

# NATURE

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## THE UNITED NATIONS: A PROPOSAL FOR INTERNATIONAL SECURITY

FOR more than five years of war, the conditions of peace and the means and organization to ensure peace have been discussed with a thoroughness and earnestness accentuated if anything by the vicissitudes and ordeal through which the United Nations have passed. The causes of the failure of the League of Nations have been probed and analysed dispassionately, and the reasons for the comparative success of other international agencies such as the International Labour Organisation have been scrutinized with the view of throwing the fullest light on the principles to be served in any subsequent attempt to build a new world organization. Even at the end of 1939, serious studies were being initiated by Political and Economic Planning and by the Royal Institute of International Affairs into the various aspects of international co-operation. The quality of the resultant studies and much of the voluminous literature of the ensuing years, with such outstanding books as Prof. E. H. Carr's "Conditions of Peace", Lord Cecil's "A Great Experiment", Mr. Harold Butler's "The Lost Peace" and Mr. R. M. Reyners' "The Twenty Years' Truce", has reached a level that provides solid ground for believing that a much more scientific approach to the whole question of world organization has become possible.

Moreover, it is realized that there are lessons to be drawn from the Armistice of 1918, and the consequences which flowed from the premature termination of the organizations set up to forward the Allied war effort, such as the Inter-Allied Shipping Control. That realization is reflected in an obvious desire to see that such agencies as the Combined Raw Materials Board, the Middle East Supply Centre and the like, shall be used to serve the purposes at least of the interim period of re-settlement and reconstruction.

That much can be discerned as a matter of general agreement, whether or not we accept in full the arguments of the functional school of thought, as represented by Prof. Mitrany, who see in the development of functional services to meet specific ends and needs the most hopeful way to build up a world organization in which resort to war is obsolete. Others, such as the American spokesmen Mr. Walter Lippmann and Mr. Sumner Welles, impressed by the Atlantic Community or by Pan-America, find the solution in regionalism; while others again, such as Sir John Fisher Williams, insist on the importance of dealing with the causes of international differences by peaceable discussion before they become critical, and on limiting action to what is possible at the present stage of human development. Another school of thought urges federation as the solution, either on the lines outlined by Clarence Streit in "Union Now" or in a more limited form by Mr. Lionel Curtis. Others again, recognizing that an international organization which is to achieve its purposes must have strength to give effect to its decisions, have



concerned themselves with the ways and means of putting teeth into the Covenant.

In contrast to the discussions on world organization earlier in the War, there has been a significant tendency of late to reconsider the verdict on the League of Nations, and to attribute its failure not to the machinery but to the lack of drive and sincerity behind it. Writing to Lord Cecil on his eightieth birthday recently, the Prime Minister said: "This war could easily have been prevented if the League of Nations had been used with courage and loyalty by the Associated Nations", and went on to speak of acting "in accordance with the spirit and principles of the League, but clothing those principles with the necessary authority". Any workable system must be a compound of realism and idealism, and in a problem of such complexity all simple formulæ are rightly suspect.

The tentative proposals for the establishment of a general international organization under the title of "The United Nations" which have now been published as an outline agreement reached between the delegations of Great Britain, the United States, the U.S.S.R. and China at Dumbarton Oaks, Washington, during August 21-October 7 on the maintenance of peace and security after the War fairly reflects this tendency. Superficially at least, they bear a marked resemblance to the old League of Nations. Membership of the organization is open to all peace-loving States, and the organization, like the League of Nations, will possess four principal organs: a General Assembly, a Security Council, an International Court of Justice and a secretariat, with such subsidiary agencies as may be found necessary. All members of the organization will be members of the General Assembly. While the General Assembly may initiate studies and make recommendations for promoting international co-operation in political, economic and social fields or for co-ordinating the policies of agencies in such fields, it will not consider concurrently any matter relating to the maintenance of international peace and security which is being dealt with by the Security Council. Again, while it may consider the general principles of co-operation in this field, questions in which action is necessary will be referred by the Assembly to the Security Council before or after discussion. These are important differences from the League's constitution.

The Security Council is to consist of eleven members, five permanent and six elected by the General Assembly for a term of two years, three retiring and not being eligible for immediate re-election. The permanent members designated are the United States, the United Kingdom, the Union of Soviet Socialist Republics, China, and, in due course, France. This Security Council will be charged with the primary responsibility for the maintenance of international peace and security.

Some of the draft proposals recall in substance the articles of the Covenant, but there are notable omissions and additions. The Security Council is empowered to investigate any dispute or situation which may lead to international friction or give rise to a dispute, in order to determine whether its

continuance is likely to endanger the maintenance of international peace or security, and any State, whether a member or not, may bring any such dispute or situation to the attention of the General Assembly or of the Security Council. But while Article 2 of the Covenant is thus shadowed, there is nothing that corresponds with Articles 13 and 15. The Security Council may call upon the parties to such a dispute to settle their differences in accordance with their obligation under the Charter by negotiation, mediation, conciliation, arbitration, judicial settlement or other peaceful means, as contemplated by Article 12, but neither the Security Council nor the General Assembly is charged with the duty either of conciliation or of investigation and report.

It is in the section which replaces the sanctions clauses of the Covenant that the major departures from the old League of Nations appear. The Security Council, having determined the existence of a threat to the peace, is empowered to determine what diplomatic, economic or other measures not involving the use of armed force are required to maintain or restore peace and security, and to call upon members of the organization to apply such measures. If the Security Council considers such measures inadequate, it is also empowered to take such action by air, naval or land forces as may be necessary. To that end, all members of the organization, not merely the members of the Council, are to accept the obligation not only to apply the diplomatic, economic and like sanctions but also "to make available to the Security Council, on its call and in accordance with a special agreement or agreements, concluded among themselves, armed forces, facilities, and assistance necessary. . . ." In particular, for urgent military measures, there are to be "held immediately available by the members of the organisation national air force contingents for combined international enforcement action".

Plans for the application of armed force are to be made by the Security Council with the assistance of a Military Staff Committee, responsible for the strategic direction of the armed forces placed at the disposal of the Security Council. This Committee will consist of the chiefs of staff of the permanent members of the Security Council or their representatives, and is clearly a continuation of the present Joint Chiefs of Staff Committee, although any member not permanently represented on the Committee may be invited by the Committee to join it. The main responsibility for the exercise of force is placed squarely on the shoulders of the Great Powers, who alone possess the necessary resources to wage war effectively.

Beyond these measures, the Charter contemplates the fostering of regional arrangements for the maintenance of peace and security and the settlement of local disputes, and the Security Council will also utilize such regional arrangements for enforcement action under its authority where appropriate. As already indicated, there is to be an International Court of Justice, constituted and functioning either by a new statute, or by a continuation or modification of that constituting the present Permanent Court of International Justice. Similarly, the clauses



relating to the secretariat are obviously modelled on Geneva experience.

In place, however, of those Articles of the Covenant relating to social activities and international bureaux, there is a separate chapter in the proposed Charter, covering international economic and social co-operation. Here it is declared to be the purpose of the organization to facilitate solutions of international economic, social and other humanitarian problems, and promote respect for human rights and fundamental freedoms, with the view of creating conditions of stability and well-being which are necessary for peaceful and friendly relations among nations. The responsibility for the discharge of this function is vested in the General Assembly, acting through an Economic and Social Council consisting of representatives of eighteen members of the organization, and elected for terms of three years by the General Assembly.

This Economic and Social Council would be empowered to make recommendations on its own initiative in international economic, social and other humanitarian matters, and to receive and consider reports from the related specialized organizations and co-ordinate their activities. It would establish an economic commission, a social commission and such other expert commissions as may be required. The Council would be provided with a permanent staff constituting part of the secretariat of the organization.

The proposals thus outlined are loosely worded and there are other questions reserved for further consideration besides the thorny one of voting procedure in the Security Council specifically mentioned. They represent a framework and not a completed edifice like the League Covenant. Within that framework, it should be possible to build a practical edifice, though in some respects the proposals are so wide that it is not easy to discern even yet the precise shape of the organization to be hammered out in due course by the drafting committee and by that public debate which, as Lord Cranborne has indicated, the Government has invited in publishing the proposals. It is essential, as was emphasized by Lord Cranborne, that the people of Great Britain and of other countries should understand the reasons for the main provisions of a peace settlement and how it came to be made, and that they should accept, and know that they are accepting, a share of the responsibility for these arrangements and for maintaining them in the future as the agreed means of preserving peace and prosperity in the world.

Conversely, it is true, as recent debates on the German problem have indicated, that whatever settlement is reached must be one which will command the support of British opinion not merely to-day but in twenty or thirty years time. From that point of view it is important to note that the proposals embody much that is common ground. They follow indeed so much on the lines of the League of Nations that at first sight it is difficult to see why the Covenant of the existing League could not be re-shaped for the present purposes. It can at any rate be said that it is proposed to utilize past experi-

ence to the full and to build on existing structures so far as possible. The scheme outlined under the Economic and Social Council should provide, for example, for continuing the work of the International Health Organization, and other technical organizations of the League.

Furthermore, the proposals meet the point on which there is now general agreement, that any system which is to be workable must take account of the special status of the Great Powers and not pretend, in the name of collective security, to diffuse the responsibility for questions of war and peace among those who could not execute the decisions. Next, they meet the argument that a system to engage the idealism of mankind must be designed to solve the great majority of questions by free agreement and without the use of force. Clearly the proposals now drafted could cover both the utilization for peacetime purposes of the regional and functional organizations established to serve the present purposes of the United Nations and provide for their effective co-ordination. There is at least a hint that the organization will ultimately address itself to the positive side of security—the elimination of the causes of war themselves by the evolution of a science of peaceful change—and it may well be that in the end the Economic and Social Council rather than the Security Council will be the important organ.

There are yet many points to be cleared up. National sovereignty still figures prominently, and with the reservation on internal causes of dispute may well be a source of danger pending the further evolution of international law or the overlaying of the conception of security on frontier lines with a natural growth of common activities and administrative agencies which make frontier changes meaningless.

Meanwhile, it should be remembered that, like the Bretton Woods and Hot Springs Conferences, that at Dumbarton Oaks stands for one of a series of conferences designed to ensure that the United Nations remain united in peace. It must not be forgotten, for example, that no machinery of security will withstand the strain of mass unemployment, falling standards of living and social and economic chaos. However excellent in themselves the proposals of the Dumbarton Oaks Conference may be, their success will depend on the sincerity and faithfulness with which the policies of the United Nations Relief and Rehabilitation Agency and of the Food and Agricultural Organization initiated at Hot Springs are carried out, and on the removal of trade barriers and the harmonization of national policies to maintain a high and stable level of employment adumbrated at Bretton Woods. It will also depend, too, on how far and thoroughly the implications of the proposals are understood by the people of Britain and of the other United Nations, and the extent to which they are prepared to make the sacrifices necessary to establish an effective organization through which the spirit of scientific inquiry can enter fields where prejudice and selfishness and the habit of judging in one's own cause have too long reigned supreme.



## SNAKES OF INDIA

The Fauna of British India, Ceylon and Burma, including the whole of the Indo-Chinese Sub-Region

(Published under the patronage of the Secretary of State for India.) Edited by Lt.-Col. R. B. S. Sewell. Reptilia and Amphibia. Vol. 3: Serpentes. By Malcolm A. Smith. Pp. xii+584. (London: Taylor and Francis, Ltd., 1943.) 45s.

**H**ERPETOLOGISTS, especially those in India, will greet with warm satisfaction the appearance of a new book dealing with the anguifauna of the Indo-Chinese sub-region. The revision of previous work has been eagerly awaited for some years, as nothing has appeared in book form dealing with this specified area since Boulenger's "Catalogue" in 1896.

The work of revision has been entrusted to Dr. Malcolm A. Smith, and nobody better qualified could have been chosen. With his high scientific attainments, he combines the unusual distinction of having by a long residence in Siam been brought into intimate association with living snakes in their natural haunts, a distinction not usually enjoyed by writers of such books. He has made an exhaustive survey of the notes and papers that have been contributed to various journals by various writers during the last forty or so years, subjected them to a searching analysis, and corrected nomenclature where necessary. In addition he has reviewed the work of every earlier herpetologist, and incorporated the result of their researches with his own.

The first thirty-five pages of this quarto volume are introductory; the later pages up to 526 are devoted to the description of some 389 species, with useful keys to assist identification. Valuable appendixes follow dealing with the Hardwicke and Russell collections, and there is a very complete list of the bibliography on the subject.

The introduction is crowded with facts, and the information therein contained should serve to satisfy the curiosity of the most inquisitive mind. The subject-matter includes numerous anatomical considerations, evolution, classification, geographical distribution, habits, etc. Each topic is considered under a separate heading, and the facts dealt with tersely but adequately. The grain of the matter is there divested of its husk.

In the realm of anatomy, special remark is called for concerning the curious and complex system of facial and salivary glands, well illustrated on pages 12 and 13, with further remarks later in the text; also the variously disposed and mysterious system of subcutaneous glands, elaborated still further in the text under individual species, and well illustrated. All this information is entirely new, and accounts for the silence on the subject of previous authors.

Another matter now introduced to our notice concerns the male genitalia. These very remarkable twin organs have been little studied in the past, but remarks accompanied by good illustrations showing them *in situ* in their quiescent state are furnished.

There is no reference to the occipital condyle. This process, so vastly different in the lowly organized families such as *Uropeltidae*, compared with the more highly organized, deserves special attention and may prove of some influence in the separation of families.

I have scanned the pages of this book closely, and find that no branch of the subject has received more favoured attention than another. Every matter has

been most thoroughly examined and treated. The scientific man will appreciate and praise every part of the volume. The unscientific reader will find the introductory part intelligible and richly informative.

I am in accord with nearly all Smith's views and his corrections of others' work, including my own. He has very rightly rigidly observed the law of priority, which some of his predecessors have not respected. As a consequence the multiplicity of changes in nomenclature is truly deplorable. Had all previous authorities been equally meticulous, the necessity for reviving earlier names that should never have been discarded would not have arisen; further, workers in this field of zoological research would have been spared the vexation and inconvenience engendered by abandoning names with which they had long been familiar, and adopting new ones.

The substitution of *Leptotyphlopidae* for the family *Glauconidae*, and of *Anilidae* for *Ilysiidae* will not be challenged; about the abolition of *Amblycephalidae*, more hereafter.

At least twenty-three of the eighty-nine genera dealt with have had their names altered from those used in Boulenger's "Catalogue"! I have critically examined these, and regard the grounds for change unassailable in every case, most of them depending on the operation of the law of priority. They are too numerous to review in detail, but a few demand special remark. It has long been apparent that the genera *Coluber*, *Zamenis* and *Ablabes* (now *Opheodrys*) needed revision, and I think the changes now effected are well founded and therefore should escape alteration by future taxonomists.

The genera *Ptyas* and *Elaphe* have been revived at the expense of *Zamenis* and *Coluber*, and there has been some reshuffling of other species. The restoration of *Ptyas mucosus* to generic rank will not be contested. I had hoped to see this species treated somewhat differently. It is unique in the arrangement of its scale rows, of which seventeen in the anterior half of the body are reduced to sixteen shortly behind. This reduction is effected by the disappearance of the uppermost costal row on the left side. A similar reduction of scale rows, from seventeen to sixteen, and by the same method, occurs in all the species of *Zaocys*, but in the neck instead of the body. This, together with other very close affinities, would warrant the abolition of the genus *Zaocys* and the inclusion of its species in the genus *Ptyas*. The affinities of *korros* and *mucosus* are not so marked as those of *mucosus* with the species of *Zaocys*, and warrants the exclusion of *korros* from *Ptyas*. *Simotes*, separated from *Oligodon* on false claims, has been very properly suppressed.

*Ahaetulla*, a revival on grounds of priority, embraces and supersedes the two genera *Dendrophis* and *Dendrelaphis*, separated on insufficient grounds.

The revision of the sea-snakes and the amended classification constitute a great advance. The arrangement of this group is now intelligible to all, where previously it was in part unintelligible even to experts. The bewildering confusion that previously existed has been swept away and order established where chaos reigned. The basis on which the classification now stands is sounder than ever before. The genus *Distira*, based on false premises, has been abolished, and eighteen species recognized by Boulenger have been placed with *Hydrophis*, which, in spite of this increase, now only numbers fifteen species where Boulenger recognized twenty-two. The recognition of the genera *Kerilia*, *Prascutata* and



*Microcephalophis* and their isolation from *Hydrophis* will receive general approval. This good work might have been further extended, and genera multiplied at the expense of *Hydrophis*.

*Hydrus platurus* was the name fixed by international approval some twenty or so years ago for the species now designated *Lapemis platurus*, and it will be regretted that after such an authoritative ruling the generic name has not been upheld.

Any disturbance of the admirable treatment of the family *Colubridæ* by Boulenger is to be deprecated, except in the ranks of genera and species. Such, for example, as the elimination of the proteroglyphs from that family, and their elevation to the dignity of independent families. I regard this as unnecessary. To be consistent, the opisthoglyphs deserve similar treatment and equal rank, which is not conceded to them.

Again, the association of the aglyphous African *Dasypeltis* with the opisthoglyphous Indian *Elachistodon* and their inclusion in one family will be severely criticized. I prefer Boulenger's views. If this arrangement stands, each deserves to be placed in an independent sub-family.

The abolition of the family *Amblycephalidæ* is a bold departure from previous views. The six species that used to figure in that family have now been deposed from the exalted position they occupied above the family *Colubridæ*, and are placed on a low rung of the *Colubridæ* ladder. *Haplopeltura* retains its title, but *Amblycephalus* has been superseded by its earlier title *Pareas*. The dentition of the latter is distinctive, and differs from any species of *Colubridæ* that I have dissected. The cephalic lepidosis is remarkably distinctive, and also differs from that of any other Colubrid known to me.

The generic name of the cobra should be altered to *Naga*. It was clearly the intention of Linnæus to attach to it the name by which it is universally known to the natives of India—"nag" (pronounced narg). It is probable that this information was conveyed by letter and that he mistook the 'g' for a 'j'. *Naja*, and still less the *Naia* of some authors, have no meaning. Under the amended and more elastic rules of nomenclature referred to on page 33, such an alteration would be permissible. The suggestion might well be referred to the next session of the International Committee of Nomenclature.

No remark as to location accompanies the list of Russell's types on page 531. I examined them in the Museum of the Royal College of Surgeons. Their transference to South Kensington would make them more accessible, and they would fittingly rejoin Russell's collection of skins already there.

I am glad to note that doubts raised as to some of Beddome's localities have been upheld, and in consequence the spurious localities rejected, and habitat appropriately amended, as instanced in the case of *Oligodon splendidus*.

The map at the end of the book would be more useful if the boundaries of the tracts had been demarcated.

The artist deserves unstinted praise for the excellence of her work. The figures depicting the dorsal and ventral markings especially are very beautifully executed. The multiplication of such figures would have been advantageous.

Dr. Smith has quoted me extensively, and paid a very generous tribute to my work. He has also corrected me freely and deservedly. The fact that in compiling his book he has had close access to the

national collection at South Kensington, with the many types it contains, and also a library to consult comprising the whole of a voluminous bibliography combine to make his opinions far more authoritative than mine.

Finally, a few discrepancies have been noticed. *Dasypeltinæ* should be excluded from the synopsis of the sub-families of *Colubridæ* on page 114 so as to agree with the family status on page 403. *Oligodon subgriseus* on page 531 should read *O. tæniolatus* to agree with page 223. *Callophis trimaculatus* on page 532 should read *C. melanurus* to agree with page 420.

