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PROFESSIONAL INSTITUTIONS

IN an important passage in its statement on "Scientific Industrial Research", Nuffield College directs attention to a problem arising out of the use of university laboratories or research workers for applied research. The suggestion is made that if there were a code of conduct recognized as generally applicable to university scientific workers undertaking outside industrial work for private firms, it would be a comparatively easy matter to work out a special code to cover these problems so as to avoid alike restrictive conditions, on either side, slackening in the pursuit of science, or undue influence over university departments by particular firms or industries. Obviously, as the memorandum indicates, the entire problem is one to be tackled jointly by the universities, professional associations and industrialists, and it is one in which the initiative might be expected to come from the professional associations of scientific workers themselves.

This is a particular example of the kind of contribution which Prof. Carr Saunders and P. A. Wilson visualized professional associations making to the development and welfare of society in their study some twelve years ago of the professions. It is of more interest since there have in the interval been so few signs that professional associations are aware of the immense opportunities before them in this connexion, or how great could be their contribution to the reconstruction of the crumbling or broken fabric of democratic life. Without their advice and co-operation, the right atmosphere and the appropriate conditions for fruitful research may be difficult to attain ; and there are other fields in which the professional contribution may be equally invaluable. As Carr-Saunders and Wilson noted, it is not that professional men are innately reactionary or unprogressive, but that they lack vision. "They do not grasp the essential features of the social and economic structure and the place of the professions in it. Moreover in so far as they do interest themselves in matters outside the development of their own technique, they often fail lamentably to display the same standards of exactitude and judgment as they demand with vigour in their immediate spheres. The pity of it is that their opportunities are so great and that they have so large a part to play, if only they would open their eyes and summon up courage to act in the large issues of contemporary life."

Despite honourable exceptions, it cannot well be said that that criticism is any the less true than when it was written, nor has there been any notable progress in the study of the urgent problem of proper relations between professional associations, as repositories of specialized knowledge, and the democratic State. We cannot reasonably claim that, despite the enhanced importance of planning, much obvious thought has been given to the problem of the methods which professional associations should employ to present their views and which the State should use to obtain their advice. The organization outlined early this year in the White Paper on Scientific Research and Development has grown almost haphazard, but it at least meets the essential criteria of Carr-Saunders and Wilson that there should be many channels of communication between knowledge and power, that they should be kept wide open, that proposals and criticisms should be freely circulated and that the mechanism should be flexible and capable of easy adaptation as circumstances demand.

That organization, however, scarcely provides for adequate consultation or representation of professional associations, whose representations are sometimes more effectively made through the Parliamentary and Scientific Committee. Its emphasis is rather on the individual expert than on his professional association, and therein lies a great weakness. One function of the professions as such is to bring knowledge to the service of power but, as Carr-Saunders and Wilson point out, that function is, and can only be, effectively discharged when men and women, finding in vocational associations their permanent anchorage and shelter, set out from these secure positions to shape organizations into instruments for the fulfilment of their social and economic purposes. Unless that is done, the organizations set up to enable men and women to perform their special service in the ordinary business of life escape from control and become a menace both to professional efficiency and to social progress and well-being.

That contribution is the more important if we consider, as Prof. H. J. Laski argues in his "Reflections on the Revolution of our Time", that the present fleeting opportunity of revolution by consent, and of experimenting with the conditions which make possible the resumption of expanding welfare, involves putting the idea of freedom in the context of equality, and discovering exactly how freedom and democracy interpenetrate one another. Post-war reconstruction and the fundamental adjustment of society to the changes in structure which the War has already brought about, offer a great and inescapable challenge to professional organization and thought. If professional men do not face the problem of reconciling freedom with power and responsibility, the prospects of winning the peace are indeed dark. To put professional advantage in face of public duty at the present time would be, in the end, fatal to their own interests. Collectively and individually, scientific workers can no longer live in their laboratories or professional associations as ivory towers: they are concerned with the social context of their work, and to see that social and political policy do not frustrate the quality or extent of their contributions to social well-being.

The chapter "Freedom in a Planned Democracy" in this same volume deserves close attention for its stimulating suggestions of the kind of contribution which trade unions and other professional associations might make in a new social order in which the concept and context of freedom are positive rather than negative. It is, in fact, this negative concept that has warped the activities of the trade associations and fostered restrictive practices, as it does in the professional field. In a new prospective in which that fear of want and insecurity is removed, professional associations will find their protective functions far less important than the contribution they can make to the improvement of the standards of professional practice, in science, in law, in medicine and in technology. Trade unions in such a context might well be set free from present inhibitions and take a fuller interest in the organization of industries in the interest of the community generally, the fostering of technical development and the support of scientific research.

These possibilities are at present scarcely glimpsed. The routines by which, as Prof. Laski rightly notes, men live have too often limited their professional horizon, and in an age of insecurity the threat to that routine has clouded their judgment. Again, arguing that the maintenance of democracy as a framework for the State is essential for the maintenance of free discussion and the spirit which scientific discovery requires, Prof. Laski maintains that a civilization at once so complex and so fragile as ours must postulate the need for scientific discovery as a primary condition of its survival. That effort, with all it means in scientific and industrial research, will demand, as we have so often urged in these columns, the widespread support and understanding of all sections of the community, and the importance of the contribution which the trade unions might make, given once a new outlook, is not easily overstressed.

The nature of the contribution of professional organizations to the social and economic structure has been further indicated by J. T. MacCurdy in a suggestive chapter in his little book "The Structure of Morale". One of the central problems of democracy is that of establishing a right balance between efficiency and liberty, and of providing effective means for discussion at the lower as well as at the higher levels. That is the importance of the production committees which the War has called into being; they may have a vital part to play in the fuller integration of industry with the community which its prime function is to serve.

The development of group loyalties in this way is of importance for two reasons. First, it encourages the expression of the ideals and experience of the individual, particularly of his creative powers, as Dubreuil has emphasized in his exposition of the idea of autonomous groups in industry. Secondly, it facilitates that contact between the upper levels of the hierarchical organization required for large-scale planning and the accurate and detailed knowledge based on experience at the lower levels which is essential for flexibility and the modification of policy in the light of experience. Huge organizations, as MacCurdy notes, are necessarily inefficient owing to their rigidity and inadaptability; to fabricate a social organization that is really adaptable, we have first to develop a liaison system comparable in its intricacy with the individual human brain.

Some recognition of this is to be found in such reports as that of the Social and Industrial Commission of the Church Assembly on "The Church and the Planning of Britain"; but it is unfortunately true that professional organizations, like the trade unions themselves, which might be making an invaluable contribution to the development of a liaison or intelligence system of the type required, are specially liable to this disease of ossification, rigidity and conservatism to which all large-scale organization seems to be a prey. A number of professional associations have, it is true, recognized their responsibilities in regard to reconstruction, either generally or in some special field. It was a major purpose, for example, of the Institution of Professional Civil Servants in submitting its proposals for the reconstruction of the technical Civil Service (see p. 743 of this issue of *Nature*) that the professional and technical services should thereby be better equipped to give the more positive services to the community that will be required of them. The Association of Scientific Workers has issued two admirable statements on "Science and the Universities" and "A Post-War Policy for Science". The Institution of Electrical Engineers has established a Post-War Planning Committee to study post-war developments in electrical engineering, with terms of reference which imply not merely important contributions to public policy but also consideration of desirable changes in the structure and machinery of the Institution.

Special contributions in the particular fields where they are qualified have been made by such bodies as the Association of Architects, Surveyors and Technical Assistants and, through its Reconstruction Committee and Architectural Science Group, the Royal Institute of British Architects. In this connexion the Modern Architectural Research Group and the Engineers' Study Group on Economics should also be mentioned. None the less, the essential danger remains. It can be seen in the general outlook of considerable bodies of scientific workers, and it has to be taken into account in considering any such proposals as those of the Royal Statistical Society for a supplementary charter enabling it to institute a professional diploma for statisticians with the view of raising their status. The rational approach is seen in Dr. Frans Verdoorn's address in the symposium on "Biologists and Rehabilitation" arranged by the Botanical Society of America and the American Association for the Advancement of Science at Cleveland on September 13 (see *Nature*, **154**, 595, 1944). Such an impartial and fundamental approach to questions of scientific co-operation, whether national or international, and especially in such matters as publications, is all too rare.

What is required is, in fact, exactly such a reconsideration of the position and functions of professional bodies in relation to society against the background we have indicated, and with particular references to the inherent weaknesses of all such associations. This outlook is hard to find in the only recent survey of professional associations in the scientific field—a brief memorandum "The A. Sc. W. and Other Bodies", issued by the Association of Scientific Workers. Here once again the approach is subjective and functional; but the memorandum clearly indicates the need for rationalization, which some of the large bodies of scientific workers, such as the chemists, have refused to face. The memorandum may well serve as a starting point for further discussion of the whole subject. In particular, it may help to clarify some of the confusion in the public mind between the scientific or learned societies and the professional associations of scientific workers.

Broadly speaking, the professional associations with which scientific workers are concerned fall into three types according to their function. There are, first, the learned societies, concerned principally with the encouragement, discussion and publication of scientific research in particular fields. Headed by the Royal Society, they cover almost every subject, and it will be noted they are the oldest societies of scientific workers in existence.

The formation of these learned societies was followed at varying intervals by the establishment of organizations or institutes concerned with the maintenance of professional standards, first of qualifications and then of conduct or ethics. Some of them, like the Institution of Electrical Engineers, the Institution of Mechanical Engineers, the Institution of Civil Engineers, the Royal Institute of Chemistry and the Institute of Physics are chartered bodies and cover wide fields of pure or applied science. Other more recently established bodies such as the Textile Institute, the Institution of the Rubber Industry and Institution of the Plastics Industry are concerned with much more limited fields, and in activities, such as publications, overlap with the functions of the scientific societies.

The third and most recent type of professional association is what may be termed the defence organization concerned with the protection of the economic interests of qualified professional men, of which type the Association of Scientific Workers and the British Association of Chemists are the best known. Here again there is some overlapping, for so far as public analysts are concerned the Royal Institute of Chemistry has proved an effective defence organization and indeed was largely formed originally to promote the interests of the public analyst. Moreover, associations formed primarily for defence purposes have taken no narrow view of their functions and have often been as concerned to maintain standards of professional qualification as to protect the economic or professional interests of their members.

Apart from the confusion of functions, one of the weaknesses of the professional organization of scientific workers has been imperfect representation. Even some comparatively numerous bodies such as the Royal Institute of Chemistry with 9,000 members are not fully representative: there are, for example, some 20,000 names on the Chemical Section of the Central Register. Others, even when fully representative of the profession or technique, are numerically too weak, and efforts to redress numerical weakness by merging with other bodies or by lowering the standard of qualification are obviously detrimental alike to public and professional interest. For the chartered institutes to fulfil their primary functions it is imperative that they maintain uniform recognized levels of qualification, on the basis of which the profession can become a well-defined and coherent whole. These levels of qualifications must be recognized and observed by the corresponding defence associations also: whatever measures are required to safeguard the interests of laboratory assistants, they emphatically should not include admission to the associations of fully qualified practitioners, however important it is that such associations should be closely concerned with the welfare and training of potential candidates. The Association of Scientific Workers shows a complete misconception on this point where its memorandum suggests that a grade of membership of the Royal Institute of Chemistry is required to cover the partly qualified assistant chemist or laboratory assistant.

Some rationalization of professional associations and societies is clearly desirable, particularly in regard to their practice in publication; but each of these three functions has its own contribution to make in bridging the gap between knowledge and power and furthering that intelligence system so essential in an effective democratic society. Moreover, the development of more effective organization for corporate representations, such as the Joint Council of Professional Scientists set up in 1942, may in time encourage such rationalization and the more effective use of available resources in publications and other matters. Again, the experience of some of the smaller societies such as the Oil and Colour Chemists' Association and the Society of Dyers and Colourists, particularly with their technical advisory panels, in assisting Government Departments in solving war problems, is of importance as indicating services which might be less easily rendered in a larger organization.

Rationalization of the associations of scientific and other professional workers can only be looked for when the point of view expressed so admirably by Carr-Saunders and Wilson permeates their councils and governing bodies and the members generally. When that time arrives, we may hope for a thorough and impartial scientific examination of the whole problem, and the outline of a plan unwarped by deference to the embedded prejudices or traditions to be found vested among scientific organizations as elsewhere. The report of the British Commonwealth Science Committee contained some concrete proposals on these matters to which there has been as yet little evidence of any general response. Meanwhile, the consciousness that effective post-war planning can only proceed as the appropriate means are found for science to make its contribution at the right stage may give a fresh impetus to the consideration of the organization of our scientific effort and the development of improved liaison between the Government and professional associations. Again, the acute difficulties in which scientific publications in Britain are now placed, partly as a result of the paper position, may induce fresh efforts to deal with the publication of scientific research and its exposition to industry and the general public on a more rational basis, and also with the vexed and difficult question of the abstracting of scientific and technical literature. Dr. Verdoon's suggestions on this point in regard to biological literature have a wider application and deserve note by scientific workers generally. The experience of the Joint Council of Professional Scientists may assist the development of new means of collaboration, but something more than organization will still be required. Without some wider vision and more urgent sense of professional responsibilities and of the possibilities and opportunities of public service, we cannot expect scientific workers and other professional men to take the first and most difficult step involved in scrutinizing anew their professional organizations in the light of the needs of the day and the fundamental principles and purposes they have to serve. Adequate organization is essential, but even more important is a high sense of public duty and the willingness to co-operate for constructive purposes. It is only when the threefold functions of professional associations are pursued co-operatively and in balance, and not to the nurturing of one at the expense of others, that professional men will play the essential part that is theirs in extending the empire of reason over the minds and habits of men, and replacing arbitrary discretion in any man or group of men by settled and agreed principles within the ambit of which their conduct must be controlled. On these two things, both fundamentally denied by Nazism and Fascism, civilization depends.

GEOLOGY WITHOUT TEARS

Principles of Physical Geology

By Prof. Arthur Holmes. Pp. xii+532+95 plates. (London and Edinburgh: Thomas Nelson and Sons, Ltd., 1944.) 30*s*. net.

A GEOLOGICAL author who introduces the word 'Principles' into the title of his work is wittingly inviting a comparison with Charles Lyell's masterpiece, "The Principles of Geology", which, more than a century ago, laid the foundations of the modern science. Whereas Lyell's was a work of genius, the present book is not; but this is no matter for the slightest regret. It may be debated whether geological science at this present time needs a genius or could make much of one were he to appear, but there can be no question at all that it needs an expositor—and here is one with a rare combination of lucidity and sprightliness. Geologists have wailed of late about the neglect of their science and of themselves in many fields both warlike and peaceful, and have traced this neglect to the ignorance of geology among all classes of the community in Great Britain and especially among those classes which should know better. Their laments have certainly been justified, but they have proposed few workable remedies. It seems that the cure has lain all the time in the hands of the geologists themselves; they cannot expect many people nowadays to struggle for knowledge, and they must accordingly make their wares attractive and take them to the customers. Here is a very attractive article indeed.

To begin with, the story of the development of the surface of the earth should interest everyone outside a penitentiary cell or a similarly secluded luxury flat, for the simple reason that we walk about on that surface, grow our food in it, get the raw materials of industry from under it and, in these days of so-called progress, dig a nice safe shelter deep below it. Apart from this, the story itself is exciting, with revolutions every so often, with the ceaseless interplay of varied forces, with a little happening for a very long time and a lot happening in practically no time at all. As has been said already, Prof. Holmes displays these matters with complete clarity, and in an even and fluent style. Further, at this time of 'economy standards', it is sheer delight to read and handle a book printed in pre-war fashion on a white paper in a good type and with wide margins, and furnished with an abundance of excellent illustrations in plates and figures. There seems to be no reason why this book should not be a best-seller, and with much more justification than most.

The book is divided into three parts. The first, and least satisfactory, is an introduction to geology intended to equip the reader for a proper appreciation of the following two parts. To write a short account of the fundamentals of a science is a far more difficult job than to write a long account of its latest developments; by the same token, the ablest teachers should teach the elements of their science and leave the last graduate to retail competently the embellishments of his own times. This first part, and a very fundamental part it is, appears to have been insufficiently thought out. It seems unlikely to the reviewer that an ordinary intelligent non-geologist could make much of certain sections of it.

Parts 2 and 3, on the other hand, are excellent. The first of these deals with operations at the surface and gives an account of weathering and the sculpture of the lands by water, wind and ice. This part ends with modern statements on life as a rock-builder and as a fuel-maker, that is, on the rocks of organic origin, limestones and coals and petroleum. It may be remarked here that the author tends to suggest that all problems in geomorphology and surface activities generally have been solved; fortunately, this is by no means the case.

In the last section of the book, we get below the surface and are presented with an exciting account of internal processes and their results. Earthquakes and volcanic activity are dealt with in a competent, modern manner. The two styles of earth-movements, the orogenic or mountain-building and the epeirogenic or plateau-building, are described, the illustrative examples being so chosen that not only is the tectonic make-up of the continental masses summarized but also more detailed expositions of specially interesting units such as the African rifts, for example, are presented. The last chapter discusses the theory of continental drift. This section differs in tone from the previous one, in that it is now admitted that there are a great many problems still unsolved; but Prof. Holmes appears to sugg st that solutions for most of these will eventually be found along the lines proposed by him. Thus, the notion of internal convection currents, elaborated by the author in recent years, is applied to account for mountain-building and for volcanic activity, and is used as the mechanism for continental drift. It is, of course, right and proper for a geologist or anyone else to have a profound belief in his own proposals, but this is no guarantee that the belief will be widely held by others. It would have been better and fairer for the general reader if some of the many other speculations on these topics had been mentioned, if not discussed.

In the estimation of a book of this calibre, minor criticisms—and many could be made—would verge on the pettifogging. There is one regrettable lapse that must be excised in a new printing; that fine Dartmoor tor at Manaton is disgraced by the title of the Mussolini Rock! In spite of minor defects that could easily be remedied, the book rises well above any recent work in English in its own field. It is to be hoped that the geological education of the community begun by this book will be continued in as pleasant a manner. H. H. READ.

POPULATION GROWTH

Plenty of People

By Warren S. Thompson. (Science for War and Peace Series.) Pp. x+246. (Lancaster, Pa.: Jaques Cattell Press, 1944.) 2.50 dollars.

