 Joyce's services were transferred to the War Office, where he became hon. lieutenant attached to the General Staff in 1916, and captain in 1917, receiving the O.B.E. in 1918.

After the War, and following on Read's retirement in 1921, he became deputy-keeper of the new Department of Ceramics and Ethnography, and reorganized the ethnographical section. He arranged for the transfer of the magnificent Maudslay Collection of Maya plaster-casts from the Victoria and Albert Museum, and for their exhibition in a special room in the British Museum, while he prepared the official "Guide to the Maudslay Collection of Maya Sculptures from Central America", published in 1923 (second edition, 1938). Of a more popular character was his "Maya and Mexican Art" (*Studio*, 1927), a most informative and attractively illustrated volume.

Joyce had always wanted to do field work, but the opportunity was late in coming to him. However, during 1926–1931, he organized a succession of expeditions to British Honduras on behalf of the Museum, four of which he led in person. These produced a rich harvest of finds, particularly from the "Old Empire" sites of Lubaantun and Pusilhá, including a number of inscribed stone stelæ and a large series of pottery whistle figurines of a new type. Illustrated reports of these expeditions were published in the *Journal of the Royal Anthropological Institute*.

Ever since 1902 Joyce had been closely associated with the activities of this Institute, of which he was honorary secretary and editor during 1903–1913, vice-president, 1913–17 and 1923–25, and president, 1931–33. Throughout this period he devoted much time and energy to furthering the aims of the Institute, attended its meetings, and was a frequent contributor of original articles and reviews to its *Journal* and to *Man*. He took an active part in organizing the exhibition of "Indigenous American Art" at the Burlington Fine Arts Club in 1920, the catalogue for which was prepared by him.

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He was president of Section H of the British Association in 1934, his address taking the form of an original piece of research into the origins of yerba maté or 'Paraguayan tea'. He contributed articles to the "Encyclopædia Britannica" and to a number of more popular serials such as Harmsworth's "Universal History of the World" and Hammerton's "Wonders of the Past", as well as to certain foreign scientific journals. He was honorary secretary of the Hakluyt Society in 1923. In 1938, at the age of sixty, he retired from the British Museum owing to ill-health.

In spite of his erudition in his chosen subjects of ethnology and American archæology, Joyce carried his learning lightly, and his work was infused with an unaffected gaiety. Possessed of a happy and sociable temperament, and a ready wit, he never wearied of introducing students or visitors to his favourite subjects, or of trying to inspire in them a genuine interest in the collections under his charge; his influence led to a number of important benefactions, and was felt indirectly in many ways. As a foremost authority on all aspects of American archæology he leaves no immediate successor in Great Britain.

It was with sincere sorrow that his many friends noted, during his latter years, the signs of failing health in a constitution never very robust. But while illness inevitably led to the curtailment of his scientific work, it never succeeded in quenching the indomitable cheerfulness of his spirit.

He is survived by Mrs. Joyce, herself a leading authority on the Latin American countries, though perhaps better known to the public under her maiden name of L. E. Elliott. He had three children by an earlier marriage. H. J. BRAUNHOLTZ.

WE regret to announce the following deaths:

Sir William Bragg, O.M., K.B.E., F.R.S., director of the Royal Institution of Great Britain, and, during 1935–40, president of the Royal Society, on March 12, aged seventy-nine.

Prof. Lawrence J. Henderson, professor of chemistry in Harvard University, foreign secretary of the U.S. National Academy of Sciences, aged sixty-three.

Dr. George Senter, formerly principal of Birkbeck College, University of London, on March 14, aged sixty-eight.

NEWS and VIEWS

India

THE announcement made by Mr. Churchill in the House of Commons on March 11 that definite proposals have been formulated, and are being submitted to the leaders of Indian thought, for terminating the state of political unrest in that great country, will be welcomed on all sides. The Government made a pronouncement in August 1940 of the general principles upon which British rule in India was proceeding, indicating that full Dominion status would be granted as soon as possible after the War, under a constitution to be framed by Indians and acceptable to the chief elements of Indian national life, subject to the protection of minorities and to the fulfilment of Imperial obligations to the native States. This promise did not satisfy certain classes of opinion, and there has been bitter controversy, notably between the Congress party and the Moslem League. Reference has been made in NATURE on several occasions to the difficulties of the situation, and a noteworthy and constructive article on the subject by Sir Denys Bray, formerly Foreign Secretary, Government of India, appeared in NATURE of September 13, 1941, p. 301.

Mr. Churchill has now stated that the War Cabinet has agreed upon certain "conclusions for present and future action", based upon the general declaration already referred to, and Sir Stafford Cripps has volunteered to take these proposals to India. There he will strive to obtain the necessary assent to them from the chief parties of the country. In view of the grave turn taken by the War in the Far East, Sir Stafford will also consult with the Viceroy and Commander-in-Chief regarding the relation of these proposals to the defence of the country. The intervention of the War Cabinet at this critical juncture is a measure of the importance attached to the promotion of unity of purpose and action in India, and the outcome of Sir Stafford Cripps's mission will be awaited with keen interest.

Wheatmeal Flour and Bread

SPEAKING in the House of Lords on March 11, Lord Woolton, Minister of Food, announced that in order to reduce the very considerable tonnage of shipping used for the import of wheat into Great Britain, the Government has decided to increase to 85 per cent the ratio of flour from wheat milled in the country. From March 23 millers will be prohibited, except under specific licence, from manufacturing any flour other than wheatmeal flour, or some authorized speciality brown flour. This increased milling ratio entails the diversion of some of the products of wheat from the feeding of livestock to use as human food. But the change has been timed to take place when, with the approach of summer, it will not be necessary for the Ministry of Agriculture to change, from now until the end of August, the scale of rations of purchased feeding-stuffs allowed to stock and poultry feeders.

In order to absorb the stocks of white flour, no miller, factor, or importer will be permitted to deliver any white flour to any person other than a licensed baker, and then only providing that three times the quantity of national wheatmeal is concurrently delivered. Further, bakers will be authorized when producing national wheatmeal bread to include up to 25 per cent of white flour with the national wheatmeal. From April 6 it will not be permissible, except under licence, to sell any white bread, and a similar order referring to the use of flour in any other item of food will come into effect on April 20. Lord Woolton said that, while complete uniformity in the production of wheatmeal flour and bread is not possible, he is satisfied that we shall get a good bread, good in substance, good in texture, and agreeable to the palate. The composition and nutritive value of wheatmeal and similar bread have frequently been discussed in NATURE; attention may be directed especially to articles in the issues of May 31, 1941 (p. 665) and August 23, 1941 (p. 219).

Mechanical Engineers in the Army

ONE of the recommendations of the Beveridge Committee on Skilled Men in the Services was for the formation of a Corps of Mechanical Engineers in the Army (see NATURE, March 7, p. 255). Replying to a question in the House of Commons on March 11, Mr. Duncan Sandys, Financial Secretary to the War Office, referred to this proposal to pool the mechanical engineering resources of the various Corps. He said that it has now been decided to bring together the greater part of the Army's engineering maintenance services and to form them into a new and separate Corps. The new Corps will be made up of three principal components: first, the entire engineering side of the R.A.O.C.; second, all the maintenance personnel of the R.A.S.C., with the exception of formation workshop platoons and independent companies; and third, a large part of the mechanical maintenance personnel of the Royal Engineers. These far-reaching measures of reorganization would entail not only extensive administrative changes but also large-scale transfers of personnel.

Nervous Shock in Peace and War

AT a Chadwick Public Lecture delivered on March 17, Dr. William A. Brend considered nervous shock in peace and war. 'Nervous shock' is the same whether it is called 'nervous shock', 'shell shock' or 'traumatic neurasthenia' or any other of its names. Evidence of nervous shock can be found in early records, for example, in the Book of Job. Shakespeare gives an astonishingly accurate picture of 'battle-shock' in Henry IV. The modern history of the disorder begins about the middle of the nineteenth century when numerous cases were attributed to railway accidents. Many cases were seen in the Army during the War of 1914–18, and after the War a committee of investigation reported that the term 'shell-shock' had been "a gross and costly misnomer" which had done much harm. The essential cause of nervous shock is fear, but the effect of fear is often increased by injudicious 'suggestion'. Physical injuries play no part in the production of the disorder. Civilians suffering from shock after air-raids are not entitled to compensation under the Personal Injuries Act. Reasons were given for thinking that this was a very wise decision of Parliament. The influence of temperament was briefly discussed.

The biological significance of fear as an instinct was then examined. Capacity to feel fear is part of our normal mental make-up, and of the defence mechanism of the species. Fear only becomes a matter of self-reproach (that is, cowardice) if it is uncontrolled. Man then sinks to the level of the brutes and sacrifices the benefit of his intelligence. The public health aspect of nervous shock arises from the fact that the affection differs from organic disease or injury in that medical men are not considered to have a monopoly of the knowledge concerning either the cause or the pathology or the proper treatment of the disorder. There is a definite public opinion on all these questions which expresses itself through the Press and influences Acts of Parliament, provision of treatment and claims for damages, etc., in courts of law acting through judges and juries. It is very important, therefore, that this public opinion should be based on accurate knowledge. There are reasons for thinking that this is not the case at present, and indeed that in certain directions encouragement is given to the development of the disorder. Increased understanding of the nature of the condition would accordingly help to reduce its incidence.