F. WALL.

## CEREALS AND HISTORY

### Six Thousand Years of Bread

Its Holy and Unholy History. By H. E. Jacob. Pp. xv+399+8 plates. (Garden City, N.Y.: Doubleday, Doran and Co., Inc., 1944.) n.p.

IN describing the history of bread, Mr. Jacob has, in effect, attempted to explain the political and economic history and social structure during the eras of their political ascendancy of ancient Egypt and Greece, the Roman Empire, Europe and the United States in terms of religion and of the cultivation of cereals. The result is, however, too simple to be of much interest to historians, and its value for lay readers, for whom it is obviously intended, is reduced by the paucity of dates.

Generally speaking, bread is made only from wheat and rye, and it is with these two cereals that the book is therefore chiefly concerned. A chapter is, however, devoted to maize, which was introduced into the eastern Mediterranean by the Venetians and was then widely planted in the Near East by the Turks, to whom its ease of cultivation and rapidity of growth made a great appeal. These cultural characteristics were responsible for its spread in the seventeenth century into south-eastern Europe and, in the western hemisphere, allowed the colonization of North America to proceed much more rapidly than would have been the case had wheat been the staple cereal. In southern Europe, the initial popularity of maize, which soon became the staple food of the poorer classes, declined when its association with pellagra was recognized in the nineteenth century; in the United States, however, the consumption of a mixed diet prevented the appearance of pellagra, and it was not until 1900 that the American taste changed and wheat was preferred to maize flour.

Mr. Jacob suggests that in the early days of human history new inventions would have been quickly forgotten had they not been sanctified by the local religion, but when the barbarian invasions of the Roman Empire brought the Nordic pagan religions into conflict with Christianity, the Roman agrarian techniques were lost in the resulting spiritual confusion, as a result, the Middle Ages became an era of ignorance and famine. Religion itself is shown to owe much to agriculture. Thus the cults of Demeter in Greece in the seventh century B.C. and of the maize god in Mexico in the fifteenth century A.D. were but recognitions of the importance of cereals in the food economy, while, in the Christian religion, with its controversies over the doctrine of transubstantiation, bread acquired a spiritual rather than an economic significance. Once the concept of personal freedom had been developed (a concept absent



from ancient Egypt), the coexistence of a stable political structure and of an impoverished peasant class was impossible, and the expropriation of the peasants is considered by the author as an important causal factor for the decline of the Roman Empire, for the European peasant wars of the Middle Ages and for the French Revolution. The importance of an adequate food supply (of which cereals and potatoes form the basis) in the waging of wars is further emphasized by reference to the American Civil War, the Napoleonic Wars, the War of 1914-18 and the present War.

The author points out that after the discovery of agriculture and the invention of the plough by primitive man, no important scientific agricultural advancements occurred until the seventeenth and nineteenth centuries A.D. The developments of the seventeenth century took place in England and consisted of the invention by Tull of a mechanical plough equipped with a sowing device and the evolution by Viscount Townshend of a four-year crop rotation. In the nineteenth century, developments in the United States were concerned with the technical improvement of agricultural machinery, whereas in Europe the work of Liebig and Pasteur together laid the foundations of agricultural chemistry. During his life-time, Liebig's work was unknown in the United States, and it was not until 1935, when soil erosion assumed immense proportions, that the Americans adequately realized the importance of a biological approach to the problems of soil cultivation. Mr. Jacob emphasizes that the range of climatic conditions within which wheat can be cultivated has been greatly extended by selective wheat breeding and by Lysenko's discovery of vernalization; but his cursory accounts of Mendelian heredity and of vernalization do not accord with the economic significance he rightly attaches to these two processes.

The specific history of milling and bread-making is scattered throughout the book, and is treated in rather a general and cursory way. In the case of reductional roller milling particularly, more detail concerning the various operations could advantageously have been included. The invention of mechanical mills by the Romans, and of windmills in the Middle Ages, and at the end of the eighteenth century the use by Evans in the United States of steam as the source of power for all the milling operations are regarded by the author as landmarks in the history of stone-milling. The principle of reductional grinding was first introduced in 1760 by Malisset, and the superior digestibility of the resulting flour, which unlike that hitherto produced was relatively free from finely divided bran, was soon recognized by Parmentier. It was not, however, until the invention of the roller mill in 1830 that reductional grinding and the consequent production of white flour became universal.

Mr. Jacob points out that bread was first made by the ancient Egyptians and, until the Middle Ages, when the miller became a countryman and the baker a townsman, milling was performed by the bakers. In the Middle Ages, the scarcity of grain resulted in the baking of substitute breads many of which had no nutritional value, while just prior to the French Revolution the use of potato flour in bread-making was investigated by Parmentier. After the Revolution, the consumption of rye bread gradually declined throughout Europe, but no important developments in bread-making occurred until about 1920 when the mass production of bread began. The

enrichment of white flour with vitamins and minerals in the United States—surely a landmark in the history of bread—is only discussed very briefly.

Mr. Jacob has presented an interesting historical account of cereal cultivation, and his book should stimulate among general readers an interest in anthropology and history. It is unlikely, however, to arouse much enthusiasm from cereal chemists.

NORAH J. WATTS.

## REINFORCED CONCRETE STRUCTURES

### Reinforced Concrete Simply Explained

By Dr. Oscar Faber. Third edition. Pp. 80. (London: Oxford University Press, 1944.) 6s. net.

### Simple Examples of Reinforced Concrete Design

By Dr. Oscar Faber. Third edition. Pp. 84. (London: Oxford University Press, 1944.) 6s. net.

THE fundamental ideas behind the design of reinforced concrete structures are simple and can be stated in a few elementary formulæ. The author of the present volume, which appeared first in 1922, aimed at producing a simple book on the subject which could be understood by comparatively non-technical readers, and the appearance of a third edition at the present time is evidence of the success and usefulness of his effort. The well-known "Code of Practice" for reinforced concrete has been adopted, with modifications, by the L.C.C. since the appearance of the first edition, and the present issue has been brought into line with the existing regulations of that body. The subject-matter covers the treatment of beams, columns and slabs, the shearing resistance of beams, and a discussion of the materials used.

Generally, the presentation fulfils its purpose, but there are occasional places where further revision would be valuable; for example, the statement on page 12, "When steel is stressed in tension it elongates and the amount of the elongation depends directly on the stress, on the length of the bar and on the material (This is called Hooke's Law)". The diagrams, too, vary considerably in style, and the general appearance of the book would be improved if they were made uniform.

These, however, are comparatively small points, and this introduction to a subject on which so much has been written has served, and will continue to serve, a very useful purpose.

The present edition (the third) of the companion volume brings the examples of calculation into line with revised official regulations necessitated by the development of materials and of design technique. The structures dealt with are intentionally simple, but they are well graded. The six examples are a circular water tank, a square tank, a floor slab and beams, a warehouse floor on concrete columns, a retaining wall and a water tower. The calculations are set out in detail, and reasons are given for the various steps and decisions taken. Perhaps one of the most useful features is the insertion of comments on practical constructional details drawn from the author's wide experience; this makes the examples very much more than mere arithmetical exercises.

The book is already well known from the earlier editions, and there is no doubt that the present generation of students and young designers will welcome this revised edition.



### Clowes and Coleman's Quantitative Chemical Analysis

An Intermediate Text-Book. Revised and edited by Dr. Julius Grant. Fifteenth edition. Pp. viii+557. (London: J. and A. Churchill, Ltd., 1944.) 21s.

ALTHOUGH this edition is sixty pages shorter than the previous one, published in 1938, the new editor states in the preface that much new material has been incorporated and that deletions are confined to doubtful or redundant material, all the classical methods being retained. The whole text has been carefully revised, and the new parts represent standard modern methods which should be described in such a work.

Clowes and Coleman's book, which was first published in 1891, is, so far as the reviewer knows, unique. It is at the same time a student's manual, providing a carefully graded course, and giving all the detail necessary for the successful procedure of the analysis, and also a very useful reference book to practical analysts. It covers a much wider range of subjects than most books of its size, and includes a number of sections on such subjects as water analysis, foods, oils, fats and waxes, soap, organic analyses, gas analysis, and some physico-chemical determinations such as vapour densities and molecular weights. The reviewer has often followed the book in past editions in carrying out analyses with which he was not very familiar, and in all cases has found the methods described satisfactory and accurate. The book is full of useful practical laboratory hints, and a good index makes it easy to use. There can be little doubt that in its modernized form, in which important and well-tried new methods find a place, the book will continue to maintain its deserved popularity. The paper, printing and binding are all very good, and the way in which it opens easily will be appreciated by workers at the laboratory bench. The book is recommended to students, teachers and practical analysts.

### Cattle at the Crossroads

Broadcast Discussions in the Home Service of the B.B.C. on Cattle Breeding from the Series 'Farming Today'. Pp. 60+8 plates. (Worcester: Littlebury and Co., Ltd., n.d.) 5s. net.

A SERIES of six broadcast discussions on the breeding, rearing and management of cattle in Great Britain is here printed, almost verbatim, from the original script. Designed principally for the interest and information of the small farmer, each talk is in the form of a dialogue between an expert in the field discussed and an eminent practical farmer, with the chairman (Mr. W. S. Mansfield) guiding the discussions and linking them together.

The speakers were drawn from widely different areas of the country, and the complexity of the cattle industry in Britain is thus well illustrated. Points touched upon—all very briefly—range from mastitis to the effects of the bull licensing scheme, and from hill cattle to artificial insemination. Problems considered are mainly the immediate ones of dairy farming and that of the post-war source of animals for beef production. The viewpoint is that of the producer: there is little consideration of the effect of government policies, and less of marketing arrangements and consumer-preferences.

The title is apt because the average quality of our milking cattle is poor, and greater efficiency will be required after the War. The discussions show how

greatly the prospects of improvement depend upon a proper understanding by breeders—the majority of whom are not specialists, but mixed farmers—of their objectives.

### Man Studies Life: the Story of Biology

By G. N. Ridley. (Thinker's Library, No. 97.) Pp. x+109. (London: Watts and Co., Ltd., 1944.) 2s. 6d. net.

AMONG specialists it is a common fallacy that, to obtain the interest of the general reader in a new subject, the introduction must consist of a potted version of the whole study under consideration. Usually, after reading one of these potted works, the unfortunate layman has to sit back until he has recovered from the pangs of mental indigestion; and when he surveys this miserable scene, the educationist once more sadly shakes his head and murmurs: "Too much attempted; too little done!" "Man Studies Life" is such a work. The author set out to write a book which badly needed writing—the story of the growth of biological science throughout the ages. In trying to condense that story into a slender volume in which almost every outstanding figure in biology is mentioned, Mr. Ridley has succeeded in producing only a disconnected series of bits and pieces which would be of doubtful value even to the most intelligent layman.

There are few diagrams, one of which is confusing, while another, a time-chart of science, would be extremely valuable if it were more directly related to the text. The whole appearance of the book is too drab to be inviting, a failing which "conformity with the authorized economy standards" does not wholly excuse.

If this book were expanded to four times its present size and presented in a brighter battle-dress, it would be received with avidity by many non-specialist readers. T. H. H.

### Applied Electricity

By A. W. Hirst. Second edition. Pp. xii+367. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1944.) 17s. 6d. net.

THE demand for this type of text-book has enabled the author to make some useful additions, particularly chapters on power distribution and thermionics. A chapter on materials gives useful notes on a subject which is too often glossed over, although pivotal in industry. In general, the text is adequate for the new Section B in the A.M.I.E.E. examination, and for the Engineering Cadet course. The treatment is everywhere clear and to the point, except in those aspects to which the reviewer objected in the first edition, namely, the relevant torque in a rotary machine is not on the conductors but on the iron, and the confusion between the terms 'electromotive force' and 'potential difference' (p. 70). While one can properly speak of the 'counter-electro-motive-force' in an inductance or condenser (better 'capacitor', according to the latest B.S.I. Glossary), because of the storage and delivery of electrical energy temporarily transformed, one simply cannot accept in these days 'counter-electro-motive-force of a resistance'. When the author states a Kirchoff Law as "the algebraic sum of all the E.M.F.s in any closed circuit is zero", what would he say of a uniform closed conducting ring embracing an alternating magnetic field? There is certainly a single Faraday electromotive force, but there is no potential difference that can be measured anywhere. L. E. C. H.



## ADVENTURES IN PHENOMENOLOGY

By F. I. G. RAWLINS

THE year 1938 marked the end of two lives rich in achievement, those of Edmund Husserl and Samuel Alexander. Not only so, but 1859 witnessed the birth of each of them. So far as Great Britain is concerned, it is scarcely possible to imagine a greater contrast between two contemporaries in regard to influence and knowledge of their works: Alexander, widely recognized and read; Husserl, almost unknown, except to the few. Perhaps it is needless to pursue this matter further, except to remark that Husserl has been but little translated into English, and that in the original German his style, but more particularly his thought, is difficult and complex to a degree rarely encountered even in the *Geistliteratur* of Continental philosophers and psychologists.

All the more, therefore, is it an occasion for deep satisfaction that in gratitude to the great thinker of Freiburg, some of his old students, admirers and critics, who now hold distinguished positions themselves, should have combined to contribute in English a volume of philosophical essays in his memory, under the editorship of Prof. Marvin Farber of the University of Buffalo\*. At the end, they have included a fragment by the master himself (in German), dealing with the origin of space. It is a precious little thing, vivid and informal, written in two days during the spring of 1934. We will leave it at that. Our concern is more with those who in this book have laboured, with considerable success, to bring Husserl before the English-speaking world of scholarship. But lest it should be imagined that his genius has meanwhile become sterile, or his flame extinguished, be it remembered that a regular publication entitled *Philosophy and Phenomenological Research* exists, devoted to the furtherance of his doctrines. In the United States, too, the presence of many of his disciples at the head of philosophical faculties is a testimony to Husserl's power as a teacher.

To trace the pattern of his thought, it is well to recollect that the nineteenth century produced a heavy pressure by scientific facts to obtain possession of the domain of 'intrinsic requiredness', a terrain necessarily strongly defended by the philosophers, but—on balance—favourable to attack. Husserl knew this only too well, and initiated counter-measures designed to focus attention upon 'things themselves' rather than upon such doubtful devices as learning and evolution to explain logical principles. This urge to basic contemplation of an object is extraordinarily difficult to implement: it is akin to an art. In any event, it is the activity which for Husserl constituted phenomenology. The word itself, however, appeared in English long before that, seemingly towards the end of the eighteenth century, when it was used in a far more naïve sense by Robison. Moreover, the present context has little in common with the term occasionally found in the theory of models, beloved of nineteenth century physics.

Phenomenological observation is more than straightforward attention; it is essentially reflective. The difference is between description of objects *per se* and that of *intentional* objects. Generally, observation

within the natural sciences is 'simpliciter', rather than of the extreme kind demanded by Husserl. It is important to realize this in view of the way in which phenomenology exhibits certain parallels with Aristotelianism, and therefore with the concepts of substantial form and matter as the schoolmen knew them. For us to-day, the fear of introspection may go too far: clearly if the process leads to an arbitrary, even capricious, dichotomy between genuine and spurious reactions, then it is reprehensible. But nobody can seriously discard it in so far as it concentrates our mental powers upon things themselves. At least it formed at one time a fair part of the psychologist's method, even if to-day its findings are considered as a creed outworn.

We have now arrived at the threshold of Husserl's early battles, namely, those with the manifestations of 'psychologism' in its various forms. This arch-enemy, as he conceived it, is a tendency to make reason depend upon something other than itself. Phrases like 'the group mind' or 'the mind of a certain cultural epoch' are suspect from this point of view. Reason is reason *pure et simple*, and to assert otherwise is to forfeit any claim to be on the side of the angels. Years ago, Koffka saw this hazard clearly enough, and with characteristic courage assembled all the forces of the *Gestalt* psychologists to vindicate their integrative principles at the crucial point. And on the whole, not unsuccessfully. In fact, 'once bitten, twice shy'.

Can it, however, be said that, as the history of thought through the ages is unfurled, any well-established philosophical system as such has attained even partial victory over the evils of psychologism? A reply to this question is one of the most remarkable passages in this collection of essays. The perennial philosophy is found to face up to the problem squarely, and starting from Plato's onslaught upon the Sophists, to grapple with it. Recalling the present-day interest in the revival, in modern form, of scholasticism, this inherent capacity of Aristotle, St. Thomas Aquinas and their followers to provide a contingent for Husserl's army is extremely significant. His radicalism, issuing in a fierce striving for a 'presuppositionless' philosophy, is enough to entitle him to a high place among the candid friends of learning, be they of the world or of the cloister. Indeed, the word 'psychophysics' has come into use now, a study partially anticipated by Brentano, when he introduced his conception of intentionality of consciousness. He tries to distinguish between physical and psychical phenomena by ascribing to the latter a species of vectorial property. The details are rejected by Husserl; but the suggestion is intriguing on account of its obvious importance for theories of the numinous on one hand and of the psychological view of causality on the other. It was G. E. Müller who once remarked that contact with psychological problems was a pre-condition for any final acceptance of a system of physics. At this stage it is just as well perhaps that not everybody is irrevocably committed to a completely rigid necessitarianism in human affairs.

The question now is whether the *supposedly* real is *really* real. This is almost, if not quite, the fundamental connexion between phenomenology and epistemology. In other words, what, if anything, does the 'reality-phenomenon' tell us about 'real' reality? A number of criteria can be advanced in favour of the reality-phenomenon, of which the following are examples, not necessarily complete:

\* Philosophical Essays in Memory of Edmund Husserl. Edited by Prof. Marvin Farber. (Published for the University of Buffalo.) Pp. viii+332. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1940.) 22s. 6d. net.



(1) Readiness, (2) persistence, (3) the perceptual periphery, (4) boundaries in concrete objects, (5) independence, (6) resistance, (7) agreement. A conservative view would suggest that there is at least a measure of reality behind the reality-phenomenon; but this is not to assert that complete identity can be expected in the case of sense perception. It may well be that some kind of equivalence is the most that mankind can achieve.

Phenomenology has already been likened to an art. This resemblance receives new force from the concept of 'horizon' which Husserl first evolved in 1913. To explore the horizon implies a move away from 'under one's nose' to a broader context. In *Gestalt* terminology it is a drive for integration; in poetry the psalmist's cry, "I will lift up mine eyes unto the hills, from whence cometh my help". Again, horizon simulates a frame, a hand outstretched towards articulation and a recognition of wholeness. But there is no need for such a frame to be irksome; ever new horizons appear as we shift away from the centre, a type of expanding experience. Teleological metaphysics invoked 'art' to couple together object and human situation: Husserl substituted 'constitution' and, as a result, found himself in an atmosphere of intense radical idealism.