"THIS book is an attempt to introduce the lay reader to the problems of population growth", says the preface. The author outlines—no more—the major economic, social, and military problems arising from populations either too big or too small for the areas which they inhabit. The fifteen chapters (or rather fifteen essays in random order) cover a world survey of population growth, with useful statistical material on birth- and death-rates, and a discussion of the relationship between population growth and age-composition, war, migration, international trade, and the treatment of minorities. A section on eugenics blames family environment rather than heredity for producing delinquent offspring from delinquent stock. Finally, the author describes existing population policies, particularly Germany's, and suggests a policy for the United States.

Dr. Thompson's book is on purpose thinly documented out of too much care for the lay reader. The most disquieting gap is the lack of any reference to Fru Myrdals' "Nation and Family", which deals more profoundly with a section of the ground covered here. Dr. Thompson could also have improved his presentation by tabulating statistics where possible instead of writing most of them into the text, and by eliminating repetition. However, these criticisms should not overshadow Dr. Thompson's basic achievement; he simplifies difficult problems without omitting major arguments, and he underlines the main points by excellent graphs and diagrams.

Dr. Thompson distinguishes two distinct stages in the development of population control. First, control of the death-rate. Secondly, control of the birth-rate. The period of greatest population growth occurs when a community has learned to control its death-rate, but has its birth-rate still at maximum capacity. There is obvious correlation between such periods of population growth and industrialization. Here Dr. Thompson is wary. Pieced together, his view seems to be that increased industrialization, that is, productivity, provides resources which result in a reduced death-rate. The consequent population increase itself creates a need for further industrialization so that the standard of living can not only be maintained, but also raised to meet a whetted appetite. This circular argument accounts for apparent discrepancies, since different parts of the book intersect it at different places. The main point is, however, clear—the Western countries have in effect passed their periods of population expansion; but the features which characterized the nineteenth century in the United States and in Great Britain will in the near future characterize eastern Europe and, particularly, Asia. "They are learning how to control their death rates and to use machines." Japan, India, China and the Soviet Union will soon rival the West, which will "cease to have sole possession of the economic and political advantages of an efficient machine industry and a rapidly growing population". In the author's opinion this will lead to wars of rivalry unless the Western nations will relax their hold on raw material resources and on under-populated areas. The Netherlands East Indies, and British Borneo and New Guinea could, he says, absorb immigrants, so could Canada and South America. But he is harshest on Australia, declaring that so long as she wilfully keeps her population some sixteen millions below potential capacity, other nations should refuse to meet her resultant military need.

The second stage in population control comes when communities learn also to control their birth-rate. At first this control operates less effectively than control of the death-rate. A rapidly declining death-rate is coupled with a slowly declining birth-rate, so that the population grows. Then the birth-rate falls faster, while the death-rate probably becomes fairly stable, health measures having reached near-maximum efficiency. At this stage nations can be said to have *control* of population growth, but this does not imply, of course, that they have any population *policy*. However, nations with a conscious policy can put it into effect only when they have achieved control of birth- and death-rates. Control of the death-rate is not a flexible instrument. Control of the birth-rate could be, and it is here that policy must operate. Each nation must itself decide whether to aim at replacement, or at more or less than replacement. Its propaganda and its social values and inducements must be set accordingly. Until such a policy is decided and made known, each family will make its own private decision about the size of its family, possibly with disastrous effects on the general well-being.

The population policies of each nation should, says Dr. Thompson, "concern themselves with the adjustment of population to its resources, giving consideration to the manner of life it considers good". This definition is not valid, however, as long as population is uncontrolled in other parts of the world. The Malthusian situation arising there will almost certainly provoke wars. Dr. Thompson is explicit about this; if all mankind is to have a decent standard of living, and, as a consequence, to live at peace, the birth-rate should nowhere exceed one third of the physiological maximum. This dictum assumes a policy for peace, but militaristic nations, or those in dread of militaristic neighbours, will scarcely favour a reduced population. Population policy may then become the opposite of that calculated to promote the welfare of citizens considered primarily as human beings.

Apart from military considerations, Dr. Thompson sees no harm in a declining population for Great Britain, Italy or Germany, and advocates it strongly for China, India and Japan. But Australia, New Zealand and Brazil should expand, he thinks, and the United States stabilize at around the predicted 1975 level. The optimum birth-rate is different for different countries and at different times. The outstanding contribution of Dr. Thompson's book is this insistence that national population policies are practicable and essential, but that these cannot be settled in isolation. Relative population numbers should, if this thesis be accepted, become a subject for future international agreement.

DE GENERATIONE

Aristotle. Generation of Animals

With an English translation by Dr. A. L. Peck. (Loeb Classical Library.) Pp. lxxviii+608. (London: William Heinemann, Ltd.; Cambridge, Mass.: Harvard University Press, 1943.) 10*s*. net.

ARISTOTLE'S biological works have never lacked translators and commentators. The latter found in them ample scope for their learning, and particularly for their ingenuity, in so far as the texts, in the words of the late Prof. A. Platt, "have suffered terribly in the process of transmission to us, and are full of grievous blunders committed by scribes". The first complete English translations by Thomas Taylor, published in 1807–09–10, were printed in so small an edition that they are among the rarest of books. The translations available to the modern English student are: "History of Animals" (Cresswell, 1862) and D'Arcy Thompson (1910); "Parts of Animals" (Ogle, 1882, 1912 and Peck, 1937); "Generation of Animals" (Platt, 1910) and the present work by Peck (1943). The last-named author is at present working on another translation of the "History of Animals", which will complete the trilogy of Aristotle's biological works in the Loeb series. Dr. Lones' general survey of these works (1912) serves as an admirable introduction to their range and importance. That ancient and curious volume known as "Aristotle's Compleat Master-piece", first published in 1684, which was already in its thirty-second edition in 1782, is still in print, despite its fallacious title and useless contents.

Translations of Aristotle's biological works have as their main concern not questions of linguistics but of subject-matter, or in other words they appeal not so much to the Aristotelian scholar as to the biologist. Nevertheless, the perfect translation must be able to satisfy both the Grecian and the man of science. This would seem to require the collaboration of two workers, since it rarely happens that the diverse interests of language and science come to rest in one individual, as they do so happily in the majestic personality of Sir D'Arcy Thompson.

Dr. Peck's approach to his task is that of the classical scholar; but he realizes that Aristotle in this work on generation is an original thinker as well as a descriptive embryologist. Indeed, as Dr. Peck himself points out, Aristotle compiled the first systematic treatise on animal generation, in which he may be said to have: (1) founded comparative embryology; (2) favoured epigenesis as opposed to preformation; (3) initiated the study of organogenesis; (4) deduced the functions of the placenta.

In addition to the obvious advantage of printing the original Greek text and the translation on opposite pages, Dr. Peck gives us a carefully revised version of the former, and also a valuable exposition of Aristotle's thought, methods and technical terms. Further, there are a useful summary and a detailed index. Such defects as there are in this edition are of quite minor interest. For example (p. xix), it is not correct to say that "Harvey was indeed the first to make any substantial advance in embryology since Aristotle". Nor must we forget that Highmore, simultaneously with Harvey, demonstrated the real nature of the cicatricula of the fowl's egg. On page 205 Dr. Peck says that Aristotle's kestreus "cannot be the grey mullet, but is probably a species of *Muraena* or *Gymnotus*". The latter genus is confined to the

New World, and Linnæus's eastern species of '*Gymnotus*' could scarcely have been known to Aristotle. On the other hand, the mullet attribution is confirmed by Aristotle's statement that his kestreus had a gizzard-like stomach, which *Muraena* certainly has not. Page 302 *f.*, Aristotle's placental fish was rediscovered by Steno in 1673 before J. Müller. Page 390, footnote *g*, includes a misprint which is good Scots, but not what Dr. Peck meant to say. But slips like these do not detract from the essential importance of the work, even if it is not ungracious to mention them, and all students of the history of biology will be deeply grateful to the author for an outstanding addition to Aristotelian literature. F. J. COLE.

INORGANIC CHEMISTRY OF NITROGEN, PHOSPHORUS, OXYGEN AND SULPHUR

Systematic Inorganic Chemistry of the Fifth- and Sixth-Group Nonmetallic Elements

By Prof. Don M. Yost and Horace Russell, Jr. (Prentice-Hall Chemistry Series.) Pp. xx+423. (New York: Prentice-Hall, Inc., 1944.) 6 dollars.

BY selecting a rather small but highly interesting and important part of the chemistry of the elements, the authors have been able to give, in a short compass, a very valuable survey of topics which should be of the highest value to students and teachers, and also, since adequate references to literature are given, to those seeking further information on the subjects with which it deals. Particular emphasis is laid on such modern aspects as molecular dimensions and shapes, and bond-lengths, and there are usually rather full statements of all the quantitative properties of the substances dealt with.

It is clear that the authors have made very full use of the original literature, and have provided concise yet highly informative summaries of a large number of papers. As an example, the fifteen-page account of the metaphosphates may be mentioned, this including all the results of a large amount of difficult literature in a clear, ample and readable form. The treatment is critical without being obtrusively so. There are many good graphs of properties and diagrams of molecular structures; but the book as a whole is rather weak on preparative chemistry, and the reviewer missed diagrams of apparatus even in cases, such as the description of the preparation of hydrogen persulphides, where these are essential in appreciating the methods.

Some matter which could well be omitted from such a book, such as the half-page dealing with the theory of electron gas on p. 141, would, in the reviewer's opinion, better have been replaced by preparative detail, but this is perhaps a point on which opinions will differ. In the description of the glow of phosphorus (p. 170) sufficient emphasis is not given to the work of Miller, quoted on p. 177; this section should be revised in a new edition. The reviewer noticed very few misprints; "Bayley" instead of Baly on p. 4, and H_2PO_3 instead of H_3PO_3 in the heading on p. 198, are examples of what can be put right in a later edition, and the text seems remarkably accurate. The book is very well written, the interest being maintained even in sections containing mostly numerical data, and students should find it stimulating and arousing interest in the subject. It is permeated by what one may call the 'research spirit', and the authors say in the preface that it contains much information from their own experience.

The fifth and sixth groups of the Periodic Table contain some of the most interesting elements, and this applies also to the metals, which the authors, unfortunately, have not been able to include in the book.

Whether for its well-conceived and executed plan, or for its objective tone, the book deserves very high praise indeed, and will undoubtedly take its place in the list of books every chemist will wish to possess. The printing, paper and binding are worthy of the text.

THE RELATION OF BODY AND MIND

Food for Thought

A Treatise on Memory, Dreams and Hallucinations. By Bernard J. Duffy. Pp. 160. (London, New York and Toronto: Longmans, Green and Co., Ltd.; Dublin: Abbey Publishers, 1944.) 10*s*. 6*d*. net.

THE evidence in favour of telepathic communication (supra-normal cognition or extra-sensory perception) is now enough, and more than enough, to convince any reasonable inquirer, and it may be time to consider theories to explain how it happens. A theory of physical transmission from agent to recipient, that is capable of experimental test by ordinary methods of scientific investigation, is to be preferred if it is at all possible, to any theory that cannot be tested in this way. Indeed, for those who hold that everything must have a physical explanation, such a theory is urgently needed.

Mr. Duffy puts forward a hypothesis of the relation of body and mind that belongs to the same genus as that of Descartes; namely, that mental processes are activities of a spiritual substance distinct from the bodily organism, but interacting with it through a specific physical mechanism. The mechanism Mr. Duffy suggests is that active brain cells produce weak radiation of wave-lengths about the range of the shortest used for radio transmission. Normally, each mind interacts with its own brain, but exceptionally with another; hence telepathy. The evidence quoted for the existence of such radiation is not convincing, but it seems a possibility, and it is almost certainly the last hope of a physical explanation of telepathy. There seems to be no reason why chemical reactions in nerve cells should not produce weak rays of wave-length between a metre and a micron; why radiation from a group of cells should not form a beam; why it should not be projected to great distances. On this hypothesis, telepathic reception should be highly localized; agent and recipient could be screened from one another; artificial production of rays of appropriate wave-length should have striking results. All these suppositions can be tested.

There are serious objections to any type of Cartesian theory of the body-mind relation, which even Mr. Duffy's ingenious suggestions do not overcome. There are considerable objections to any radiation theory of telepathic transmission. Still, an improbable theory which can be tested has a scientific value so long as it has not been disproved, and no theory in this sphere starts with any high probability. Mr. Duffy's theory, therefore, deserves serious consideration. A. D. RITCHIE.

INTERNATIONAL ACTIVITIES IN SCIENCE*

By SIR HENRY DALE, O.M., G.B.E., P.R.S.

WITH the outcome of the War ever more certain, there can be no relaxation yet of the demand on what our scientific effort can contribute to the hastening of its end. It is none the less our duty to begin to look further ahead and to prepare for the part which science must play in the world which will follow. The needs of alliance in war have evoked, especially between the two great branches of the English-speaking nations, a closer interchange and collaboration in science, between men of different national traditions and loyalties, than has ever before been a matter of organized policy. It is not too early to begin to consider to what degree, and in what form, such a collaborative effort should be continued into the conditions of peace, and extended to scientific men of international goodwill throughout the world. Even in the twenty years of uneasy armistice which ended in 1939, a measure of co-operation among the world's scientific men was achieved.

Our traditions go back to days when the fellows of the Royal Society belonged to a community embracing all Europe in its enthusiasm for the new experimental philosophy, and the Society will have a particular duty to be among the leaders in the resumption of international activities in science, and to use all its influence to establish these on an ever wider and firmer basis. The Society has a standing committee on international relations in science, with its foreign secretary appropriately as chairman, to prepare for what action the Society can usefully undertake or promote, as the opportunity presents itself. Meanwhile, we may observe other signs that the spirit of international friendship and recognition in science is beginning to move again, even while the chaos of war is still with us. Among such signs, we may note that one of the committees which, since their foundation in Stockholm, have awarded the Nobel Prizes with unchallenged impartiality among the scientific discoverers of all nations, has resumed awards this year. The Royal Society has welcomed the return to London of a group of distinguished French leaders in science from the United States of America, whither they had escaped from the hostile occupation of their country. We have been able to share their rejoicing at the liberation of France, and to welcome here others who had remained there, often in hiding and always in peril, as leaders in the steadfast resistance opposed by all but a negligible minority of the French men of science to the enemy's demands for their collaboration. Even to-day we are able to welcome another distinguished French colleague, just arrived from Paris —Prof. Emil Borel. We are glad to think that new and lasting bonds of comradeship in science have been created for us with those from other allied countries occupied by the enemy who have been our country's war-time guests, and through them with all the men of science in the countries which they represent. A happy chance brings also to our meeting to-day four men of science from the U.S.S.R. Very near to the heart of every British man of science is the desire for a growing intimacy of confidence and collaboration with our colleagues of that great partner-nation in the war for the world's freedom.

The Royal Society had recently the opportunity of showing its interest in the revival of international scientific co-operation in another special connexion. During October 16–19, a small international conference met in the Society's rooms, under the auspices of the Health Organisation of the League of Nations, to discuss the creation of an international standard of reference for penicillin and the definition, in terms of this, of a unit of activity.

Though the League has failed tragically of its central purpose, it has achievements of value to its credit, and science has an interest in ensuring the permanence of some of these. I have myself had the privilege of taking part in the activities of an international commission under the Health Organisation of the League, which succeeded, in the years between the Wars, in obtaining world-wide acceptance of standards and units of activity for a whole range of modern remedies—antitoxins, hormones, vitamins and certain drugs—the strength of which could only be determined by direct biological measurements of the specific activity, in comparison with that of a fixed standard preparation in each case. Insulin was an early instance of a new remedy requiring such intervention; its general use for the treatment of diabetes could not have attained the present level of safety and effectiveness, unless a world-wide uniformity on these lines had replaced the chaos of widely different units in different countries, which was threatened in 1923. Now research has produced another new remedy, penicillin, the success of which, in the treatment of a range of dangerous infections, has also had such a dramatic quality that its reputation has spread rapidly beyond our scientific community and caught the interest even of a war-distracted world. Here, indeed, was a discovery which could rank as a major contribution of science to the mitigation of the suffering which war inflicts, and, at the same time and no less, as a gift of healing to mankind at peace. The needs of war had given a stimulus to the researches which proved penicillin's remedial value, but its rapid production on an adequate scale had to face greater difficulties in Great Britain, where material and human resources had been more completely absorbed by earlier requisitions than in the United States. So the present position was reached, in which, as we are proud to recognize, the existence of penicillin and then, after a decade, the methods by which it could be separated in sufficient purity to demonstrate its brilliant possibilities as a remedy, were discoveries made here in England, while, in the further researches and technical developments needed for its large-scale production, our American colleagues have played a major part.

Thus early in its history, therefore, penicillin and its applications had become a matter of international concern; and, though war had restricted the work in this field almost entirely to scientific workers of the English-speaking peoples, and had brought them into an unusual intimacy of co-operation, progress had been so rapid and action so urgent that there was a real danger of a divergence of meaning in the terms used to express its activity and define its dosage, even among the few countries already using it. Prompt action was required to avert this by accepting a common standard of reference; and, when the proposal of a conference for this purpose was made from Great Britain to the League of Nations Health Organisation, we were grateful to our colleagues from the United

* From the address at the anniversary meeting on November 30.

States, as well as from Canada and Australia, for the generous promptitude with which they agreed to make the journey to England, so as to meet with us here in London. After all arrangements for the holding of the conference here had been completed, the liberation of Paris opened a new possibility; Dr. Tréfouel, now director of the Pasteur Institute in Paris, was able at the last moment to accept an invitation to join us, and thus to give our deliberations, and our eventual agreement, a wider international basis.

To illustrate how rapidly a divergence may arise under present conditions, I may just mention the fact that several different penicillins have now been recognized, produced by variations in the metabolism of the growth, possibly due to mutations of the mould itself, possibly to changes in the nutritive conditions offered to it by the medium or the cultural method employed. Three such varieties of penicillin have already been isolated in pure condition, and distinguished by certain chemical characters; but, while British workers had come to refer to these as penicillin 1, 2 and 3, their colleagues in America spoke of penicillin F, G, and X; and it was not until they met around the table at the Royal Society a few weeks ago, but then in less than ten minutes, that they became quite certain of the identity of 1 with F, of 2 with G, and of 3 with X. All these penicillins have the specific remedial action in high, though not quite identical degrees, and there are probably differences, still to be explored, in their proportional efficiencies against different infective organisms. When once their identities were thus put beyond doubt, however, the small conference had no hesitation in deciding, for the present, to use as the common basis of reference a sample of the penicillin which is predominant in most preparations now available, and most easily obtained as a pure salt in adequate quantities. The unit could then be defined as the activity of a precise, though very small weight—0·6 μgm.—of a particular sample of the perfectly dried, crystalline sodium salt of penicillin 2, or G; and the unit thus chosen for definite fixation, and for international recognition henceforward, was, by a unanimous choice, so defined as to be as closely equivalent as possible to the unit first propounded by Sir Howard Florey's team of collaborators, and widely known as the 'Oxford' unit.