Physical Society Optical Group

THE inaugural meetings of the newly formed Optical Group of the Physical Society were held on March 6 at the Science Museum and the Imperial College, South Kensington. It is ten years ago since the Optical Society was merged with the Physical Society, and although in this period a good number of meetings have been devoted to optical subjects, there has been a widely expressed desire for the formation of a Group for discussions and lectures of a less exacting and critical character than those associated with papers intended as original contributions to science. A preliminary meeting was held in December 1941 at which a draft constitution was approved, the objects of the Group being the provision of opportunities for the meeting of those with optical interests, the promotion of research and education in optics (including the improvement of optical literature), and fostering public interest in this branch of science. The first business of the inaugural meeting was to adopt the Constitution, and to elect Dr. A. O. Rankine as chairman with Prof. L. C. Martin as honorary secretary. A representative committee consists of Instructor Capt. T. Y. Baker, Mr. R. J. Bracey, Mr. W. H. A. Fincham, Dr. V. G. W. Harrison, Mr. W. C. Hynd, Dr. H. Lowery, Capt. T. Martin, Mr. J. Perry and Mr. E. W. H. Selwyn.

The first lecture was delivered by Dr. W. M. Hampton (Messrs. Chance Bros. and Co., Ltd.) who took as his subject "Some Problems relating to Optical Glass", dealing especially with recent work on the effects of heat treatment on the optical properties of the medium. The meeting in the afternoon was devoted to a paper by Mr. R. J. Bracey describing "A Multi-purpose Collimator" and a discussion, opened by Mr. J. Perry, on "Thermal Effects on the Performance of Lens Systems". Both subjects provoked a good discussion in which valuable technical points were brought out. Upwards of fifty members attended a luncheon at which Profs. A. V. Hill and A. C. G. Egerton, secretaries of the Royal Society, were guests of the Physical Society. In proposing the toast "The Optical Group", Dr. Rankine said the membership already includes 127 names. He hopes that the formation of the Group will be of value in the scientific life of the country, and that where papers of optical interest are forthcoming they will in future be made available for discussion by its members. Exacting demands are being made upon the optical industry in Great Britain, and the new Group can do considerable service if it leads to increased co-operation among those whose duty and honour it is to be called upon to fulfil them.

Royal Microscopical Society (1839–1939)

THE recent publication of the presidential address delivered by J. E. Barnard before the Royal Microscopical Society (*J. Roy. Mic. Soc.*, 61, 1; 1941) in celebration of its centenary, and the republication in the same journal of the address given in 1895 by A. D. Michael (the president in that year) calls forcibly to mind the comparatively recent advent of the microscope particularly as applied to the variety of fields in which it is now so familiar. At the time

of the foundation of this Society, microscopes were primitive and were generally regarded as playthings compared to the telescope, although Lister had already published his epoch-making paper on the achromatic objective. The paucity of microscopical research in Great Britain had, in fact, already been noted by Schleiden, a slur which the Society was to do much to remove. Under Prof. Owen as first president the Society flourished from the start, and the first number of the *Journal* was published in 1841. One of the main features of the early meetings, attended in the nature of things almost exclusively by amateurs, was apparently the rapid introduction of new types of microscopes and much enthusiasm over technical improvements upon old. Among the members of the time we may note such names as John Queckett, Michael Faraday, Thomas Bell, with Ehrenberg as the first honorary fellow. Throughout its life the Society has stimulated interest not only in improvement of instruments but also in perfection of microscopical technique. The use of Canada balsam had been described shortly before the foundation of the Society, but it was not until 1848 that the use of glycerine was noted by Warrington.

In its first fifty years the Society achieved much—the homogeneous immersion lens suggested by Stephenson and worked out by Abbe, the binocular microscope, the Society's standard screw for objectives, the mechanical substage and hundreds of other improvements large and small—and in its *Journal* were presented many epoch-making papers the authors of which are now almost forgotten but whose work has formed a sure foundation for modern studies. In more recent times the Society has become progressively professional. Among the outstanding features of these later years we may recall the controversy over Abbe's diffraction theory of microscopic vision, with E. M. Nelson and J. W. Gordon as the more notable figures and calling to mind such great names as Sylvanus Thompson and Lord Rayleigh, a topic which has arisen from time to time during ensuing years, culminating in 1928, when it was generally agreed that under the conditions of illumination commonly employed the theory is no longer tenable. In 1902 Siedentopf introduced the ultra-microscope and in the following year the first paper appeared on ultra-violet light microscopy, marking perhaps the most important advance during the present century. The basis for the modern standard of procedure in microscopy was laid by Nelson in 1910 in a description of his method of "critical microscopy". Since that time, perhaps one of the more notable advances with which the Society has been connected is the improvement in design and the use of the polarizing microscope figuring so largely in current microscopy. It is confidently to be expected that in the future the Society will continue to serve microscopy with the same success as in the past. (See also NATURE, 144, 850; 1939.)

The Australian Anthropological Association

IN 1939 the Australian Anthropological Association was formed after discussion between the Anthropological Associations of New South Wales, Victoria and South Australia at the meeting of the Australian and New Zealand Association for the Advancement of Science held in Canberra that year. The headquarters of the new Association are to be situated in rotation for a period of two years in each State of the Commonwealth in which there is an anthropological society affiliated with the Association. During the first two years of its existence the headquarters of the Association were in Adelaide. Now they are at Sydney and will remain there until October 1, 1943, when they will be transferred to Melbourne. The official organ of the Association is *Mankind* which is the official journal of the Anthropological Society of South Australia. Officers of the Association are as follows: *President*, Prof. A. P. Elkin; *Vice-president*, Mr. F. L. S. Bell; *Hon. Secretary-Treasurer*, Mr. G. W. Watkins ("Hansard" Staff, Parliamentary House, Sydney).

Early Civil Engineering in France

IN a paper read to the Newcomen Society on March 11 entitled "The French Civil Engineers of the Eighteenth Century", Mr. S. B. Hamilton gave an account of the Corps des Ponts et Chaussées, founded in 1716, and of the school established in 1747 in connexion with it. The Corps was responsible for the main roads, canals, bridges, etc., of the country, and it has had many distinguished men on its staff. These men, such as Gautier, Frézier, Perronet, Gauthey, Chezy and Prony, possessed high scientific attainments, and in their memoirs and textbooks they established many of the principles underlying constructional work. When Telford looked for the literature of civil engineering, it was to France he turned, and his collection of books was bequeathed to the Institution of Civil Engineers. The outstanding man of the eighteenth century was Perronet (1708–94), who entered the Corps in 1745 and became director of the École des Ponts et Chaussées in 1747. His bridges, said Mr. Hamilton, were remarkable for boldness of design. Moreover, in an age of corruption, he set his face against the patronage which ruined some civil administrations; he selected his subordinates strictly on the grounds of ability and character.

Indian Journal of Genetics and Plant Breeding

THE formation of the Indian Society of Genetics and Plant Breeding at New Delhi in January 1942 has been quickly followed by the publication of the *Indian Journal of Genetics and Plant Breeding*. This journal is edited by Dr. B. P. Pal, Imperial Agricultural Research Institute, New Delhi, on behalf of the executive council of the Society. This welcome addition to genetical publications provides a valuable outlet and source of reference for the ever-increasing work of the research institutes of India. The volume for 1941 consists of one part, but in the succeeding years it is intended to publish twice a year.

In the first volume there are articles on hybrid vigour in rice by K. Ramiah and K. Ramasamy, chlorophyll deficiencies in rice by B. S. Kadam, colchicine induction of polyploids in *Capsicum annuum* by B. P. Pal, S. Ramanujam and A. S. Joshi, cytology of sterile *Sesamum orientale* by L. S. S. Kumar and A. Abraham and vernalization of Indian crop plants by B. P. Pal and G. Suryanarayana Murty. The Agricultural Commissioner with the Government of India, Dr. W. Burns, in the first paper of the publication, points out the great opportunities for plant genetics and plant breeding in India and welcomes the advent of the Society and *Journal*.

Smithsonian Institution Activities

THE report of the Secretary of the Smithsonian Institution and the financial report of the Executive Committee of the Board of Regents for the year ended June 30, 1941, includes a summary of the year's activities and reports on the United States National Museum, the Bureau of American Ethnology, the International Exchange Service, the National Zoological Park, the Astrophysical Observatory, the Division of Radiation and Organisms and other activities (Washington: Gov. Printing Office. 25 cents). The Smithsonian Institution has already been assigned a number of defence problems. The revision of all solar-constant values collected by the Astrophysical Laboratory from all Smithsonian observing stations from 1923 to the present is nearing completion and publication is expected to commence in 1942. A promising method has been developed of following the sun's variation by observations limited to the blue-violet region of the spectrum.

The Division of Radiation and Organisms has continued its studies on the relation of radiation to various phases of plant growth, and much information has been acquired on the respiration of etiolated barley seedlings. In addition to improvements in the performance of the spectrograph used in measuring carbon dioxide for very short periods, the spectral effectiveness of radiation for the growth inhibition of the oat mesocotyl has been further studied, as well as those of other species of grasses, and the ultra-violet irradiation of algæ. M. W. Stirling has made further archæological discoveries in southern Mexico in co-operation with the National Geographic Society, and Dr. Frank H. H. Roberts, jun., has completed his sixth and final expedition to the Lindenmuir site in northern Colorado, work which has added greatly to our knowledge of Folsom man and the early occupation of America. The work of the International Exchange Service was seriously hampered by world conditions, but scientific and other publications which cannot now be sent are being stored until the end of hostilities.

Meteorology in Art

MR. L. C. W. BONACINA'S paper on the "Scenic Approach to Meteorology" (*Quart. J. Roy. Meteor. Soc.*, Oct., 1941), his fifth essay on the landscape-impression of weather, is a valuable contribution to that co-operation between science and art which is so important for the development of human personality. Truth and beauty, long kept in separate compartments of the mind, are now being welded together, a task in which Mr. Bonacina is a diligent and gifted worker. The papers of 1937–38 contain analyses of the paintings of Constable and Turner; that of 1939 carries on the subject to the treatment of landscape-meteorology by men of letters, and those of 1940–41 deal with the pictorial relation of atmosphere and the landscape background as seen by the author. In these descriptions there is a power of expression which enables the reader to share that faculty of observation with which the writer is endowed. Development of the æsthetic appreciation of Nature is especially valuable at the present time. At long last it is beginning to be realized that beauty should take an equal place with truth and goodness in that trinity of enduring values which is needed to fortify the mind during the stress and strain of war.