A difficulty, apparently inseparable from much of this activity, arises from the temptation to assume that its penetrating light can be cast upon problems of theoretical physics in their present form. At the moment, this is an error. The contrast is mainly between logical empiricism and phenomenology, with little effect outside what the men of science would commonly call philosophy. Logical empiricism, flowing from the Sophists, continues in its historic course alongside, but separated from, the waters welling up from Plato and Aristotle and finding rest in Descartes and Leibniz. In a way, these latter seem nearer to Husserl. However, the natural sciences to-day are not altogether enamoured of Cartesianism, and a natural question to ask is whether any bridges exist, or whether they have already been blown. Two signs look hopeful (at least as regarded by those who believe it not impossible to retain and even to reinforce the solidarity of knowledge); one is the conviction, almost universally held, that Greek geometry is not *a priori*, and the other is the progress made in recent years in symbolic logic. A full grasp of these disciplines is only possible by liberating problems of origin from that mental habit which confuses mind with nature. Clearly, what is involved is no less than the whole structure of history, a position which some other thinkers have adopted, if not with quite the same ruthlessness as Husserl. It is interesting to notice how his radicalism pervades everything he does; it is with him much more than a mere *façon de parler*. For example, he rejects the classical and more traditional concept of a 'root', in favour of the Empedoclean term. This latter is altogether more primitive. It connotes a rough, shapeless thing, rather than the perfect form of mature growth. This is potency—and teleology—with a vengeance; not the ideal—though that is what is sought—but the possibility of life and development. In this is displayed the true historian, and simultaneously the need for 'intentional history' if phenomenology is to live.

Paradoxically enough, however, Husserl produces an analysis of the origin of mathematical physics—without recourse to actual historical inquiry as we know it—by means of his intentional-historical

method; an example of the lengths to which empathetic treatment can go.

So far, phenomenology has appeared mainly in the company of the exact sciences; this, however, is far from the limit of its powers. We are faced with what it has to say about the social sciences, art, and in general, the immediate activities of mankind. Later on, however, it will be needful to return to mathematical symbolism, seeking therein the bond between Husserl's earliest work and our hopes for the future. Meanwhile, he strives to appreciate to the full the problem of the *alter ego*. His way of thinking can best be illustrated by a remarkable passage in which he 'dares' phenomenology to enter the dark corners of other people's experience and not to run away, adding that fear of the dark is only for children in philosophy, expecting at any moment to meet the bogey of solipsism. One cannot resist putting this side by side with the Pauline care for those of (spiritually) tender age, offering them milk rather than meat. Thus, as in Corinth long ago, so in Freiburg, the master will demand no more of his followers than he thinks they can bear. Even Leonardo da Vinci confesses to terror of a dark cave when searching for prehistoric bones, but overcoming his emotion, continues his quest and achieves his object. In the abstract, Husserl did much the same in his groping after a phenomenological basis for the social sciences. Above all, he is not prepared to immunize the physical world against mankind.

A natural step from here is into the realm of art. A measure of aesthetic purity involves appropriateness in that there must be purposeful accuracy for the expression of feeling: greatness in a work of art, however, demands profundity in making manifest the depths of being previously experienced. Some years ago Birkhoff evolved his aesthetic formula and by its means gained considerable success in objective judgment relating to patterns, vases, music and poetry. His method was restricted almost entirely to the formal domain of art. Later, the present writer attempted an application of *Gestalt* principles to paintings, based essentially upon energetics. This treatment tried to penetrate the fringe of the connotative region. Phenomenology shows a certain divine discontent with the ontological in its more naïve forms, very roughly analogous to the tendency of aesthetic experience to turn inwards upon itself. Nevertheless, though art may be more imaginative than truly inventive, there is an undisputed place for what Samuel Alexander has so well called 'constructive excitement'. Rilke's "Sonnets to Orpheus" contains the words "He binds with more cunning the boughs of the willows to whom the roots of the willows are known". This applies not only to the poet and to the philosopher but also to the man of science. In the early stages of knowledge trial and error may be the only way of making progress; later, a comprehensive grasp of 'requiredness' may enable the whole to be rapidly completed. One gains the impression that Husserl himself no less than those who write in support, or in criticism, of his doctrines are resolved to avoid the cruel folly of conducting a blind man into a pitch-dark room, to look for a black cat that isn't there.

For something like a couple of centuries physicists have worked away without any apparent regard whatsoever for metaphysics. Philosophers, for their part, have not failed to notice the impressive strength of scientific fact arrayed against their own internal conflicts of opinion and so forth. But they are con-



tinually re-examining some of their systems and stressing the need for yet another consideration of the relations between science and philosophy. Phenomenology has not escaped, but has been provisionally eased out a little on a frame of neo-positivism. But the source of inspiration is still Husserl himself. Even his omissions and denials possess importance. For example, for him experience is immediately social in a limited sense, but to say "that one's own experience contains the actual experience of others as real, immanent elements" would be unacceptable by him.

Already in this review a mild defence of introspective methods in experimental psychology has been offered. In virtue of certain materialistic approaches to phenomenology which have been made, it is unavoidable that they must become attractive targets. But their very weakness was one reason among several which impelled the then youthful Wertheimer to heroic efforts to end or to mend psychology as it then was. The result was the founding of the *Gestalt* concept. Ironical as it may be, perhaps intentional-history is asserting itself within the sphere of embryonic research.

That phenomenology is an art, a methodology and even a way of life all at once, should not blind us to its main characteristic as a mental construct suitable for dealing with the Universal rather than with the Particular. It is therefore not surprising that some of Husserl's followers should be attempting something like a metaphysics of the factual element. One such system is sketched in the work now before us. It is distinguished for its moderation and resilience. At least, it is held, mankind can express a desire to understand the world without postulating that it is wholly 'intelligible'. It will suffice for the purpose if the world is 'fact', but not 'mere fact'. The significant point is contained in the attitude that slavery to fact may be quite as oppressive as that to 'authority' and the rationalizers. The latter types of bondage produced a series of explosions too well known to need recapitulation here. But a decision in advance never to venture outside 'mere fact' (if only, so to say, for fun, to see what happens) is as dyspeptic as it is unenterprising. Metaphysics is not prepared to come to terms finally either with 'authority' or with 'mere fact', if only because, should the world be meaningless, so would metaphysics be too. Doubtless there will be some dissent from much of this, but it is refreshingly robust all the same. One should not read these essays in and around Husserl's life and influence unless reasonably shock-proof. Their charm—which applies to one and all—resides very largely in an engaging humility and a certain lack of the doctrinaire, ready to 'take it all back' if something better can be found.

A contribution entitled "Men and the Law" is included in the collection. At first glance it would seem to have little to do with phenomenology. But it is followed by another, the theme of which is symbolic logic. The juxtaposition of these two articles was a happy thought, for between them they supply something very valuable indeed. Briefly, it amounts to this. The law says *yes* or *no*. It is not directly concerned with the vast majority of the events of daily life, which fall well within the excluded middle. Its power is of another kind. Now mathematicians are intent upon the quest of finding a place for *possibility* in symbolic logic, as 'objectivized' by Hilbert's quantifier ( $\exists x$ ). Is it at least conceivable that, far ahead, some light will come from this

quarter to illuminate the very practical twilight subjects like rheology and, more generally, the applied sciences? A philosophy of the latter is awaited with some impatience for regions in which academic simplifications do not, and cannot, hold, and wherein 'facing the facts' is almost literally all that can be done.

So now, Prof. Marvin Farber and his colleagues bring their tribute volume to an end. Poured forth in honour of a master mind, their libations leave a most gracious and lasting impress, as they trickle silently away.

## ESTABLISHMENT OF VEGETATION ON COAL TIPS AND OTHER SPOIL MOUNDS

By J. W. B. SISAM

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AND

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**S**POIL mounds of varying type and composition are the inevitable end-product of many mining and manufacturing operations. Anyone familiar with the Black Country of England or the mining areas of South Wales, to cite two important examples, well knows how the countryside can be disfigured by these tips. Under natural conditions considerable time may elapse before even a coarse grass or scrub vegetation becomes established on such material, and then the result is of little aesthetic or economic value. While in the past a certain amount of work has been undertaken locally in reclaiming tips of various kinds, usually through afforestation, such programmes have been limited in scope and difficult to maintain. It is only recently that there has been any widespread interest regarding the vegetation of spoil mounds by artificial means, with or without preliminary levelling, in order to improve the landscape, amenities and living conditions in the districts concerned. It is the purpose of this short article to indicate how knowledge on the ecology of pioneer vegetation, both forest and grassland, can be applied to this particular problem, and to suggest methods of establishing a vegetation cover on what may appear to be a not particularly promising medium.

In Great Britain, the industries responsible for spoil mounds include coal-mining, quarrying for iron and other minerals, and the manufacture of chemicals, pottery and glass. The vegetation of the tips and general waste material from these industries has been referred to in the reports of the Scott and Kennet Committees, and is receiving the attention of several Ministries, of local planning organizations such as the West Midland Group on Post-War Reconstruction and Planning, of local authorities such as borough councils in South Wales, and of the industries themselves. The problem is also being studied in the United States, South Africa and Germany.

When once the planning authority has decided on the general purpose of the reclamation, whether for amenity purposes (landscape improvement and provision of parks and recreation grounds) or for yielding an economic return, it becomes the task of the plant ecologist and the soil specialist to decide which species



of trees, shrubs, herbage or other plants are adapted to this rather abnormal environment, and what method of establishment would be most efficient for the purpose in view. Surveys are necessary to determine the degree of weathering of spoil material, the nutrient or toxic status of the forming soil, the soil moisture and degree of drainage within tips, the surface temperature and the degree of erosion and soil-wash. The problem of air impurities in districts still in active production must also be considered.

It is probably correct to say that the establishment of grass swards should be attempted only when levelling can be done. If the cost of such an operation with modern mechanical equipment is not prohibitive, and land adjacent to the tip is available, the ultimate creation of pastures or parkland can be visualized. The establishment of grass can be greatly accelerated if a covering of six to nine inches of soil or a compost made from town waste can be provided, but it should be possible to establish certain types of grass even on the crude tip material after a certain amount of weathering has taken place, especially if the weathered surface layer on the tops of the mounds is carefully preserved during levelling.

If soil is available, the usual technique of establishing grass on poor soils can be adopted, starting possibly with rape and turnips that can be grazed with sheep, and following with a grass-legume seeds mixture composed according to local conditions and requirements. Direct turfing is also possible, particularly in the formation of bowling greens.

If soil is not available, it will probably be necessary to use species with very low fertility requirements, not generally used for agricultural purposes. Surveys of natural revegetation made by botany students will provide useful information for this work. There are indications that grasses requiring low fertility such as *Aira caespitosa*, certain species of *Agrostis*, and certain weeds could be established, and it may become necessary to commence the production of seed of unusual plants for this purpose. Lupins are important legumes that can be grown for increasing the nitrogen content of the soil. The non-palatable species are generally used, but it is desirable to test the sweet varieties, as these could be grazed at the appropriate time, and the soil would thus gain considerably from the sheep droppings. Unorthodox methods such as the spreading of mixtures of root or rhizome cuttings of bracken or *Agrostis* may be applicable in certain circumstances. The ultimate aim of all this work must be to improve the organic matter content and nutrient status of the soil as rapidly as possible, up to a stage when the establishment of secondary and superior species with higher fertility requirements can be attempted.

The creation of market gardens and allotments on tip soil is dependent upon the availability of organic manures. If stable manure or similar material can be obtained, good crops of vegetables can be expected, and have actually been obtained on the tops of coal tips.

In many cases, however, tree planting will be the method adopted for spoil-mound reclamation; the cost of levelling may be prohibitive, or the general landscape plan may require the establishment of plantations for timber production or the planting of individual trees in parkland development on levelled or partly levelled tips. Here the general principles of the ecology of pioneer vegetation will again apply, although this aspect of the subject raises a number of special problems.

The choice of tree species, the size and quality of the planting stock, and the method of planting to be used can be decided only after a careful study of the site. Waste materials are extremely variable in composition and rate of weathering, and species that do well on one site may not do so on apparently similar sites; each case must be dealt with on its own merits. Mention has already been made of the site factors that require to be surveyed; where possible a chemical analysis should be made of the constituent material of the tip before any reclamation work is undertaken.

Old, well-weathered spoil mounds, particularly those consisting of easily decomposed materials such as certain shales and fire clay that has been burnt, are readily covered with natural vegetation and should offer little difficulty in the establishment of trees. On the poorer sites, where the material is largely unweathered and sterile, it is of the greatest importance to improve the humus content and moisture-retaining capacity of the soil as rapidly as possible. The first trees to be planted on these sites should have the characteristics of true pioneer species—low nutrient requirements, a vigorous and penetrating root-growth, and the ability to build up the organic content of the surface soil through the annual fall of leaves and other debris. Species of willow, birch, poplar and alder are useful for this purpose.

Best results may be obtained if the trees are planted with their roots in a ball of earth, and such treatment is essential if species with more exacting site requirements are used. In general, it is recommended that the planting stock be 1-year transplants not more than 2 ft. in height, although poplars may be up to 5 ft. high; the plants used should have a well-developed fibrous root system and should be planted to the same depth as when taken from the nursery. They should be spaced at about 5-ft. intervals and left to form canopy before thinning. Poplars have been successfully established on a fairly well weathered tip of shale and clay by placing cuttings in holes 12 in. deep, made with a crowbar, and consolidating colliery slag around the cuttings. The only subsequent treatment was the application of manure to the base of the saplings at the end of the first year.

If feasible, a new tip may usefully be covered with a layer of soil, and the use of 'over burden' from sand quarries has been suggested for this purpose. The danger of drought in the summer, due to lack of contact with sub-soil moisture, can be counteracted by placing some peat in the planting hole. Alternatively, if the tip has weathered for some time and bears a skin of coarse grass over unweathered material, the turf removed for purposes of tree-planting should be inverted, placed in the planting hole and covered with fresh soil. Moisture conditions will be improved as the turf gradually rots and forms a humus layer. In addition, the sowing of common lupin seed in the inverted turf some time before the trees are planted will help to increase the available nitrogen in the soil. Gorse, broom and alder are also valuable as nitrogen fixers, and, in addition, provide shelter on bare, exposed sites if established before the young plants of the main crop are put in. As site conditions improve, species of greater economic value, having higher fertility requirements, may be used. Among the tree species that have been recommended for use on spoil mounds in Great Britain, in addition to those already noted, are mountain ash, elder, wild cherry, wych elm, hawthorn, laburnum, sycamore, ash, Austrian pine, Corsican pine, Scots



pine and European larch. Of the conifers, Corsican pine is particularly recommended, as it is not exacting in its requirements, stands up to smoky conditions, and thrives on a low rainfall.

Apart from soil conditions, the choice of tree species may be limited owing to exposure of the site to wind and insolation, especially at high elevations. In exposed situations, where shelter is required at any cost, alder, wych elm, thorn, elder, willow and stout birch plants have been recommended. The conifers, Sitka spruce and Scots pine, are suited to planting at relatively high altitudes. On exposed sites it is important that the planting stock be not too large in order to avoid damage by wind before it becomes properly acclimatized.

Air pollution by certain gases may prevent the establishment of any kind of vegetation, while with other forms of pollution, such as smoke, vegetation can be grown, but the species must be carefully selected. Deciduous species have an advantage over conifers in that they lose their foliage annually, whereas conifers usually retain their needles for several years. Among the species that have been recommended to stand up to smoky conditions are alder, willow, birch, mountain ash, London plane, certain species of poplar and Corsican pine.

A hazard to the success of spoil mound plantations that has nothing to do with choice of species or method of planting is the possible interference with, and injury and ultimate destruction of, the trees by animals or human beings. Fencing affords protection, but is expensive and not necessarily effective where children are concerned. It is far better to give them a personal constructive interest in the plantation by enlisting their help in its establishment.

The ultimate value of tree plantations depends not only on the successful establishment of the plants but also on their subsequent care, particularly in the early stages of development. Close attention should also be given to the sequence of succession that will best meet the needs of the planning authorities and at the same time satisfy ecological requirements.

With reference to the problem of spoil-mound reclamation in Great Britain, the general conclusion that can be drawn after visiting representative areas in the Birmingham conurbation and in South Wales is that a great deal can be done in a short period, and reasonably soon after tipping has stopped, provided soil analyses are made and expert advice taken regarding the selection of species and the methods that are to be adopted. A full statement of the information available from the literature and from local experience is now in preparation, to be issued as a Joint Publication of the Imperial Agricultural Bureaux.

## OBITUARIES

### Sir Julien Cahn, Bart.

SIR JULIEN CAHN, BART., who died on September 26, aged sixty-two, was known to a wide circle as a keen sportsman; he was particularly interested in cricket and he took teams to many parts of the Empire and to many countries. He was a far-seeing philanthropist, being a generous supporter of medicine and hospitals and particularly of the cause of reducing maternal mortality. It was due, too, to Sir Julien Cahn's munificence that it was possible to found the Cahn Hill Improvement Scheme in connexion with

the University of Wales, Aberystwyth—that was in 1932 and before any purposeful action was being taken to increase home food production in the event of war. The nation owes much to Sir Julien Cahn because, as a result of the experiments then started on the hill and rough lands of Wales, the foundations were laid for establishing a technique applicable to the radical improvement and more intensive utilization not only of such lands but also of much neglected pasture in the lowlands.

During the War of 1914–18, the rough and hill lands of England and Wales (more than 5,000,000 acres) made no materially increased contribution to our food resources; in this War the matter has been very different, as is well exemplified by the pioneer endeavours of the Montgomeryshire War Agricultural Committee and by the work undertaken by the Committees in Lancashire and Breconshire and by those of many other counties of England and Wales. The success and magnitude of all this work have been, in no small measure, due to the good and quick start that was rendered possible by the results of the investigations which Sir Julien Cahn had so largely financed. Of the many lessons of the War, few are more compelling than the emphasis that must necessarily be put on the importance of the rising generation and on a thriving agriculture, capable at all times of producing an abundance of food.

The War has, therefore, greatly accentuated the wisdom behind, and the value to the nation of, Sir Julien Cahn's benefactions—benefactions which have served as an inspiration to large numbers of workers in two of the most important fields of national endeavour.

R. G. STAPLEDON.

### Prof. F. Plzák

News has reached London that the death of Dr. F. Plzák, professor of organic chemistry at the Charles University of Prague, occurred there on May 4. Prof. Plzák, who was sixty-six years of age, had occupied the chair of organic chemistry since 1910 and was at one time well known in America and to a less extent in Great Britain, being a frequent visitor prior to the outbreak of the War of 1914–18. Before entering the University he was employed in a pharmacy and did not graduate until he was twenty-five years old. Then he went to Zurich to study under Prof. Lorenz before becoming, first lecturer and then (1910) professor of organic chemistry. His researches were not numerous and mainly related to the lesser known alkaloids (for example, tubocurarine) and glycosides (for example, cyclamin,  $C_{23}H_{11}O_{32}$ , which he found in potatoes as well as in cyclamen tubers, and showed to contain various sugar groups). Plzák was part-author (with Prof. Baborovský) of a standard Czech work on electrochemistry.

As a part of the Czech University, his laboratory was closed by the Germans in 1939 and Plzák, like the other professors, was relieved of his post. Afterwards the Chemical Institute was reopened with a German staff.

WE regret to announce the following deaths:

Dr. E. L. G. Clegg, director of the Geological Survey of India, on September 8.

The Right Hon. Sir William Mulock, K.C.M.G., vice-chancellor (1881–1900) and chancellor since 1924 of the University of Toronto, on October 1, aged one hundred.



## NEWS and VIEWS

## University of Ankara

THE University of Ankara has appointed the following, nominated by the British Council, to professorships: Mr. B. E. C. Davis, reader in English language and literature, Westfield College, University of London, to the chair of English; Dr. W. J. McCallien, Carnegie teaching fellow in geology in the University of Glasgow, to the chair of geology; and Prof. J. A. Strang, professor of mathematics in the University of Lucknow, to the chair of mathematics.