The international standard for penicillin is thus added to an already numerous series, of which the custody, on behalf of the League of Nations Health Organisation, has been shared by the National Institute for Medical Research with the State Serum Institute of Denmark, at Copenhagen; and all these standards, we may hope, will be available for transfer to whatever international authority may be established in succession to the League, as a tangible and material result of genuinely international collaboration, which the League has been able to initiate and maintain among men of science, to the permanent advantage of the world.

Though penicillin has rightly made a special appeal to the imagination and sympathetic interest of a wide public, it is, of course, only one out of a varied range of inventions and discoveries, hastened by the stimulus of war's demands and produced, in many cases, behind the veil of its secrecy; but ready, when peace returns, to take their proper place as new gifts to the welfare and the civilized progress of mankind. From what has already been made generally known, it is clear that we may look forward to revolutionary advances in the means of communication and in the speed and safety of travel across the world and in methods of controlling insect pests and the diseases which insects convey. These are but a few examples of the gains which we and the world may hope to set against the tragic loss and sacrifice of the years of war.

There were probably few who even suspected in 1939 that science, in countries then so dangerously unready, would find itself, before the War ended, in its present position of central importance. None of us, I think, would claim more for science even now, than to have played in this War a part of growing predominance in the provision for the fighting men of the material means of warfare, without which their heroism and sacrifice could not have prevailed. Even that duty, loyally accepted, is one from which the scientific community of the free nations must long for the release which victory will bring. But, while the operations of war have come to depend on science to a degree beyond all earlier experience, it cannot be doubted that little more than a beginning has yet been made in exploiting the possibilities of destruction, which science could progressively offer, if the world should continue thus to misuse it, and if science were still on offer for such ends. Allow me to quote a passage from a letter which the Prime Minister, whom we are proud to number among the fellows of the Royal Society, wrote a year ago to Prof. A. V. Hill, in sending his greetings to Indian men of science.

"It is the great tragedy of our time," wrote Mr. Churchill, "that the fruits of science should by a monstrous perversion have been turned on so vast a scale to evil ends. But that is no fault of science. Science has given to this generation the means of unlimited disaster or of unlimited progress. When this War is won we shall have averted disaster. There will remain the greater task of directing knowledge lastingly towards the purposes of peace and human good." Noble words indeed, and a profession of faith which will find an immediate echo in the hope and the desire of every true man of science. "When this War is won we shall have averted disaster"—surely that is a confidence which every one of us will long to share. It must be clear, however, that Mr. Churchill's reference was to the present threat of disaster, from which the prospect of our escape is even more fully assured to-day than when he wrote, a year ago. We may be certain that nobody sees more clearly than he that the threat of final disaster to all man's hopes and achievements will not be for ever averted, if the possibility of the "monstrous perversion" of science is allowed to remain and to continue its evil growth. Even in the past year our enemies have thrown a new and vivid light on future possibilities, by the new weapons which science has enabled them to put on trial for our destruction. Though a people's unflinching courage and an answering effort of science and organization, together with the progress of the Allied Armies over the launching areas, have given us confidence that flying bombs and the like will not affect the issue of this War, the warning which they give, as to what the future might hold, is not the less clear. The writing on the wall must be plain for all to read. If, when the memories of the present War begin to fade, the world should allow science again to be exploited by a nation grasping at predominance by conquest, science will no longer be invoked only as an aid to what valour can achieve by land, sea or air, but as an agent, in itself, of blind annihilation at an ever-lengthening range.

When we men of science regain that freedom for the ultimate preservation of which we have loyally accepted, through these tragic years, the bonds of secrecy and submission to authority, we cannot put aside with these our proper share in the new responsibility for the future of mankind, which the experiences of this War have laid upon the men of goodwill in all nations. It is true, indeed, that neither the present abuse of science, nor any possibility of final disaster to civilization which might come of a future perversion of its powers, can be charged as a fault to science itself; no more, indeed, than we could properly charge to religion, as such, the wars which once devastated much of Europe in its name. But we men of science cannot escape from our growing share in the responsibility, in "the greater task", as Mr. Churchill has written, "of directing knowledge lastingly towards the purposes of peace and human good". No man of science has the right to prescribe for another his interpretation in detail of that duty; but there is one aim which may unite us, perhaps for the most effective action within our common grasp, and one which is worthy of all our common influence and effort. Let me quote again from Mr. Churchill's letter: "in this task", he writes, "the scientists of the world, united by the bond of a single purpose which overrides all bounds of race and language, can play a leading and inspiring part".

ROYAL SOCIETY MEDAL AWARDS, 1944*

Copley Medal

THE Copley Medal is awarded to Sir Geoffrey Ingram Taylor, Yarrow research professor of the Royal Society, in recognition of his contributions to knowledge of aerodynamics, of hydrodynamics and of the structure of metals, which have had a profound influence on the advance of physical science and of its practical applications.

Taylor is probably the most accomplished living exponent of the application of the methods of classical dynamics to problems of fluid motion. To great mathematical powers he adds high skill as an experimenter. His theoretical work is particularly noteworthy for its approach to reality. In place of the ideal conceptions presented by perfect incompressible fluids moving in stream-line motions and perfectly elastic solids, with which his great forerunners at Cambridge dealt, Taylor has studied turbulent motion, viscous and compressible fluids, and plastic movements of metals, obtaining results of great importance for the understanding of a wide range of phenomena.

Taylor's early work was concerned with eddy motion in the atmosphere, and opened up new fields of meteorological investigation. It threw light on the variation of wind with height and on the transference of heat and water vapour in the atmosphere, with a consequent bearing on the formation of fog. He also carried out work on the tides. Later he developed the theory of general turbulence, to which statistical methods can be applied which are somewhat reminiscent of the kinetic theory of gases.

Among Taylor's extensive researches on precise hydrodynamical problems, that on the motion of a viscous fluid between two coaxial cylinders, rotating with any speed in the same or in opposite directions, may be particularly mentioned, since it offers the only case so far of the complete solution of a problem of motional instability in the viscous liquid. In dealing with the elastic deformation of metals, Taylor has shown how the slip planes can be determined in certain cases by purely geometrical methods, and has offered a formal theory of the process of work-hardening in single crystals.

Taylor has also applied his great mathematical powers to a variety of practical questions. During the War of 1914–18 he did work of great distinction on aerodynamical problems for the Advisory Committee on Aeronautics, and during the present War he has been extensively concerned with complicated problems concerning the propagation of explosive processes. Taylor's work may be said to be in the line of a great British tradition, which, in the past generation, was represented by investigators like W. J. M. Rankine, Osborne Reynolds and Rayleigh. Like these he has the mathematical equipment, the originality and the insight required for the fundamental solution of problems presented by practical experience in the laboratory, in the workshop, and in the wider world. Taylor has carried his quest for experience and for scientific problems on to the sea and into the air. His work during this War has been of the greatest value to the nation and its allies, and his fundamental discoveries are extending the boundaries of knowledge for all mankind.

Rumford Medal

The Rumford Medal is awarded to Dr. Harry Ralph Ricardo, consulting engineer, in recognition of his important researches on the internal combustion engine.

There is a special fitness at the present time in the award of this Medal to one who, during the last twenty years, has been the leading spirit in the development of the high-speed internal combustion engine. Ricardo's researches were begun under Bertram Hopkinson in 1905 and continued, after he left Cambridge, as a consulting engineer in his grandfather's firm. Investigating the effect of turbulence on the speed of combustion, he was led to appreciate the importance of 'knocking', to determine its cause and to show that the tendency to 'knock' is dependent on the nature of the fuel. Taking charge of a special design department for his firm, he produced a four-cycle, supercharged aero-engine, long in advance of accepted practice. In 1916 he was invited to plan a special engine for the secret fighting machine which was to become known as the tank, and his unorthodox and daring design was an outstanding success.

Forming a private company to maintain a laboratory for research on the internal combustion engine, Ricardo further investigated the relation of the phenomenon of 'knocking' to the maximum compression-ratio of the engine and to the character of the fuel, matching the latter by adding toluene in variable proportion to heptane, and thus paving the way for the modern octane-rating.

It is not possible here to make more than general reference to the far-reaching influence of Ricardo's investigations and his steady advocacy on the designs of slide-valve engines, of sleeve-valve aero-engines, of high-speed Diesel engines, and on other important developments in engine design. In all directions there is evidence of his special genius and flair for design,

*Remarks made by Sir Henry Dale in presenting the Royal Society Medals for 1944.

and, behind this, of his full appreciation of the thermodynamical principles which control the behaviour of engines, and of a deep knowledge of the physical and chemical factors involved, as well as of the characters of fuels and of the materials of the working parts.

Royal Medals

A Royal Medal is awarded to Prof. David Brunt, professor of meteorology in the Imperial College of Science and Technology, in recognition of his contributions to meteorology.

Brunt has made fundamental contributions to this science in its statistical, dynamical and physical aspects. The subjects which he has treated include cycles in weather; atmospheric radiation; atmospheric turbulence; the dynamical causes of rainfall; instability and convection in their bearing on the forms of clouds and on soaring flight; and the dynamics of depressions and anticyclones. He has rendered an outstanding service to his subject by his book on "Physical and Dynamical Meteorology", in which he gives the first connected and critical account of the physics and dynamics of the atmosphere, and reduces to order a large amount of material which was previously available only in isolated papers. The book contains much original matter, and has played a leading part in the recent development of meteorology in all countries.

Brunt has been a pioneer in the analytical approach to his subject. Of recent years he has devoted several papers to the discussion of the factors which influence bodily comfort, and has gone far to provide a natural basis for the classification of climates in relation to human health and human needs.

For many years Brunt has conducted, at the Imperial College of Science and Technology, a flourishing school of meteorology, which has attracted students from all parts of the world. He has always been generous with his services to colleagues in other fields who have required expert meteorological assistance. During the War his wide knowledge and sound judgment on meteorological questions have been of the utmost value to the cause of the nation and its allies.

A Royal Medal is awarded to Dr. Charles Robert Harington, director of the National Institute for Medical Research, in recognition of his work on the structure and synthesis of thyroxine, and on the chemical basis of immune reactions.

Harington's reputation, as a leader among biochemical investigators, was established by a brilliant series of researches dealing with the chemical nature, the origin, and the form of the natural combination of the thyroid hormone, thyroxine, with its remarkable content of iodine. He improved the method of isolating this active principle from the thyroid gland, determined its structural constitution and then produced it by artificial synthesis. Later he demonstrated that diiodotyrosine is present in the gland and accounts for the balance of its iodine content. By enzymatic cleavage he proceeded to show that thyroxine and diiodotyrosine are natural amino-acid constituents of the complex thyreoglobulin. These discoveries gave an entirely new precision to knowledge of the thyroid hormone, of the manner of its natural occurrence and function, and of the diseases which result from excess or defect of its supply from the gland.

In more recent years, Harington's work has contributed very important advances to knowledge of the chemical basis of immunological specificity. By a new method of coupling haptene groups artificially to proteins, he has studied the role of carbohydrates and of tyrosine in developing antigenic properties. By such methods he has created artificial antigens, the specificity of which is determined by the attachment of physiological active haptenes, such as thyroxine and acetylsalicylic acid. He has thus produced and determined the limits of specificity of antisera reacting with free thyroxine or acetylsalicylic acid, and has observed the antagonism of such sera to the physiological effects of such principles in the animal body. In other directions also Harington has made brilliant contributions to biochemical knowledge, as by his work on the conditions determining the crystallization of insulin and on the synthesis of glutathione.

Davy Medal

The Davy Medal is awarded to Sir Robert Robertson, lately Government Chemist, in recognition of his researches on explosives, analytical methods, the internal structure of the diamond and infra-red absorption spectra.

After studying at St. Andrews, Robertson made his first acquaintance with the field of explosives as a chemist at the Waltham Abbey explosives factory, where he was occupied on the nitroglycerine plant. He acquired a knowledge of all aspects of the manufacture of cordite, and contributed improvements, such as the acetone recovery process which has been widely adopted. His researches in this period covered calorimetric measurements, and in particular the study of the mode of decomposition of gun cotton which led to the publication of work of great practical importance on the stabilization of that material (1916).

A succession of spontaneous explosions in cordite magazines led to a visit by Robertson to India and to the issue of an exhaustive and valuable report in February 1917. Shortly afterwards he entered the Research Department at Woolwich as superintending chemist, and he occupied this post with distinction until 1920. Much valuable work was done before and during the War of 1914–18. A process for the manufacture of T.N.T. introduced novel features and prepared the way for the large T.N.T. factories established under Lord Moulton. Other notable achievements by Robertson were the introduction of cordite R.D.B., which relieved the acetone position, and of amatol, of which it was said by the Director of Artillery that "amatol won the War". Throughout his time at the Woolwich Research Department, Robertson showed himself a resourceful investigator, an able leader and an indefatigable worker.

There followed for Robertson a further period of effective organization and active enterprise in research, as Government Chemist. He was one of the first to recognize the importance of infra-red spectrography for the determination of molecular structure, and in his pioneering work on the infra-red spectra of ammonia and of arsine he pushed the accuracy of the instruments then available to their ultimate limits. These researches directed the attention of chemists to the possibilities of the analysis of molecular vibrational and rotational bands, and materially assisted in opening up the wide field which has been explored in recent years. Robertson's studies of the absorption spectra of diamonds have produced results of very great interest; they show that diamonds exist in two types differentiated by the condition of strain originating in their high-temperature formation.

During the present War Robertson has occupied very responsible positions in relation to the earlier field of his researches and has played a keen and active part in the contribution of chemistry to the national emergency.

Darwin Medal

The Darwin Medal is awarded to Prof. John Stanley Gardiner, lately professor of zoology and comparative anatomy in the University of Cambridge, in recognition of his life's work on coral reefs.

Gardiner is universally recognized as an authority on coral reefs and on the organisms associated with such habitats. His contributions to these fields of biological and geographical research began not long after his graduation, when he was a member of the coral reef boring expedition to the atoll of Funafuti, organized by the Royal Society in 1896. Since then he has himself organized and led two most important expeditions, the first to the Maldive and Laccadive Archipelagoes in 1899 and the second to the Indian Ocean in 1905; the results of these expeditions are embodied in nine large quarto volumes and represent a most valuable contribution to a field of knowledge closely associated with the work of Charles Darwin. Within recent years Gardiner has organized and, to a large extent, directed the Cambridge Expedition to the Suez Canal, 1924; the Great Barrier Reef Expedition, 1928–31; the John Murray Expedition to the Indian Ocean, 1933–34; and the expedition to Lake Titicaca in Chile, 1937. He is an authority on the taxonomy and systematics of Alcyonarian and Zoantharian Corals, and has taken a keen interest in their ecology and geographical distribution.

Gardiner realized the great importance, in the study of corals, of the examination of the polyps themselves, as well as of their coralla, and he paid special attention to variations which may result from slight differences of habitat and are correlated with physical and other conditions, showing that in several instances so-called 'species' are merely variations. He also realized the immense value of an accurate knowledge of the coral fauna of any given locality in relation to its environment, in enabling one to deduce the conditions under which tertiary and earlier coralline deposits have been formed.

There is scarcely a branch of research on corals and coral reefs in which Gardiner's work is not of great importance. It was his observations on the Funafuti atoll and the atolls of the Maldive and Laccadive Archipelagoes that caused him to realize that no one theory, such as the 'subsidence' theory of Darwin, or the 'solution' theory of Murray, can account for the formation of all such reefs and atolls though, when once formed, every reef has been moulded and modified by world-wide phenomena, such as a change in the relative levels of sea and land.

Stanley Gardiner has given us an admirable summary of this, his life's work, and of the conclusions that he has drawn from it, in his book "Coral Reefs and Atolls", a most valuable supplement to Darwin's own volume "On the Structure and Distribution of Coral Reefs". There is a special fitness in the award of the Darwin Medal for work of such "acknowledged distinction in the field in which Charles Darwin himself laboured".

Hughes Medal

The Hughes Medal is awarded to Prof. George Ingle Finch, professor of applied physical chemistry in the Imperial College of Science and Technology, in recognition of his fundamental contributions to the study of the structure and properties of surfaces; and for his important work on the electrical ignition of gases.

Finch has carried out two important bodies of research in different fields, both involving electrical considerations in a fundamental manner. The first was a detailed study of the electrical ignition of gases, the second the application of electron diffraction to a wide range of chemical and physical surface problems.

In his work on electrical ignition, Finch not only elucidated the chemistry of the ignition of simple gaseous systems, but also was the first to develop the theory of the sparking ignition coil. His inductance component control interrupter has been used by the Radio Research Board for the production of single electromagnetic pulses. In the course of his ignition work, Finch developed, as a pioneer in Great Britain, the high-speed cathode-ray oscillograph.

In the field of electron diffraction Finch has developed the electron diffraction camera into an equipment giving results of high accuracy with speed and ease of manipulation. The Finch camera has found wide application outside his laboratory, and examples made under his direction have been installed, among other places, at the National Physical Laboratory, University College, London, the University of Brussels (two), and in the laboratories of Messrs. Ferranti and of other industrial research centres. The pictures which he has obtained with it are outstanding in beauty of detail. He has contributed notably to the interpretation of the electron diffraction pattern and has applied his methods to many problems of theoretical and practical importance.

Of special interest are Finch's studies of the relation between crystal size and lattice dimensions and, in the more practical field, his investigations into the effect of the substrate on adhesion of electro deposits, into the nature of polish and into the mechanism of boundary lubrication and the wear of sliding surfaces. In all these he has materially advanced our knowledge, and his work on sliding surfaces, in particular, has found important applications in engineering practice.

His work during the War has covered a variety of fields, some involving the application of electron diffraction. That which he has carried out as scientific adviser to the Ministry of Home Security, while less closely related to his normal lines of research, has been of the greatest value.

ANIMAL PRODUCTION AND ANIMAL BEHAVIOUR

On Tuesday, October 24, the British Society of Animal Production held a discussion on the British sheep industry; on the morning of October 25, a joint meeting with the Institute for the Study of Animal Behaviour was held to consider the grazing behaviour of sheep and cattle; the Institute, on the afternoon of October 25, discussed the food preferences of dairy cows and the importance of the study of behaviour from the veterinary aspect.