Rainbow Bridge over the Niagara Falls

THE approaching completion of the Rainbow Bridge at Niagara Falls, is a happy augury of that closer co-operation between the United States and Canada which has been intensified by the present state of world relations. The bridge was built under the auspices of an international body, the Niagara Falls Bridge Commission, consisting of eight members, four having been appointed by the Governor of New York and four by the Lieutenant-Governor of Ontario. The project has been financed by a bond issue of four million dollars.

The previous bridge at the same place, the correct name of which was the Falls View Bridge, was built in 1895. This was an arch structure which stood until January 27, 1938. On that day an ice jam which had formed in the gorge rose to an unprecedented height, and crushed the end portions of the arch ribs, causing a complete collapse of the bridge. The Falls View Bridge was the property of the International Railway Company, which after its destruction immediately prepared plans for a new structure. Public opinion, however, opposed the construction of another privately owned toll-bridge at this site and as a result the Company did not proceed with the plans for rebuilding. The Niagara River at the Bridge site flows through a gorge approximately 1,250 ft. wide and 180 ft. deep from the surface of the water to the top of the cliffs. The river is about 830 ft. wide and 175 ft. deep, and the flow is 25–30 m.p.h.

Demonstration of the Circulation by Experiment

IN a recent paper (*Isis*, 33, 443; 1941) entitled "The Significance of the Demonstration of the Harveyan Circulation by Experimental Tests" Dr. H. P. Bayon raises the question already put forward by Sarton in 1937 as to why the discovery of the circulation of the blood was completed by an English physician and why its acceptance was delayed until the middle of the seventeenth century. Galen's erroneous doctrine of the to-and-fro movement of the blood which was accepted for so long a period was based on the belief that the anatomical features of the heart, uterus and liver in the dog or pig must also be present in man. According to Dr. Bayon, the delay in the acceptance of Harvey's discovery of the circulation until the middle of the seventeenth century was due to the fact that it was not until then that accurate comparative anatomical observations became available through woodcuts, printed works and dissection. It was by the intelligent use of the experimental method that Harvey was able to test and control his interpretation of clinical observation and comparative anatomy. His investigations were completed by the discovery of the capillaries, which formed the missing link between the arteries and veins.

Golf Courses during War-time

VOL. 6 of the *Journal of the Board of Greenkeeping Research*, which has just been published, shows that the Research Station at Bingley is adapting itself most successfully to the new problems which are confronting golf clubs owing to the War. Land is being ploughed up on many courses, hay and silage crops are being taken from others and sheep-grazing is widespread. In consequence, the erection of adequate fencing has become a major problem. Trials are

described which show that electrified fencing is likely to prove a simple and effective method of control, while at the same time it gives a cash saving of 80–90 per cent over the ordinary post and wire type. Methods for making silage from grass mowings have been investigated with very satisfactory results. Information is supplied as to how the grass can be collected, the type of silos to use and precisely how they should be filled. Young grass mowings are so nutritious that a really valuable contribution to the country's feeding-stuffs could be made in this way. If silage-making is not practicable, the grass mowings need not be wasted, but can be either composted for manure or dried for cattle feeding. An appeal is made to former subscribers for their continued support, as this is essential if the Research Station is to be in a position to fulfil its normal functions directly the War is over.

Certificate in Natural History

A NEW edition of the emergency regulations for the certificate of proficiency in natural history has just been issued by the University of London. The work, which has been specially designed to take advantage of the fact that large numbers of teachers are, owing to war conditions, presented with a unique opportunity of natural history study in the field, involves a directed course of private reading at home, attendance at a practical laboratory course of two weeks duration in the summer vacation, an approved plan of field-work suited to the student's locality to be written up in the form of an essay, and examination. Definite arrangements have not yet been made, but it is hoped that the practical course this year will be held at the Royal Holloway College, Englefield Green, Surrey, during July 26–August 8. Copies of the regulations and further information may be obtained from the University Extension Registrar, University of London, at Richmond College, Richmond, Surrey.

Diagrams and Formulæ for Lantern Slides

PROF. A. C. CHIBNALL, of the Imperial College of Science and Technology, London, has utilized 'Cellophane' and 'carbon' paper for the preparation, without photography, of lantern slides of line diagrams and chemical formulæ. Mr. J. W. Minnis, of the Chemistry Department, Heriot-Watt College, Edinburgh, states that he has obtained good results with two lantern-slide cover-glasses. A piece of typewriter 'carbon' paper is placed on one and the required diagrams or formulæ are drawn on the back of the 'carbon' paper, using a glass rod pulled to a point. The paper is removed, the second cover-glass placed over the carbon image, and the two glasses bound together in the usual manner. The resulting slide gave good reproduction in the lantern.

Synthetic Rubber Production in Canada

MR. HOWE, the Dominions Minister of Munitions, has announced the establishment of a Government-owned company called the Polymer Corporation, Ltd., with headquarters in Toronto, which will undertake the production in Canada of synthetic rubber of the Buna type. According to the Ottawa correspondent of *The Times*, Mr. Howe said that four plants would probably be required for the three stages of the manufacturing process to be employed. The output, when the plants are working at full capacity, is expected to be about 34,000 tons a year, but production cannot begin before the end of 1943. Colonel Arthur L. Bishop, a prominent Toronto industrialist, has been appointed president of the Corporation, and there are four other directors.

Announcements

MR. R. A. BUTLER, president of the Board of Education, is to be chairman of the Scientific Advisory and Engineering Advisory Committees in succession to Lord Hankey.

SIR JOHN GREENLY was elected president for 1942–43 of the Institute of Metals at the annual general meeting held on March 11.

THE Committee of the Athenæum has elected the following gentlemen, under the provisions of Rule II of the Club, which empowers the annual election by the Committee of a certain number of persons of distinguished eminence in science, literature, or the arts, or for their public services: Prof. P. M. S. Blackett, Langworthy professor of physics, University of Manchester; Mr. T. D. Kendrick, keeper of British and Mediæval Antiquities, British Museum; Mr. J. M. Keynes, economist, and fellow and bursar of King's College, Cambridge.

THE following appointments in the Colonial Service have recently been made: S. R. Payne, assistant conservator of forests, Gold Coast; C. B. Garnett (senior agricultural officer, Zanzibar), senior agricultural officer, Nyasaland.

THE conference on "European Agriculture: Scientific Problems in Post-war Reconstruction", arranged by the Division for the Social and International Relations of Science of the British Association, and postponed from March 13–14 owing to the death of Sir William Bragg, will be held on March 20–21 at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, with sessions at 10.15 a.m. and 2.15 p.m. on each day as previously arranged, and the programme, so far as possible, unaltered. Fresh tickets will not be issued.

THE Science Faculty of the Marx Memorial Library and Workers' School has arranged symposia on "Science and Technology in the Soviet Union" and the "Scientific Attitude to Fascism, with particular reference to Racial Theories", to be held at the London School of Hygiene and Tropical Medicine on April 5 and 6. Papers at the first symposium will include those by Prof. J. D. Bernal, Mr. Eric Godfrey, Dr. Norman Henry, Mrs. B. King, Dr. J. Needham, Mr. H. Rose, Dr. M. Ruhemann and Mr. H. P. Vowles. Those for the second symposium include the following authors: Prof. J. B. S. Haldane, Dr. C. F. D. Hawkes, Dr. P. Gorer, Prof. H. Levy, Dr. G. M. Morant and Mrs. Dona Torr. Further information can be obtained from the secretary, Faculty of Science, Marx House, Clerkenwell Green, London, E.C.1.

ERRATA. The May Lecture of the Institute of Metals is to be delivered on May 13, not May 31 as stated in NATURE of March 14, p. 299.

In NATURE of February 28, p. 243, under "Night Sky in March" the word "occultations" of the planets was inadvertently used for "conjunctions".

LETTERS TO THE EDITORS

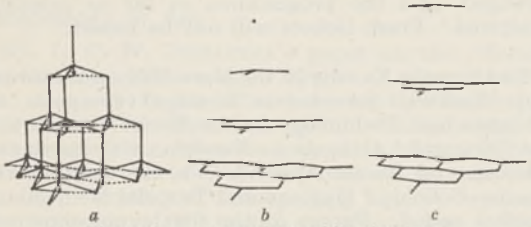
The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

A New Structure of Carbon

ATTENTION has been directed by Taylor and Laidler[1] to the appearance of 'extra' lines on X-ray photographs of graphite. These lines are given by several quite unrelated specimens and they do not seem to be connected with impurities. Finch and Wilman[2] and Taylor and Laidler[1] tried to interpret them as secondary diffraction phenomena of the graphite structure, but without producing any convincing evidence for their theories[3]. We find, however, that the lines may be explained by the presence of about 10 per cent of another structure that is closely related to graphite, and this therefore implies that carbon can exist in three different crystalline forms.

The new structure may be described in the following way. Ordinary graphite is composed of layers of carbon atoms arranged in hexagonal rings, these layers are so disposed that alternate atoms lie directly over other atoms and centres of hexagons respectively in the layer below. There are three different layers that can be built together to satisfy this condition; graphite uses two of them alternately; the new structure uses the three in sequence. Thus its unit cell has a c-axis $\frac{3}{2}$ times as long as that of ordinary graphite, in agreement with Finch and Wilman's observation that many of the lines may be indexed on the basis of the ordinary unit cell if the fractional l indexes $\frac{1}{3}$ and $\frac{2}{3}$ are allowed.