British scholars already occupy ten chairs at the University of Istanbul, as follows: \*Prof. C. E. Bazell (English philology); Prof. F. H. Constable (physical chemistry); Prof. P. du Val (mathematics); Prof. V. H. Legg (industrial chemistry); Prof. A. K. Mellwraith (English); Prof. W. C. W. Nixon (gynaecology); Prof. J. S. Rankin (theoretical mechanics); Prof. F. Royds (astronomy); Prof. the Hon. Stephen Runciman (Byzantine art); Prof. Ronald Syme (ancient history).

## British Trade Associations: Structure and Functions

THE broadsheet "British Trade Associations" which has been issued by P E P gives a description of the structure and activities of these associations, which should provide a useful factual basis for discussion of a subject much to the fore at the present time. The arguments for and against trade associations and related questions of policy are not considered, but this well-documented summary of the internal structure, functions and techniques of trade associations and of recent trends, such as the growth in numbers, in the representation both of firms and of output in a given trade, the range of activities, the growth of distributive and composite associations, and the coalescence of trade associations, should at least stimulate the growth of informed opinion of this subject and facilitate its objective discussion. In regard to technical functions, trade associations have furthered co-operation in such matters as standardization, pooling and interchange of patents, and research. Discussion and negotiations with Government departments and co-operative advertising are also considerable spheres of activity. Commercial functions may be distinguished as non-regulative, such as credit bureaux, mutual insurance schemes, market research, and, less frequently, joint purchase of materials and regulative activities. The latter are of four types: control of prices, as by price agreements; control of the channels of distribution; the regulation of productive activity; and the centralization of selling activities. Examples illustrating all these activities are cited in the broadsheet, which also points out that in practice it is not always easy to maintain the distinction between trade associations concerned primarily with trade, and employers' federations which are concerned primarily with labour questions.

## Royal College of Physicians of Edinburgh

ALTHOUGH research work is the major occupation of the staff of the Laboratory of the Royal College of Physicians of Edinburgh, the Laboratory has, during the War, been occupied with Government work for the Armed Forces and for the Emergency Medical Services. In the annual report for 1943 of the Curator, it is stated that the agreement between the College and the Carnegie Trustees for the Universities

of Scotland, made forty years ago, is being modified as from this autumn. The Trustees will retain the proprietor's obligations in respect of the building in which the Laboratory is situated and will contribute £1,000 a year for research for five years, but the treasurer of the Carnegie Trust will no longer do the Laboratory's accounting work. The retirement of Mr. James Davidson, who for forty years has acted as the Laboratory's treasurer and financial adviser, ends a long and devoted service. Plans for reorganization and future work depend on the development of post-war medical schemes in general.

Considerable work has been done by the Laboratory on the histology of cancer, on sarcoma of the breast and on tumours of the adrenal gland, the nervous system and the pituitary gland. Other problems studied have been congenital microphthalmos in mice, a research promoted by the Ross Foundation for the Study of Blindness, Edinburgh; the diagnosis of sterility; and the study of haemoglobin and the testing of haemoglobinometers. The Biochemistry Department, directed by Dr. W. O. Kermack, who also directs the Department of Statistics, has continued the difficult study of the synthesis of new anti-malarial drugs, and considerable progress has been made. The Bacteriological Department has studied the anaphylactic theory of rheumatic diseases and is engaged on the typing of pneumococci and on chemotherapeutical research on corneal infections, which has shown that the cornea of the rabbit is highly susceptible to the gonococcus and can be used for chematherapeutic research on this organism. Work on blood groups is planned for the future. During 1943 the Laboratory issued 22,461 reports on laboratory findings, and this side of its work is increasing. This work provided a revenue of £5,744, with a profit of £781; it is thus a valuable help to the finance of a laboratory which is not run for profit, but seeks only to maintain itself and to contribute to the advancement of knowledge.

## Paper for School Text-books

IN reply to a question in the House of Commons on October 12 referring to the shortage of school text-books, Mr. Butler, Minister of Education, said: "I have been in touch for some time with those of my colleagues who are concerned with the object of securing an increase in the allocation of paper for educational books, and I am glad to say that, in spite of the many pressing calls upon the available supplies, a substantial additional tonnage of paper has now been allocated which should go a considerable way towards meeting the most urgent cases of shortage."

## The Reversible Transit Circle, Greenwich

Sir Harold Spencer Jones and R. T. Cullen (*Mon. Not. Roy. Astro. Soc.*, 104, 3; 1944) describe the principal features of, and preliminary results of tests and observations with, the new reversible transit circle of the Royal Observatory, Greenwich. The instrument was installed in 1936 and replaced the transit circle designed by Airy and installed in 1851. This latter instrument had a wonderful record for work, and the value of the Greenwich meridian observations is due very largely to the continuity of observation with the Airy transit circle. The new instrument was constructed by Messrs. Cooke, Troughton and Simms, Ltd., and follows closely in design the reversible transit circle of the Cape Observatory, designed by Gill. After the erection of



the instrument in February and March 1936, various kinds of researches were initiated, concurrently with observations for the establishment of a fundamental system of right ascensions. The work was interrupted in the autumn of 1940 owing to air attacks on London, and the objectives of the instrument and the two collimators and the micrometer eye-end were dismantled and removed to a place of safety. Fortunately sufficient material had been obtained and conclusions formed to guide the planning of post-war observations with the instrument.

The investigations have shown various ways in which systematic discordances of instrumental origin can enter into meridian observations, and the results may be useful to others who are planning a similar equipment. The paper gives the results of the investigation of the diurnal and seasonal changes of the instrumental errors of adjustment, and it is pointed out that a close control over the error of collimation will be essential when the instrument is brought into use again. A pronounced effect of wind directions on azimuth error has been shown to exist, the correction being a maximum,  $0.33''$ , when the direction of the wind is north.

#### Spot Gluing by High-Frequency Heating

ONE of the advantages of high-frequency heating as applied to dielectrics is that it is very easily localized by the use of two small electrodes placed close together. Heating is confined to the material in the relatively strong electric field in the immediate neighbourhood of the gap between the electrodes. A pair of electrodes mounted in a suitable handle and connected by a flexible coaxial cable is sometimes used rather like a soldering iron for the gluing of joints in wood structures. Synthetic resin glues can be heated to the setting point in a few seconds. Another arrangement of electrodes in the form of two small wheels which roll over the opposite faces of sheets of material passing between them has been used as an 'electric sewing machine' for cementing together sheets of material.

Yet another device of this kind is a 'spot gluing' outfit recently developed by Pye Telecommunications, Ltd., in co-operation with Aero Research, Ltd. The electrodes are mounted in the form of a gun, the active electric field occupying the space between the end of the gun barrel and a central electrode coaxial with it. The central electrode is spring-mounted and projects slightly beyond the barrel, and pressure of the electrode on the work is made to operate switches, so that the power is automatically applied for an appropriate time interval, say, 2 sec. In operation, therefore, the process is closely analogous to spot welding, although it is used for tacking components into position when building up a complicated assembly, rather than for making complete joints. The importance of the process lies mainly in the fact that it holds out the possibility of dispensing with the use of brads, metal staples, clamps, etc., in forming some of the complex structures required in aircraft work.

#### Crop Rotation

AN entirely new and re-written edition of Bulletin No. 85, "Rotations", has been published by the Ministry of Agriculture and Fisheries (H.M. Stationery Office, 4d.). The author is Dr. H. G. Sanders of the School of Agriculture, Cambridge, as Prof. R. G. Whyte, writer of the previous editions, was unable to undertake the necessary revision. The principles

of rotations are set out clearly, and the Norfolk four-course rotation, which had been followed for some two hundred years on the lighter soils of England, is discussed in some detail. During the last thirty years, however, this system has had to be radically altered to meet changed economic conditions, and cash crops of high value, such as sugar beet and potatoes, have been introduced. The extension of the rotation by means of the seeds ley is discussed, and a separate section is devoted to the special problems on heavy land, while catch-cropping forms the subject of the final section of the bulletin. Emphasis is laid on the fact that for successful farming a thorough understanding of traditional methods is the only sound basis for deviation from established practice.

#### Chemotherapy and Tropical Medicine

IN a lecture to the Chemical Society (*J. Chem. Soc.*, 351; 1943), Dr. A. J. Ewins dealt with the above subject, and his lecture is particularly interesting in giving a concise historical account of the development of the use of chemical agents in the treatment of tropical diseases, which are caused not only by bacteria but also by virus, protozoal and parasitic infections. One of the first applications was in the treatment of sleeping sickness, in which the work of Ehrlich was predominant; for many years this field of investigation was one of the major concerns of the great German firms dealing with synthetic drugs, and these may be regarded as having taken a most prominent role in the welfare of parts of the world which otherwise looked to Great Britain as the proper source of research into matters so intimately affecting the Empire. Dr. Ewins is able to show, however, that a start has been made in overtaking the great gap between the development of research in chemotherapy in Britain and our responsibilities to the British Empire, and that the potentialities of such research are now being realized. The lecture is very concise and readable, and is recommended to the attention of all who may be concerned with Empire matters.

#### U.S. National Vitamin Association

THE organization in the United States of a National Vitamin Foundation was approved at a meeting of fifty representatives of all sections of the vitamin industry in New York on May 23 (*J. Amer. Med. Assoc.*, July 28). Its objects are to award grants for research in the vitamins or related fields, the dissemination of information in the vitamin trade, medical profession and public with respect to the quality, purposes and uses of vitamins, and to confer and consult with medical societies, medical schools, health organizations, public health agencies and government agencies with respect to vitamins and the vitamin industry. The Foundation will be administered by a board of trustees. Details of the organization are to be formulated by a committee of which Basil O'Connor, New York, president of the National Foundation for Infantile Paralysis, has been made chairman.

#### Recent Earthquakes

THE United States Coast and Geodetic Survey, in co-operation with Science Service and the Jesuit Seismological Association, has determined the epicentres of three recent earthquakes. The first was on June 28 at 7h. 58.9m. G.M.T. with an epicentre at latitude  $14.6^{\circ}$  N., longitude  $92.6^{\circ}$  W., off southern



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Crystallography is playing an increasingly important part in the chemical laboratory and in the development of chemical theory. The applications range from the identification of solid substances by microscopic or X-ray methods, through the determination of molecular weight, size, shape, and symmetry, to the detailed study of stereochemistry by the determination of precise atomic positions in crystals. This book describes the methods which have been developed for these purposes, and is written by one who has been concerned with these applications in a large industrial chemical laboratory for many years. No previous knowledge of crystallography on the part of the reader is assumed. The book includes an account of the elements of crystal morphology and optics, the interpretation of various types of X-ray diffraction photographs, and the location of atoms both by the method of trial and error and by Fourier series methods.

## STRUCTURAL INORGANIC CHEMISTRY

By A. F. WELLS

Shortly

Classical stereochemistry was restricted to the study of the configuration of finite groups of atoms (molecules and complexions). The introduction of modern structural methods, in particular the study of the solid state by the methods of X-ray crystallography and of vapours by electron diffraction, has greatly extended our knowledge of the spatial arrangement of atoms. Much of the subject-matter of stereochemistry and crystal chemistry must eventually be incorporated into inorganic chemistry as an integral part of that subject. This is the task attempted in this book. After introductory chapters on the structure of the atom, forces between atoms and the spatial arrangement of atoms in the various states of aggregation—particularly in the solid-state—the author reviews the structural chemistry of the more important groups of inorganic compounds. In the sense that the book is not concerned with preparative details and properties it is complementary to the usual text-book of inorganic chemistry.

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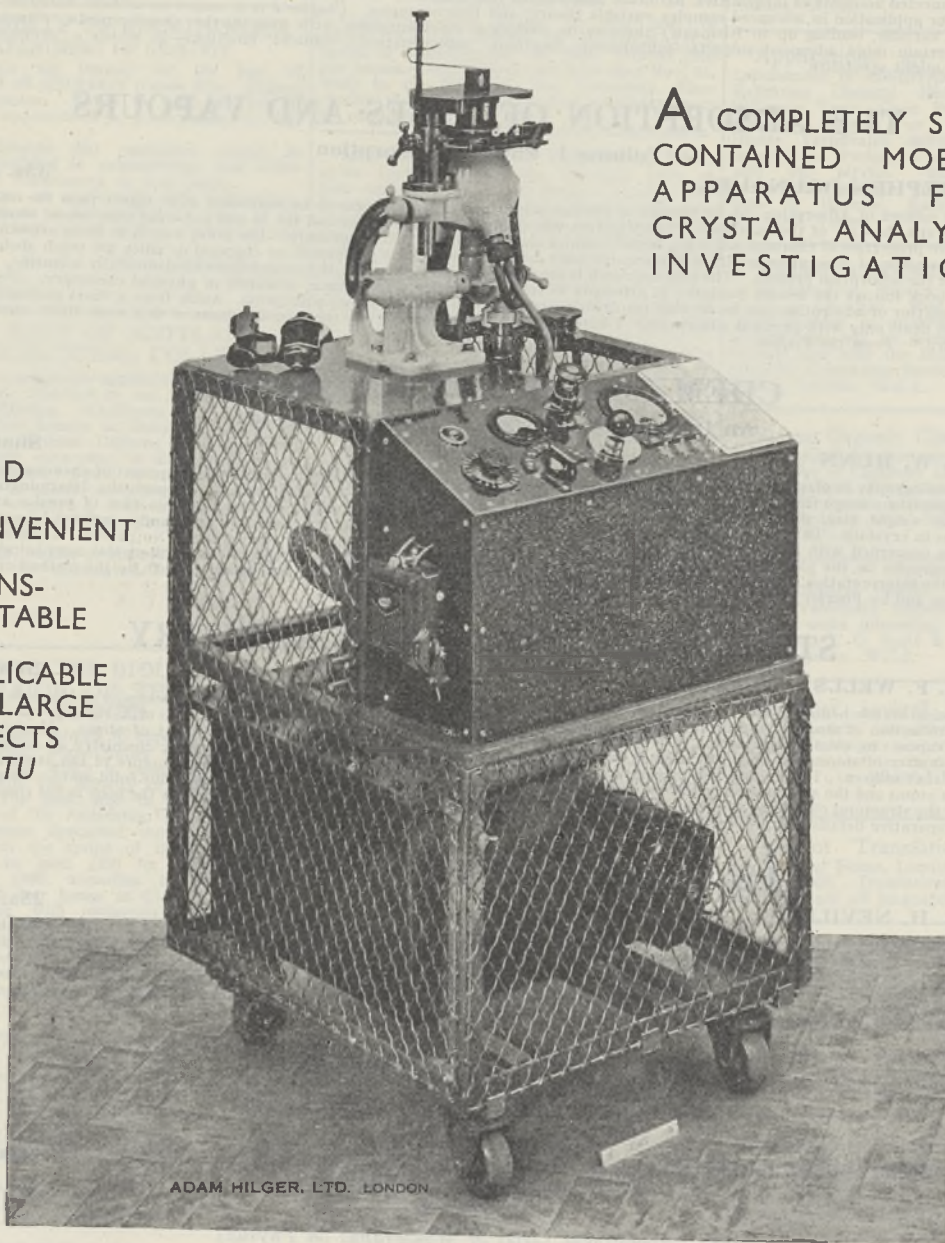
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Mexico. This shock was registered at fifteen American stations and at Honolulu, Ottawa and Toledo (Spain), but not in any strength at Wellington, New Zealand. The second shock was on July 12 at 19h. 30.4m. G.M.T. from an epicentre at latitude  $44.7^{\circ}$  N., longitude  $114.4^{\circ}$  W. in Idaho. This was recorded at six United States seismograph stations. The third shock was on July 19 at 10h. 20.9m. G.M.T. from an epicentre at latitude  $33^{\circ}$  N., longitude  $138^{\circ}$  E. (off Japan). This was recorded at five U.S. stations and at Honolulu. All interpretations and calculations are tentative. During June twenty-two local earthquakes were felt in New Zealand. One, on June 28, may have attained an instrumental magnitude of  $5\frac{1}{2}$ . This was felt in eastern and southern parts of North Island and at Nelson just after 13h. 14m. G.M.T. The shock of June 26 had instrumental magnitude 5 and was felt at Gisborne, Hawkes Bay and Taupo region. Several shocks had Scale 4 intensity.

#### New Division of the Institution of Civil Engineers

THE Council of the Institution of Civil Engineers has approved the formation of a fifth division to be known as the Works Construction Division, under the chairmanship of Lieut.-Colonel C. M. Norris. Its objects are: "The promotion of the science and art of engineering in relation to the ways and means of carrying out engineering construction on the site: e.g. the use of machinery and plant, the design and maintenance of temporary works, the organization of engineering labour (including foremen and inspectors), and the use and inspection of materials". The opening meeting will be on January 2, 1945, when there will be a discussion on a report on "The Organization of Civil Engineering Work", recently prepared by the Institution and to be available shortly. All corporate members of the Institution who wish to apply for registration as members of the Division should inform the Secretary by post-card, giving name (in block letters), address, and grade in the Institution. The fourth division, approved also during 1944, was the Maritime Engineering Division dealing with harbours and docks, together with works of coastal protection and the like, under the chairmanship of Mr. Asa Binns. This will hold its first meeting on February 13, 1945. The other three divisions of the Institution are those of Road Engineering, Railway Engineering and Structural and Building Engineering.

#### Research Grants by the Society of Sigma Xi

ELEVEN grants-in-aid, totalling 2,415 dollars, have been made by the Society of the Sigma Xi, the national honorary research society of the United States. The committee which made the awards consisted of Dr. Harlow Shapley of Harvard College Observatory (president of the Society of the Sigma Xi), Dr. Hugh S. Taylor of Princeton University, and Dr. L. C. Dunn of Columbia University. They are as follow: Robert O. Bloomer, Corcoran School of Geology, University of Virginia, 200 dollars for aid in the study of Pre-Cambrian rocks of the Bear-tooth Mountain, Montana; Miles P. Givens, Pennsylvania State College, 100 dollars for aid in the investigation of the quantum nature of X-rays; C. Clayton Hoff, Department of Biology, Quincy College, 200 dollars for assistance in bibliographical work and to defray part of the expense connected with the study of the pseudoscorpions (taxonomy and distribution); Frank M. Hull, Department of Biology, University of Mississippi, 150 dollars for

the continuation of the study on *Baccha* and *Mesogramma* and related genera of Syrphid flies. Ying-chen Li, Department of Forestry, National Szechwan University, China, 500 dollars for the study of seed-production of several varieties of *Aleurites fordii*, the Chinese tung oil tree; David C. McClelland, Department of Psychology, Wesleyan University, 100 dollars for assistance in the preparation of a new scoring key for the Bernreuter personality inventory and for the Strong vocational interest test; Marie B. Morrow, Department of Botany and Bacteriology, University of Texas, 240 dollars for aid in the continuation of studies on methods of preparation of allergenic mould extracts; Donald M. Pace, Department of Physiology, University of Nebraska, 250 dollars for technical assistance in the continuation of studies on growth phenomena in *Chilomonas*; Hugh M. Raup, Department of Plant Ecology, Harvard University, 400 dollars for use in defraying expenses in connexion with the continuation of studies on the botany and plant geography of regions along the new Alaska Military Highway; Sidney Roberts, Department of Physiology, University of Minnesota Medical School, 150 dollars for aid in the study of the source and control of gluconeogenesis in the kidney; Pierre Van Rysselberghe, Department of Chemistry, University of Oregon, 125 dollars for aid in the study of the conductivity of non-aqueous solutions of metallic salts.

#### Announcements

THE Paris correspondent of *The Times* states that Prince Louis de Broglie, Prof. Pasteur Vallery Radot and M. André Siegfried have been elected members of the Paris Academy of Sciences, and M. Georges Duhamel has been appointed *secrétaire perpétuel*.