The familiar classification of British sheep into hill, lowland and Down types tends to split the industry into distinct sections, although it implies separation on ecological grounds or according to conditions of husbandry. In fact, as Prof. R. G. White clearly demonstrated in his opening general survey, the sections of the sheep industry in Great Britain are closely interrelated and interdependent, so that the industry must be considered as a whole, with that whole in turn forming an appreciable factor in the complex pattern of British agriculture. Although war-time food production policy has tended to relegate the sheep to a lowly place in the British livestock industry and to distract popular attention from its important role in British agriculture, we, as a nation, like mutton and lamb. Sheep consume home-produced grass, fodder crops and foods not suitable for human consumption, and are thus quite different from pigs and poultry. We have large areas of hill and mountain lands which under present conditions can only be exploited economically by sheep-grazing. The sheep of these areas are important not only in themselves but also because they are the basis on which the great majority of the 'flying flocks' of the lowland pastures are founded, and these in turn depend largely upon the arable flocks for the supply of rams for mating to the hill ewes and their crosses to produce fat lamb. If, after the War, we have to increase our home meat production, this will be done mainly by the sheep, and the sheep industry as a whole will be involved.

Mr. D. H. Dinsdale showed, from the economic point of view, that although there is a complementary relationship between hill and lowland sections of sheep farming, and recent trends have emphasized the importance of the foundation nature of the hill flocks, there is also a competitive relationship, as both tend to cater for the same market for meat. To this end the changes in the industry have been of character rather than extent. Most hill farms are small economic units and receive only a small proportion of their income from sheep and wool; the problems of a broad policy for improvement and rehabilitation would, therefore, affect many people. There are physical limits (soil, climate) to improvement as well as economic limits (price, capital expenditure); also, in the sheep enterprise on hill farms, questions of fluctuations in the annual lamb crop, of replacement of stocks (most hill flocks being self-maintained), and of selection for characters of hardiness and mothering ability, raise important biological considerations on which more data are needed. He concluded that no "single-track solution can be expected, of itself, to restore hill sheep to the place they should hold in a balanced farm economy".

In the ensuing discussion, the prime necessity was emphasized of a co-ordinated programme in Britain for improvement of stock and of land, for social betterment and co-ordination between forestry and agriculture in land use; knowledge is required of the efficiency of both sheep and grazing, of suitable ratios of cattle and sheep for successful grazing management, and of losses of efficiency due to inappropriate selection, to subclinical parasitism, and to low nutritional levels of pregnant ewes during winter.

The general lack of adequate data for framing policies was neatly exposed by Mr. T. L. Bywater, who presented a summary of the results of the University of Leeds crossbreeding trials. These have been carried out since 1898, first at Garforth and later at Askham Bryan, and bear upon the question of the most suitable kinds of stock for the flying flocks on long leys. Many different breeds and crosses of ewes were used, mated to different breeds of rams; records of fertility and of weight and age of lamb when sold have enabled a general comparison of the results of the various crosses to be made on a basis of the total live weight of lambs produced per ewe put to the ram. A significant feature is that smaller differences in results occur from different breeds of rams as compared with different types of ewes—in flying flocks the ewe is more important than the ram; moreover, the results from individual rams of the same breed vary more than between rams of different breeds. For desirability in a flying flock, the ewe should be thrifty, able to rear on the average about 1½ lambs per year, have a sufficient milk yield to produce not less than 120 lb. live weight of lambs at six months or less, and be capable of bearing at least five lamb crops in her life-time. Under the conditions represented in these trials, such characters were found to be most fully expressed in 'North' (Border Leicester × Cheviot) and Masham (Wensleydale × Swaledale) ewes, while for general conditions such types as the Clun, Kerry Hill, Greyface (Border Leicester × Blackface), and Welsh crosses could be relied upon. For mating to such ewes the ram should be able to grow quickly and to fatten readily and be well developed in loin and leg; Suffolk, Oxford and Hampshire rams had been satisfactory, with Suffolks giving the most consistent results.

Mr. Bywater contended, and other speakers supported him, that it is necessary to have similar trials carried out in other localities before an enlightened policy can properly be devised. Among the allied problems to be taken into account are the quality of the lamb product, the most suitable methods of measuring productivity, profitability and depreciation, as well as the source of supply of ewes. In any event, the possibility of different combinations of ewes and rams gives advantages in adjusting production to the various local circumstances; fresh combinations of breeds may be well worthy of study.

The complexities of management of arable flocks were discussed by Mr. J. F. H. Thomas. This section of the industry has declined for economic reasons—lower grain prices, expansion of dairy cow production, high costs of labour and of cultivations. But in spite of these, arable flocks in the south of England enable the large areas of unfenced, unwatered land on the chalk formations to be utilized and the fertility of the ploughland to be maintained. So far as the sheep themselves are concerned, the important questions are those of the suitable types or breeds for commercial production, the standard of which is affected by the present low fertility. Over-specialization on high carcase quality has neglected the factors of high fertility and milking ability of the ewe. Mr. Thomas does not believe, although some of the subsequent speakers did, that the only future for a able flocks is to produce rams for crossing purposes. He sees a favourable prospect for the commercial meat-producing flock, provided that all conceivable sources of loss can be reduced, whether they are due to defects of management, to parasitism (to which the intensive system predisposes but which can be controlled largely by good husbandry), or to other diseases that are favoured by heavily stocked land. He considers that this most complicated branch of the livestock industry has as yet received little help at the practical level from the agricultural scientific worker—and the general trend of the subsequent discussion admitted this by implication, although the advantages of phenothiazine in control of parasitic worm infestation were stressed.

The second day's proceedings indicated some of the ways in which scientific inquiry is throwing light upon practical problems, and in some cases leading to a reconsideration of attitude towards them.

Mr. John Hammond, jun., summarized the results of observations on the breeding season in sheep and its extension by treatment with pituitary extracts and pregnant mare serum, which induce ovulation in anœstrous ewes, but without heat at the first ovulation. This year it was found that stilbœstrol administration, following injection of mare serum hormone, failed to accelerate onset of heat, and that treatment with pregnant mare serum alone, followed by artificial insemination, did not lead to fertilization. The maximum lamb crop under practical conditions would be produced, without treatment, by mating in mid-October and again in February or March, when a second crop could be expected from about 25 per cent of the ewes; with successful hormone treatment, a natural mating in October could be followed by a second service in June.

Experiments at Cambridge on the feeding of pregnant ewes were described by Mr. L. R. Wallace, who showed that lambs from ewes allowed to lose weight during the last six weeks of pregnancy were significantly lighter at birth than those from well-fed ewes. Further, the milk yield of the former ewes was, both at the peak and throughout a sixteen-week suckling period, materially less than that of the second group. This greatly affected the growth of the lambs, which at sixteen weeks averaged 56 lb. and 72 lb. for the two groups respectively. The importance of the level of nutrition during late pregnancy was emphasized by the spectacular differences in size at birth of the lambs from groups of ewes which had been well fed either throughout or during the last two months of pregnancy, as compared with those which had been poorly fed throughout or for the last two months. The ewe's udder remains small, and little affected by feeding level, until ninety-one days of pregnancy; after this the degree of its development is markedly influenced by the nutritional level of the ewe.

Detailed observations on an inbred Romney flock enabled Dr. Nancy Palmer to present a general picture of wool-growth on a unit area of skin; the length of fibres is determined by follicle density at birth, the subsequent rate of skin expansion, and the weight of wool produced. The last factor is found to be the same every summer for all sheep, of any age, in this particular flock.

The practical importance of Mr. Wallace's findings is patent; those of Dr. Palmer were shown by several speakers to throw light upon some of the factors which have to be taken into account in selecting for density of fleece-covering on one hand and increased body-size on the other.

The succeeding papers were concerned with an aspect of livestock management which has received relatively little direct attention. Though conditions of animal behaviour have long been tacitly recognized as affecting experimentation and practical procedures, apparently only in recent years have they been subjected to scientific study, interpretation, and even deliberate exploitation. For example, Dr. J. E. Nichols referred to one of a series of investigations on the problem of drought-feeding in Western Australia, in which the preferential grazing of the sheep and their habits of necessary and unnecessary movement were studied parallel with observations on the food values and ecology of different forms of *Acacia aneura*. As a result, it proved possible to devise, in the particular circumstances, a practical, and economical, procedure for maintaining the condition of the stock and preventing losses by exploiting the highly developed discriminatory sense of the sheep for the most nutritious shrubs and conserving their expenditure of energy by restricting their travelling as much as possible.

This evoked instances of how similar behaviour patterns could be examined in relation to preferential grazing in Britain, and consequently to the selection of more highly utilizable fodder plants and grasses, and to increasing the efficiency of food utilization under hill conditions as well as in folded flocks.

Mr. A. N. Worden communicated a résumé of Prof. Johnstone-Wallace's studies at Cornell on the grazing habits of beef cattle. From observations on the time taken in grazing and travelling, on the mechanics, methods, and selectivity of grazing, and on the frequency of defœcation, principles of rotational use and management of the pastures can be formulated. While the idea and practice of rotational grazing are not new, it has become clear that detailed investigations on these lines are necessary to enable the most efficient utilization of the various patterns of pasture-growth to be made, if only to overcome the loss of efficiency due to the rapid reduction of herbage consumed as the amount available for consumption is reduced by grazing. Our present ideas of what constitutes good pasture and good management of stock and pasture may require modification.

A similar view in relation to byre feeding emerges from Mr. K. L. Blaxter's observations on the habits and food preferences of dairy cows; refusals of food may occur before the mechanical satiation of the digestive tract, which places an upper limit on appetite, is reached. Broadly, food preferences are in the order: young grass, excellent quality hay, certain protein cakes and cubes, green fodders and roots, certain cereal and protein meals, average hay, then cereal chaff and straw. Moreover, the rates at which different foods are eaten, and at which different cows eat, vary greatly, the differences being most noticeable with bulky foods. Since the most nutritious foods are taken first and eaten most rapidly, these considerations must certainly affect herd rationing, where individual feeding is impossible through lack of adequate housing and facilities.

Some of the variables in this field are easily recognizable, others are as yet less obvious; examples of both kinds were suggested in the discussions which followed these papers. Thus a fertile ground was prepared for Dr. J. T. Edwards' analysis of the development of the study of animal behaviour and its general importance from the aspects of natural history and psychology, as well as in its didactic and economic considerations. In respect of the last, he instanced the work at Cornell, that of Stapledon (see *Vet. Rec.*, June 3, 1944), and Walton's observations on artificial insemination. Other speakers gave further examples of the necessary extension of the general approach, especially with regard to questions of degree and spread of parasitism in relation to grazing and other habits; these served to strengthen Dr. Edwards' plea for provision for systematic research on animal behaviour at institutes dealing with problems of animal husbandry and agronomy, and for the incorporation of appropriate courses at least into the veterinary curriculum.

J. E. NICHOLS.

The vacancies advertised in these columns are available only to applicants to whom the Employment of Women (Control of Engagement) Orders, 1942-3, do not apply.

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(5) Applications, with copies of two testimonials, should be forwarded to the Secretary, Universities' Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1, not later than Jan. 15, 1945. The appointment will date from as early as possible in 1945.

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The Education Committee invite applications for the position of PRINCIPAL of the above-named College (which is affiliated to the University of Durham in the Schools of Engineering and Electrical Engineering in the Faculty of Applied Science), at a salary of £1,000 per annum, plus war bonus. The person appointed must be between 35 and 50 years of age and an Honours Graduate of a British University.

Canvassing members of the Committee, directly or indirectly, until after the first selection of candidates by the Committee, will disqualify the applicant by or on whose behalf such canvassing shall have been made.

Particulars of the appointment and forms of application may be obtained from the undersigned, to whom they should be returned, together with not less than three recent testimonials, endorsed "Technical College—Appointment of Principal," on or before Dec. 23, 1944.

W. THOMPSON,
Director of Education.

Education Offices,
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Persons desirous of being considered for the office are requested to lodge their names with the Secretary to the University on or before March 31, 1945.

The conditions of appointment may be obtained from the undersigned.

H. J. BUTCHART,
Secretary.

The University, Aberdeen.

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The successful candidate will be expected to lecture and undertake researches on fresh-water Zoology and to assist in the teaching of General Zoology.

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STANLEY DUMBELL,
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UNIVERSITY OF BRISTOL

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Sudan Government. Applications are invited for the post of INSPECTOR OF AGRICULTURE, on a short-term contract of five years. Candidates must have had a thorough practical training and experience in agriculture, and should preferably be holders of a University Degree in Agriculture. Tropical experience will also be useful. Age 35 to 45. Slight physical disability would not necessarily debar candidates. Commencing salary £E.800 to £E.1,000 per annum (£E.1=£1 0s. 6d.). Free passage on appointment. At the present time there is no Income Tax in the Sudan. Applicants should write, quoting F.3285A, to the Ministry of Labour and National Service, Central (T. & S.) Register, Room 5/17 Sardinia Street, Kingsway, London, W.C.2, for the necessary forms, which should be returned completed on or before Jan. 2, 1945.

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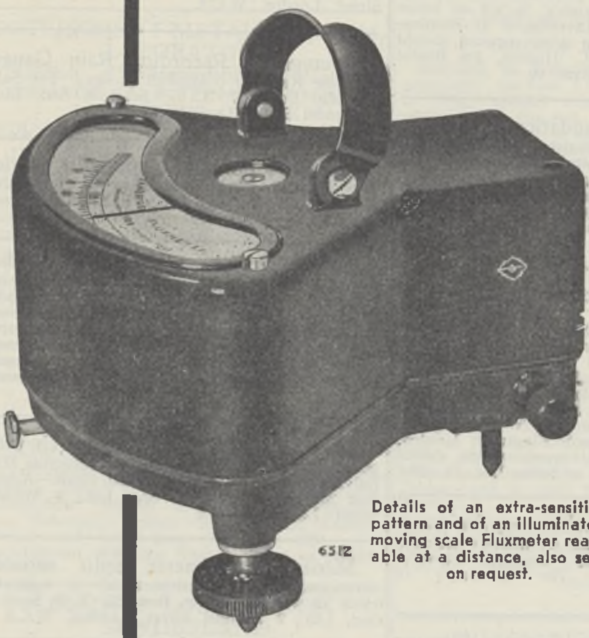

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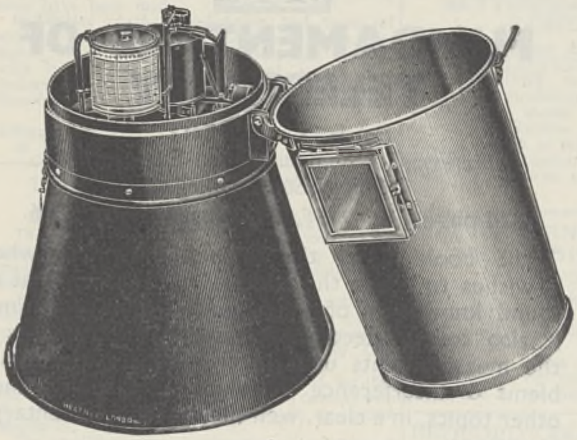

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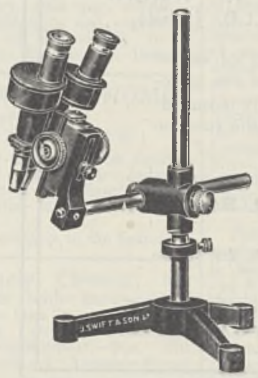

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OBITUARIES

The Right Hon. Lord Moyne, P.C.

In the preface to "Atlantic Circle", Lord Moyne says that had it not been for the South African War (for which he volunteered instead of going to the university) he would have become a biologist. A man endowed with his gifts of character and intellect, reinforced by a tireless energy and ample means, could scarcely have failed to make his mark. As it was, science had to take second place as an intermittent hobby pursued in the intervals of an exceptionally strenuous public life; and it was not until the last few years before the War that Lord Moyne was able to indulge more fully his taste for the biological sciences, among which anthropology took a prominent place.

Lord Moyne made a number of voyages in his steam yacht *Rosaura*, of which the last two, in 1935–36 and 1938, were scientifically the most important. These were no pleasure cruises. They had as their main objects the collection of ethnographical, archæological and zoological records and specimens for the British Museum and the London Zoo, and these objects were pursued with Lord Moyne's characteristic zeal, efficiency and courage. Danger seemed to attract rather than to repel him. At any rate, he was never afraid to take risks which seemed justified by the end in view, and it was only by great skill and (it must be admitted) a fair spice of luck that disaster was averted on each of these expeditions, which involved the wrecking of his two launches in New Guinea and damage to his yacht in the pack ice off Greenland.

These two expeditions yielded a rich harvest, which included a splendid series of photographs taken by Lady Broughton, and colour films of great beauty and scientific interest. Out of the large ethnographical collection from New Guinea and the East Indies made in 1936, the British Museum received as a gift more than three hundred selected specimens, as well as photographs, all of a kind new to science or not hitherto represented in the national collection. The majority were from the almost unexplored southern regions of Netherlands New Guinea and from the little known Sepik and Ramu Rivers of the Mandated Territory. They included many objects of large size such as carved house posts, paddle spears and 18-ft. long blowguns, the safe transport of which would have been beyond the power of the ordinary collector without a yacht. From the 1938 expedition the British Museum received a very large and interesting collection of antiquities, chiefly pottery, excavated in the Bay Islands, Honduras. Other leading ethnographical museums including those of Oxford and Cambridge, and the Royal College of Surgeons, received a share of the spoils. Before the dispersal of his collections, Lord Moyne arranged attractive exhibitions of them at his house in Grosvenor Square (see *Man*, No. 121; 1936; and No. 71; 1938).

Lord Moyne was the first to publish records of a group of 'pygmy' folk from the Aiome Mountains on the Upper Ramu River, the average stature of which (based on a small number of individuals) was the lowest ever reported from New Guinea. These were described in his book "Walkabout", and briefly in *Man* (No. 121; 1936), while a detailed description of their material culture, written in collaboration with Miss K. Haddon, appeared in the *Journal of the Royal Anthropological Institute*, 66 (1936). Illustrated notes on some decorated shields and other specimens were published in the *British Museum Quarterly* (8, No. 129 and 11, No. 89).