Although the structure may be referred to hexagonal axes, it is really rhombohedral, the basal symmetry plane of the graphite structure being replaced by centres of inversion, so that the alternating six-fold symmetry is lost. The simplest description of the structure is that it belongs to the space-group $R\bar{3}m$, ($a = 3{\cdot}635$ A., $\alpha = 39{\cdot}49°$) and has atoms at $\pm(\frac{1}{8}, \frac{1}{8}, \frac{1}{8})$.



a *b* *c*

a. Diamond ⟶ *α*-pseudo-graphite structure.
b. *α*-pseudo-graphite structure.
c. *β*-pseudo-graphite structure.

The structure, although closely resembling graphite, is similar to diamond in the arrangement of its planes; but in diamond the planes are puckered and closer together. Nath[4], in a theoretical study of the transition from diamond to graphite, has suggested that there is an intermediate structure formed, and it is interesting that this structure is exactly that described here. The accompanying figure is reproduced from his paper. It shows the diamond structure (*a*), an intermediate structure which has not been observed (*b*), and the new structure (*c*). There is, however, no explanation of the apparent existence in equilibrium of the two structures.

The experimental evidence on which we base these results will be described elsewhere.

We wish to thank Dr. Taylor for the loan of one of his photographs, and Mr. H. P. Rooksby of the General Electric Company for specimens of Ceylon and Bavarian graphites.

H. LIPSON.
A. R. STOKES.

Cavendish Laboratory,
Cambridge.
Feb. 20.

[1] Taylor and Laidler, NATURE, **146**, 130 (1940).
[2] Finch and Wilman, *Proc. Roy. Soc.*, A, **155**, 345 (1936).
[3] Lonsdale, K., Knaggs, I. E., and Smith, H., NATURE, **146**, 332 (1940).
[4] Nath, N., *Proc. Ind. Acad. Sci.*, **2**, 143 (1935).

Purification of Penicillin

PENICILLIN has been obtained in the form of a highly purified barium salt by repeated fractional extraction from amyl acetate into water, chromatographic separation on an alumina column, treatment of the active fraction with aluminium amalgam and further repeated chromatographic separation until the alumina column appeared homogeneous. The preparation thus obtained, though not crystalline, has an activity of 450–500 Oxford penicillin units per mgm., corresponding to a complete inhibition of the growth of *Staphylococcus aureus* in broth in a dilution of 1 : 25,000,000. Penicillin must therefore be regarded as one of the most powerful antibacterial substances with predominantly bacteriostatic action known.

Details of the method of purification and an account of some chemical, physical and biological properties of penicillin will be published shortly.

E. P. ABRAHAM.
E. CHAIN.

Sir William Dunn School of Pathology,
University of Oxford.
Jan. 31.

Further Observations on the Increased Yield of Nucleic Acid from Irradiated Yeast*

DURING the course of investigations intended to extend previously reported observations[1] of increased yields of nucleic-acid-like substances from yeast irradiated with full ultra-violet radiation under conditions resulting in prolonged injury to the yeast cells, certain irregularities in the yields were noted. It now appears that these may be attributed to lack of quantitative yields in the final step of the chemical procedure wherein nucleic acid is precipitated.

As in the previous experiments[1], starch-free yeast (*S. cerevisiæ*, Fleishmann bakers' strain) was employed at a concentration of 300 gm. wet weight to each litre of suspension medium. Each suspension was divided into two equal portions. One was irradiated with full ultra-violet light from a quartz mercury arc. The other, which served as a control, was not irradiated but was subjected to the same conditions of stirring. Because of rise in temperature of the irradiated suspension above that of the control in certain of the experiments in which an air-cooled arc was used, a Kromayer water-cooled arc was substituted in other experiments. With it, the energy was insufficient to obtain an appreciable degree of killing (methylene blue test) during the period of irradiation (10–22 hr.). Subsequent to irradiation, nucleic acid was prepared from the con-

* Contribution No. 198 from the Department of Biology, Massachusetts Institute of Technology, Cambridge, Mass.

trol and irradiated suspensions by the method of Johnson and Harkins[2].

In all, six preparations were carried through chemically, but spectrographic data, forming the basis of this report, are available for only four of these. Table 1 shows the yields in terms of dry weights of

TABLE 1. WEIGHTS OF PRECIPITATES OBTAINED IN THE PREPARATION OF NUCLEIC ACID FROM IRRADIATED AND NON-IRRADIATED YEAST.

Preparation	U.V. Source	Suspensions medium	Time of irradiation, hr.	Extent of killing, per cent	Yield of nucleic acid per 100 gm. wet wt. of yeast	
					Non-irrad.	irrad.
5.2.41	Air-cooled	Reader's[3]	10	*ca.* 30	1·60 gm.	1·90gm.
7.17.41	Water-cooled	Reader's	22	negligible	1·73	1·83
7.23.41	Water-cooled	Isotonic saline	19	*ca.* 5	1·19	0·89
8.4.41	Water-cooled followed by air-cooled	Reader's	*ca.* 24	*ca.* 98	0·96	0·73

the precipitates obtained by the Johnson and Harkins procedure. It will be noted that there was no correlation between the extent of injury and the yield of nucleic acid, and that in two of the four instances yields were actually much less from irradiated than from non-irradiated yeast. However, various irregularities in the final precipitations were noted; for example, the formation of suspensions of very fine particles in some instances (which were precipitated with difficulty) as contrasted with the formation of large, flocculent, easily precipitable particles in other instances. This suggested that an appreciable proportion of the nucleic acid might remain in solution in the supernatants after precipitation.

In order to determine whether this could account for the irregularities, ultra-violet absorption spectra were taken of the final supernatants from both irradiated and non-irradiated yeast. These showed, in every instance, the typical absorption spectra of nucleic acids (marked maximum near 2600 A., etc.)[4]. Quantitative determinations were then made of the amounts of nucleic acid (or nucleic-acid-like materials) remaining in the supernatants, employing the value 25·0 for the extinction coefficient of yeast nucleic acid in terms of gm. per litre concentration and cm. cell thickness[5]. The results of these determinations are shown in Table 2. These results indicate that in five instances out of eight, the amount of nucleic-acid-like material remaining in the supernatants was actually greater than that precipitated.

When the yields of the precipitates were added to the amounts remaining in the supernatants (Table 3), the total yields were in each instance greater for irradiated than for non-irradiated yeast. In the two instances (second and third preparations) in which the irradiation conditions were such as to result in

TABLE 2. NUCLEIC ACID REMAINING IN SUPERNATANTS AFTER REMOVAL OF PRECIPITATES, GM. PER 100 GM. MOIST YEAST.

Preparation	Non-irradiated	Irradiated
5.2.41	1·66	1·80
7.17.41	0·97	0·93
7.23.41	1·35	1·89
8.4.41	1·11	3·24

TABLE 3. TOTAL YIELDS OF NUCLEIC ACID IN PRECIPITATES AND SUPERNATANTS, GM. PER 100 GM. WET WEIGHT OF YEAST.

Preparation	Precipitate only			Total, precipitate and supernatant		
	Non-irradiated	Irradiated	Per cent increase or decrease	Non-irradiated	Irradiated	Per cent increase or decrease
5.2.41	1·60	1·90	+18·8	3·28	3·70	+13·5
7.17.41	1·73	1·83	+ 5·8	2·70	2·76	+ 2·2
7.23.41	1·19	0·89	−25·2	2·54	2·78	+ 9·4
8.4.41	0·96	0·73	−24·0	2·07	3·97	+91·8

only slightly lethal effects on the cells, the increased total yields were small. In the case of the 7.17 preparation, the total increase observed was within the limits of experimental error. In the case of the 8.4 preparation, however, in which the conditions were such as eventually to kill almost all of the cells, the total yield from irradiated yeast was almost twice that from non-irradiated yeast.

These data demonstrated the lack of reliability of chemical precipitations alone in estimating the quantities of nucleic-acid-like substances present in various preparations. They show also the value of the spectrographic technique as a quantitative evaluation of the reliability of the chemical procedures.

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Department of Biology,
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HERMANN LISCO.
Department of Pathology,
Harvard Medical School,
Boston, Massachusetts.
Jan. 15.

[1] Loofbourow, Englert and Dwyer, NATURE, **148**, 113 (1941).
[2] Johnson and Harkins, *J. Amer. Chem. Soc.*, **51**, 1784 (1929).
[3] Reader, *Biochem. J.*, **21**, 901 (1927).
[4] Heyroth and Loofbourow, *J. Amer. Chem. Soc.*, **53**, 3441 (1931).
[5] Heyroth and Loofbourow, *Bull. Bas. Sci. Res.*, **3**, 237 (1931).

Acute Inhibition of the Corpus Luteum Excited by the Onset of Anœstrus in Elephantulus

OVER several years we have accumulated extensive material of serially sectioned ovaries and uteri of *Elephantulus myurus jamesoni*. From an examination of the ovaries it is now possible to identify accurately the physiological state of the animal in respect of its menstrual or reproductive cycle.

Elephantulus is a primitive mammal usually included among the Insectivora, but this mammal may turn out to be an important link between the Insectivores and the Primates.

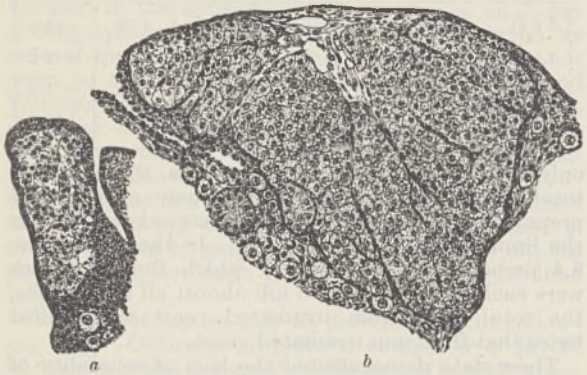
Attention has already been directed to the extraordinary reactions shown in the ovary during ovulation[1] and in the uterus throughout the menstrual cycle[2]. In our most recent investigation we have correlated the post-ovulatory changes in the uterus with the structure of the corpus luteum[3].