THE Lord President of the Council has appointed Sir Frank Smith to be chairman of the Road Research Board of the Department of Scientific and Industrial Research, in succession to the late Sir Clement Hindley.

THE Council of the University of Sheffield has made the following appointments: Dr. Z. P. Dienes to be temporary assistant lecturer in mathematics; Dr. I. F. S. Mackay to be lecturer in experimental physiology; and Mr. H. Lewis, Mr. J. Sedgwick, Mr. S. Waterworth and Mr. D. White to be part-time teachers in engineering.

AT the annual general meeting of the London Mathematical Society on November 16, in the rooms of the Royal Astronomical Society at 3.0 p.m., Prof. Jacques Hadamard, of the Paris Academy of Sciences, will give a lecture, "Psychological and Personal Recollections of a Mathematician". Members of other scientific societies will be welcome.

PROF. S. K. MITRA, of the University College of Science, Calcutta, and chairman of the Radio Committee of the Board of Scientific and Industrial Research of India, who is one of the delegation of Indian men of science now visiting Great Britain, will give a lecture on "Active Nitrogen" at a meeting of the Physical Society to be held at the Cavendish Laboratory, Cambridge, on October 24 at 2.30 p.m.

THE one hundred and fiftieth course of six lectures "adapted to a Juvenile Auditory", the well-known Christmas Lectures given at the Royal Institution, will be delivered by Sir Harold Spencer Jones, Astronomer-Royal, on December 28, 30, January 2, 4, 6 and 9 at 2.30 p.m.



## LETTERS TO THE EDITORS

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

## Persistence of D.D.T. in Oil-bound Water-Paint

THE property of D.D.T. of becoming firmly adsorbed on to a surface was demonstrated in the early work of Wiesmann<sup>1</sup>, when he found that it was possible to render walls effective against stable-flies and houseflies for periods of about two months by spraying a suspension of a powder impregnated with 5 per cent of D.D.T. Another interesting application of this property is to be found in the fact that garments impregnated with a solution of D.D.T. withstood 6-8 weeks wearing and six to eight launderings before losing their insecticidal efficacy<sup>2</sup>. It has been reported<sup>3</sup> that beds sprayed with a kerosene solution containing 10 per cent of D.D.T. and 5 per cent of cyclohexanone retained the power of killing bedbugs for 104 days after treatment.

The outstanding persistence effect of D.D.T. raises the question as to whether it might be incorporated in paint or other surface coatings, and during the past year we have been investigating this application with promising results<sup>4</sup>.

It is natural to expect that if the D.D.T. powder is but lightly bound to the surface, as say, in white-wash or dry distemper, there is every prospect of retaining the insecticidal action; but on the other hand, in the more durable coatings such as oil paints and synthetic varnish paints, one might expect the D.D.T. particles to be prevented from exercising their insecticidal effect because of the strongly adsorbed oil film. These expectations were, in fact, confirmed by our results; but we were particularly pleased to find that when D.D.T. is incorporated in an oil-bound water-paint it continues to exert its insecticidal action.

In the laboratory experiments, plywood was cut to fit inside zinc mesh fly cages. The first cage had plywood—painted with D.D.T. (5 per cent) paint—covering the floor, half-way up the sides and two thirds of the lid, whereas the second cage was covered with an identical area of plywood painted with the same paint in which D.D.T. had not been incorporated. One hundred housefly pupæ in a crystallizing dish were placed in each cage together with containers of sugar and water, and the cages were inspected daily.

The results of one typical experiment are summarized below:

Date	Cage fitted with wood painted with oil-bound water-paint and D.D.T.		Cage fitted with wood painted with oil-bound water paint as control	
	Flies alive	Flies dead	Flies alive	Flies dead
22/3/44	6	1 on its back waving its legs	4	Nil
23/3/44	4	3	20	Nil
24/3/44	5	6	35	Nil
25/3/44	6	10	35	Nil
27/3/44	1	15	33	Nil
28/2/44	Nil	68	86	Nil
29/3/44	Nil	90	86	Nil
30/3/44	Nil	93	86	Nil

From these results it will be seen that the oil-bound water-paint incorporated with D.D.T. was effective against houseflies, and tests carried out after two months showed that the paint had not lost its insecticidal properties.

Small rooms were then painted with a D.D.T. paint, and by a fortuitous mistake the oil-bound water-paint used contained only 0.5 per cent of D.D.T.—exactly one tenth the amount used in the laboratory experiments. It was then found that 90 per cent kills of houseflies were obtained overnight as compared with negligible kills in an identical room painted with the oil-bound water-paint containing no D.D.T. It has proved difficult to obtain accurate and reproducible data for the distribution of the flies on the various surfaces of the room, but our preliminary observations indicate that the flies tended to avoid contact with the D.D.T.-painted surface. Our experiments continue with oil and resin media, and there is already evidence that in certain continuous film-forming media D.D.T. retains its insecticidal effect.

The results now being obtained in a factory canteen painted with this D.D.T. oil-bound water-paint are fully supporting the results obtained in the laboratory and laboratory-field experiments. The social implications of these findings need no stressing.

A full account of this work will be published elsewhere.

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<sup>1</sup> See reviews by West, T. F., and Campbell, G. A., *Indust. Chem.*, 20, 461 (1944); *Chem. and Indust.*, 36, 319 (1944).

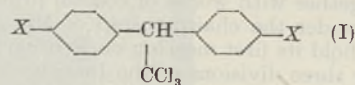
<sup>2</sup> Bushland, R. C., McAllister, L. C., Eddy, G. W., and Jones, H.A., *J. Econ. Ent.*, 37, 126 (1944).

<sup>3</sup> Madden, A. H., Lindquist, A. W., and Knippling, E. F., *J. Econ. Ent.*, 37, 127 (1944).

<sup>4</sup> British Patent Application 1943.

## Insecticidal Action of D.D.T.

A STUDY of the insecticidal properties of D.D.T. ( $\alpha$ -bis (4-chlorophenyl)- $\beta\beta$  trichlorethane; I, X=Cl) and its analogues, carried out in this laboratory,



has led to a working hypothesis on their mode of action which has enabled the prediction of insecticidal activity in related compounds.

Although D.D.T. is chemically unreactive and stable to long boiling with water, it readily loses hydrochloric acid to alcoholic alkali or on heating to form  $\alpha$ -bis(4-chlorophenyl)- $\beta\beta$ -dichlorethylene. This compound as well as 4:4'-dichlorobenzophenone and bis(4-chlorophenyl) acetic acid are almost inactive both as contact and stomach insecticides, indicating that the  $>\text{CH}-\text{CCl}_3$  group is associated with insecticidal activity.

It is possible that the toxicity of D.D.T. is due to its chemisorption at vital centres, with interference with essential enzyme systems. In view of its chemical inertness, however—for example, no evidence of compound formation between D.D.T. and either the 'acceptor' phenolic hydrogen of the naphthols or the 'donor' nitrogen of the naphthylamines was obtained from melting-point curves—the alternative hypothesis of the intracellular decomposition of D.D.T. is preferred. As the ethylene derivative is non-toxic although presumably sharing the permeability



of D.D.T., the toxicity of the latter is ascribed to the hydrochloric acid simultaneously produced either by elimination or reduction.

The insecticidal activity of a compound to which this hypothesis is applicable would then depend on the ease with which hydrochloric acid is produced, provided that the compound is stable enough to survive translocation to its site of action. Preliminary work has shown that some other compounds, for example, certain chlorinated cyclic polymethylenes and non-aromatic substituted ethanes susceptible to this decomposition are insecticidal, whereas related compounds from which hydrochloric acid elimination is not possible are inactive.

On the other hand, diphenyl trichlorethane (I,  $X = H$ ) loses hydrochloric acid readily to alkali yet is relatively non-insecticidal. An additional factor, lipid solubility of the molecule as a whole, is therefore operative. The chlorophenyl groups of D.D.T. would be expected to confer high lipid solubility and thus high permeability. The more polar dihydroxy derivative (I,  $X = OH$ ) and its diacetate, with lower lipid solubilities, are less insecticidal than the dimethoxy-analogue of D.D.T. (I,  $X = OMe$ ).

Fuller details of this work will be published elsewhere.

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### Experimental Corroboration of the Mechanism of Biological Action of Quinones of the Type of Vitamin K

A HYPOTHESIS was suggested<sup>1,2</sup> in the course of chemical and biochemical studies of the anti-hæmorrhagic compounds that the activity of the quinones of the vitamin K group is due to their bio-oxidative decomposition to phthalic acid and is largely a function of their capacity for transformation into this acid. It is phthalic acid that is apparently to be regarded as the carrier of the biological properties of such quinones.

These statements were based on the following experimental evidence. (1) The quinones of the type of vitamin K are extremely liable to transformation into phthalic acid merely when warmed with water<sup>2</sup>. (2) The structural peculiarities of quinones that give them anti-hæmorrhagic activity are also responsible for their capacity for transformation into phthalic acid<sup>3</sup>. (3) The transformation of such quinones into phthalic acid is linked with the capacity of their molecules for tautomeric transition to a peculiar alycyclic system which is easily oxidizable into phthalic acid<sup>1,2,3</sup>. (4) It was found, on the other hand, that phthalic acid itself possesses a weak<sup>4</sup>, and some of its derivatives, for example, diethylphthalate<sup>5</sup>, a significant, anti-hæmorrhagic activity. The smaller activity of phthalic acid as compared with diethylphthalate as well as with quinones of the vitamin K type is presumably due to the rapid excretion of this acid from the organism (for details cf. ref. 3). (5) The quinones of the vitamin K type undergo very rapid changes in the blood (cf. J. V. Seudi and R. P. Buchs<sup>5</sup>), although their anti-hæmorrhagic action is

known to appear only after a considerable lapse of time. This likewise suggests that these quinones apparently do not circulate within the organism as such at the moment when the anti-hæmorrhagic action becomes manifest, and that the effect at issue is elicited not by these substances but by the products of their transformation.

It occurred to us that one of the most conclusive pieces of evidence supporting the above suggestions as to the mechanism of biological action of the quinones of the vitamin K type would be their transformation within the organism into phthalic acid. It seemed, therefore, worth while to study the metabolism of both phthalic acid and of 2-methyl-1,4-naphthoquinone (the so-called vitamin K<sub>3</sub>) in the dog and man.

Upon repeated subcutaneous administration to dogs (weighing 12–13 kgm.) of appreciable doses of a rather concentrated aqueous solution of a bisulphite derivative of 2-methyl-1,4-naphthoquinone (total dose about 0.8 gm.) phthalic acid was isolated from the urine and afterwards identified as phthalic anhydride. Urine was shown to lack both 2-methyl-1,4-naphthoquinone and its bisulphite derivative as well as 2-methyl-3-oxy-1,4-naphthoquinone (phthio-col). Phthalic acid was also found in human urine upon subcutaneous injection of 50 mgm. bisulphite derivative of 2-methyl-1,4-naphthoquinone dissolved in water. Nevertheless, phthalic acid itself as well as its di-sodium salt were practically completely excreted after subcutaneous injection of an aqueous solution both in man and the dog without undergoing any changes. This was shown by J. Pohl<sup>6</sup> in the dog and by us in man. The urine of a control man or dog does not contain phthalic acid at all. Hence it follows that phthalic acid is the metabolic end product of 2-methyl-1,4-naphthoquinone.

Thus, our previous hypothesis as of the mechanism of biological action of quinones of the vitamin K group is substantiated not only by the anti-hæmorrhagic activity of phthalic acid but also by the capacity of such quinones for transformation into phthalic acid both *in vitro* and *in vivo*.

Mention must also be made of the publication by K. P. Link *et al.*<sup>7</sup> on the mechanism of the hæmorrhagic action of 3,3'-methylene-4,4'-dioxycumarin, which is an antagonist of vitamin K. It was shown by these authors that salicylic acid possesses the same type of biological action as 3,3'-methylene-4,4'-dioxycumarin. As the former is apparently the metabolic product of the latter, it may be regarded as the carrier of its hæmorrhagic functions.

These data become particularly interesting if we recall that, according to our finding, phthalic acid is not only the metabolic end-product of quinones of the vitamin K type, but obviously also the carrier of their anti-hæmorrhagic function.

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<sup>1</sup> Shemiakin, M. M., Schukina, L. A., and Shvezov, J. B., *Nature*, **151**, 585 (1943).

<sup>2</sup> Schukina, L. A., Shvezov, J. B., and Shemiakin, M. M., *J. Obschei Khimii*, **13**, 327 (1943).

<sup>3</sup> Shemiakin, M. M., Schukina, L. A., and Shvezov, J. B., *J. Obschei Khimii*, **13**, 398 (1943).

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<sup>6</sup> Pohl, J., *Biochem. Z.*, **16**, 68 (1909).

<sup>7</sup> Link, K. P., Overman, R. S., Sullivan, W. R., Huebner, Ch. F., and Scheel, L. D., *J. Biol. Chem.*, **147**, 463 (1943).



### Specialized Analgesic Effects of $\beta$ -Hydroxy- $\alpha$ : $\beta$ -diphenylethylamine

CLINICAL trials by other workers not yet reported have confirmed our original observation<sup>1</sup> that  $\beta$ -hydroxy- $\alpha$ : $\beta$ -diphenylethylamine will relieve pain due to pressure on nerve in patients with inoperable tumours. This was the only type of pain included in our trials, and it is now clear that the compound has no universal analgesic action and cannot be used generally as a substitute for morphine. Tests using the method of Sivadjian<sup>2</sup>, which measures the tolerance of rats to electric shocks, have now been carried out with morphine and the diphenylethylamine compounds the morphine-like properties of which we have described<sup>1</sup>. The results, which will be reported in detail elsewhere, were entirely negative for the diphenylethylamine compounds; but analgesic activity was demonstrated in the hydrochlorides of morphine and pethidine, showing that the negative results were not due to the method used. The cause of the specific action of  $\beta$ -hydroxy- $\alpha$ : $\beta$ -diphenylethylamine on nerve pressure pain awaits further pharmacological investigation.

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<sup>1</sup> Dodds, E. C., Lawson, W., and Williams, P. C., *Nature*, **151**, 614 (1943); *Proc. Roy. Soc.*, B, **132**, 119 (1944).

<sup>2</sup> Sivadjian, J., *Arch. Int. Pharmacodyn.*, **52**, 142 (1935).

### Genetic Proof of Heterokaryosis in *Penicillium notatum*

IN a recent paper, Baker<sup>1</sup> has given an account of nuclear behaviour in *Penicillium notatum*. We had, independently, reached the same conclusions, summarized as follows: (a) the older 'cells' of the mycelium, the sterigmata and the conidia are usually uninucleate; (b) the 'cells' at the growing edge of the colony are usually multinucleate, containing up to a dozen nuclei each; (c) hyphal fusions occur between branches of the same hypha and also between hyphae of different origin. From her cytological work, Baker infers that *P. notatum* is liable to be 'heterokaryotic', that is, may carry genetically unlike nuclei in a multinucleate cell, or in different cells of a hypha. This condition, widespread in fungi, well deserves careful investigation in view of its important implications for the theories of gene action and of the evolution of genetic systems. Some of these implications have been discussed by Hansen<sup>2</sup>, Dodge<sup>3</sup>, Lindgren<sup>4</sup> and, especially, by Beadle and Coonrad<sup>5</sup>.

The above cytological inference, in the case of *P. notatum*, needs the support of a genetic counter-proof: this can now be supplied. Even though *P. notatum* has no known sexual stage involving alternation of karyogamy and meiosis, the fortunate circumstance that conidia are uninucleate makes a genetic analysis possible. The technique—an obvious simplification of those used<sup>3,5</sup> for species with a sexual stage and multinucleate conidia—is as follows: (1) production by X-rays of mutant strains; (2) mixed inoculation two by two of different mutant strains; (3) search for non-mutant ('wild type') patches, or



MIXED COLONY OF TWO WHITE STRAINS SHOWING GREEN HETERO-KARYOTIC PATCHES AT THE CENTRE AND ALONG THE LINES OF CONTACT BETWEEN THE TWO STRAINS.

for patches differing from either strain, at the centre of the mixed colony and along the radii where the mycelia of the two strains are in contact. The following are the results of mixed inoculation two by two of five such X-ray induced mutants, all characterized by a reduced pigmentation of conidia or by complete failure to form conidia. The formation of patches with wild type (green) conidia, or with conidia differing from those of either parental strain, is represented by +, and failure to form such patches by —.

Designation of strain	Type of conidium	Results of mixed inoculation				
		y-1	w-16	w-2	w-3	2C4
y-1	yellow	—	+	+	+	—
w-16	white	—	—	+	—	—
w-2	white	—	—	—	+	—
w-3	white	—	—	—	—	—
2C4	no conidia	—	—	—	—	—

\* Very pale green conidia.

All combinations of any two of the first four strains, and none of the combinations involving the non-conidial strain 2C4, produce patches of mycelium with green conidia, or with conidia differing from either of the strains used (see accompanying reproduction). When these conidia are plated out, the two component strains are recovered, thus confirming that fusions between hyphae of the two strains had taken place, followed by migration of nuclei from one strain to the other, and the nuclei segregated later. Segregation of parental nuclei does not take place at the formation of the conidiophore but at some stage between this and the formation of conidia, probably at the formation of the sterigmata. In fact, even though each conidium gives rise to one or the other parental type, both types may be recovered from different conidia of the same (green) penicillus.

Points of interest are, first, that despite the fact that each conidium carries a single nucleus, all those of one penicillus are uniform in their pigmentation: hence this pigmentation is controlled not by the genetic constitution of the nucleus segregated into each conidium, but by the constitution of the hypha from which the penicillus arose. Secondly, if the familiar criteria of genetics are valid in the present case, four out of the five X-ray mutations tested, namely, y-1; w-16; w-2; w-3, behave as if they were recessive, involving four different loci. As for the fifth mutation—the non-conidial 2C4—failure to produce green conidia in mixed inoculi is probably due to dominance of the non-conidial effect, as inter-



strain hyphal fusions have been seen to occur also with this strain. Should this inference be confirmed, the high frequency with which non-conidial mutants have been found, even without irradiation<sup>6</sup>, would simply be the consequence of dominance.

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Aug. 25.

<sup>1</sup> Baker, G. E., *Bull. Torrey Bot. Club*, 71, 367 (1944).

<sup>2</sup> Hansen, H. N., *Phytopathology*, 32, 639 (1942).

<sup>3</sup> Dodge, B. O., *Bull. Torrey Bot. Club*, 69, 75 (1942).

<sup>4</sup> Lindgren, C. C., *J. Genet.*, 28, 425 (1934).

<sup>5</sup> Beadle, G. W., and Coonradt, V. L., *Genetics*, 29, 291 (1944).

<sup>6</sup> Hansen, H. N., and Snyder, W. C., *Science*, 99, 264 (1944).

## Diurnal Fluctuation in a Physical Property of Leaf Cuticle

THE extent to which the outer surface of a leaf is wetted by water may depend on factors varying with species, age, and position on the plant. A series of investigations on advancing contact angles has made it clear that, in addition, the adhesion of water for leaf surfaces may vary considerably with the condition of the leaf, and, in particular, with factors showing a cyclic diurnal change.