Although written in narrative form, Lord Moyne's books, "Walkabout" and "Atlantic Circle", contain much scientific information, the value of which is increased by the accompanying photographs. There is also an introduction by the late Dr. A. C. Haddon and an appendix on the human crania by Dr. A. J. E. Cave in the former work. As an example of Lord Moyne's swiftness in action, it is worth mentioning that these volumes were each written and published within a few months of his return to England.

Lord Moyne had been for a number of years a fellow and a generous benefactor of the Royal Anthropological Institute, in the work of which he took a lively interest. He was elected a member of its Council in 1942. Only recently he had privately discussed his ideas for promoting archæological research in South America, particularly the highlands of Peru, either by an expedition or other means after the War. His untimely death has thus cut short a career in which his services to science, already considerable, would certainly have been continued and added to in the post-war years.

H. J. Braunholtz.

Lord Moyne's public activities left little time for detailed zoological work, but he had a life-long interest in the subject, and helped in many ways to advance our knowledge of general natural history and marine biology. He was for many years president of the Marine Biological Association and took a leading part in recent developments of the Plymouth Laboratory. In addition he was a valued member of the Council of the Zoological Society of London, and a generous donor to the collections in the Gardens.

Lord Moyne's main contributions to zoological science were the results of his yachting cruises to various parts of the world. On these he was generally accompanied by other naturalists, the Hon. Anthony Chaplin on the 1936 cruise, Captain Jean Delacour and Dr. John Colman in 1938, and Lady Broughton, whose excellent photographs help to illustrate his two books. Large and valuable collections of mammals, birds, reptiles, etc., were brought back either alive or carefully preserved, most of the live specimens being presented to the Zoological Society, and the preserved material to the British Museum (Natural History).

Among animals obtained on the cruise to New Guinea, a list of which is given in an appendix to "Walkabout", many, including two Komodo dragons, are still on view in the London Zoo. The collections of live animals brought back on this cruise alone and presented to Regent's Park included no less than sixteen species not previously exhibited in Britain.

All those who enjoyed the privilege of working with Lord Moyne have been impressed by his remarkable gifts, of which perhaps they will remember longest his thoroughness, his unfailing sincerity and his genius for friendship.

Edward Hindle.

We regret to announce the following deaths:

Prof. D. MacCallum Blair, regius professor of anatomy in the University of Glasgow, on November 10, aged forty-eight.

Mr. E. V. Suckling, an authority on water purification and author, with J. F. Beale and J. C. Thresh, of "Examination of Water and Water-supplies", on November 16, aged fifty-one.

NEWS and VIEWS

Royal Society: Anniversary Meeting

THE customary anniversary meeting of the Royal Society took place on St. Andrew's Day, November 30, and the main part of the address by the president, Sir Henry Dale, is printed on p. 724 of this issue of *Nature*. In addition, Sir Henry referred to other matters, more of a domestic character. Prof. A. V. Hill's mission to India, to advise on science in general and a new programme of research and its applications, occupied the prominent place justified by the unqualified success which has attended it. A special meeting of the Royal Society was held in India, the first to be held outside Great Britain, and eventually a mission consisting of six of India's scientific leaders came to Britain, as the first stage of a tour extending to Canada and the United States, to see for themselves the scientific activities and organization with which the demands of war are being met and preparations being made for the tasks ahead in a largely devastated world. The members of the Indian mission used the rooms of the Royal Society as headquarters, and shortly before they left they were received by the King and Queen, who thus showed their interest in the promotion of closer understanding and comradeship in science between India, Great Britain and the whole of the British Empire.

Sir Henry Dale then turned to plans which are being made for increased provision for research in Great Britain. Last year he announced that the Royal Society had appointed a committee to consider the prospective needs of fundamental researches in physics. As the result of representations from other branches of science, a series of other committees was appointed, to consider the requirements in chemistry, biology, geology, geophysics, geography and mineralogy. The inquiries of these committees have been directed towards the advancement of knowledge without immediate or even implicit reference to practical needs or objectives; this was decided, not because of any inferior status or interest of applied research and related investigations, but because it is felt that such researches are already receiving support from the three Advisory Councils and are more likely to attract support from private benefactors. Sir Henry also referred to the problem of State accommodation for the principal scientific societies, with which he dealt in his address last year. The Royal Society was asked by several of the specialist societies to take up the matter, and a deputation was received by the Lord President of the Council, the Chancellor of the Exchequer and the Minister of Works and Buildings, on behalf of the Government. The case for the inclusion in any scheme for the rebuilding of London of a centre adequate to house the principal scientific societies was presented, and the deputation was asked to furnish quantitative data as a basis for further consideration of the question.

Science and National Welfare

IN his address on receiving the Priestley Medal of the American Chemical Society on September 13, under the title "Science and the National Welfare" (*Chem. and Eng. News*, 22, 1642; 1944), Dr. J. B. Conant suggested that one of the many ills of the world seems to lie in the fact that certain aspects of accumulative knowledge, roughly what we call science, are often substituted for philosophy, while certain aspects of philosophy (a large part of the social sciences) are considered as science. If the United States is to live up to its responsibilities in the post-war years, it must foster all learning—accumulative knowledge, philosophy and poetry, including literature and the fine arts. So far as is humanly possible, all the potential talent in these manifold activities must be recognized at an early age and given adequate educational opportunity. Dealing more specifically with the physical sciences, Dr. Conant stressed the dependence, here as elsewhere, of the rate of advance on the number of really first-class men engaged, and he urged the institution of a national scholarship programme for young men who gave promise of becoming leaders in science and technology. For the most effective scientific advance in the applied fields, he believes there must be keen and strong rivalry between a number of strong and independent groups, but since we must look to the universities for the fundamental advances to be applied later and for the trained men required, industrial concerns and research institutes should beware of making too heavy demands on the universities for either time or their most promising men. Again, the mobile striking power of scientific talent required to exploit new advances resides ideally in the universities, but for the last twenty-five years the American universities had suffered from two great evils: their system of making life appointments, which so often fails to distinguish between men of real ability and men of medium competence; and the tendency to overburden the former with undergraduate teaching. Dr. Conant looks to the professional societies to play a leading part in forming the public opinion required to correct both these faults. With regard to funds, Dr. Conant believes it is more important for the universities to be able to find really first-rate investigators worthy of support than to find funds to support investigations.

Scientific Film Association

THE first annual general meeting of the Scientific Film Association was held on November 25 in London. The chairman, Mr. Arthur Elton, proposing the adoption of the annual report, stressed the need for critical appreciation in the field of scientific films. He pointed out that the world of publishing has an elaborate organization for criticism and documentation of every book directly it is published; without some such machinery, the film will remain an ephemeral thing instead of being part of our national culture. He suggested that this deficiency in the scientific film might be made good by the Scientific Film Association, which is now publishing a catalogue of such films. Mr. Elton said that a North of England Section has been formed of the Association and that considerable interest has been shown in the United States and Canada. The Canadian Government has appointed a representative in Ottawa to cater for interest there in scientific films. Mr. Elton hopes that the Association will play its part in the international exchange of information by films. In the discussion which followed, members stressed the importance of developing the work of the standing committees of the Association dealing with medical, educational and industrial films. The problems of criticism and appraisal of scientific films were discussed and a request was made for specimen programmes for scientific film societies. A short film on Brownian movement made at the Glasgow Technical College, and the new film "Children of the City" and two

British Council films from the Central Film Library, "Life Cycle of the Maize" and "Development of the Rabbit", were shown.

Russian Astronomy Resurgent

A TELEGRAM from Moscow gives the news that the Astronomical Council of the Academy of Sciences of the U.S.S.R. has already made a start on the task of rebuilding those Russian astronomical institutions which have suffered at German hands. Plans are being made both for the reconstruction of wrecked observatory buildings and for the design of new ones. A workshop under the direction of Prof. D. D. Midsutov, builder of the telescope with all-spherical surfaces, has been organized for the design of instruments and construction of scale models. The rebuilding of Poulkovo Observatory will begin in the near future: the new buildings, especially that which will house the great refractor, are designed to meet all the requirements of modern astronomical technique.

A site has been selected for the projected Central Asiatic Observatory on Zaili, a spur of the Ala Tau Mountains near Alma Ata. This observatory is not to be confused with the new astrophysical one, plans of which have already been drawn up, which in its scope and equipment is to be on a level with the best modern observatories. The site for this latter institution will probably be in the Crimea. The Ukrainian Academy of Sciences has decided to build a new observatory near Kiev, and Simeiz Observatory is already being rebuilt. In Moscow an astronomical laboratory is being established where visiting astronomers will be able to calibrate their photometric apparatus. The Leningrad Astronomical Institute will in future engage in purely theoretical work, including an attack on some problems in celestial mechanics, and will publish such periodical works as annual ephemerides.

Total Solar Eclipse of June 9, 1945

A SOVIET broadcast announces that a commission set up by the Academy of Sciences of the U.S.S.R. to observe the total solar eclipse of June 9 next year has opened its first plenary session in Moscow. Prominent astronomers from Moscow, Leningrad, Kiev and other cities are taking part in the scheme. The band of totality passes from America through Norway, Sweden and Finland, crossing into Soviet territory near Lake Ladoga, and then stretching through Yaroslavl, Ivanovo, south of Gorki and Kuibyshev and north of Uralsk. The longest period of totality in the U.S.S.R. will be near Lake Ladoga, where it will last 61 seconds. Twenty Soviet expeditions are being organized. The Sternberg Astronomical Institute and similar bodies in Kiev, Kharkov and Kazan are to take part. Most of the sites of the expeditions are concentrated in the areas of Rybinsk and Yaroslavl. Preparations for observing the eclipse are also well forward in Sweden. A paper by Grönstrand, which is to appear in the *Annals* of the Stockholm Observatory, gives the circumstances of the eclipse in northern Sweden, and a party led by Lindblad plans to observe the flash spectrum.

University of Melbourne

THE trustees of the estate of the late E. L. Baillieu have given the University of Melbourne £A105,000 for a new library to commemorate Mr. Baillieu's brother, the late W. L. Baillieu.

The following appointments have recently been made: Dr. L. H. Martin, formerly associate professor of physics in the University, but recently on leave for special duties under the Council for Scientific and Industrial Research, to be professor of physics; Dr. E. S. Hills, hitherto associate professor of geology in the University, to be professor of geology and mineralogy; Dr. S. Dattilo Rubbo, hitherto senior lecturer in bacteriology in the University, to be professor of bacteriology.

Director of Army Education

BRIGADIER CYRIL LLOYD has been appointed director of army education under the Director-General, Mr. P. R. Morris. Brigadier Lloyd was educated at Brighton Grammar School and at the University of London, where he took his B.Sc. with first-class honours in 1926. He taught at Sir George Monoux Grammar School and later at Brighton Grammar School until the outbreak of war.

Announcements

MR. D. A. OLIVER, research director of William Jessop and Sons, Ltd., and J. J. Saville and Co., Ltd., Sheffield, while continuing in this position, has also been appointed director of research to the Birmingham Small Arms Group, of which Jessops and Savilles form part. The B.S.A. Group research activities, in addition to being carried on in the existing laboratories situated at the different works of the Group, notably the Daimler Co., Ltd., Coventry, the B.S.A. Co., Ltd., Small Heath, Birmingham, and B.S.A. Tools, Ltd., Birmingham, are to be considerably expanded. Recent additions to the research staff include Dr. A. J. Bradley, formerly of the Cavendish Laboratory, Cambridge, and Mr. P. H. Lawrence, formerly of the Ministry of Aircraft Production, London.

THE Clough Memorial Research Fund, which was instituted in 1935 for the purpose of encouraging geological research in Scotland and the north of England, provides a sum of approximately £30 annually. Applications for grants are invited for the period April 1, 1945–March 31, 1946, and should state (1) the nature of the research to be undertaken; (2) the amount of grant desired; (3) the specific purpose for which the grant will be used, for example, travelling expenses, maintenance in field, excavation of critical sections, etc.; (4) whether any other grant-in-aid has been obtained or applied for. Applications must be in the hands of the Secretary, Clough Memorial Research Fund Committee, Edinburgh Geological Society, Synod Hall, Castle Terrace, Edinburgh, not later than March 1, 1945.

THE Summary of Current Technological Developments issued by the U.S. Department of Labour is prepared each month by the Productivity and Technological Development Division of the Bureau of Labour Statistics. Started at the end of 1941, it summarizes recent changes in processes, materials and manufacturing techniques as reported in current trade and technical periodicals, of which about two hundred are now covered each month. In addition to short abstracts of the articles or notes appearing in the periodicals cited, brief special reports are frequently presented on matters of current interest, based on a number of sources or on the work of the Division. The February 1944 issue, for example, includes a fifth article in a series on labour utilization, dealing with employee training and upgrading.

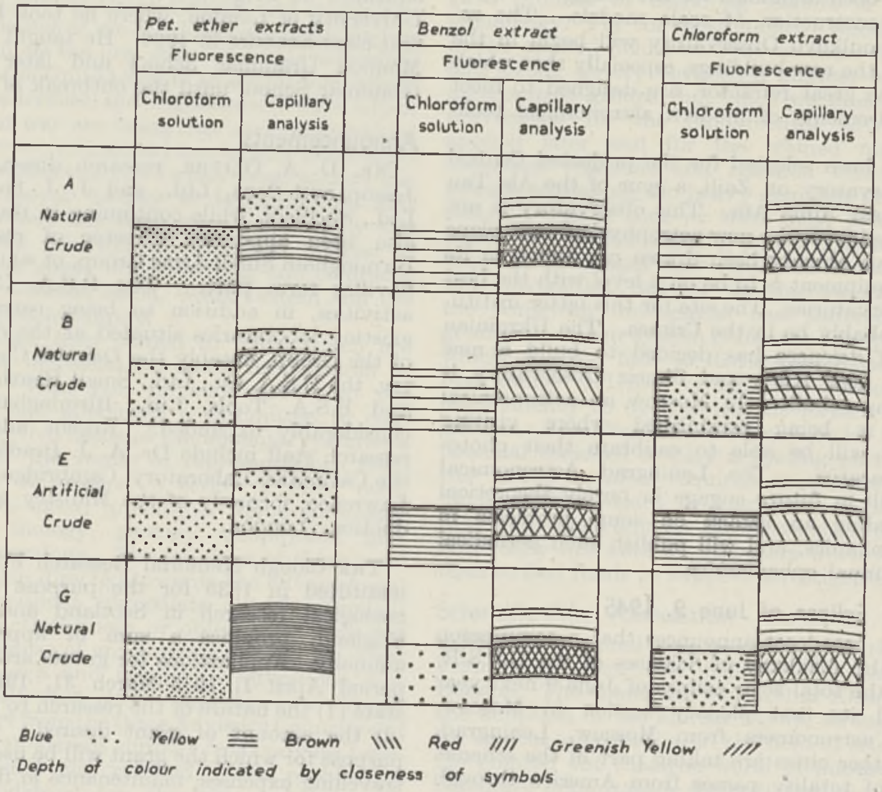
LETTERS TO THE EDITORS

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

A Method of Differentiation of Crude Oils based on Chromatography, Capillary Analysis and Fluorescence in Ultra-violet Light

CRUDE petroleum and the refined oils obtained from it fluoresce strongly in ultra-violet light. This property has recently been utilized for the differentiation of various types of crudes from one another and from refined oils or artificial mixtures prepared to resemble natural crudes[1 2 3]. The oil is either dissolved in a non-fluorescent solvent or spotted on a filter paper and fluorescence noted. Several crude oils from a particular field, some samples of refined oils, and two artificial crudes were examined using a Hanovia Universal fluorescence lamp as the source of ultra-violet light. The samples of refined oils could be readily distinguished from the crudes; but only minor differences were observed between the real and artificial crudes.

A technique based on the use of chromatography and capillary analysis on filter paper strips has been developed and found to be more satisfactory than fluorescence analysis of crude oils as such. The use of chromatographic adsorption analysis for testing asphalts and bitumens has recently been reported by Grader[4]. We adopted the following procedure. The chromatogram was formed on a column of Brockmann alumina from a dilute solution of the oil in petroleum ether (40–60° C.). After washing the column with the same solvent until a colourless filtrate appeared, it was dried by suction and then benzol percolated



EXAMPLES OF FLUORESCENCE IN WASHINGS FROM ALUMINA.

Sample*	Petroleum ether extract		Benzol extract		Chloroform extract	
	Fluorescence of chloroform solution	Fluorescence after capillary rise	Fluorescence of chloroform solution	Fluorescence after capillary rise	Fluorescence of chloroform solution	Fluorescence after capillary rise
A	Intense blue	Blue / Yellow	Light yellow	Light yellow / Deep reddish brown	Light yellow	Light yellow / Reddish brown
B	Blue	Blue / Greenish yellow	Very light yellow	Light yellow / Brown	Light blue with yellow fringe	Light yellow / Yellowish brown
E	Blue	Blue†	Yellow	Light yellow / Reddish brown	Yellow	Light yellow / Brown
G	Strong blue	Deep yellow	Light blue	Light yellow / Deep reddish brown	Blue with yellow fringe	Light yellow / Reddish brown

* *A*, *B* and *G* were different natural crudes and *E* artificial crude.
† Characteristic of refined oil.

through it. The filtrate was collected in a separate receiver, and washing with benzol continued until a colourless filtrate was again obtained. This cycle of operations was repeated with chloroform. Different fractions of oils obtained by evaporating the extracts were dissolved in chloroform and the fluorescence of the solutions compared at equal concentrations. Capillary analysis was then carried out. Some results are given in the accompanying table and chart.

The oil samples gave blue fluorescence when dissolved in chloroform; but the fractions separated by chromatography showed marked differences in fluorescence colour.

These investigations have been carried out with the aid of a grant from the Assam Oil Co., Ltd. The method is being developed further. Our thanks are due to Mr. P. Evans and Mr. A. Reid for their help.

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[1] Bentz and Strobel, Proc. World Petroleum Congress, Vol. 1, 334 (1933).
[2] Balada, *Petroleum*, **31**, No. 48, 11 (1935).
[3] Fabian, *Ol. u. Kohle*, **39**, 631 (1943).
[4] Grader, *Oel. u. Kohle*, **38**, 867 (1942).

Amides, Imides and Peptides

IN suggesting the term 'polypeptides' for describing condensates of amino-acids at large, Dr. Jordan Lloyd[1] is seemingly extending the meaning of the word beyond that originally proposed by Emil Fischer[2], who introduced it for the condensates of α-amino-acids. Indeed, 'peptide' was not proposed for the link –CONH– but for the residue –CH*R*–CO–NH–, as is indicated by the use of 'dipeptide' for glycylglycine, which contains only one –CONH– group. Fischer, in his original lecture[3], put forward the proposal that by analogy with known distinctions made in carbohydrates between disaccharides, trisaccharides, etc., compounds of the glycylglycine type should be termed dipeptides and the higher condensates of amino-acids termed tripeptides, tetrapeptides, etc.