Although not previously mentioned in our publications a third factor facilitates the identification of the stage in the cycle that an animal happens to be in after ovulation. This is the extent of decomposition

of the numerous eggs[4] present in the uterus after ovulation.

Anœstrus in Elephantulus extends from March or April until the end of July or the beginning of August.

Recently in examining our series No. 428 of an animal killed in April 1939, we found that both the ovaries and uterus presented an appearance typical



TWO CORPORA LUTEA OF ELEPHANTULUS ASSOCIATED WITH EGGS IN THE UTERUS IN APPROXIMATELY THE SAME STAGE OF DEGENERATION.

(*a*) From an animal in early anœstrus; (*b*) from an animal in the menstrual cycle. (× 125.)

of anœstrus. To our surprise, however, we discovered degenerating eggs in the uterus. In an œstrous animal such eggs are normally associated with well-developed corpora lutea in the ovary and the stage of dense stroma in the uterus. On carefully re-examining the ovaries we discovered curious cellular bodies which were neither corpora lutea of the normal menstrual cycle nor corpora lutea of a remote or recent pregnancy (see accompanying illustrations).

Obviously this animal ovulated just a little while before the precipitous onset of anœstrus inhibited the whole post-ovulatory process and the normal development of the corpora lutea.

From these facts we venture to conclude the following:

(*a*) Anœstrus inhibits the pituitary in respect of its gonadotropic hormones.

(*b*) The continued development of the menstrual corpus luteum after ovulation is dependent upon the presence of a gonadotropic hormone from the pituitary.

(*c*) This hormone maintaining lutein growth is acutely inhibited by the factor or factors responsible for anœstrus.

(*d*) The onset of anœstrus in any individual animal is a relatively acute process.

C. J. VAN DER HORST.
JOSEPH GILLMAN.
University of the Witwatersrand,
Johannesburg.
Dec. 31.

[1] *S. Afr. J. Med. Sci.*, **5**, 73 (1940).
[2] *S. Afr. J. Med. Sci.*, **6**, 27 (1941).
[3] *Anat. Rec.*, **80**, 443 (1941).
[4] *S. Afr. J. Med. Sci.*, **7** (in the press) (1942).

Anthracotheriidæ in Ceylon

IN 1941 a collection of fossils made by Mr. M. C. Wickremasekera from the Ratnapura beds near Kuruvita in Ceylon was sent to the Colombo Museum by Mr. D. N. Wadia, Government mineralogist. Examination revealed the premolar tooth of a member of the family Anthracotheriidæ of the order Ancodonta. Dr. E. H. Colbert, of the American Museum of Natural History, to whom sketches and photographs of the tooth were afterwards sent, agrees with my identification and this confirms a discovery of considerable importance to Ceylon geology. In the first article[1] describing mammalian fossils from Ceylon it was suggested that they were of late Pliocene or early Pleistocene age.

The subsequent discovery that remains of a race of the most recent member of the Proboscidea, namely, *Elephas maximus* Linné, occur with those of the hippopotamus, suggested that the Ceylon fossil beds are much younger, but the more advanced mineralization of the present discovery suggests that the age of these deposits dates back to the Pinjor or even farther. A feature of unusual interest is that in Ceylon fossils of anthracothere, hippopotamus, *Elephas maximus* and bovines occur in the gem-bearing bed which ranges in thickness between six inches and three feet, whereas in the Siwaliks the last of the Anthracotheriidæ occurs in association with the hippopotamus over a thickness of about seven thousand feet of fossiliferous beds, after which the hippopotamus survives alone in later beds which are about another three thousand feet thick. The Siwaliks are separated from Ceylon by nearly 25° of latitude and should the Ceylon tooth prove to belong to a local subspecies of *Merycopotamus dissimilis* (F. et C.) it will be of importance in correlating the fossil deposits of the Pinjor horizon of India, the Upper Irrawaddy beds of Burma, the Tji Djoelang horizon of Java, and the Ratnapura deposits of Ceylon.

The dimensions of the tooth are as follows: length of base 32 mm., width of base 18 mm., height above root 30 mm. The specimen was obtained from the debris at the mouth of a gem pit where the gem-bearing bed, which is usually also fossiliferous, lay at sixteen feet below the surface.

P. E. P. DERANIYAGALA.
Colombo Museum,
Ceylon. Jan. 1.

[1] Deraniyagala, P. E. P., *Geol. Mag.*, **73**, 316 (1936).

Nitzschia Cultures at Hull and at Plymouth

MORE than thirty years ago a persistent culture of a minute diatom was obtained by Allen and Nelson[1]; they refer to it as *Nitzschia closterium*, W. Sm., *forma minutissima*. This persistent culture has been maintained at Plymouth ever since, and has been distributed to many workers at home and abroad. The species has proved to be a useful food for many kinds of marine larvæ and a convenient diatom for experimental work. A sample was sent to Hull about 1930 and has been grown there until the present time. When first sent the great majority of the frustules, as at Plymouth, were of the straight or slightly curved fusiform shape characteristic of the species, but in 1932 a very few three-rayed or tri-radiate cells were present; their abundance was certainly much less than 1 per cent. In cultures derived from Plymouth stock such cells have been seen by other workers, notably by Barker[2]. By 1934 there had, at Hull, been a slight increase in the abundance of these tri-radiates and they may have formed as much as 1 per cent of the cultures. In 1936 the proportion had risen to more than 50 per cent. Thereafter the abundance of tri-radiates steadily increased so that by the spring of 1939 they comprised 97 per cent, and by the summer of 1941 more than 99 per cent, of the cultures.

The Plymouth stock cultures first passed into the care of one of us late in 1937, from which time two strains have been kept. In 1939, when attention was specially directed to them, well over 90 per cent of the frustules were tri-radiate, indeed in one strain the culture was almost entirely tri-radiate. By June 1941 both strains were about 99 per cent tri-radiate. In 1939 two clone cultures of normal cells and one clone culture of tri-radiates were established, a sample of the latter—as well as of one of the former—being sent to Hull in February 1940 and maintained there by sub-culturing. All clone cultures for long remained almost true to type: after the first few months a very few cells of the alternate kind were to be seen; lately, there have been some significant changes. At Plymouth one clone normal (the clone normal not sent to Hull) has become about 5 per cent tri-radiate, but the other clone normal at Plymouth and at Hull is still almost pure. It is, however, to the tri-radiate cultures that attention is here directed.

The two strains of Plymouth stock and the clone, all three about 99 per cent tri-radiate in the preceding June, had by November 1941 produced large numbers of normal cells. There is little doubt from the appearance of the cultures that this was done by the gradual reduction and eventual elimination of one ray of the tri-radiate, for of the remaining tri-radiates a large proportion had one ray reduced. Another process by which normals may derive from tri-radiates is known but does not appear to have played any part in this particular change-over. The very remarkable feature is that while these changes were taking place at Plymouth almost identical changes were occurring in the cultures at Hull: until a short time ago neither author was aware of this fact. Even the percentages are now closely similar, as the following table shows. It is based on sub-cultures made at the end of November 1941 and counted recently when dense.

	Percentage tri-radiate June 1941	February 1942
Plymouth Stock 569	99·3	61·6
,, ,, 589	98·6	64·7
,, clone tri-radiate	98·8	60·3
Hull Standard Stock	>99·0	62·0
,, General ,,		64·5
,, clone tri-radiate		68·25

The almost parallel recent history of these cultures, grown so far apart and differently treated as to time and frequency of sub-culturing, lighting, temperature, etc., is so striking that we are anxious to hear from anyone who, in the past ten years, has kept cultures of this diatom, especially if their cultures be derived originally from Plymouth stock. It is hoped to include in a paper to be published later any relevant observations other workers may be able to contribute.

D. P. WILSON.

Marine Biological Laboratory,
Citadel Hill,
Plymouth.

C. E. LUCAS.

Dept. of Zoology and Oceanography,
University College.
Hull.
March 2.

[1] Allen, E. J., and Nelson, E. W., *J. Mar. Biol. Assoc.*, **8**, 421 (1910).
[2] Barker, H. A., *Archiv Mikrobiol.*, **6**, 141 (1935).

Occurrence of a Halophilic Alga in Mid-Cheshire

ON October 26, while conducting some preliminary investigations in the course of an ecological survey of a salt-spring situated at Aldersey[1], seven miles south-south-east of Chester, the filamentous alga *Percursaria percursa* (formerly known as *Enteromorpha percursa* (Ag.)) was encountered. The presence of this alga is interesting because Percursaria is usually found in rock pools on the shore between tide marks. The only previous record of Percursaria from a brackish non-coastal region, which has come to my notice, is that mentioned by Grove[2] from brackish waters in the Midlands. The alga was evidently found in a ditch near the canal at Salwarp, Worcestershire. A note of this find is recorded by West and Fritsch[3]. The species is described and figured by Newton[4].

Percursaria percursa occurs in large masses at the Aldersey spring and is spreading into a neighbouring brackish gutter. The spring water, at the time the specimen was collected, had a salinity of 1,675 parts per 100,000 and a *p*H value of 7·0 (Lovibond comparator).

I gratefully acknowledge the assistance of Dr. Helen Blackler, of the Liverpool Museum, and Mr. E. G. Williams, of Chester, for their independent identifications of the alga.

FREDERICK BURKE.

12 Queen's Road,
Chester.
March 3.

[1] Sherlock, Mem. Geol. Survey, Mineral Resources of Gt. Brit. Rock-salt and Brine, **18**, 111 (1921).
[2] *J. Bot.*, **58**, 33 (1920).
[3] "British Freshwater Algæ", p. 162 (1927).
[4] Brit. Museum: Handbook of British Seaweeds (1931).