Measurements made at intervals over periods of up to 26 hours have shown the existence of distinct diurnal fluctuations in the magnitude of the advancing contact angle of water on the leaves of the two plant species so far investigated from this point of view. Contact angles were determined by a method similar to that of Ebeling<sup>1</sup>, in which a value is derived from the characteristics of the curve obtained by tracing the projected profile of a drop resting on a horizontal surface. The accompanying graph represents results obtained with *Brassica sinapis* Visiani growing in an outdoor plot. Contact angle increased after dawn, reaching a maximum in the afternoon and falling after sunset to a minimum before sunrise. The difference between the two extremes was of the order of 30°. In other experiments contact angle has been observed to rise again to a second maximum after the minimum occurring about four hours after sunset, afterwards falling once more to a low value

just after dawn. Essentially similar fluctuations through a smaller range (6–9°) have been found to occur in *Triticum vulgare* Host. under both greenhouse and outdoor conditions. When the two species have been compared, the changes in contact angle of *Triticum* have been found to parallel very closely those of *Brassica*.

In detached leaves the effect of temperature has been found to be negligible; but a marked rise in the value of contact angle has been observed in wilting leaves and it appears that the water relations of the leaf are of considerable importance in determining its magnitude. The following results were obtained using the upper surface of leaves, removed in the morning from young *Triticum* plants, left to dry out under laboratory conditions of temperature and humidity. Control leaves, kept from the start of the experiment with their cut ends immersed in water, showed no statistically significant change in the characteristics investigated. Each value for contact angle is the mean of nine determinations.

Time in hours	0.0	0.5	1.0	1.5	2.0	2.5	4.0
Mean contact angle for water (θ)	123.7°	128.6°	133.2°	138.3°	141.6°	145.2°	152.4°
Standard deviation of θ	2.0	2.2	1.9	1.1	1.7	0.8	2.7
Wt. of leaves as % of initial value	100.0	96.0	92.1	86.2	84.5	82.4	72.0

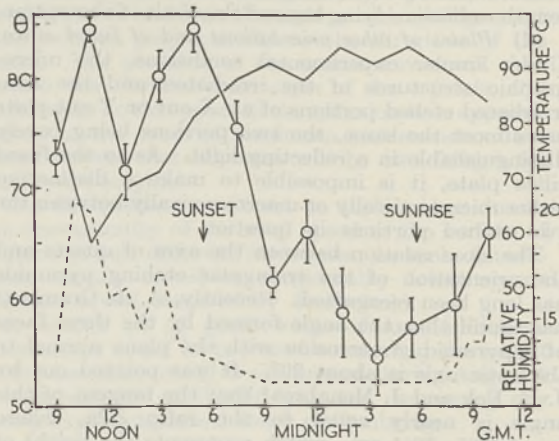
Such a change in contact angle is fully reversible on recovery of turgor. Thus the contact angle of water on *Triticum* leaves rose on wilting for three hours from  $117.7° \pm 2.3$  to  $146.0° \pm 0.8$ , but returned to  $118.4° \pm 2.4$  after the leaves had stood with their cut ends in water for a further three hours. Water applied directly to the surface of the leaf appears to be ineffective in restoring the low value of contact angle.

The contact angle of water on wilted or turgid leaves stretched uniformly has been found not to differ appreciably from that on similar unstretched leaves. It seems unlikely, therefore, that the observed changes in the surface properties of the cuticle can be due simply to alteration in the closeness of packing of hydrophilic or hydrophobic units, produced by expansion or contraction in response to turgor changes. Variation in the extent of water-imbibition of the cuticle is possibly of more importance in determining the magnitude of contact angle.

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<sup>1</sup> Ebeling, W., *Hilgardia*, 12, 665 (1939).



DIURNAL FLUCTUATION IN THE ADVANCING CONTACT ANGLE OF WATER (θ) ON THE UPPER SURFACE OF LEAVES OF *Brassica sinapis* VISIANI GROWING IN AN OUTDOOR PLOT (SEPTEMBER 1943). EACH VALUE IS THE MEAN OF TEN DETERMINATIONS, THE STANDARD DEVIATION OF THE MEAN BEING INDICATED. CONTACT ANGLE, —○—; RELATIVE HUMIDITY (BY WHIRLING HYGROMETER), - - - - -; TEMPERATURE, . . . . .

## Wilting of Shoots in Scented Geranium (*Pelargonium odoratissimum*)

*Pelargonium odoratissimum* Ait. (scented geranium) is a perennial trailing herb extensively cultivated for the essential oil present in the leaves, which is used as a cheap substitute for the attar of roses. Large numbers of these plants growing in Bangalore were parasitized by a species of *Sphaeropsis* which caused the wilting of the shoots. When the infection extended up to the collar region it resulted in the death of the entire plant.

A detailed microscopic and cultural study of the fungus was undertaken and the pathogenicity of the



infecting organism was established. The pycnidia on the shoots are numerous, appearing as black specks on the surface of the shoot. The mycelium is purplish-black, intercellular and causing the death of the host cells. The size of the pycnidium is variable, and sometimes on account of coalescence they appear locular in sections. The spores are glassy, hyaline, ovate to cylindrical, and measure  $18-24 \times 11-14 \mu$ . In moist weather the spores emerge out of the long

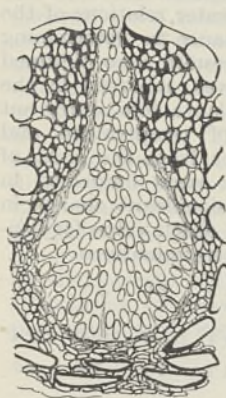


Fig. 1.

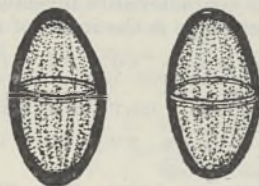


Fig. 2.

narrow ostiole (Fig. 1) and become brown after they are extruded from the pycnidium. Later on they become 'Diplodia'-like, the exospore being traversed by longitudinal hyaline streaks (Fig. 2). The spores readily germinate and cause further infection of the host.

The time of colouring of the pycnospores is shown by Stevens<sup>1</sup> to be an important diagnostic character. He further points out the folly of attempting to decide matters relating to the life-history of this group of fungi on the basis of the association of the host<sup>2</sup>. Since most of the fungi belonging to this group are present on more than one host their identity becomes a matter of extreme difficulty. Recently Da Camara, De Oliveira and Da Luz<sup>3</sup> have recorded *Sphaeropsis Pelargonii* as a new species on the shoots of *Pelargonium zonale*. Since the type of the species was not available for comparison, it was not possible to decide the identity of the *Sphaeropsis* species under investigation.

I wish to express my grateful thanks to Dr. B. B. Mundkur, for help with the literature, and to Dr. L. N. Rao, for kind encouragement.

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<sup>1</sup> Stevens, N. E., *Mycologia*, 25, 536 (1933).

<sup>2</sup> Stevens, N. E., *Mycologia*, 28, 330 (1936).

<sup>3</sup> Da Camara, E. de S., De Oliveira, A. L. B., and Da Luz, C. G., *Rev. agron. Lisboa*, 24, 37 (1936) (original not seen).

## Influence of Ultra-Violet Radiations on the Etching of Quartz

EXPERIMENTS have been carried out to investigate the influence of ultra-violet radiations on the etching of quartz by hydrofluoric acid. The quartz plate under investigation is subjected simultaneously to the actions of the corrosive acid and the ultra-violet radiations. The etching cell used consists of a short pitch-coated glass tube of which the quartz plate under study forms the bottom. The inner surface of the plate is in contact with the acid while the rim of its polished outer surface is covered by a paper ring. In this way, the ultra-violet radiations which

penetrate the plate from underneath will irradiate only the central portion of its inner surface. With such a device, the two parts of an etched surface, one subjected to, and the other protected from, the action of ultra-violet radiations, can be conveniently compared. The strong ultra-violet radiations used come from a 'condensed' discharge between two iron electrodes. They are focused on the base of the etching cell by means of a quartz lens. Plates cut in different orientations and plates of amorphous fused silica have been investigated. With a moderately strong acid, the duration of each experiment lasts generally about eight hours.

(1) *Plate normal to the optic axis.* For plates of this orientation, there is a marked difference in many respects between the two portions etched. Irrespective of the original surface condition, that is, whether it is polished or unpolished, the irradiated part becomes practically transparent shortly after the introduction of hydrofluoric acid into the etching cell, while the other part becomes completely mat as usual. On examining the etched surface under a microscope, it is observed that the characteristic etching figures, namely, the well-known projecting triangular pyramids, are present in both etched portions, but with different aspect; those produced in the irradiated portion are notably flattened and changed in orientation. The transparency of this portion is undoubtedly due to the flattening of the etching figures. The sense of change of orientation of the deformed pyramids depends upon the nature of the crystal. Relative to the orientation of the normal pyramids, it is anti-clockwise for right-handed quartz, but clockwise for left-handed quartz. The angle of change of orientation increases with the intensity of the source, and an angle so large as  $15^\circ$  has actually been observed. In this connexion, it should be pointed out that the dissolution of quartz in the corrosive acid is far greater in the irradiated portion; this can be easily verified by comparing the depression of the surface-levels of the two etched portions. All the phenomena mentioned above will disappear if a glass plate, even as thin as 0.5 mm. in thickness, is interposed between the light source and the etching cell. A spectroscopic examination shows that the glass plate absorbs all radiations of wave-lengths shorter than some 2800 Å. Hence it is clear that the observed effects on etching are due to the short wave-length radiations lying beyond this limit of absorption.

(2) *Plates of other orientations and of fused silica.* Under similar experimental conditions, the micrographic structures of the irradiated and the non-irradiated etched portions of an X-cut or Y-cut plate are almost the same, the two portions being barely distinguishable in a reflecting light. As to the fused silica plate, it is impossible to make a distinction either microscopically or macroscopically between the two etched portions in question.

The close relation between the axes of quartz and the orientation of the triangular etching pyramids has long been recognized. Recently, A. de Gramont<sup>1</sup> has found that the angle formed by the three faces of a pyramid of corrosion with the plane normal to the optic axis is about  $29^\circ$ . It was pointed out by J. B. Eck and J. Menabrea<sup>2</sup> that the tangent of this angle is nearly equal to the ratio  $c/2a$ , where  $c = 5.38 \times 10^{-8}$  cm., which represents the height of the hexagonal lattice, and  $a = 4.89 \times 10^{-8}$  cm. represents the distance between the axes of the adjacent spirals. Should this equality be not due to a fortuitous coincidence, the flattening and the change



of orientation of the elementary pyramids might be regarded as evidence of some modification of the crystalline structure by the action of the ultra-violet radiations.

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<sup>1</sup> de Gramont, A., *Rev. d'Optique*, 10, 213 (1931); and "Recherches sur le Quartz Piezoelectrique" (1935), 31.

<sup>2</sup> Eck, J. B., and Menabrea, J., *C.R. Acad. Sci.*, 200, 1610 (1935).

## A Solar Halo Phenomenon

SIMILAR phenomena to those described by G. H. Archenhold<sup>1</sup> were observed in France during the War of 1914-18 near the fighting zone, and there are records of similar waves observed during this War<sup>2</sup>. Some of the records are, however, scattered in publications not accessible to me at the present time.

A probable explanation of this phenomenon is that it is caused by acoustic waves from explosions passing through a cloud of ice crystals. The explosions might be so distant that they may not necessarily be heard at the point of observation. The perfect straightness of the bands observed by Archenhold supports this view of their distant origin. The observed very high velocity of about 5° per second agrees well with the velocity of sound at the height at which ice clouds are forming. The spacing of the bands of  $\frac{1}{2}$ -1°, when compared with their speed, corresponds to the frequency of 2.5-5 cycles per second, which also corresponds to the fundamental frequency of sound caused by heavy explosions.

Ice crystals floating in air are usually oriented with their greatest cross-section perpendicular to the direction of the field of gravitation, that is, platelets have their six-fold axis of symmetry vertical, needles have it horizontal. The mock sun ring is usually produced by the reflexion of light on the vertical side faces of the plates, but it might be produced sometimes by the vertical end faces of the needles. The passage of the sound waves through the cloud would produce a movement of the air relative to the crystals, due to their inertia. This would have also an orienting influence on the floating crystals, which should tend to orientate themselves with their greatest cross-sections perpendicular to the direction of the sound. The presence of the sound waves will thus disturb the vertical orientation of the crystals, and dark bands would appear in the reflexion halo approximately in the zones of maximum acceleration of the sound waves, that is, there will be two fringes for each wave-length.

The disturbances could not be explained as due to the discontinuity of the wind speed at the surface of contact of two different air masses, as such disturbances usually travel at considerably lower speeds than the speed observed by Archenhold.

It would be of great value if any additional information could be procured concerning the height of the aeroplane cloud trails formed during August 9 (not necessarily at Cambridge), and concerning any heavy explosions heard south of Cambridge.

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<sup>1</sup> Archenhold, G. H., *Nature*, 154, 433 (1944).

<sup>2</sup> *Flight*, Aug. 8, 1940. *Times*, Aug. 31, 1944.

THE phenomenon of moving dark bands travelling across a solar halo, as reported by Mr. G. H. Archenhold<sup>1</sup>, seems to be linked with the optical effect of blast such as results from the explosion of bombs, etc.

An account of moving dark bands passing across cirrus cloud was given by a special correspondent of *The Times* in the issue of August 31, the date of the occurrence being August 9, and the locality of the observance of the occurrence as southern England.

It would be interesting to know from Mr. Archenhold whether any gunfire was heard on the morning in question.

The optical effects of blast from flying bombs have been reported by other observers and myself within recent weeks and have appeared in the columns of *Engineering*, *The Aeroplane* and *The Times*.

In my own experience, the moving dark bands have been observed on very low stratus cloud.

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<sup>1</sup> *Nature*, 154, 433 (1944).

## Abnormal Paranthelia

TWICE within the last year I have observed a paranthelion bearing about 165° from the sun—a position in which the paranthelion does not seem hitherto to have been reported.

The features common to the two appearances were as follows. The sky in the neighbourhood of the phenomenon was a dilute blue with wisps of cirrus. A region of the sky, covering about 3° of altitude and 5° of azimuth, was singled out by the fact that whenever a wisp of cirrus drifted into it the cloud became brilliantly luminous, without colour, and remained so until it left the region; blue sky within the region was not differentiated from that without. The centre of the region was, as nearly as could be estimated by eye, at the same altitude as the sun and approximately 15° eastward of the position which would have been occupied by the anthelion, had one been present. There was, however, no trace of anthelion, nor of any other paranthelion. Each appearance lasted some twenty minutes from the time of first observation.

The distinguishing details were as follows.

	I	II
G.C.T. of first observation	11.50; Sept. 24, 1943	11.10; Aug. 9, 1944.
Place	Moulsoford Down (51° 32' N., 1° 11' W.)	Reading (51° 26' N., 0° 57' W.).
Sun's altitude (computed)	38½°	53½°.
Bearing of centre of luminous region	160-165° E. of sun.	165-170° E. of sun.
Weather	Brilliant sunshine; no cloud beyond that described below; sky-blue very little diluted; wind S.W., force 2 at ground; some cumulus blew up shortly afterwards.	Bright sunshine; much cirrus; lower cloud types in other parts of sky; sky-blue much diluted; wind N.W., force 1 at ground.
Other contemporary meteoroptical phenomena	None.	Traces of parhelic circle between 100° and 160° E. of sun.

On occasion I no other meteoroptical phenomena were seen on the same day. On occasion II, Mr. R. Adecock and Mr. M. Barker, who directed my attention to II, reported having seen a parhelion (III) (? colourless), 46° E. of sun, at 9.15 g.c.t. on the same day. Unfortunately, no instruments were available for any of these observations, so that the azimuths are rather uncertain; III was carefully aligned on marks which were measured later.



It has been suggested that the increased frequency with which haloes and parhelic phenomena, especially of the rarer types, have been observed of recent years is due to some special tendency of condensation trails from aircraft to crystallize in the appropriate manner. Trails were being formed in other parts of the sky before and during the observation of II and III, but the clouds manifesting the paranthelion were not seen to be formed from them and had the general appearance of natural cirrus. No trails were noted on occasion I, but the clouds, which were of normal cirrus texture, had an unusual disposition. Some eight to ten dense, parallel bundles of cirrus wisps, somewhat entangled, evenly occupied a rhombus of about 20° side, outside which the sky was conspicuously cloudless.

I am unable to offer any explanation of II. I might possibly be the rare and doubtful paranthelion of 35-38°, set back by the high altitude of the sun. On the basis of Pernter and Exner's<sup>1</sup> tentative theory of this phenomenon, the computed bearing from the sun is 155° (observed 160-165°). Their doubts, however, have special force in this case owing to the high altitude of the sun and the extreme brilliance of the phenomenon. This explanation is quite unacceptable for II (theoretical bearing 179°). III cannot have been the primary parhelic of 46° owing to the high altitude, but might have been the secondary parhelic of 2 × 22°.

I have taken the liberty above of introducing the word 'meteoptical' in place of 'meteorological optical', which is cumbersome.

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<sup>1</sup> Pernter and Exner, "Meteorologische Optik" (1910 edit.), 392.

### Antiquity of Man in Australia

It was very gratifying to read Prof. F. Wood Jones' article and also Dr. F. E. Zeuner's appraisal of the Keilor skull discovery<sup>1</sup>. In Australia, the significance of the skull has only been appreciated in part, a fact which can largely be explained by preoccupation with the War. Mahoney's scholarly memoir<sup>2</sup> has indicated that, even if his altimetric estimation of the age of the skull is not accepted as final, every endeavour should be made to conserve all relevant data available.

The deposit in which the skull was found is very limited, probably of less than an acre; nevertheless the site of the discovery is still being exploited as a sandpit, and although contemporaneous deposits no doubt will be found, no attempt has been made to preserve the site for a thorough scientific search.

Furthermore, I am given to understand that the sand contractor who found the original skull had in his possession another skull, bones and possibly artefacts, which seemingly will be lost to the scientific world.

Zeuner expresses the hope that "the Keilor discovery will encourage further search for early man in Australia". It is suggested that a more urgent task for Australian science is not so much archaeological as anthropological, for in the sociology of the few remaining tribalized aborigines we have the key to our own social evolution which, even if the aborigines themselves do not die out, will, in a matter of a few decades, be irretrievably lost.

The riddle of the world-wide mother-in-law taboo<sup>3</sup>

can only be solved by assuming social conditions in the past similar to those of the Australian aborigines, and it has been indicated how man's earliest social evolution must have been determined by the progressive avoidance of incest. The structures of Australian societies show how this avoidance was obtained by the introduction of taboo and exogamy<sup>4</sup>.

It is therefore to be regretted that in the southern hemisphere there has been during the past few years a marked swing away from the study of the Australian aborigines towards the study of the more colourful island people to the north of Australia, whose societies will still be virtually intact when those of the Australian aborigines will be, like the Tasmanians, a thing of the past.

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<sup>1</sup> *Nature*, 153, 211, 622 (1944).

<sup>2</sup> *Mem. Nat. Mus. Melbourne*, 13, 79 (1943).

<sup>3</sup> Jolly and Rose, *Man*, 42 (Jan-Feb. 1942).

<sup>4</sup> Jolly and Rose, *Ann. Eugen.*, 12 (July 1943).

### A New England Naturalist

In connexion with the interesting and entertaining review<sup>1</sup> by Sir D'Arcy Thompson of Dr. Barbour's book "A Naturalist at Large", it is worth putting on record that the Zoo has had two specimens of the Páca rána (*Dinomys branickii*) from South America during the past twenty years. The first was presented by Mr. Herbert Whitley in June 1925 and the second was purchased from a dealer in September 1929.

At death, both bodies were preserved, the former being sent for dissection to Dr. A. B. Appleton at Cambridge, the latter to Tring Museum at the request of the late Lord Rothschild.