Dr. Jordan Lloyd's proposal, in addition to departing from Fischer's original conception which has been preserved in general usage, would bring within the scope of the term such polycondensates as those obtained from ω-amino-acids, for example, ω-aminocaproic acid. We agree that it is desirable to avoid confusion between proteins and nylons, but we think that Dr. Lloyd's suggestion would lead to more confusion in that it would not help in differentiating between condensates of α-amino-acids and those of ω-amino-acids, which must be classed as nylons[4].

It is misleading to say that nylon chemistry has its origins in organic chemistry: it is a part of organic chemistry, and not a different subject. Dr. Lloyd's complaint would seem to be based on a lack of knowledge of recent history. The word nylon is used as a short *generic* term[5] for what the inventor of the compounds, Carothers, described, prior to the introduction of the word nylon, as polyamides[6]; that is, the term polyamide is older than the term nylon.

To call the group –CO–NH– an amide or amido group is not wrong: to quote from the "Instructions to Abstractors" of the Chemical Society (see also ref. 7) "when . . . the NH_2 group is substituted with an acid residue such as acetyl it becomes acetamido, etc.".

Dr. Jordan Lloyd's definition of an imine as a compound containing the $>NH$ group only represents general usage when the group is part of a cyclic system, for example, as in ethylene-imine and *cyclo*hexamethyleneimine, or present as a : C=NH group. Similarly, imides are *cyclic* secondary amides of dibasic acids[8].

We agree with Dr. Jordan Lloyd that it is not so easy to use existing terms, or to devise new terms, for purposes of classification in organic chemistry as it is in, for example, botany; but we do not agree that clarity will be brought into any relations when 'polyimide' is suggested as a general term with a definition which would seemingly include the well-known hydroxynaphthoic arylamides.

It is an objection to polyamide that it offers itself as a generic term also for the polymers of methacrylamide $CH_2 : C(CH_3)–CO.NH_2$ but, we think, few one-word terms are used without a context.

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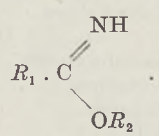
[1] Lloyd, D. Jordan, *Nature*, **154**, 486 (1944).
[2] Fischer, E., *Ber.*, **36**, 2094 (1903).
[3] *Chem.-Zeitung*, **26**, 939, No. 80 (1902).
[4] Brit. Pat. 461,236 and Brit. Pat. 461,237.
[5] Hoff, *Ind. Eng. Chem.*, **32**, 1560 (1940). Loasby, *J. Text. Inst.*, **34**, P 45 (1943).
[6] Carothers and Hill, *J. Amer. Chem. Soc.*, **54**, 1566 (1932), reproduced in "Collected Papers of Wallace Hume Carothers" (New York, 1944), p. 165.
[7] Smith, *J. Chem. Soc.*, 1076 (1936).
[8] Sidgwick's "Organic Chemistry of Nitrogen", Taylor and Baker, p. 152 (Oxford Univ. Press, 1942).

DR. JORDAN LLOYD is wrong in her conception of the nomenclature of imides and imines. While organic chemists will agree with her dictum that substances carrying the $–NH_2$ group are amines, those which carry the $>NH$ group are not necessarily imines. Thus, dimethylamine, $(CH_3)_2NH$, has such a group, and is still an amine; surely an imine must contain the structure $>C=N–$, as in the imino-ethers



With imides and amides the problem is similar; if Dr. Jordan Lloyd is correct in her view, any substance containing the –CONH– group would be an imide. Thus, on conversion of acetamide, CH_3CONH_2, to its methyl derivative $CH_3.CO.NH.CH_3$, a change in nomenclature would also take place, and the substance would be known as 'methyl acetimide'. This is quite in opposition to current practice and would be a most undesirable feature of nomenclature. Such substances are properly known as 'substituted amides'. The conception associated with imides dates from the recognition by Wurtz[2] in 1854 that amides could react as if derived from either of the structures I or II, and this persists in the 'lactam-lactim' nomen-

$R.CO.NH_2$ (I) $\qquad$ $R.C(OH)=NH$ (II)

clature used by Baeyer for the parallel case of isatin and its homologues.

It is clear that the term 'imine' should be confined to substances in which the $>C=N-$ is present, and that 'imide' should be reserved for derivatives of the enolic form of the amide structure and for the cyclic amides of dibasic acids. Substances of the structure R_1CONHR_2 should be termed 'substituted amides'. The term 'polyamide' for nylon is, therefore, correct.

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[1] *Nature*, **154**, 486 (1944).
[2] Wurtz, *Jahresb.*, 566 (1854).

IN reply to the above communications, I wish to say that the main point in my complaint is that in two closely allied fields of chemistry the connecting link –CONH– is being called by two different names, namely, 'amide' and 'peptide', and that the expression 'amide (or amido) group' is being used to cover both the connecting –CONH– and the terminal group $-CONH_2$, both of which are present in proteins.

For example, in a recent paper by P. J. Flory[1] dealing with three-dimensional polymers and the theory of gelation, in the section on protein gels he refers to "amide-amide hydrogen bonds" and quotes a paper by Myers and France. Reference to the latter paper[2] shows that these workers talk of hydrogen bond formation (with acetic acid) at "the loose ends of the salt-bridges after neutralisation has permitted them to separate", and of the "possibilities of hydrogen bond formation at each peptide link". They do not refer to 'amides' at all. When Dr. Astbury talks of an 'amide-hydroxyl' hydrogen bond in keratin, he means a side-chain link between the group $-CONH_2$ and OH.

Some of the correspondents also appreciate the difficulty. I am not an authority on organic nomenclature, and am willing to accept any ruling which would lead to clarity and be acceptable to the Chemical Society. As regards the past history of polypeptides and synthetic polyamides, this has not escaped my attention, but it does not of itself suggest how to deal with the future.

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[1] *J. Phys. Chem.*, **46**, 132 (1942).
[2] *J. Phys. Chem.*, **44**, 1113 (1940).

Endocrine Reaction to Tissue Injury

IT has been reported previously that tissue damage produces in animals a state of resistance to the lethal effects of a subsequent trauma[1,2]. Resistance, as detected by the decrease in post-traumatic mortality, was accompanied by the following functional changes: inhibition of the normal release of histamine from blood cells[3]; shortening of the bleeding time; and increase of the capillary resistance[4]. All changes could be transferred to normal animals by injection of the serum of traumatized animals. It was also shown that the substance present in the serum and responsible for the resistance was produced by the pituitary and acted through the adrenal cortex[4].

Further investigations have been carried out, using the shortening of bleeding-time as test. Trauma, as well as injection of serum from traumatized animals, reduces the mean bleeding-time by about 40 per cent in groups of guinea pigs and rats. In hypophysectomized, adrenalectomized or splenectomized animals, however, neither trauma nor the injection of traumatic plasma produces a shortening of bleeding-time.

The part played by various tissues was further tested by studying the action of tissue extracts on bleeding-time. Of eighteen tissues investigated, only the extracts of pituitary, adrenals and spleen shortened bleeding-time. The same effect was observed with purified products from these organs: corticotrophic hormone of the pituitary and whole cortical extract (synthetic desoxycorticosterone was inactive). A spleen extract was prepared which shortened bleeding-time in a dose of 0·02 μgm. per kgm. body weight. Chemical identification of the latter is being attempted.

It has also been shown that the pituitary hormone is without effect in adrenalectomized or splenectomized animals. Adrenal extract had no action in the absence of the spleen, but spleen extract was still active in animals deprived of pituitary, adrenals or spleen.

Selye[5] observed hypertrophy of the adrenals in the 'adaptation' phase of the 'alarm reaction' which can be elicited by tissue injury. It is also known that adrenalectomized animals are particularly sensitive to 'shock' conditions[6]. The intervention of the pituitary in protection against these conditions was suggested by Reiss, Macleod and Golla[7]. Perla and Marmorston put forward the idea that the spleen might play a part in the resistance to infections[8]; but the facts mentioned above supply probably the first experimental proof of an endocrine function of the spleen.

The results of the experiments reported here point to the existence of a physiological mechanism responsible for the resistance to lethal effects of trauma. The pituitary responds to tissue damage by the secretion of corticotrophic hormone, which determines the release of an adrenal product stimulating eventually the secretion of the splenic substance. The mode of action of the latter is not yet known; some of its effects suggest either a change in the reactions of the capillary wall, reducing perhaps the escape of fluid into the tissues, or the inhibition of the release of toxic substances from certain cells.

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(French Scientific Mission
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Nuffield Institute for Medical Research,
Oxford.
Oct. 29.

[1] Noble, R. L., *Amer. J. Physiol.*, **138**, 346 (1943)
[2] Ungar, G., *Lancet*, i, 421 (1943).
[3] Ungar, G., *J. Physiol.*, **102**, 19P (1943).
[4] Ungar, G., in the press.
[5] Selye, H., *Endocrinology*, **21**, 169 (1937).
[6] Hechter, O., Krohn, L., and Harris, J., *Endocrin.*, **31**, 439 (1942).
[7] Reiss, M., Macleod, L. D., and Golla, Y. M. L., *J. Endocrin.*, **3**, 292 (1943).
[8] Perla, E., and Marmorston, J., "The Spleen and Resistance" (London: Baillière, 1935).

A Crystalline Serum Muco-Protein with High Choline-Esterase Activity

IN a recent article[1], Bader, Schütz and Stacey state: "It appears to be an undecided question whether choline-esterases from different tissues, such as blood and brain, are identical".

Bader and his associates must have failed to note that it has definitely been established that the cholinesterases from different tissues are not identical. The investigations reported by us[2] have conclusively demonstrated the existence of two distinct cholinesterases, a specific or true cholinesterase and a non-specific or pseudo-cholinesterase. Erythrocytes and brain[3] throughout the vertebrate kingdom contain true cholinesterase only, while a mixture of both enzymes is present in most of the sera[4] and tissues[3] of the many mammals investigated.

Furthermore, Bader and his co-workers report that they have isolated from horse serum a crystalline muco-protein with a cholinesterase activity 20–25 times higher than that of the original serum. As the purified enzyme preparations from horse serum described by one of us[5] are about three hundred times more active than their crystals, it seems likely that at least 299 out of 300 parts of these crystals, that is, 99·7 per cent, represent inert material.

Since Bader *et al.* are inclined to the view that the great discrepancy between their results and our own might be due to the use of different methods of assay, we feel that an exchange of samples, giving both parties an opportunity of comparing the activity of the two preparations by their own test, would be the most satisfactory solution of the controversy.

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H. RUDNEY.
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Sub-Department of Cellular Physiology,
Banting and Best Department of Medical Research,
University of Toronto.

[1] Bader, R., Schütz, F., and Stacey, M., *Nature*, **154**, 183 (1944).
[2] Mendel, B., and Rudney, H., *Biochem. J.*, **37**, 59 (1943).
[3] Mendel, B., and Rudney, H., *Science*, **98**, 201 (1943).
[4] Mendel, B., Mundell, D., and Rudney, H., *Biochem. J.*, **37**, 473 (1943).
[5] Strelitz, F., *Biochem. J.*, **38**, 86 (1944).

An Effect of Overdosage with Corticotrophic Pituitary Extract on the Rat Kidney

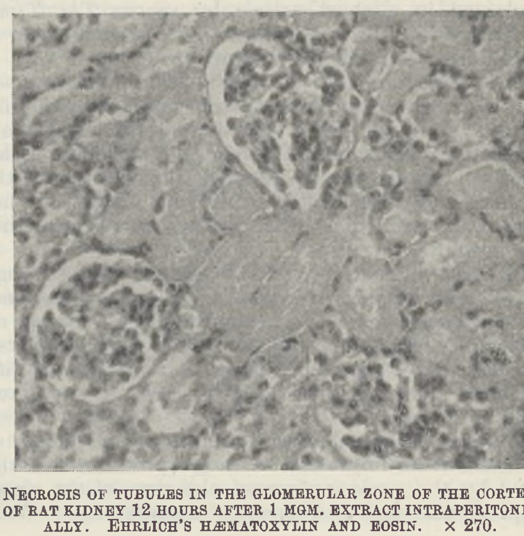
RECENT progress in the purification of the corticotrophic fraction of the anterior pituitary lobe (the preparations contain 24–48 cortic-lipoid units per mgm.) has made it possible to inject rats with very large doses of this hormone. While investigating the effect of such large doses, it was noticed that the kidneys of animals intraperitoneally injected with a dose exceeding 100 units presented a picture which differed considerably from that of the kidneys of the control rats.

Kidneys of rats injected with the corticotrophic hormone showed the following abnormalities. Macroscopically, the kidneys appear pale, mottled and swollen, with a tense capsule. This observation was borne out by a comparison of the weight of kidneys of injected animals with that of the kidneys of controls. It will be seen from the accompanying table that, after injection of doses of corticotrophic hormone ranging from 4 to 24 mgm., weight increases of 14–46 per cent have been found.

Treatment	No. of rats	Combined body weight of whole group (gm.)	Combined weight of kidneys (gm.)	Combined weight of kidneys as per cent of combined body weight	Increase in kidney weight (per cent)
Controls	3	125	1·77	1·41	
24 hours after 8 mgm. intraperit.	3	121	2·32	1·91	+35·5
Controls	3	135	1·74	1·29	
5 hours after 4 mgm. intraperit.	3	145	2·45	1·69	+32
3×4 mgm. in 48 hours	3	126	2·38	1·89	+46·5
Controls	3	129	1·8	1·39	
3×4 mgm. in 48 hours	3	122	2·1	1·68	+22·4
6×4 mgm. in 72 hours	3	133	2·6	1·92	+38·1
5 hours after 12 mgm. intraperit.	3	132	2·21	1·59	+14·4

Histological findings. In kidneys of rats injected with 1 mgm. of extract per animal and killed after 12 hours, the main pathological change consists in a patchy necrosis of the tubules of the glomerular zone of the cortex (see photomicrograph). There is marked swelling of the tubular epithelium, usually sufficient to obliterate the lumen, nuclei are absent or shrunken and pyknotic, and the cytoplasm stains a light pink with eosin without showing the granularity of cloudy swelling. Staining with Sudan III or IV shows deposits of lipoid granules in a minority of these tubules; but fatty change is not a conspicuous feature, nor do these kidneys contain anisotropic lipoid. The glomeruli are somewhat enlarged and may exhibit a slight cellular swelling and capillary dilatation. With larger doses (for example, 8 mgm. after 12 hours) in addition to the changes described above, which are now more marked in the case of the glomeruli, there are larger areas of infarction, with necrosis of all elements of the cortex, corresponding to the areas of hæmorrhage observed macroscopically.

The changes described could be seen as early as five hours after injection of the high doses of the corticotrophic hormone, and they seem to be fully developed twelve hours after the hormone administration.



NECROSIS OF TUBULES IN THE GLOMERULAR ZONE OF THE CORTEX OF RAT KIDNEY 12 HOURS AFTER 1 MGM. EXTRACT INTRAPERITONEALLY. EHRLICH'S HÆMATOXYLIN AND EOSIN. × 270.

Considerably larger doses of egg albumen, peptone and dried whole pituitary gland suspensions failed to produce similar changes in control animals.

In a further series of experiments, a number of epinephrectomized rats were injected with high doses of the corticotrophic hormone preparation. The kidneys of some of these animals showed similar though less pronounced changes to those observed in rats with intact adrenals.

The occurrence of these kidney changes after injection of the hormone might be ascribed to either of two factors, if it is possible to rule out a direct toxic action due to the concentration of some substance during the process of purification. These possibilities are: (*a*) an effect of the anterior pituitary hormone on the accessory adrenals; (*b*) a direct action of the purified corticotrophic hormone on the kidneys.

The first possibility would appear to be more acceptable, as Selye[1], with overdosage of desoxycorticosterone acetate, has produced nephrosclerotic changes in the kidneys of young chicks. Other investigations[2] point in the same direction.

It may also be remembered that pathological changes of the kidneys and the kidney function have been observed in cases of Cushing's syndrome, a disease in which a hyperexcretion of corticotrophic hormone[3] and of cortine[4] has been demonstrated.

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Sept. 28.

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Optical Phenomena in the Atmosphere

THE "Solar Halo Phenomenon" described by G. H. Archenhold in *Nature* of September 30 was referred to in recent correspondence in *The Times* and was explained in a short article by me in *The Times* of August 31. The occurrences of August 9 seem to have been particularly striking.

Accounts from meteorological observers have made it fairly certain that the "dark bands moving like waves" or ripples across solar optical phenomena are connected with sound waves from explosions. I saw some in France during the War of 1914–18 on the occasion of a series of big explosions, though at that time the connexion with sound waves was not appreciated[1].

It seems that the sound waves passing through the air can affect two types of optical phenomena: (1) the type such as iridescence which depends on diffraction of light through minute water droplets; and (2) the type depending on reflexions in ice crystals floating with their axes in a fixed direction.

In the first type, as a result of the sequence of adiabatic warmings and coolings produced in the cloud by the explosion waves, the sizes of the cloud droplets diminish and increase respectively. With the changes in the size of the cloud particles, changes in the interference colours and thus in the iridescence are brought about. It might at first sight seem that changes in size of water drops could not take place sufficiently quickly to render sound waves visible in this way; but according to theoretical calculations made by Findeisen and experiments on artificial fogs made by H. Mache about 1933, the rate of evaporation of water droplets can actually be sufficiently great in the very small droplets characteristic of thin, newly formed clouds.

In the ice crystal type of phenomenon, it is presumably the momentary displacements caused by the explosion waves in the lie of the crystal axes which cause the ripple effect. The angular speed of the ripples mentioned by G. H. Archenhold (5° per second) would give the velocity of sound at a distance of some 12,000 feet, though the height of the cloud trail was much more likely to have been about twice as great. The band width mentioned ($\frac{1}{5}$°) or the distance between bands ($\frac{1}{2}$°–1°) would correspond to a very low frequency sound which, however, is a characteristic of heavy explosions.