RESEARCH ITEMS

The Sargasso Sea

THE problem of the origin and extent of the weed in the Sargasso Sea, which has long been a debatable matter, is discussed by G. E. R. Deacon in a paper on the Sargasso Sea in the *Geographical Journal* of January. A century ago, Meyen argued that the weed grew as it drifted in the sea, that normal reproduction was vegetative and that the origin was in the Gulf of Mexico. Murray and Hjort did not subscribe to this theory; they believed that the weed would disappear if fresh supplies did not continually arrive from the coast. The weed certainly is not disappearing and there is not the least foundation for the statement of Tilden to that effect. It occurs in strips or patches, large and small, and is rarely out of sight in the whole area of the sea. Most of the weed belongs to two species, *Sargassum natans* and *S. fluitans*, but other forms are recognized. Mr. Deacon believes that there is little doubt that the weed is self-supporting, the total having been built up during centuries from plants drifted from the West Indies and by vegetative growth *in situ*. The annual contribution from the coasts is small. Evidence of vigorous vegetative growth, in leaves and branches free from Bryozoa, is abundant. Neither of the main forms, however, has been identified from the shores of the West Indies, but this does not preclude its original coastal origin. The absence of any field of weed on the coasts large enough to keep the Sargasso Sea as full as it is of weed shows that the weed must grow and multiply as it drifts, while the distribution of the currents is responsible for its accumulation and maintenance.

Excretion of Ammonia by Blowfly Larvæ

IN contrast with the vast majority of insects, which excrete the greater part of their nitrogenous waste in the form of uric acid and its salts, the larvæ of blowflies eliminate most of their waste nitrogen in the form of ammonia. This latter method of nitrogenous excretion results in a most economic procedure since it involves no loss of unburned carbon. Pamphlet No. 109 of the Council for Scientific and Industrial Research, Commonwealth of Australia, comprises two papers on the above subject by F. G. Lennox, the insect studied being *Lucilia cuprina*. In the first article, the rate and distribution of ammonia production form the main subject. It appears that practically all the ammonia produced in the mid-gut passes to the hind-gut via the Malpighian tubes. It does not reach its maximum until one or two days after the peak of larval growth. The second article is concerned with the enzymes responsible for ammonia production in the species named. Judging by the large quantity of ammonia liberated in the presence of adenosine, it is concluded that adenosine deaminase is probably an enzyme of major importance in blowfly larvæ. Deamination occurs chiefly in the midgut region where proteolysis can also be demonstrated. The few other insects known to excrete ammonia nitrogen include the larvæ of *L. sericata* (Hobson, 1931), and of *Calliphora vomitoria* (Wienland 1906). In order to establish the claim that the ammonia liberated by such larvæ is a product of their own metabolism and not of associated micro-organisms, the insects were reared from sterilized eggs in a sterile synthetic media. The details of the technique employed and the apparatus are fully described in the present pamphlet.

Rate of Growth and Timber Quality

L. P. V. JOHNSON, forest geneticist, National Research Laboratories, has reported the results of an examination of the effect of rate of growth upon timber quality carried out upon forty-three trees of hybrids and parents involving *Populus alba*, *P. grandidentata* and *P. tremuloides* (*Canadian J. Res.*, 20, 28; 1942). As these hybrids can usually be propagated readily by vegetative means and may have a rate of growth far in excess of their parents, the point is of great interest and the tentative conclusion—that rapid growth is not seriously detrimental to quality for paper pulp production—suggests great practical possibilities for these new hybrids. A short, thick habit of growth in these trees was found to be significantly correlated with high wood density, but correlation between growth-rate (in terms of annual increment of volume) and wood density was insignificant. In the same tree the fibres in wide annual rings were longer on the average than those in narrow rings—in the same annual ring the fibres of the early wood were shorter and thicker than those of the late wood. The last point recalls the observation of Priestley and Scott (*Proc. Leeds Phil. Soc.*, 3, 235; 1936) that the fibres among the vessels of the early wood of Fraxinus were shorter than those in the later wood.

Mechanism of Germination of Conidia of Erysiphe

THE mildews are characterized by a dispersal mechanism which seems to operate in relatively dry conditions and the conidia then seem to germinate and the infection to spread under low humidity conditions that would seem likely to militate against a mildew epidemic. Some very interesting observations and suggestions upon the subject appear in a paper by Harold J. Brodie and C. C. Neufeld of the Department of Botany, University of Manitoba (*Canadian J. Res.*, 20, 41; 1942). In *Erysiphe Polygoni* the conidium is cut off by a ring of wall material which forms from the periphery of the hypha inwards until a perforate disk is formed. Later, the pore in this disk is closed by a minute papilla by which alone the mature conidium remains attached until passively discharged. The wall of the conidium is relatively impermeable to water and stains enter only at the papillate end. This papilla thus seems to provide a permeable spot on the wall which is only exposed after detachment. The authors suggest that abstriction is thus followed by release of carbon dioxide and entry of oxygen through the papilla and that germination then starts even at low humidities. In support of this view they show that germination is checked in an atmosphere of nitrogen or in one containing 10 per cent carbon dioxide.

Volatile Reducing Substances in Vinegars

A STUDY of the volatile reducing substances in vinegar was reported by J. M. Whitmarsh to the Society of Public Analysts and Other Analytical Chemists on February 4. The Edwards and Nanji tests for oxidation and iodine values have been applied to a number of vinegars and the results compared with the results obtained by those authors. Estimations have been made of the amounts of various volatile reducing substances in vinegars and the presence of acetyl methyl carbinol in spirit vinegar has been demonstrated, contrary to several statements in the literature. The oxidation and iodine values of solutions of these volatile reducing

substances have been measured, and it is concluded that the distinctive values for spirit vinegar are due to its content of alcohol, and those for malt vinegar are due, largely if not entirely, to the presence of alcohol and acetyl methyl carbinol.

Equilibrium between Cuprous and Cupric Compounds

MANY cuprous compounds tend to decompose into cupric compounds and copper, and the chief controlling factor governing this instability has been shown by J. E. B. Randles (*J. Chem. Soc.*, 802; 1941) to be the degree of covalency or electrovalency of the bonding between the copper ions and neighbouring ions or molecules, which depends mainly on the polarizability of the latter. The transition from ionic to covalent type depends on a large decrease of ionic charge and so of electrostatic interaction. As the polarizability of the anions or molecules interacting with the copper ions increases, the interaction energy increases and the cuprous compound becomes more stable. The equilibrium between cuprous and cupric ions in presence of metallic copper was investigated with different compounds, and the results confirm the theoretical deductions.

Absorption Spectra of Unsaturated Ketones

THE absorption spectra of a number of β-unsaturated ketones have been examined by L. K. Evans and A. E. Gillam (*J. Chem. Soc.*, 815; 1941). Woodward (*J. Amer. Chem. Soc.*, **63**, 1123; 1941) has tabulated the wave-lengths of the absorption maxima of many ketones, and his data show that they fall into three classes according to the substitution of the C=C—C=O group, the locations of the intense absorption bands being as follows: monosubstitution (α or β), 2250 ± 50 A.; disubstitution (αβ or ββ), 2390 ± 50 A.; trisubstitution (αββ) ± 2540 ± 50A. The nature of the substitution of the chromophoric group in these compounds can thus be predicted from the location of the main absorption band. Evans and Gillam find that, with very few exceptions, this generalization is well obeyed, which increases the usefulness of absorption spectra in the elucidation of organic structure. The study of the effect of substituting simple αβ-unsaturated ketones with methyl groups showed that a larger bathochromic effect is produced by substitution on the β-carbon atom than by substitution on the α-carbon atom. Other types of compounds are also discussed in the paper.

Measurement of the Flow of Liquids and Gases

A USEFUL summary of methods used for measuring the flow of liquids and gases is given in a paper by E. Ower and the subsequent discussion (*Trans. Inst. Chem. Eng.*, 18, 87; 1940). The various types of instruments used are described and the methods of calculation discussed, and there is a short bibliography of recent literature.

Time Bases

O. S. PUCKLE, in a paper read before the Institution of Electrical Engineers on February 4, refers to the development of various types of time bases employing hard and soft valves, both for general- and special-purpose applications, the aim of the paper being to elucidate the principles involved rather than to describe the actual instruments in detail. Several little-known devices are described, and the highly important technique of producing and controlling pulses is considered. The results of recent investigations into some peculiarities of the gas-discharge triode are included, and presented in the form of an appendix.

Radial Velocity Curve of δ Cephei

INVESTIGATIONS of radial velocity curves of Cepheids have been published by Rufus and other Michigan observers, and these indicate the existence of marked relative displacements between spectral lines originating at different levels in the stellar atmosphere. These levels have been taken as equivalent to the heights of the same lines in the solar chromosphere. It is significant that Jacobsen and Mendenhall found no convincing evidence for the existence of relative displacements, and the same conclusion was reached by Petrie, who obtained about a hundred single-prism spectrograms of δ Cephei, using the same instrument as the earlier Michigan observers. H. A. Brück and H. E. Green have now discussed this subject (*Mon. Not. Roy. Astro. Soc.*, 101, 8). They have made use of a number of four-prism spectrograms of δ Cephei which had been secured with the Newall 25-in. refractor of the Solar Physics Observatory, Cambridge, and which had been originally used for a spectrophotometric study of line intensities and their variations during the cycle. These spectrograms have a dispersion of 13 A./mm. near $H\gamma$ and are in good focus over a wave-length region extending from λ 4250 to λ 4650. The negative results of Petrie and Jacobsen were confirmed, no definite relative displacements between lines of different atmospheric levels being detected. It is possible that small differences between the velocity curves of groups of neutral iron and ionized titanium lines exist, and there is some evidence for relative shifts in the case of the neutral calcium line λ 4425·6.