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<sup>1</sup> *Nature*, 154, 411 (1944).

### Photochemistry in Retrospect

DR. IREDALE<sup>1</sup> discusses in his retrospect on photochemistry the surprising fact that Einstein's Law of Photochemical Equivalence seems to be almost forgotten by modern photochemists. This oblivion is still more astonishing if one remembers the role of the law in general chemistry.

From the beginning, it was quite clear that any experimentally established failure of the law in a complete photochemical reaction was due to purely chemical secondary reactions. These are independent of the photochemical primary processes, which are without exception controlled by Einstein's Law. E. Warburg's<sup>2</sup> finding that not one molecule as expected but two molecules of hydrogen iodide are decomposed by one light quantum led him to the fundamental assumption of the interaction of short-lived hydrogen and iodine atoms in the secondary reaction chain. This chain reaction is the model for all modern conceptions of chemical and photochemical reaction kinetics, which operate with free atoms or radicals.

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<sup>1</sup> *Nature*, 154, 326 (1944).

<sup>2</sup> *Ber. Berlin. Akad.*, 314 (1916).



## RESEARCH ITEMS

## Blood Sugar Levels in the Bengal Famine

DR. M. L. CHAKRABARTY, at the Campbell Medical School, Calcutta, has measured the blood sugar in a series of starvation cases admitted to hospital during the recent famine. In a communication to *Nature*, he states that some surprisingly low figures were found; the lowest recorded was 20 mgm. per 100 c.c., and this case recovered under treatment. In a normal individual, definite symptoms of hypoglycæmia occur when the blood sugar falls below about 70 mgm. per 100 c.c.; but these starvation cases, although weak and lethargic, with profound depression of all bodily activities, never exhibited any of the typical nervous symptoms of hypoglycæmia in spite of their extremely low blood sugars. The absence of hypoglycæmic symptoms was probably due to the slow and insidious onset of the hypoglycæmia; in such cases of 'chronic' hypoglycæmia it seems that the nervous system has time to adapt itself to the low sugar level. Biochemical investigation of these cases is proceeding and the main interest so far is the demonstration that life can continue, albeit at a low ebb, with a blood sugar of only 20 mgm. per 100 c.c.

## Immunization against Malaria

H. R. JACOBS (*Amer. J. Trop. Med.*, 23, 597; 1943), working on immunization against malaria, has shown that, in ducklings, the subcutaneous injection of saline-insoluble residues of *Plasmodium lophuræ*, mixed with a staphylococcus toxoid, give practically 100 per cent immunity to malaria. The substance used is "an extract of protamide plasmodial precipitate insoluble in saline solution". It appears that such plasmodial substances insoluble in saline contain antigenic material which is effective, and that by addition of bacterial toxin its efficacy could be increased sufficiently to give promise of a wider application. F. F. Schwenker and F. C. Comploier (*J. Exp. Med.*, 70, 223; 1939) have shown that a toxoid combined with a non-antigenic material served to make it antigenic. Jacobs does not claim that immunity is produced, but that effective protection against malaria is obtained; and he feels that the way is opened for the preparation of a good vaccine which will provoke an immunity so powerful that overwhelming doses of the parasites will be neutralized quickly.

## Poisoning by Tetrodon Fishes

WARREN HAROLD YUDKIN in an interesting paper discusses and summarizes information on the poisoning properties of the Tetraodontidæ or puffer fishes (Tetrodon Poisoning. *Bull. Bingham Oceanographic Coll.* Peabody Museum of Natural History, Yale University, 9; 1944). Poisoning by various fishes belonging to this family has been known for centuries and much has been written about it, as is shown in the present paper. A certain amount of research has been done, especially by the Japanese on species of *Tetrodon*. These fishes are eaten to a large extent in Japan and a number of people die of poisoning every year. Macht and Spencer (1941) have recorded interesting work done on *Spheroides maculatus*, the Atlantic puffer. This fish has recently attained market status as a result of the increased utilization of 'trash fish'. Evidence is provided that toxic substances of many Tetraodontidæ are located chiefly in the gonads and liver and may vary with the breed-

ing seasons. *Spheroides maculatus* has been eaten for some time in various regions, with few, if any, reports of ill-effects, and it is probable that when properly cleaned it is not ordinarily toxic. Experiments are now being conducted at the Bingham Oceanographical Laboratory on this fish to ascertain whether it can be toxic under certain conditions, and it is strongly recommended that similar detailed researches should be made in other localities.

## Diphyllobothriidæ in the South Wales Trout

FURTHER reference to the occurrence of larval stages of Diphyllobothriidæ in trout in South Wales and in the Dublin area (see *Nature*, Aug. 5, p. 185, and Aug. 26, p. 267) is made by K. Unsworth (*Brit. Med. J.*, 385, Sept. 16, 1944), who says that a full account of the life-cycle of the parasite found in the trout in South Wales will be published in the near future. The life-cycle has now been successfully completed experimentally in the dog, with *Cyclops* and the stickleback (*Gasterosteus aculeatus*) as intermediate hosts. Discussing the view of M. D. Hickey and J. R. Harris that cormorants and seagulls are the naturally infested definitive hosts of the parasite in the Dublin area, Unsworth suggests that the trout in South Wales were infested with two distinct species, one of which develops in an avian and the other in a mammalian host.

## Naked Pigeons

"PIGEON courtship, with its strutting, cooing and puffing out of feathers is an interesting performance. When there are no feathers to puff or to clothe the performer it becomes a ludicrously macabre travesty of a dance." L. Cole and R. D. Owen (*J. Hered.*, 35, 3; 1944) describe such a case which results from a simple recessive gene. The accompanying photographs suggest a complete picture of the Dodo in "Alice in Wonderland". The interest of the case is that all the normal reactions of attempting to fly, to parade before the female and to fight with the wings are present. As a result of the absence of feathers the birds do not retain the heat and must be kept in artificial warmth; they are infertile as males since they are unable to balance properly in mating. Artificial insemination has been successful, but is laborious. There was no inferiority complex shown by featherless pigeons and artificial clothing was deeply resented.

## Occurrence of Epilepsy in Cattle

A YOUNG brown Swiss bull showed signs of epilepsy at six months old. Tongue chewing, slight foaming at the mouth and collapse in coma were the chief symptoms. Injections of calcium gluconate relieved the symptoms in about fifteen minutes. F. W. Atkeson, H. L. Ibsen and F. Eldridge (*J. Hered.*, 35, 45; 1944) describe this case and the progeny derived from this bull. There were thirty-seven offspring, of which twenty-three were apparently normal, thirteen were epileptic and one died at birth. There are indications that this autosomal dominant is of recent origin. The attacks take place in the first two years of life; as the animal gets older, the intensity and frequency of the attacks varies considerably and in some cases may not be detected.

## Oxidation and Mechanism of Action of Mutagenous Factors

ACCORDING to the current biophysical theory, a mutation caused by X-irradiation is regarded as a



result of direct action of a secondary electron upon an atom in a genetically significant structure. Investigations undertaken by I. A. Rapoport in the Institute of Cytology of the U.S.S.R. Academy of Sciences (*J. Gen. Biology, Moscow*, 4, No. 2; 1943) suggest that the phenomenon may be more complex. It appears that the mutation effect of short-wave irradiation is due to the appearance in the irradiated cell of a substance inducing mutations. Such a substance is possibly ozone, formed in the cell from oxygen as a result of irradiation. Combined action of iron (in the larval food of *Drosophila*) and X-rays resulted in a marked increase in the percentage of mutations. This stimulating effect of iron on the mutation process cannot be explained on the basis of biophysical theory but it accords well with the fact that physiological action of ozone is stimulated by iron. The chemical action of X-rays and of the activated oxygen is similar in some respects. The disturbance of continuity of a chromosome thread due to irradiation may be compared with the rupture of ozonides at the site of the unsaturated bond. The presence of such unsaturated bonds in the chromosome would make it possible to interpret synapsis and crossing-over as phenomena of labile polymerization and depolymerization. Since very active forms of oxygen are formed regularly in the course of normal metabolism, they may constitute an important factor in a spontaneous mutational process.

#### Non-Coherent Scattering in Astronomy

A DETAILED review by Spitzer has appeared (*Astro-phys. J.*, 99, 107; 1944) of a paper by Houtgast of Utrecht on the variations in profile of strong Fraunhofer lines across the sun's disk, and some remarks are made (*ibid.*, p. 1) by the same author on the theory of non-coherent scattering, stimulated by Houtgast's work. The observational material in Houtgast's paper is by far the most extensive and homogeneous yet obtained; but divergences between the measured profiles and those previously published suggest the presence of systematic differences which may be instrumental or may be real, caused perhaps by variations in solar activity. The centre-limb variations found in the far wings of absorption lines are compared in turn by Houtgast with what would be expected for pure absorption, pure extinction and pure scattering. It is found that coherent scattering does not adequately represent the observations even qualitatively, especially in the ultra-violet lines, for which the absorption wings should vanish towards the limb and be replaced by emission wings close to the limb. It is therefore suggested that the dominant process in the formation of strong absorption lines is non-coherent scattering, a phenomenon which arises when the selectively scattered radiation is first captured in the usual way and then re-emitted with a slightly different wave-length, and which appears as pure absorption in the wings. Spitzer's own investigation shows that non-coherency may be expected to occur, partly or wholly, in the scattering process which forms almost all absorption lines of astrophysical importance. The effect of the process on line profiles is not very large: no major change in the curve of growth is to be expected, but the cores of strong lines will be sharper than predicted on the assumption of coherent scattering, especially away from the limb. This is in qualitative agreement with accurate profiles determined interferometrically for the *D* lines in the sun, and with the sharp cores of

the hydrogen lines in *A*-type stars. Further study of this almost unexplored field promises to be interesting.

#### Relation between Magnetic Storms and Solar Activity

C. W. ALLEN, Commonwealth Solar Observatory, Canberra, has described a statistical investigation of the influence of solar flares and sunspots on terrestrial magnetic storms (*Mon. Not. Roy. Astro. Soc.*, 104, 1; 1944). The magnetic data cover the period 1906-42, and up to 1937 international character figures were employed; during 1938-42, *K*-index daily sums were used. In the period 1906-43 there were 2,800 disturbed days, and these were divided into four groups on the basis of recurrence tendency, as shown in 27-day charts. There is some evidence to support the view that great magnetic storms are caused by chromospheric eruptions, the time interval between the eruption and the maximum of the great storm being approximately  $1\frac{1}{2}$  days. Eruptions are also responsible for some smaller storms with a  $2\frac{1}{2}$ -day interval. Smaller storms tend to recur at intervals of 27 days, which betrays their solar origin, and shows that there are regions on the sun's surface, known as Bartel's '*M* regions', not distinguished by any markings, which are associated with these minor geomagnetic disturbances. A period of about three days is required for *M*-region particles to travel from sun to earth. The *M*-region is considered to be an emission coming continuously from almost all the sun's surface, and constrained to move in streams by forces in the sun's atmosphere. The persistence and changes of the recurrent magnetic storms would then be due to the continuity of these streams. A close relationship has been found to exist between sunspots and coronal plumes, though the foci of the plumes do not coincide exactly with sunspots. While the plumes come from areas that in general surround or are close to group spots, the 1919 eclipse did not show this relationship, thus proving that the large groups and spots are not invariably connected with one another.

#### Meteor Observations during 1941-42

MOHD. A. R. KHAN (*J. Hyderabad Acad.*, Studies No. 6; 1943) has discussed observations during two years of shower meteors and exceptionally bright meteors. The shower meteors were the Quadrantids, Lyrids,  $\eta$  Aquarids,  $\delta$  Aquarids, Perseids, Orionids and Geminids. In 1941 the Quadrantids and Lyrids were extremely scarce, only one of each being observed, but the other showers were fairly active. In 1942 moonlight and other hindrances prevented systematic observation of the first four showers, and few of the meteors recorded during the Perseid and Orionid period belonged to either of these showers. In addition to some exceptionally bright meteors emanating from the showers referred to, 28 more were observed during the two years. In 1941 during a watch totalling 57h. 02m. over 114 nights, 914 meteors were seen, and in 1942 a total of 44h. 54m. was spent on 118 nights, during which 710 meteors were seen. The questions of persistence of streaks and of their colour and size are discussed. Dryness of the air, like clearness or dust-free conditions, seems to determine the visibility of enduring trains. The author's observations lead him to conclude that the drier the air is in certain regions the more likely will enduring streaks be seen. In addition to this factor, it is suggested that the electrical condition of the upper atmosphere is also important, because it is known that ionization plays a very important part in the development of meteor trains.



# SURFACE TENSION AND THE DEGENERATION OF NERVE FIBRES

By J. Z. YOUNG

Magdalen College and Department of Zoology, Oxford

A NERVE fibre is an immensely elongated cylindrical cell the content of which is a viscous fluid. Around it there is often a semi-fluid covering, the myelin. Now Plateau<sup>1</sup> showed that a cylinder of liquid only remains stable under its surface tension if its length is less than its circumference. High viscosity and other factors may allow cylinders of somewhat greater length, but as the length is increased a point is reached at which small deformations are not corrected by the surface tension, which rather causes the cylinder to acquire an unduloid outline and break into droplets. Instances of the operation of this principle are common in Nature<sup>2</sup>; for example, the protoplasm of plasmolysed root hairs assumes an unduloid form.

There are many indications that such surface forces operate in nerve fibres. For example, during the degeneration of the peripheral section of a severed nerve fibre the myelin and axon lose their cylindrical shape and form a series of ovoid segments. The first sign of this 'degeneration' is the assumption of an unduloid outline by the myelin, followed by a breaking into segments, long at first, then shorter and shorter, until a series of spherical droplets remains. The process goes on very slowly and in a rabbit's nerve examined three or four days after severance all stages can be seen. During the separation of the segments a neck is first formed, and this then breaks to form 'Plateau's spherules', which appear with a regularity almost equalling that of the experiments which Plateau himself and Darling<sup>3</sup> made with equidense liquids (Fig. 2).

The situation is of course complicated by the fact that the axon and myelin are enclosed in a tube composed of the protoplasm of the cell of Schwann and the neurilemma and endoneurium (Fig. 1). The last two form a wall which is moderately rigid and little elastic. The Schwann cell forms a fenestrated membrane between the myelin and the neurilemma. It seems probable that the tube wall as a whole is permeable to water, and that the myelin does not wet it. There is therefore little difficulty in the formation of new surfaces and segmentation of the contents of the tube.

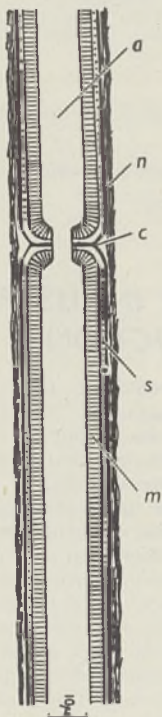


Fig. 1. DIAGRAM OF A LONGITUDINAL SECTION OF A PORTION OF A PERIPHERAL NERVE FIBRE: a, AXON; m, MYELIN; n, NEURILEMMA; c, 'CEMENTING DISC' AT NODE; s, PROTOPLASM OF SCHWANN'S CELL.

If surface tension causes the isolated nerve fibre to break up, what is the force emanating from the cell body which normally maintains its integrity? It was suggested<sup>4,5</sup> that the fact that material flows from the central but not the peripheral end of a severed nerve fibre indicates that there is an intra-axonic turgor pressure and flow. Weiss<sup>6</sup> has recently adopted a similar view in showing that there is a continual growth of axons, leading to a damming of axoplasm behind a constricted point on a nerve. No one has yet actually measured the rate of movement of the axoplasm; but it seems likely that it takes place continually, if slowly, presumably forcing out material over the surface of the fibre. It is possible that it is the resulting pressure, blowing up the fibre from inside, which maintains the cylindrical outline

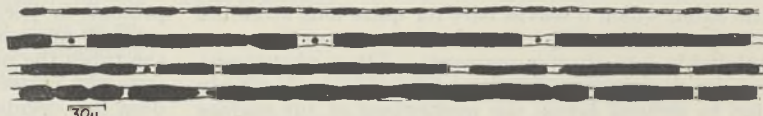


Fig. 2. NERVE FIBRES OF A RABBIT THREE DAYS AFTER SEVERANCE, SEEN AFTER STAINING WITH OSMIUM PTEROXIDE. NOTE UNDULOID OUTLINES AND SEPARATION INTO OVOIDS WITH PRIMARY AND SECONDARY PLATEAU'S SPHERULES BETWEEN.

against the surface tension forces. If this is correct it might be possible to prevent degeneration in a peripheral stump by providing a substitute for the normal pressure.

The tendency to assume an unduloid outline is certainly very strong, and probably operates even during the normal life of a nerve. Fibres teased carefully in Ringer's fluid show various degrees of departure from a strictly cylindrical shape. There is a close topographical relationship between the unduloids and the incisures of Schmidt-Lanterman (Fig. 3). These oblique cracks in the myelin always lie in the region of concavity of a wave. Now the myelin consists of coaxial sheets of orientated phosphatide and protein molecules<sup>7</sup>, and in some stages of incisure development the breaking of these lamellæ can be clearly seen, especially in the troughs of the unduloid. Longitudinal stress increases the incisure<sup>8</sup>. The material of the myelin is evidently very peculiar if it can flow and yet break in this way, and further investigation is necessary. Fig. 4 suggests that the broken edges of the lamellæ constitute the 'spiral apparatus of Golgi-Rezzonico' which appears to occupy the cleft.

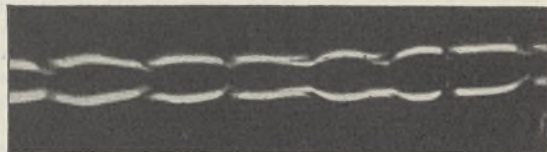


Fig. 3. NERVE FIBRE OF RABBIT ISOLATED IN RINGER'S SOLUTION AND PHOTOGRAPHED IN POLARIZED LIGHT. (x 600.)

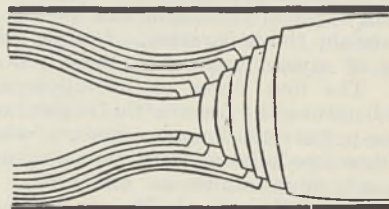


Fig. 4. DIAGRAM TO SHOW RESULT OF ASSUMPTION OF UNDULOID OUTLINE BY A NERVE FIBRE, BREAKING THE LAMELLÆ OF THE MYELIN TO FORM AN INCISURE.



Ranvier<sup>9</sup> suggested that the myelin can be considered to be included within its Schwann cell as a fat droplet in a fat cell, and hinted at the possible importance of its surface tension. Several observations indicate that each whole internodal segment can be regarded as a drop, elongated to a length of as much as 1.2 mm. on a mammalian nerve fibre 20 $\mu$  in diameter (Fig. 5). If a piece of rabbit's nerve is placed in hypotonic Ringer's solution (say 0.6 or 0.3 per cent) at 37° C. it soon becomes very turgid, and material is expelled from the ends to form mushroom-like outgrowths. Incidentally, as Ranvier pointed out in interpreting the effects of treating nerves with water, this provides further evidence that the contents of a nerve fibre are fluid and can move longitudinally. At the same time, the myelin shows remarkable movements, flowing over the surface of the axon, which it leaves bare for quite long stretches at the nodes (Fig. 6). Later the myelin may subdivide into shorter segments. These phenomena can be explained as follows. The swelling is mainly due to osmosis across the membranes at the surface of the axons, the latter increasing in volume. This produces a tendency to increase the area of the myelin, which rounds up under its surface tension, leaving the axon bare at the nodes.