It may be relevant to mention here another kind of optical phenomenon which has recently been described in letters to *The Times* and discussed in an article on September 3 under the heading of "Flying Bomb Waves". Such waves have been seen by observers of nearby explosions and have been described as "a faint but distinct line in the form of a seemingly perfect arc centred on the spot where a bomb had disappeared". These effects are connected with the explosion wave within a few hundred yards of the explosion itself, and it seems that the curved line represents the hemispherical wave of compressed air. In this case the optical effect might arise either from evaporation of water droplets in cloudy air or even as a refraction (mirage) effect from the relatively steep gradient of air density. Calculation of the effect produced by a ton of high explosive suggests that either effect is physically possible up to a radius of the order of 500 yards from the exploding bomb, provided the bomb explodes before burying itself in the ground or in buildings, and assuming the observer to be suitably placed—say, half a mile distant—to view the effect.

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[1] *Q. J. Roy. Met. Soc.*, **45**, 366 (1919).

THE arc through the sun described by Mr. C. J. P. Cave[1] can only, I fear, be identified with the horizontal circle and not with some rare tilted arc. Its identity is clear from the fact that it passed both through the sun and through the parhelia to the 22° halo, which have the same altitude as the sun. The impression of upward tilting, due to perspective, was unquestionably enhanced by the comparatively high sun and the small amount of the circle that was visible; a lower sun and a more extensive development of the circle make it clear that all parts of it are the same distance from the horizon. The apparent tilting is an effect with which Mr. Cave will certainly be familiar from observations of clouds.

I have advisedly used the word 'tilted', since the word 'vertical' is inadmissible in the sense used by Mr. Cave. Haloes are, of course, simply rays of light with a particular orientation to the eye, but for convenience we regard them as having a definite location. The 22° halo, generally seen as a circle normal to the line from the sun to the eye, if seen in hoar frost soon after sunrise is so obviously on the ground that we say it is a horizontal hyperbola. Similarly the rainbow, when seen as a dewbow on ponds covered with an oily film, on cobwebs, or on delicate new-sown grass, becomes an ellipse. In general, halo phenomena are regarded as projected on the celestial sphere. A little consideration makes it clear that a horizontal circle through the sun, as it is progressively raised on the side away from the sun, becomes steadily smaller and finally disappears when its inclination to the horizontal is equal to the zenith distance of the sun.

Although the number of observations is too small to allow definite conclusions, it is of interest to note that the four well-developed horizontal circles that I have observed have all been in small cirro-stratus sheets far below the ordinary cirrus level, at some 5,000 ft. or less ; of trace observations, one has been at low level in ice-crystal fog, three at high level, and three at doubtful heights. The brief life and sudden appearance and disappearance of Mr. Cave's display suggest a low level, and consequent high angular velocity, of the cloud.

The occurrence of these arcs in cloud believed to have originated from condensation trails is of interest to me because such trails sometimes seem to yield no arcs, which suggests that they may be made up of very small crystals, complex crystals, or sub-cooled droplets. Of nine sets of trails seen, five did not approach the sun, three yielded no arcs, and one yielded a brilliant circumzenithal arc. The aircraft that formed the latter trail was estimated to be flying at 3,000 ft. and a thin ice-crystal haze was present at the same general level, since a faint circumzenithal arc was present below small patches of alto-cumulus. It may be significant that the two possible orientations of crystals forming this arc (vertical axis of symmetry, and horizontal axis of symmetry with two side faces horizontal) are two of the possible orientations of crystals forming the horizontal circle (vertical axis of symmetry, horizontal axis with two side faces horizontal, horizontal axis with two side faces vertical, and horizontal axis with side faces randomly oriented). Perhaps readers in Britain, where condensation trails must have been only too common in the last five years, can give more information on optical effects in this type of cloud.

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[1] *Nature*, **154**, 240 (1944).

THE letter of Dr. Savile and private correspondence I have had with Dr. Paul White convinces me that I must have been mistaken, and that what I saw on May 2 was a small part of the parhelic circle.

No doubt 'tilted' is a better word to use in connexion with halo phenomena than 'vertical'; but the latter term has been in use for a long time and did not originate from me.

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Cryoscopy of Solutions

A. V. Brancker, S. J. Leach and V. A. Daniels suggest[1] that θ, the depression of the freezing point of a solvent by a solute of m molal concentration, can be given by $\theta = Km^b$, where K is the cryoscopic constant and b a constant very nearly unity.

Such a relation, admittedly empirical, is fundamentally of an incorrect form because it cannot lead to the necessary thermodynamic requirement that θ/m is finite when $m = 0$, and furthermore, K so defined is a cryoscopic constant at unit molality, a quantity smaller than the limiting or van't Hoff value. The ability of this relation to accommodate data over a wide range of concentration from 0 to 1 molal is apparent only. This agreement exists because $d\theta/dm$ and θ/m, although identical at $m = 0$, diverge very slowly with increasing concentration, and b is the ratio of these quantities.

It can be shown thermodynamically, for solutions obeying Raoult's law, that $m = \alpha\theta + \beta\theta^2 + \gamma\theta^3 + \ldots$, where α is the reciprocal of the van't Hoff constant, β and γ are functions of heat of fusion and its temperature coefficient. From this it follows that b is given by $d \log \theta / d \log m = (\alpha + \beta\theta + \gamma\theta^2)/(\alpha + 2\beta\theta + 3\gamma\theta^2)$, a function rather insensitive to variation in θ because of the relative magnitudes of α, β and γ. This small variation is illustrated well by ideal benzene solutions, for which $m = 0{\cdot}1953\theta + 2{\cdot}4 \times 10^{-3}\theta^2 + 1{\cdot}4 \times 10^{-5}\theta^3$. This leads to values of b varying from 1 to 0·945 for concentrations from 0 to 1 molal respectively. Non-ideal solutions can be represented in a similar form with different coefficients and slightly smaller values of b. Such variations in slope would be barely noticeable in a logarithmic plot of the empirical relation, and most certainly tend to be masked by experimental variation in θ.

There remains to discuss the experimentally observed decrease in θ/m with increasing concentration. Many of the reported anomalies in the literature can doubtless be attributed to the use of the van't Hoff limiting constant at finite concentrations. Rigid calculation shows that, for ideal benzene solutions, we must expect θ/m to change from 5·122 at $m = 0$ to 4·81 at $m = 1{\cdot}0$ molal. The effect of applying the limiting constant to ideal solutions of a substance of formula weight 100 would be to give an apparent value of 107·5 at 1 molal. For non-ideal solutions such variations will be even larger.

The data given for solutions of tetralin in benzene[1] show anomalies which are too large to be so explained.

1. Low concentrations give θ/m already in excess of the accepted limiting value 5·122, a value expected from thermal data and corroborated by the careful and extensive measurements of Bury and Jenkins[2] on the freezing points of numerous benzene solutions.

2. The molecular weight of tetralin found is 136 instead of 132·2 which its formula requires.

These abnormalities are removed if one assumes that insufficient precaution was taken to prevent access of moisture to the benzene during the measurement. Assuming these solutions to be saturated with water (0·0335 per cent at 5·4° C.)[3], then approximately the observed depressions are too high by 0·120° C. Making this correction gives the values θ/m in column 4 (below). Excluding the value at the lowest concentration, which appears to be in error, θ/m now shows a variation with concentration which is quite close to the values calculated for an ideal solution and shown in column 5.

The data extrapolate to $\theta/m = 5{\cdot}1$. Assuming this value, molecular weights so calculated are given in column 6. These show a small variation with concentration, which extrapolates to a value lying between 132 and 133.

Tetralin (molal)	θ corr.	(θ/m) uncorr.	(θ/m) corr.	(θ/m) calc.	M
0·8422	4·196	5·120	4·982	4·86	135·2
0·6008	3·045	5·267	5·069	4·93	132·9
0·3008	1·516	5·441	5·040	5·03	133·9
0·1495	0·756	5·859	5·056	5·07	133·6
0·0518	(0·201)	(6·197)	(3·880)	—	(172·6)
	Extrapolated		5·1	5·12	132–133

The abnormal data for camphor given by Meldrum, Saxer and Jones[4] can also be explained by assuming the presence of some impurity. This is the explanation offered by Ricci[5]. Another possible source of error is the loss of camphor by sublimation during measurement.

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[1] *Nature*, 153, 407 (1944).
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[3] "Int. Crit. Tables", 3, 389.
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THE exact equation for an ideal solution has the form

$$d \log x/dt = \frac{\Delta H}{RT^2} \quad . \quad . \quad . \quad . \quad (1)$$

where x is the mol. fraction of the solvent and ΔH is the molar latent heat of fusion.

It can be shown that the classical equation

$$\theta = Km \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where m is the molality results from two main approximations applied in the reduction of (1) to (2), and it has been assumed in the literature that the variation in θ/m found with (2) is due to these approximations.

Banks has now shown that θ/m still varies even when an accurate expression derived from (1) is obtained, namely,

$$m = \alpha\theta + \beta^1\theta^2 + \gamma^1\theta^3 \quad . \quad . \quad . \quad . \quad (3)$$

Using equation 2, K found experimentally falls from an abnormally high value at $m = 0$, approaching the thermodynamic figure at $m = 1$.

Equation 3 likewise shows a fall in the value of θ/m, but in this case K is defined at $m = 0$. Because of the difficulty in obtaining experimental data at low concentrations and therefore extrapolating to infinite dilution, we evolved the empirically deduced equation:

$$\theta = Km^b \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

For the ideal case studied by Banks, b has been found to vary, but as he has pointed out, the order of this variation is such as to be masked by experimental error. From the practical point of view, therefore, this variation must be insignificant.

If, as it has been suggested, the abnormal results of Meldrum, Saxer and Jones were due to sublimation or impurities in the camphor, then we should have to accept the untenable conclusion that in our confirmatory work on camphor the same amount of sublimation and the same unspecified impurities were present. Further, the experimental results on which equation (4) is based have been checked by plotting $\log x$ against $1/T$, and the slopes of the lines obtained at any point gave latent heats of fusion of the solvents in close agreement with the literature values.

Finally, we have applied the moisture correction of 0·120° C. to the tetralin results; also to solutions of naphthalene in a different sample of benzene:

Tetralin: $b = 0·9394$

Concentration (gm. per 100 gm. solvent)	Molality	θ	θ corrected	θ corr./m	$\frac{\theta}{m^b}$
0·685	0·0518	0·321	0·201	3·880	5·180
1·977	0·1495	0·876	0·756	5·056	5·220
3·976	0·3008	1·636	1·516	5·040	5·169
7·942	0·6008	3·165	3·045	5·069	5·107
11·134	0·8422	4·316	4·196	4·982	5·072

Naphthalene: $b = 0·9846$

Concentration (gm. per 100 gm. solvent)	Molality	θ	θ corrected	θ corr./m	$\frac{\theta}{m^b}$
0·653	0·0510	0·279	0·159	3·118	5·225
0·922	0·0720	0·390	0·270	3·750	5·201
1·126	0·0880	0·477	0·357	4·058	5·223
3·430	0·2680	1·452	1·332	4·970	5·310
7·181	0·5610	2·922	2·802	4·995	5·162
10·160	0·7938	4·162	4·042	5·092	5·225

If the moisture correction were valid and could be accepted as the explanation of the anomaly found by using (2), then the results given in column 5 of the above table should extrapolate to 5·12 at $m = 0$.

In view, however, of the results obtained with naphthalene, we cannot conclude that the water correction can be used as an explanation of the anomaly. The values of θ/m^b, however, approximate to a constant value for K, which we believe can be used in actual determinations of molecular weights.

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Commutation of Annual Subscriptions

DR. HERON'S letter in *Nature* of September 23 should be of special interest to British scientific men, in that commutation gets over the legal anomaly that subscriptions to technical societies are not chargeable as expenses for the purposes of income tax, unless the taxpayer is working on his own. Those paid by salary cannot enter subscriptions as an expense, even when appointment is conditional on membership of some appropriate technical institution.

The difficulty is eliminated because commutation is equivalent to buying an annuity for the amount of the annual subscription, without the member becoming liable to tax on the capital part of the annuity; and also to tax on the income part, if the body happens to come within the rather artificial legal definition of a charity, and most technical ones do so. With non-charitable bodies commutation fees should necessarily be higher, in that tax has to be paid on the income from the commutation fund.

The fact is that it almost always pays for good lives to commute, even when the purpose is not to avoid income tax; for there is a general tendency to fix commutation fees too low, even in relation to the current annual subscription. Actually the fees should make some provision for the possibility of future rise in annual subscription, necessitated not only on account of the tendency for the value of money to fall in the course of years, but also by the desire of any active institution to widen the scope of its activities, for the general benefit of its members.

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RODS AND CONES, AND THOMAS YOUNG'S THEORY OF COLOUR VISION

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MR. E. N. WILLMER'S recent communications[1,2] on the physiology of colour vision once more direct attention to the essential principles involved in Thomas Young's theory. As is well known, it is on purely logical grounds that Young in 1801 came to the conclusion that the existence of three kinds of receptors having different spectral sensitivities—as we would say to-day—should account for the facts of normal colour vision[3]. At the basis of the theory lies[4] the principle of the 'specific energy of nerves', formulated by J. Müller[5] in 1840, according to which each nerve fibre can send only one kind of sensory message to the brain. This would seem to lead to the conclusion that there must be as many different kinds of receptors as there are colours; but Young's well-known hypothesis allows this number to be reduced to three. For the abnormal colour vision of such persons as his contemporary Dalton, Young himself suggested as an explanation "the absence or paralysis of those fibres of the retina which are calculated to perceive red"[6]; that is, dichromats would possess only two colour receptors instead of three. To-day the strength of this theoretical argument referring to the whole retina remains undiminished[7,8,9,10].

Meanwhile, however, as the properties of the actual retinal receptors became better known, the duplicity theory was evolved. According to it, the rods mediate only a colourless kind of vision, while colour vision is entirely mediated by the cones[11]. If this is the case, then Young's reasoning must be applied to the cones, leading to the conclusion that there are three different kinds of cones. Now, however, Mr. Willmer[1,2] has made the radically different suggestion that the rods constitute one of the kinds of receptors which mediate colour vision. It seemed advisable, therefore, to make some new experiments on the response to coloured lights of rod-free and rod-containing regions of the retina when the eye is completely dark-adapted, that is, when the sensitivity of the rods is greatest.

Two observers whose colour vision is normal according to the Ishihara test were used. The observer's right eye viewed a small red fixation point through a 2 mm. artificial pupil. The test field, the diameter of which subtended an angle of 10′ at the eye, was constituted by the surface of an opal electric bulb seen through a small circular opening. It was exposed in flashes of 0·04 sec. It could be presented at various distances from the fixation point on the horizontal meridian. Violet light was obtained using Corning filter 511, which transmits only below 470 mμ; red light, using Wratten filter 88, which transmits only beyond 700 mμ. The light intensity could be changed by using a system of two neutral wedges calibrated for these lights. The brightness of the test field was calculated from the colour temperature of the light source, the spectral transmission of the filters, the I.C.I. photopic visibility curve and the brightness of the opal bulb. The latter brightness is not very accurately known, but this is of little importance here, for the error would affect all threshold values by the same amount. Using this arrangement, the absolute threshold (brightness at which the stimulus is seen with a 50 per cent frequency) was determined in various regions of the dark-adapted fovea and parafovea.

Fig. 1 shows the results of a typical experiment. For violet light, the threshold decreases slightly as the angular distance between test field and fixation point increases from 0·15° to 0·75°. Then it drops suddenly and at 3·75° it is about 2 log units lower than near the centre of the fovea. At angles up to 0·75°, both observers reported that the field, when seen at all, appeared of a deep violet or blue colour; at the higher angles it always appeared colourless. For red light the threshold value changes little with the angle, being slightly higher at higher angles. When it was seen, the test field always appeared red. In the central region, the present results differ from those of Wentworth[12] who, using a larger test field (1° 16′ in diameter), found an achromatic threshold lower than the chromatic threshold. The present results for extreme red are similar to those of Mandelbaum[13].

Fig. 2 reproduces the distribution of rods and cones in a human retina studied by Østerberg[14]. The central region contains only cones, the first rods appearing at an angle of about 0·34°. The number of rods per unit area goes on increasing while the number of cones decreases, the two numbers being

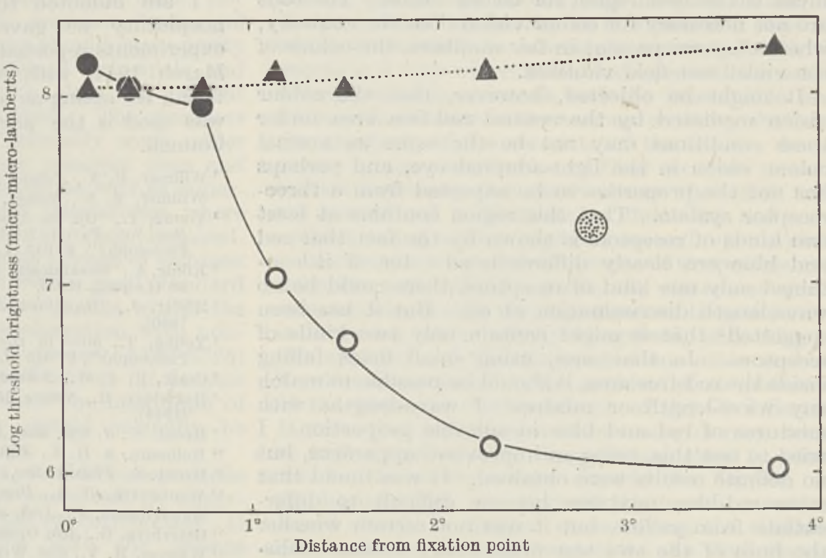

Fig. 1. THRESHOLD VALUES FOR EXTREME BLUE (SMALL CIRCLES) AND EXTREME RED LIGHT (TRIANGLES) IN VARIOUS PARTS OF THE RETINA, TEMPORALLY TO THE FIXATION POINT.

The full circles and triangles correspond to coloured vision; the open circles, to colourless vision. The large dotted circle represents the dimensions of the test field.

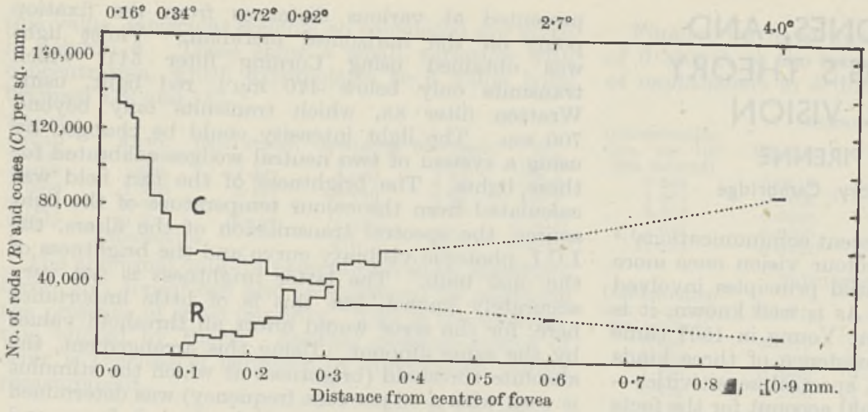

Fig. 2. DISTRIBUTION OF RODS AND CONES IN THE CENTRAL PART OF A HUMAN RETINA, FROM THE DATA OF ØSTERBERG[14].