Solar Parallax and Mass of the Moon

THE Astronomer Royal has published a paper on "The Solar Parallax and the Mass of the Moon from Observations of Eros at the Opposition of 1931" (*Mon. Not. Roy. Astro. Soc.*, 101, 8); this is a summary of his complete results (*Mem. Roy. Astro. Soc.*, 66, Part 2). Independent determinations from observations of R.A. and Declination are in good agreement and the value adopted for the solar parallax is 8·7904″ ± 0·0010″. The probable error which has been assigned to the final value of the solar parallax is based on the high internal accordance of the results, and the question arises regarding a possible systematic source of error due to differential atmospheric dispersion. A discussion of this problem shows that the effects of colour differences between Eros and the reference stars tend to assume a random nature and the general effect is small. A description of the procedure adopted for the determination of the constant of the lunar equation is given, and the value derived from the Eros observations is 6·4390″ ± 0·0015″, and from this and the solar parallax the reciprocal of the mass of the moon is 81·271″ ± 0·021″. From this value and that of the constant of precession, 5493·156″, the computed value of the constant of nutation is 9·2266″ ± 0·0008″; this is much larger than the adopted value, 9·210″. An unexplained discordance has existed between the observed value of the constant of nutation and the value inferred from the observed values of the constant of precession and the mass of the moon, and it is remarkable that the new value of the mass of the moon has increased this discrepancy. It is highly desirable that an accurate value of the constant of nutation should be determined from observations specially planned for the purpose.

CHEMOTHERAPEUTICAL USE OF HALOGENIZED PHENOLS AS EXTERNAL DISINFECTANTS

By PROF. BERNHARD ZONDEK

Rothschild Hadassah University Hospital and Hormone Research Laboratory, Hebrew University, Jerusalem

FOLLOWING the detection of large quantities of œstrogenic hormone in pregnant mare urine[1], we have observed that mare urine remains for months without decomposing. Germs inoculated in long-standing urine did not multiply. The disinfecting action of horse urine is due to phenol bodies present in it (1 gm. per litre). Human urine contains 100–150 mgm. free phenol per litre urine and 150–250 mgm. combined phenol.

The fact that large quantities of phenol are eliminated in the urine encouraged us to study the chemotherapeutic use of the phenol bodies in human beings, in spite of the fact that Robert Koch and Paul Ehrlich had pointed out in their classical studies on this subject that no internal disinfection is possible by means of external disinfectants. Bechhold and Paul Ehrlich[2] ascribed the failure of this method to the fact that the halogenized phenols studied by them (tetra-bromo-*o*-cresol, hexa-bromo-di-oxy-diphenyl-carbinol, etc.), although not causing precipitation, developed only a limited activity in serum.

In the following a brief account is given of our investigations, as a result of which it became apparent that the external disinfectants—the halogenized phenols were studied—were able to effect internal disinfection. For therapeutic use a phenol body had to be chosen which, although harmless to the organism, would have a high disinfective potency. Most promising in this respect seemed a mono-halogen-phenol containing various methyl groups. Halogenized xylenol, a substance which has been employed for many decades as an external disinfectant[3], was found most suitable. It is also a halogenized xylenol that constitutes the basic principle of 'Dettol', which is much used in England as an effective disinfectant for the surgeon's hands as well as for the genital region in obstetrics[4].

In our experiments we used mostly *p*-chloro-xylenol (1, 3-methyl, 5-oxy, 2-chloro-benzene), briefly referred to here as *CX*. We also studied the chemotherapeutic action of several esters and ethers of *CX* (sodium sulphate ester, acetate ester, benzoate ester, ethyl ether, methyl ether). Furthermore, we examined *ortho-iso*-propyl-*CX* and *sec.-iso-amyl-CX*.

The disinfective action of *CX in vitro* was found to be 25–30 times as strong as phenol[5]. In several experiments we found that *CX* is able to destroy typhoid germs as well as proteus or *B. coli* in dilutions of 1 in 10,000 and staphylococci in dilutions of 1 in 20,000 within 60 minutes.

In contrast to the results of Paul Ehrlich's experiments, we found that *CX* exercises a protective effect *in vivo*. Although it was not possible to save mice infected with streptococci, the experiments gave positive results when rats were infected with pneumococci. It was only in some of these experiments that we succeeded in saving the rats from this deadly pneumococcal infection. Parallel experiments with sulphapyridine gave similar results.

A colorimetric method for the quantitative determination of *CX* in the urine and blood of animals and men was elaborated in co-operation with Dr. Benyamin Shapiro. This method will be described elsewhere.

An oily solution of 10 per cent *CX* was found most suitable for parenteral application in man. Good results were also obtained with a mixture of *CX* and *CX*-benzoate, 10 c.c. of which contained 2 gm. of the active substance. These preparations had to be injected deep intragluteally. The disadvantage of the parenteral route of administration is the occasional occurrence of painful infiltrations.

Following observation made in 1929[6], that œstrogenic hormone, which is also a phenol body, is absorbed by the skin, we have also studied the behaviour of halogenized phenol in this respect. The quantities of *CX* excreted during five days after injection of 1 gm. *CX* intramuscularly in a rabbit and after rubbing in 1 gm. *CX* in the form of an ointment on the shaved back of a rabbit were found to be the same, approximately 15 per cent. It thus follows that *CX* is absorbed through the skin, circulates in the blood and is excreted with the urine.

Percutaneous application in man in the form of a 30 per cent *CX* ointment never causes any secondary effects and may be given in large doses (10–20 gm. of the active substance a day). The following observations indicate that both the parenteral as well as the percutaneous application of *CX* in man has a chemotherapeutic effect:

(*a*) After administration of small doses the urine excreted remains sterile for many weeks. In this respect *CX* is more than seven times as active as sulphanilamide and six times as active as sulphapyridine. The total elimination of free *CX* amounts to 2–8 per cent, its excretion being greater in alkaline urine as compared with acid urine. It is thus advisable to give sodium bicarbonate and sodium lactate, before treatment with *CX*, so as to obtain an alkaline urine (*p*H 7·5–8·5). In human urine 31 per cent of the *CX* administered is eliminated in a combined form; 14 per cent is combined with glycuronic acid and 17 per cent with sulphuric acid.

(*b*) Twenty-four hours after inoculation of 5–50 staphylococci in 2 c.c. of defibrinated blood, 100–800 million staphylococci may be counted. When the blood of *CX*-treated patients is used for the same experiment, the multiplication of these organisms is hindered, making any count impossible; nevertheless, the organisms are not all destroyed, since on further passage of this blood to blood agar, staphylococci do grow. This powerful bacteriostatic effect is possible after the intramuscular or percutaneous application of only 2·5 gm. *CX*. So far as the bacteriostatic activity in the blood is concerned, the treatment with *CX* is far more effective than with sulphanilamide and more active than with sulphapyridine and sulphathiazole. The antibacterial action of *CX* in blood has so far been tested against staphylococci only.

(*c*) While organisms inoculated in the contents of cantharide blisters of normal men multiply rapidly, strong antibacterial effects are possessed by the same in *CX*-treated patients. This is an indication that *CX* penetrates the body tissues.

So far as the mechanism of action of *CX* is concerned, we found the following. Bouillon containing 100 mgm. *CX* per litre will destroy inoculated staphylococci. In order to obtain a similar effect

with serum, 5–10 times higher doses of *CX* must be added. This is in conformity with Paul Ehrlich's experiments, in which serum was found to hinder the activity of halogenized phenols. From our experiments it is apparent that this inhibitory effect is due to proteins, since after addition of serum-protein to bouillon, higher amounts of *CX* were needed to inhibit the growth of bacteria, as compared with clear bouillon. After treatment with *CX*, it is the whole blood and not the serum that possesses antibacterial properties. We may thus conclude that *CX*, or a substance derived from it, attaches itself to the red blood corpuscles. The blood bactericidity of *CX*, which was examined in 500 cases, begins after 24 hours, at a time when no *CX*, or only a small amount of it, is present in the blood. We may thus assume that the active antibacterial substance is formed in the blood and is possibly not identical with *CX*. The bactericidal substance is bound to the red blood corpuscles since bactericidity disappeared once the erythrocytes hæmolized.

The clinical results obtained with *CX* will be reported in detail elsewhere. Here we may briefly note the following. The percutaneous application of 15 per cent *CX* ointment is an excellent means for the disinfection of the operative field, the skin remaining sterile for 12 hours. By the percutaneous application of 3 gm. *CX*, an antibacterial activity of the blood is simultaneously provoked, thus providing some protection against possible post-operative infection. Since this anti-bacterial effect lasts for 24–48 hours, a further application of *CX* is advisable. The same is true of its use in obstetrics. In these cases at least 3 gm. of the active substance must be rubbed in the vulva, in order to combine the disinfection of the external genital organs with an antibacterial effect in the blood.

We have obtained most encouraging results in the treatment of urogenic infections (cystitis, pyelitis). Infections due to staphylococci and proteus react particularly well, and a disinfection of the urine is obtained. Infections due to *B. coli* react clinically well, that is, the symptoms disappear after a short time, but in most cases the *B. coli* are not destroyed, a bacteriostatic effect thus being obtained. The treatment lasts five days, the daily dose of *CX* amounts to 10–20 gm., which is given percutaneously with 1–2 gm. parenterally.

Up to now we have treated seven cases of puerperal septic infections. In two cases of streptococcal pyæmia, the treatment failed to give good results. In the other five cases the patients recovered. These included two cases of staphylococcal pyæmia. In septic general infections the treatment—mostly percutaneous—should last at least fourteen days. Our experience in the treatment of other infectious diseases is still limited.

It should be especially emphasized that treatment with halogenized phenols in man is harmless and causes no secondary effects.

[1] Zondek, B., *Klin. Wschr.*, **9**, 2285 (1930).

[2] Bechhold, H., and Ehrlich, P., *Z. phys. Chem.*, **47**, 173 (1906).

[3] Schottelius, M., *Münch. Med. Wschr.*, **59**, No. 49 (1912); Raschig, F., *Z. angew. Chem. Ztbl. tech. Chem.*, **38**, 1939 (1912).