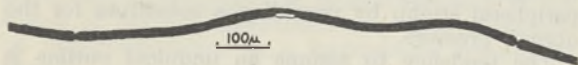


Fig. 5. NORMAL NERVE FIBRE, SHOWING A SINGLE INTERNODE WITH THE SCHWANN CELL NUCLEUS AT ITS CENTRE.

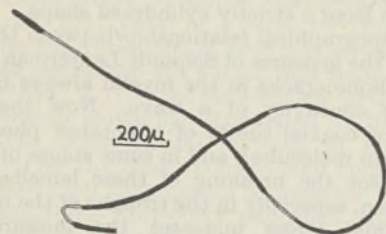


Fig. 6. FIBRE WHICH HAD BEEN FOR THREE HOURS IN DILUTED RINGER'S SOLUTION (0.3 PER CENT), SHOWING RETRACTION OF THE MYELIN AT THE NODES.

The experiment gives a clue to the factors controlling node-length during development. The myelin is laid down as the fibre is increasing in diameter, being first formed in the neighbourhood of the Schwann nuclei, which are spaced at more or less regular intervals along the fibre<sup>10</sup>. In the early stages, quite long regions of axon are left bare at the nodes. As the fibre grows in length and diameter the myelin continually tends to round up, as in the experiment with hypotonic solutions, and this prevents the individual segments from running together to make a continuous cylinder. By the time growth in length and diameter have ceased, the inturning of the neurilemma and the presence of a special 'cementing disc' (c, Fig. 1) at the node maintain the separation. During growth the segments of myelin increase in length but not in number. The first fibres to medullate are those which will ultimately become the largest, and these thus come to have the longest segments, whereas the smaller fibres, medullating later, have proportionately shorter and more numerous internodes. In confirmation of this hypothesis Mr. A. Vizoso, in this department, has recently found that after regeneration of an adult nerve for periods of more than a year,

the internode-lengths remain short, even on the largest fibres. The internode-length is therefore not a function of diameter as such, but is determined by the relation between time of medullation and subsequent growth. Drs. F. K. Sanders and D. Whitteridge measured the conduction velocity of the nerves studied by Vizoso and found it similar to that of normal fibres of the same diameter, in spite of the short segments. Evidently conduction velocity does not have a close relationship to internode-length. Although the function of the nodes remains obscure, it may be that they serve to prevent movement of the fluid within the fibres. The aggregate of forces produced by the surface tension at the ends of a series of droplets is considerable.

Fibres of the central nervous system are usually without nodes, and lack the definite tubes which are present in peripheral nerve, no doubt to meet the stresses imposed by movement. In the absence of the tubes the myelin of the central fibres presumably wets the material which surrounds it, and therefore does not divide into segments. In confirmation of this is the fact that the central fibres rarely show incisures. They may develop an unduloid outline, but then proceed to break outwards, forming spheres and other figures at the crests of the waves.

There is obviously much to be done to confirm and extend this view of the nature of nerve fibres. The presence of the unduloid outlines and the forms seen during degeneration show quite decisively that the axon and myelin behave partly as liquids the surface tension of which affects their shape, and it seems likely that the intra-axonic pressure has an important influence on the stability of the fibre.

<sup>1</sup> Plateau, J., "Statique expérimentale et théorique des liquides soumis aux seules forces moléculaires" (Paris, 1873).

<sup>2</sup> Thompson, D'A. W., "On Growth and Form" (Cambridge, 1942).

<sup>3</sup> Darling, C. R., "Liquid Drops and Globules" (London, 1914).

<sup>4</sup> Young, J. Z., *Physiol. Rev.*, **22** (1942).

<sup>5</sup> Young, J. Z., *Nature*, **153**, 333 (1944).

<sup>6</sup> Weiss, P., *Anat. Rec.*, **88**, 464 (1944).

<sup>7</sup> Schmitt, F. O., Bear, R. S., and Palmer, K., *J. Cell. Comp. Physiol.*, **18**, 31 (1941).

<sup>8</sup> Glees, P., *J. Anat.*, **77**, 153 (1942).

<sup>9</sup> Ranvier, M. L., "Leçons sur l'histologie du système nerveux" (Paris, 1878).

<sup>10</sup> Speidel, C. C., *Amer. J. Anat.*, **52**, 1 (1933).

## ENGINEERING AND INDUSTRY IN RECONSTRUCTION

IN his inaugural address on October 12 to the Institution of Electrical Engineers, Sir Harry Railing made an assessment of the extent to which engineers, particularly those in the electrical industry, can and should contribute to the solution of some post-war problems. A broader understanding of sociological problems has become essential for the engineer, for the products of his technical skill affect every human individual and human organization. A greater understanding of science in general and engineering in particular has become essential for every citizen, not necessarily in the form of detailed knowledge, for a better comprehension of life. In the logical pursuit of his mission to help the post-war world, the engineer must therefore teach the principles which underlie his work, in the hope that they may be accepted and applied.

As to some of the more specific contributions which engineers can make towards solving international and



national post-war problems, we cannot envisage either an individual or an organization within a country, or a country within the community of nations, which will be able in future to maintain any monopoly in production, unless it can forge ahead in new developments and products, or can lead in quality or in production cost.

It is to-day more than ever essential that every individual in industry should be as highly developed and receive as good a general education and training in his handicraft or profession as possible, and that he should be taught a deep sense of personal and collective responsibility. This means not only education in engineering, but in team-work as well; and such education must stress the fact that anybody who accepts more from the team than he contributes, who seeks to take more out of life than he gives, constitutes a liability rather than an asset; on the other hand, every man who gives more than he receives creates values and therefore leaves something of positive value to his fellow workers at the end of his career.

Coming to the part played by industrial associations, it is now generally acknowledged that there is an ever-increasing volume of interests common to all members of a particular industry, the furtherance of which can be undertaken by such associations with great advantage both to the industry itself and to the market which it serves. Properly constituted associations have made great contributions to ordered industrial progress, and proved themselves a socially beneficial instrument through such activities as the standardization of specifications and common parts, the pooling and exchange of patents and manufacturing experience, a measure of joint research, the standardization of trading conditions, the collection of statistical information, the maintenance of good relations with other industries, and negotiations with Government departments and with labour.

So far as the position of industry within the State is concerned, we may start from two premises which to-day are generally accepted. The interests of the individual, of a group, of a class must all be subject to the proved interest of the community. With this reservation, however, a community will be most successful, advance furthest, and obtain the highest degree of development, if it allows the utmost freedom of thought, action and development to the individual and to groups of individuals. The action of any central authority should be not so much to instruct people what to do as to restrain them from actions which might be prejudicial to others.

Regarding the influence of wages, if wage-rates in a country increase more than the normal cost of living, there will generally be an increase in the volume of articles produced, owing to an increase in the effective demand. Also, with increasing wages, taken by themselves, the cost of the product increases, and therefore the quantity of goods which can be sold in the export market decreases; or alternatively, there is an increase in the cost of raw materials and food bought in exchange. There is, therefore, a wage limit which, for a country such as Great Britain, cannot be exceeded so long as other countries lag far behind its standard of living. It is consequently of vital concern to us to-day that the living conditions of less advanced countries, especially those which have become industrialized, should approach our own, and so bring about an expansion of world demand and the possibility for us to advance further, or at any rate to maintain our own standard.

The essentials needed to maintain the advance of British industry, therefore, are first of all, measures that assure the maintenance of any lead we can gain by increased research, better education, and the development of the more complicated and advanced problems; secondly, the provision of increased capital assistance for each worker, whether it takes the forms of increased power supply, tool equipment, transport facilities, improved lighting, or working conditions in general; and thirdly, the enlightenment and education of management and labour, and indeed of every worker, both as regards his own contribution and that of each partner with whom he must work; finally, any measures which help to increase the volume of our export business, and especially those which create expansion of world demand by raising the standard of living in backward countries.

## THE LISTER INSTITUTE OF PREVENTIVE MEDICINE

THE report for 1944 of the Governing Body of the Lister Institute of Preventive Medicine again records the wide scope of the work of members of its staff. The death of Prof. W. W. C. Topley has been a severe loss to the Council, and the Governing Body also lost the services of Sir Joseph Arkwright, who has retired after long service both in administration and research. Many of the staff remain in their war-time stations in laboratories in Cambridge, Oxford and elsewhere, and many of them are serving on committees set up by the Medical Research Council. Bacteriological and immunological researches in progress include work on the anti-proteus OX 19 serum for the treatment of louse-borne typhus, trials of which have been carried out in North Africa in co-operation with United States Army medical authorities. All the six severe cases treated with it recovered. The typing of typhoid, paratyphoid and food-poisoning bacilli with the *V<sub>i</sub>* bacteriophage has been continued and a hitherto unknown *V<sub>i</sub>*-phage type of the typhoid bacillus has been identified. The study of dysentery prophylaxis is making good progress and valuable work is being done on the immunology and nuclear structure of the gas gangrene organisms and on hyaluronidase. In collaboration with the Stormont Laboratory of the Ministry of Agriculture, Northern Ireland, outstanding contributions have been made to the study of trichomoniasis. Biochemical studies are in progress on specific blood-group substances, on the action of various bacterial toxins and on gramicidin, while work on low-temperature drying of biological materials and on foetal and maternal serum is making good progress. The work on the large-scale processing of human serum and plasma for transfusion has produced valuable results. Problems arising in the kaolin processing of plasma have been solved and the Serum Unit has been filtering the entire output of the London blood transfusion depots before sending it on to Cambridge for freeze-drying.

Other work includes the cultivation of the virus of vaccinia, work on sex and other hormones and nutritional studies. The work done with the aid of volunteers at Sheffield has indicated how large are the vitamin A reserves of the liver of healthy human adults. Studies of the nutritive value of the potato have shown that potatoes are a rich source of vitamin



A and that, weight for weight, the nitrogen in potatoes has a biological value at least equal to that of whole wheat, although only about half of it is in the form of protein. It is believed that there is a supplementary action between the protein and non-protein nitrogenous substances in the tuber which is probably attributable to the amino-acids present among the latter, although the amides and basic nitrogenous compounds probably also take part.

When the nutritional state of housewives in Oxford and of women working in factories there was studied for a year, it was found that their nutritional state deteriorated very little, although that of the workers deteriorated more. There were no clinical signs of special nutritional defects, except that 25 per cent of the workers showed enlargement of the thyroid and 36 per cent of them had dental fluorosis: the incidence of both these conditions is high in north Oxfordshire.

The Institute continues to perform that valuable service, the maintenance of the National Collection of Type Cultures, for which more accommodation has been provided. Everyone will hope that very soon the staff of this Institute will be able to re-assemble in London and at Elstree to continue, in the closer collaboration made possible by that return home, the valuable work which is here so modestly reported.

G. LAPAGE.

## FORTHCOMING EVENTS

### Saturday, October 22

BRITISH RHEOLOGISTS' CLUB (at the University, Reading), at 2.30 p.m.—Annual General Meeting. Discussion on "The Measurement of Tack" (Introductory Papers by Dr. N. A. de Bruyne and Dr. R. F. Bowles).

QUEKETT MICROSCOPICAL SOCIETY (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Dr. Nellie B. Eales: "Some Aspects of the Malaria Problem".

SHEFFIELD METALLURGICAL ASSOCIATION (at 198 West Street, Sheffield, 1), at 2.30 p.m.—Mr. A. Preece: "The Oxidation of Steels in Furnace Atmospheres".

### Monday, October 23

INSTITUTION OF ELECTRICAL ENGINEERS (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Discussion on "The Engineer's Part in Certain Post-War Problems" (to be opened by the President).

### Tuesday, October 24

BRITISH SOCIETY FOR INTERNATIONAL BIBLIOGRAPHY (at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2), at 2.30 p.m.—Mr. J. E. Wright: "The Application of the Universal Decimal Classification to Telecommunication Literature—Some Suggestions for Developing the Tables to meet Modern Requirements"; Mr. L. S. Harley: "Document Classification in a Limited Field—Radiocommunication and Allied Subjects".

ROYAL PHOTOGRAPHIC SOCIETY (SCIENTIFIC AND TECHNICAL GROUP) (at 16 Princes Gate, South Kensington, London, S.W.7), at 6 p.m.—Mr. C. F. Sayers: "Quartz Crystals and some of their Applications, with Specific Reference to Telecommunications".

ROYAL INSTITUTE OF CHEMISTRY (LEEDS AREA SECTION) (joint meeting with the LEEDS UNIVERSITY CHEMICAL SOCIETY) (in the Chemistry Lecture Theatre, The University, Leeds), at 6.30 p.m.—Prof. J. W. Cook, F.R.S.: "Some Chemical Aspects of Cancer Research".

### Tuesday, October 24—Wednesday, October 25

BRITISH SOCIETY OF ANIMAL PRODUCTION (at the London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1), at 10.30 a.m.—Discussion on "The British Sheep Industry".

### Tuesday, October 24

Prof. R. G. White: General Survey; Mr. D. H. Dinsdale: "Hill Sheep"; Mr. T. L. Bywater: "Sheep for Long Leys"; Mr. J. F. H. Thomas: "Arable Sheep".

### Wednesday, October 25

(Joint Meeting with the INSTITUTE FOR THE STUDY OF ANIMAL BEHAVIOUR). Mr. John Hammond, Jr., Mr. L. R. Wallace and Dr. Nancy Palmer: "Current Investigations relating to Sheep"; Dr. J. E. Nichols: "The Behaviour of Sheep Browsing under Drought Conditions"; Prof. Johnstone-Wallace: "The Grazing Habits of Beef Cattle"; Dr. K. L. Blaxter: "Food Preference and Food Habits in Dairy Cows".

### Wednesday, October 25

INSTITUTE OF FUEL (MIDLANDS SECTION) (at the James Watt Memorial Institute, Birmingham), at 2.30 p.m.—Mr. L. C. Southcott and Mr. D. W. Rudorf: "Superheaters for Water Tube Boilers" (Précis and Discussion).

SOCIETY OF CHEMICAL INDUSTRY (FOOD GROUP) (at the Chemical Society, Burlington House, Piccadilly, London, W.1), at 3 p.m.—Mr. W. B. Adam and Mr. D. Dickinson: "Diagnostic Methods in Problems concerned with the Corrosion of Cans".

INSTITUTION OF ELECTRICAL ENGINEERS (RADIO SECTION) (joint meeting with the PLASTICS GROUP OF THE SOCIETY OF CHEMICAL INDUSTRY) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Prof. Willis Jackson and Mr. J. S. A. Forsyth: "The Development of Polythene as a High-Frequency Dielectric".

INSTITUTE OF WELDING (at the Institution of Civil Engineers, Great George Street, Westminster, London, S.W.1), at 6 p.m.—Discussion on "Welding in British Industry after the War" (to be opened by Mr. H. I. Hodgson (Automobiles and General Engineering); Mr. C. S. Lillierap (Shipbuilding); Mr. H. N. Pemberton (Pressure Vessels); Dr. H. Sutton (Aircraft)).

ROYAL INSTITUTE OF CHEMISTRY (DUBLIN SECTION) (at University College, Upper Merrion Street, Dublin), at 7.30 p.m.—Mr. H. G. Leonard and Mr. P. Whelan: "Spectrographic Analysis".

### Friday, October 27

INSTITUTION OF CHEMICAL ENGINEERS (CHEMICAL ENGINEERING GROUP) (at the Institution of Civil Engineers, Great George Street, Westminster, London, S.W.1), at 3 p.m.—Sir Alexander Gibb, G.B.E., F.R.S.: "Hydro-Electric Development in Great Britain and its Influence on Chemical and Allied Industries" (Fifth Hinchley Memorial Lecture).

INSTITUTION OF MECHANICAL ENGINEERS (at Storey's Gate, St. James's Park, London, S.W.1), at 5.30 p.m.—Mr. Edward Reeve: "The Influence of Engineering on Social Advancement".

INSTITUTE OF FUEL (SCOTTISH SECTION) (at the Royal Technical College, Glasgow), at 5.45 p.m.—Mr. W. J. Skilling and Dr. M. McGregor: "Scottish Coal Resources".

### Sunday, October 29

ASSOCIATION OF AUSTRIAN ENGINEERS, CHEMISTS AND SCIENTIFIC WORKERS IN GREAT BRITAIN (joint meeting with the ASSOCIATION OF AUSTRIAN DOCTORS) (at the Austrian Centre, 69 Eton Avenue, Hampstead, London, N.W.3), at 11.30 a.m.—Dr. F. Bergel: "Life Saving and Life Preserving Plant Products".

## APPOINTMENTS VACANT

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

YOUNG CHEMIST AND METALLURGIST for Heavy Engineering Works in North-West Region—The Ministry of Labour and National Service, Room 432, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. P.2955.XA) (October 25).

LECTURER (full-time) IN MECHANICAL ENGINEERING, and a LECTURER (full-time) IN STRUCTURAL ENGINEERING—The Clerk to the Governors, Technical College, Chesterfield, Derbyshire (October 27).

CHIEF ELECTRICAL ENGINEER AND MANAGER—The Clerk to the Ashford Urban District Council, The Cedars, Church Road, Ashford, Kent (October 30).

TEACHER (full-time, Graduate) OF ENGINEERING up to Higher National Certificate standard in the Crewe Technical College—The Director of Education, County Education Offices, City Road, Chester (October 31).

THREE PROFESSORSHIPS at the Indian Institute of Science, Bangalore, India, to organize Departments of (a) AERONAUTICAL ENGINEERING, (b) METALLURGY, and (c) APPLIED MECHANICS with special reference to I.C. Engines—The Ministry of Labour and National Service, Room 432, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. C.2310.A) (October 31).

LECTURER (full-time) IN ENGINEERING SUBJECTS in the Ashington Mining School—The Director of Education, County Hall, Newcastle-upon-Tyne (October 31).

DEPUTY BOROUGH ELECTRICAL ENGINEER—The Town Clerk, Town Hall, Huddersfield (endorsed 'Deputy Borough Electrical Engineer') (November 8).

LECTURER (full-time) IN THE MECHANICAL ENGINEERING DEPARTMENT of the Municipal Technical College—The Director of Education, Education Office, St. Helens.

DIRECTOR OF RESEARCH—The President, Paper Makers' Association of Great Britain and Ireland, Melbourn House, Aldwych, London, W.C.2.

SPEECH THERAPIST—The Director of Education, Education Offices, Becket Street, Derby.

MECHANICAL ENGINEERS for Colombo, Ceylon—The Ministry of Labour and National Service, Appointments Department, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. O.S.192).

ASSISTANT LECTURER IN AGRICULTURAL BOTANY, and a SENIOR SCIENTIFIC ASSISTANT IN THE DEPARTMENT OF ECONOMICS—The Principal, Harper Adams Agricultural College, Newport, Shropshire.

ASSISTANT MASTER to teach PHYSICS up to Lower Sixth Standard, with subsidiary MATHEMATICS and/or CHEMISTRY, in the Vardean School for Boys—The Education Officer, 54 Old Steine, Brighton, 1.

GRADUATE TEACHER OF ENGINEERING SUBJECTS up to and including Graduateship Examination of the Institution of Mechanical Engineers—The Principal, Wolverton Technical School, Wolverton, Bucks.

LECTURER IN AGRICULTURE, and a WARDEN AND ASSISTANT to the Lecturer in Agriculture—The Principal, Kent Farm Institute, Sittingbourne.