The distances in mm. are uncorrected for shrinkage of the preparation (multiply by 1·31 to obtain the real distances). The corresponding distances in perimetric degrees have been calculated by Østerberg.

Perfect correspondence between Figs. 1 and 2, of course, cannot be assumed, since they refer to different eyes.

equal at an angle of about 1°. Comparison of Figs. 1 and 2 clearly shows that, for violet light, the threshold is high and the light is seen coloured in the rod-free area, while the threshold is much lower and the light appears colourless in the area where the rods are considerably more numerous than the cones, that is, at angles larger than 2°. In the intermediate region, the passage from coloured to colourless vision occurs only at an angle where the rods are fairly numerous, as might have been expected. For red light, the presence or absence of rods has little influence on the value of the threshold or on the colour of the light in the region studied here (at an angle of 7·5°, however, the light appeared orange).

These results are in full agreement with the duplicity theory[11,15,16]. With regard to the special problem of colour vision, it can be concluded that, under the present conditions, the rod-free area of the fovea is the best region for colour vision. The rods are not necessary for colour vision: on the contrary, where they are present in fair numbers, the colour of the violet test field vanishes.

It might be objected, however, that the colour vision mediated by the central rod-free area under these conditions may not be the same as normal colour vision in the light-adapted eye, and perhaps has not the properties to be expected from a three-receptor system. That this region contains at least two kinds of receptors is shown by the fact that red and blue are clearly differentiated: for, if it contained only one kind of receptors, there could be no wave-length discrimination at all. But it has been suggested[2] that it might contain only two kinds of receptors. In that case, using small fields falling inside the rod-free area, it should be possible to match any wave-length or mixture of wave-lengths with mixtures of red and blue in suitable proportion. I tried to test this, using an improvised apparatus, but no definite results were obtained. It was found that some red-blue mixtures become difficult to differentiate from yellow, but it was not certain whether the hues of the two test fields really became indistinguishable. Hue discrimination becomes poor when the test fields are small[17]. This well-known effect, and the imperfections of the apparatus, may or may not account entirely for the fact that at times a match appeared to be obtained. Experiments with a good colour-mixing apparatus are needed to settle this question.

As the assumption that there are only two kinds of receptors leads to conclusions at variance with the facts of normal colour vision, Young's theory asserts that at least three kinds of receptors—whatever they may be—must exist. On the other hand, the conclusions derived from the two-receptor assumption are in agreement with the observations made on dichromats. This provides a more positive kind of evidence in favour of the theory, and this evidence is perhaps more complete than is generally supposed. As is well recognized, if there are only two kinds of receptors there must be one wave-length—the neutral point in the spectrum of the dichromats—which stimulates the two receptors precisely in the same ratio as composite white light does. Now, on the short wave-length side of this neutral point, the stimulation by any wave-length must be the same as that by white light plus, say, 440 mμ; on the other side of the neutral point, by white plus, say, 650 mμ. In either of these parts of the spectrum, therefore, saturation changes must be the sole basis for wave-length discrimination and colour matching. This is precisely what has been found in a relatively recent investigation of the vision of dichromats[18]. The same situation should also be expected to exist in the rod-free area of normal subjects if this area is really a two-receptor system.

I am indebted to Prof. F. C. Bartlett for the hospitality he gave me in his laboratory. The experiments reported here were made in January and March 1944, with Mr. Willmer, whom I wish to thank for acting as a subject. The apparatus which was used is the property of the Medical Research Council.

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STATUS OF PROFESSIONAL CIVIL SERVANTS

THE recommendations of the Emergency Executive Committee of the Institution of Professional Civil Servants, which it is claimed represents more than 30,000 members of all grades and classes of the professional, scientific and technical staffs of the Civil Service, for the post-war reconstruction of the technical Civil Service, are summarized in a pamphlet recently issued by the Institution (Pp. 4). Broadly, the proposals aim at common salary scales for all professional classes, and a high standard of recruitment and service conditions which will attract to the service of the State the best brains in Great Britain. Within the membership of the Institution there are more than five hundred grades, and the Institution takes the view that the calibre of the officer should be the touchstone in deciding remuneration and that there is no reason why fully qualified scientific workers, engineers, architects, surveyors, etc., should not be paid on common scales. The education of the fully qualified professional man has been such that it produces a man at least equivalent in calibre to the normal entrant to the administrative class, and accordingly the remuneration of the fully qualified technician or scientific man should be on a parity with that of the administrative class. It is proposed that there should be three classes in the Service, each class being normally divided into two grades. Above this basic structure there should be directing posts, the salaries of which would be fixed according to the responsibility of the post. The three classes are designated principal class, executive class, and ancillary class.

Recruitment to the principal class should be from those possessing full professional, scientific or technical qualifications, such as a first or second class honours degree in the relevant science, or membership of the appropriate technical institution. The two grades within this class would be assistant principal and principal, appropriately amplified by fuller titles for different branches of work (for example, assistant principal engineer, principal scientific officer); and the grades should carry parity in remuneration with the assistant principals and principals of the administrative class (at present £275–£625 and £800–£1,100 a year). The members of the executive class would generally work under the direction of members of the principal class and undertake normal technical duties, as well as supervisory duties in workshops and laboratories where full professional qualifications are not required. Recruitment would normally be at the age of eighteen to nineteen years from persons with a good standard of secondary education. The two grades within the class should have parity of remuneration with non-technical executive officers (at present £150–£525) and staff officers and senior staff officers (at present £550–£750). In both these classes the maximum of principal or executive officer should normally be reached well before retiring age.

The third, the ancillary class, would be responsible for routine duties for which it would not be appropriate to employ members of the executive class. It would be roughly comparable with the present clerical class, the standard of education of which is the general schools examination or matriculation. The greatest care should be exercised in the employment of young persons in the ancillary class. Those who show special ability should be afforded an opportunity of acquiring training which would qualify them for entry into the executive class, and this training should not involve undue evening work.

With regard to recruitment, central recruitment should replace recruitment on a purely departmental basis, with a central recruiting board for technical posts under the ægis of the Civil Service Commissioners, and composed of persons with wide experience of professional, scientific and technical staffing requirements. This board's duty would be to certify as eligible for posts in the Civil Service candidates whose qualifications fulfilled agreed standards. It should have the fullest co-operation of the universities and professional institutions, but actual appointments would be made by departmental or regional boards from among those selected by the central board. Since all staff would be recruited by the Civil Service Commissioners, they should be treated on the same basis as the non-technical Civil servants, and come under whatever superannuation scheme is agreed for the Civil Service as from their date of entry into the Service, instead of having to wait several years to qualify for pension rights as have the majority of technical staffs at present.

The reasons for these proposals, which the Institution believes would greatly strengthen the technical service of the State and enable it to play its full part in the post-war reconstruction of Great Britain, are set forth in fuller detail in a second statement prepared on the instructions of the Emergency Executive Committee (Pp. 16. 6*d*.). Some of the recommendations, it is emphasized, are the considered views of that Committee; others are first thoughts, but all are capable of revision in the light of discussion among the membership. A brief report of the Conference on Post-War Reconstruction, held on March 4 and 5, when the draft proposals were considered is included.

Discussing the scope of the recommendations, the statement, recognizing that the professional, scientific and technical branches of the Civil Service need a drastic overhaul, urges that it is essential that this side of the Service should play its part in shaping the post-war Civil Service as a whole, and that the whole Service will be intimately associated with the people in a way which would have seemed impossible before rationing, controls and the inescapable need for central direction of the national economy shattered the aloofness of the servants of the State. As the extent of the contribution of Civil servants to social welfare increases, they must ensure that their tasks are carried out with initiative, flexibility and a full understanding of their implications and repercussions.

In a brief survey of the functions of the professional, scientific and technical staffs, the statement quotes recent evidence that the importance of those functions is becoming more widely recognized, and refers to the approach of the Anderson Committee and the Tomlins Commission to the problem of simplification of the structure of this branch of the Civil Service. It notes that provision must be made for recruitment at higher age-levels to the principal class to obtain the benefit of experience outside the Service, and emphasizes that the duty of the central recruiting board should be limited to certifying the eligibility of candidates for appointment to the Civil Service, selections being made by the departmental or regional boards on the basis of interviews.

A section of the statement deals with the special problems of the immediate future, such as priority for permanent posts, redundancy, and recruitment at the termination of hostilities. The statement also emphasizes the desirability of the Appointments Department of the Ministry of Labour remaining in being after this transition period and not only registering the qualifications of professional, scientific and technical personnel, but also keeping a register of posts occupied by them, including at least the scale of remuneration of the post. The Institution's support of equal pay for men and women and opposition to the marriage bar is re-affirmed. Consideration of the possibility of the Civil Service Commission adding to its functions in order to become a body for determining salaries is suggested, and an endeavour is proposed to restore the true functions of the Whitley Councils, which include the utilization of the experience of the staff in planning the work of the departments.

FORTHCOMING EVENTS

*(Meeting marked with an asterisk * is open to the public)*

Monday, December 11

ROYAL ANTHROPOLOGICAL INSTITUTE (joint meeting with the ENGLISH FOLK DANCE AND SONG SOCIETY) (at Cecil Sharp House, 2 Regent's Park Road, London, N.W.1), at 6.30 p.m.—Dr. Ethel John Lindgren: "Shamanism—Some Manifestations in Manchuria".

Tuesday, December 12

CHADWICK LECTURE (at the Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, London, W.1), at 2.30 p.m.—Dr. George H. Walker: "Food and its Adulteration during the Present War".*

CHEMICAL ENGINEERING GROUP (joint meeting with the INSTITUTION OF CHEMICAL ENGINEERS) (at the Geological Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Mr. Norman Clarke Jones: "Forestry, and the Utilisation of Waste Wood and its Products as Fuel".

ROYAL INSTITUTION (at 21 Albemarle Street, Piccadilly, London, W.1), at 5.15 p.m.—Sir Henry Dale, O.M., G.B.E., Pres.R.S.: "Modern Developments in Chemical Therapeutics", (ii) "Recent Advances in Chemotherapy".

Tuesday, December 12—Wednesday, December 13

AGRICULTURAL EDUCATION ASSOCIATION (at the London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1).—Yearly Conference.

Tuesday, December 12

At 9.30 a.m. (County Education Section)—Mr. F. H. Garner: "The Growing of Field Beans"; Dr. W. A. R. Dillon Weston: "The Fungus Diseases of Field Beans".

At 10 a.m. (Biology Section)—Discussion on "Modern Methods of Pasture Evaluation" (to be opened by Messrs. William Davies and J. Lambert).

At 10.15 a.m. (Analysis of Fodders Sub-Committee)—Discussion on the Report on "The Sampling of Baled Dried Grass for Chemical Analysis".

At 11 a.m. (Dairying Section)—Mr. E. L. Crossley: "Dried Milk Production in War-time".

At 11.15 a.m. (Agriculture Section)—Dr. T. Wallace: "Some Aspects of Mineral Deficiencies in Farm Crops"; Mr. V. C. Fishwick: "The Influence of Nutrition during Early Life on Breeding Capacity and Milk Production".

At 11.15 a.m. (Chemistry Section)—Mr. F. Knowles: "Notes on the Poisoning of Plants by Zinc".

At 2.30 p.m. (First Paper Reading Session)—Dr. C. Crowther: "Agricultural Education and the Work of the A.E.A., 1894–1944"; Mr. James Mackintosh: "Fifty Years of Dairying in Great Britain".

Wednesday, December 13

At 10 a.m. (Second Paper Reading Session)—Prof. R. G. White: "The Live Stock Industry in Britain during the last Fifty Years".

Wednesday, December 13

INSTITUTE OF FUEL (at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1), at 2.30 p.m.—Mr. N. S. Billington: "The Insulation of Buildings—Domestic and Industrial".

INSTITUTE OF PETROLEUM (at 26 Portland Place, London, W.1), at 4.30 p.m.—Prof. V. C. Illing: "Exploration".

INSTITUTION OF ELECTRICAL ENGINEERS (TRANSMISSION SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Mr. W. Szwander: "Valuation and Capitalization of Transformer Losses".

BRITISH INSTITUTION OF RADIO ENGINEERS (at the Neville Hall, Westgate Road, Newcastle-upon-Tyne), at 6 p.m.—Dr. T. H. Turney: "Wave Guides".

Thursday, December 14

GENETICAL SOCIETY (at the Geological Society, Burlington House, Piccadilly, London, W.1), at 2 p.m.—Mr. D. G. Catcheside: "Nature of Lethals in *Drosophila melanogaster*", 1: "Experimental"; Mr. D. E. Lea: "Nature of Lethals in *Drosophila melanogaster*", 2: "Theoretical"; Dr. G. Pontecorvo: "Genetic Aspects of Heterokaryosis"; Prof. J. B. S. Haldane, F.R.S., and Mr. H. L. K. Whitehouse: "Meiosis in some *Ascomycetes*"; Mr. A. Haddow: "The Artificial Induction of Coat Coloration in Albino Rats"; Mr. P. T. Thomas: "Experiments Imitating Tumour Development"; Mr. U. Philip and Mr. A. Sorsby: "Mutation-rate of Retinoblastcma in Man".

ROYAL INSTITUTION (at 21 Albemarle Street, Piccadilly, London, W.1), at 2.30 p.m.—Prof. James Gray, F.R.S.: "Locomotory Mechanisms in Vertebrate Animals", (iv) "Relationship of Limb Form to Habit and Environment—Evolution of Types for Climbing and Running".

INSTITUTE OF FUEL (YORKSHIRE SECTION) (at the Chemistry Lecture Theatre, The University, Leeds), at 3 p.m.—Mr. D. W. Milner and Mr. E. Brett Davies: "Coal Tar and its Products as Fuel, and in the Chemical Field".

INSTITUTE OF PETROLEUM (joint meeting with the ROAD AND BUILDING MATERIALS GROUP OF THE SOCIETY OF CHEMICAL INDUSTRY) (at 1 Grosvenor Place, London, S.W.1), at 4 p.m.—Mr. P. Alexander and Mr. J. F. T. Blott: "Factors Influencing the Structural Stability of Sand Carpets".

INSTITUTION OF ELECTRICAL ENGINEERS (INSTALLATIONS SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Mr. J. C. B. Nicol: "Organization of Industrial Electrical Maintenance".

PHARMACEUTICAL SOCIETY (at 17 Bloomsbury Square, London, W.C.1), at 7 p.m.—Dr. G. W. Scott-Blair: "Rheology and the Pharmacist".

BRITISH INSTITUTE OF RADIOLOGY (in the Reid-Knox Hall, 32 Welbeck Street, London, W.1), at 8 p.m.—Mr. A. Craig Mooney: "Disc Lesions in relation to Pain"; Mr. Hugh Davies: "The Symptomatology and Radiology of Cervical Intervertebral Discs".

Friday, December 15

SOCIETY OF CHEMICAL INDUSTRY (PLASTICS GROUP) (at the Chemical Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Dr. R. R. Smith: "Kinetics of Vinyl Polymerisations in the Liquid Phase".

ROYAL INSTITUTION (at 21 Albemarle Street, Piccadilly, London, W.1), at 5 p.m.—Dr. L. R. G. Treloar: "Rubbers and their Characteristics, Real and Ideal".

INSTITUTION OF MECHANICAL ENGINEERS (at Storey's Gate, St. James's Park, London, S.W.1), at 5.30 p.m.—Mr. E. J. Heeley: "Some Considerations in the Design of Class 1 Pressure Vessels"; Dr. S. F. Dorey: "A Note on Design Stresses in Class 1 Pressure Vessels".

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (in the Lecture Theatre of the Literary and Philosophical Society, Newcastle-upon-Tyne), at 6 p.m.—Prof. C. E. Inglis, F.R.S.: "The Determination of Critical Speeds, Natural Frequencies and Modes of Vibrations by Means of Basic Functions" (Parsons Memorial Lecture).

Saturday, December 16

PATHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND (joint meeting with the BIOCHEMICAL SOCIETY) (at the Royal Society of Medicine, 1 Wimpole Street, London, W.1), at 11 a.m.—Discussion on "Cancer".

QUEKETT MICROSCOPICAL SOCIETY (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Dr. W. S. Bristowe: "In Quest of Spiders".

APPOINTMENTS VACANT

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

GRADUATE LECTURER IN BIOLOGY, with qualifications in Anatomy and Physiology, in the Mining and Technical College, Crumlin—The Director of Education, Higher Education Department, County Hall, Newport, Mon. (December 13).

AGRICULTURAL TRAINING OFFICER (administrative)—The Executive Officer, Leicestershire War Agricultural Executive Committee, 7 Friar Lane, Leicester (December 16).

ASSISTANTS (2), one in the MECHANICAL and one in the ELECTRICAL ENGINEERING DEPARTMENT—The Principal and Secretary, Harris Institute, Preston (December 18).

ANALYST by an Engineering Establishment in Lancashire (works experience in the analysis of ferrous and non-ferrous metals and alloys essential)—The Ministry of Labour and National Service, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. F.1169.XA) (December 19).

LABORATORY ASSISTANT (Grade I) IN THE DEPARTMENT OF BOTANY—The Secretary, Bedford College for Women, Regent's Park, London, N.W.1.

YOUNG ENGINEER OR PHYSICIST with good mathematical qualifications, for development work on Turbines—The Manager, Employment Exchange, Warwick Road, Wallsend.

TECHNICAL ASSISTANT IN THE EDINBURGH ELECTRICITY DEPARTMENT—The Engineer and Manager, 1 Dewar Place, Edinburgh 3.

DIRECTOR of a comprehensive scheme for Recruitment, Training and Education of personnel of all grades in all Coalfields of the country—The Chairman, Mining Association of Great Britain, 53 Parliament Street, London, S.W.1.

LABORATORY ASSISTANT IN THE DEPARTMENT OF BOTANY—The Bursar and Acting Registrar, University College of North Wales, Bangor.