[4] Colebrook, L., *J. Obst. and Gyn. British Emp.*, **40**, No. 6 (1933); *Brit. Med. J.*, 723 (1933).

[5] Klarmann, E., Shternov, V. A., and Gates, L. W., *J. Amer. Chem. Soc.*, **55**, 2576 (1933); Lockemann, G., and Kunzmann, Th., *Angew. Chem.*, **46**, 296 (1933); *Ztbl. Bakteriol.*, I, **145**, 61 (1933).

[6] Zondek, B., *Klin. Wschr.*, **8**, 2229 (1929); *Schweiz. med. Wschr.*, No. 49 (1935).

FOLK-LORE OF ERUPTIVE FEVERS

AT a meeting of the Section of the History of Medicine of the Royal Society of Medicine on February 4, Dr. J. D. Rolleston read a paper on the folk-lore of eruptive fevers, in which he said that during the last two Congresses of the International Society of the History of Medicine held at Madrid in 1935 and at Zagreb and Belgrade in 1938, medical folk-lore formed a considerable part of the proceedings. In contrast with some diseases, particularly whooping-cough, pulmonary tuberculosis, skin diseases, especially warts, and eye diseases, the folk-lore of the eruptive fevers is somewhat scanty.

The abundance of folk-lore connected with each exanthem appears to be directly related to the antiquity and importance of the disease, so that the amount of folk-lore of smallpox, measles, scarlet fever and chicken-pox is represented in the order named. There does not seem to be any folk-lore connected with German measles, which did not receive general recognition as an independent disease until after the International Congress of Medicine held in London in 1881.

As regards the causation of the acute eruptive fevers there do not appear to be any popular causes for their occurrence, such as catching colds, sexual excess, or punishment for an evil life, as in the case of pulmonary tuberculosis, skin diseases and venereal diseases. With the exception of smallpox, none of them has been assigned a divine origin. In accordance with medical folk-lore generally, prophylaxis was rarely employed in the acute exanthemata except smallpox. There were many examples of the same treatment being applied to the eruptive fevers generally, such as overheating the patient or flagellation with nettles with the object of bringing out the rash, the use of red blankets and bed-hangings and coprotherapy.

As regards the causation of smallpox, numerous examples were given by Sir James Frazer and others of outbreaks of smallpox in different parts of the world being attributed to a goddess or, much more rarely, to a god, and of the various means employed to win their favour or prevent their visitation. Examples were also given of the avoidance of calling the deity or the disease by its proper name and using instead some more or less euphemistic words or phrases. The supposed transfer of smallpox to animals, plants and inanimate objects in accordance with folk-lore practice in other diseases was also described. Prophylaxis of smallpox by inoculation was a folk-lore method carried out by old women in Turkey long before it was adopted by the medical profession in Great Britain and France. Besides overheating the patient, the folk-lore treatment of smallpox consisted mainly of animal and plant remedies and the invocation of patron saints.

There are more popular errors concerned with measles than with any of the other acute exanthemata, such as the belief that it is a trivial disease, that it cleans out the system and makes the child less liable to contract other diseases, and that patients should not be washed, owing to the delusion that such an act tended to drive the rash inwards. In none of the acute exanthemata is coprotherapy more frequently employed than in measles, especially in the early stage of the disease. There were several examples of the belief that measles could be best treated by transfer of the disease to animals and plants, and apart from any idea of transfer numerous

folk-lore remedies were supplied by animals, plants and minerals.

Doubtless owing to scarlet fever having been isolated as an independent disease much later than smallpox or measles, its folk-lore is much less than that of the other two diseases. Popular errors connected with it included the view that the term 'scarlatina' meant a mild form of the disease, that second attacks did not occur, and that a mild attack could transmit only a mild attack to another person. Instances are occasionally met with in which scarlet fever was supposed to be transferred to animals, such as a dog, bear or sheep. Amulets were sometimes worn for prevention of the disease. There does not appear to be any patron saint connected with scarlet fever as in smallpox or measles.

Although chicken-pox is probably as old as smallpox, owing to its usually mild character and uncomplicated recovery very little folk-lore is connected with this exanthem, but it has had a large number of popular synonyms which are out of proportion to its real significance. The term 'chicken-pox' was first used in medical literature in 1694 by Richard Morton, who spoke of a form of smallpox "called in the vernacular the Chicken-Pox". Fuller also in 1730, in a paragraph in his "Exanthematologia", wrote: "I have adventur'd to think that this is that which among our women goeth by the name of Chicken-pox."

Another example of folk-lore anticipating scientific medicine is furnished by the fact recently mentioned by W. N. Pickles that the connexion between herpes zoster and chicken-pox was known at Aysgarth in Yorkshire long before this connexion was demonstrated by Bokay in 1892.

FORTHCOMING EVENTS

(Meetings marked with an asterisk are open to the public)

Friday, March 20—Saturday, March 21

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (DIVISION FOR THE SOCIAL AND INTERNATIONAL RELATIONS OF SCIENCE) (at the London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1).—Conference on "European Agriculture: Scientific Problems in Post-War Reconstruction".

Friday, March 20

10.15 a.m.—"Measures for Reconstruction". (Chairman: Sir John Russell, F.R.S.)

2.15 p.m.—"Economic and Kindred Problems". (Chairman: Mr. F. L. McDougall.)

Saturday, March 21

10.15 a.m.—"The Future Betterment of European Farming". (Chairman: Dr. A. J. Drexel Biddle.)

2.15 p.m.—(Chairman: Sir John Russell, F.R.S.)

Monday, March 23

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Mr. H. P. Rooksby: "X-Ray Technique in the Industrial Laboratory". (Cantor Lecture, 2; Subsequent lecture on March 30.)

ROYAL GEOGRAPHICAL SOCIETY (in the Kinematograph Theatre of the Imperial Institute, Prince Consort Road, London, S.W.7), at 5 p.m.—Geographical Sound Films, by courtesy of the Belgian Government: "Nos Soldats d'Afrique"; "Musée du Congo Belge"; and "Sous l'étoile d'or", with commentary in French.

Tuesday, March 24

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 2.30 p.m.—Sir Lawrence Bragg, F.R.S.: "Metals", 4: "Strength and Flow of Metals".*

Wednesday, March 25

GEOLOGICAL SOCIETY OF LONDON (at Burlington House, Piccadilly, London, W.1), at 3 p.m.—Annual General Meeting. Prof. H. L. Hawkins, F.R.S.: "Some Episodes in the Geological History of the South of England" (Anniversary Address).

Thursday, March 26

INSTITUTION OF NAVAL ARCHITECTS (at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2), at 2.30 p.m.—Eighty-third Annual Meeting. 3 p.m.—Sir Stanley V. Goodall, K.C.B.: "Sir Charles Parsons and the Royal Navy" (Parsons Memorial Lecture).

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 2.30 p.m.—Sir Lawrence Bragg, F.R.S.: "Physicists after the War".*

SOCIETY OF CHEMICAL INDUSTRY (FOOD GROUP) (JOINT MEETING WITH THE BRISTOL SECTION) (in the Chemical Department, the University, Bristol), at 6.30 p.m.—Prof. F. L. Engledow: "Science and the Land" (Jubilee Memorial Lecture).

Friday, March 27

INSTITUTION OF CHEMICAL ENGINEERS (at the Connaught Rooms, Great Queen Street, London, W.C.2), at 11 a.m.: Twentieth Annual Corporate Meeting.

APPOINTMENTS VACANT

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

PRINCIPAL OF THE TECHNICAL COLLEGE, COATBRIDGE—The Director of Education, Lanarkshire House, 191 Ingram Street, Glasgow, C.1 (March 25).

DEPUTY SUPERINTENDENT, Telegraph Works, Calcutta, for duties as PRODUCTION ENGINEER FOR TOOL AND LIGHT MACHINE SHOPS—The Secretary, Central Register (Section D.261), Ministry of Labour and National Service, Queen Anne's Chambers, Westminster, London, S.W.1 (March 28).

ASSISTANT IN THE NUTRITION DEPARTMENT—The Secretary, Pharmaceutical Society of Great Britain, 17 Bloomsbury Square, London, W.C.1 (April 7).

ASSISTANT (MALE) TO THE PUBLIC ANALYST—The Secretary, Health Department, Grey Friars, Leicester.

PROFESSOR OF CIVIL ENGINEERING AND DIRECTOR OF THE SCHOOL OF ENGINEERING at Canterbury College, Christchurch, New Zealand—The Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Economic Proceedings of the Royal Dublin Society. Vol. 3, No. 9: Notes on some Lepidopterous Pests on Fruit Trees, and their Parasites, in Ireland during 1941. By Dr. Bryan P. Beirne. Pp. 107–118. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) 1s. [172

Committee on Skilled Men in the Services. Second Report and a Memorandum by the War Office. (Cmd. 6339.) Pp. 74. (London: H.M. Stationery Office.) 1s. 3d. net. [232

Carnegie Trust for the Universities of Scotland. Fortieth Annual Report (for the Year 1940–41) submitted by the Executive Committee to the Trustees on 16th February 1942. Pp. iv+80. (Edinburgh: Carnegie Trust for the Universities of Scotland.) [232

Other Countries

Canada: Department of Mines and Resources, Mines and Geology Branch: Bureau of Geology and Topography: Geological Survey, Memoir 229: Noranda District, Quebec. By M. E. Wilson. (No. 2461.) Pp. vii+162 (14 plates). 50 cents. Memoir 231: Bousquet-Joannès Area, Quebec. By H. C. Gunning. (No. 2463.) Pp. v+110. 25 cents. Memoir 234: Mining Industry of Yukon, 1939 and 1940. By H. S. Bostock. (No. 2466.) Pp. iii+40. 25 cents. (Ottawa: King's Printer.) [112

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