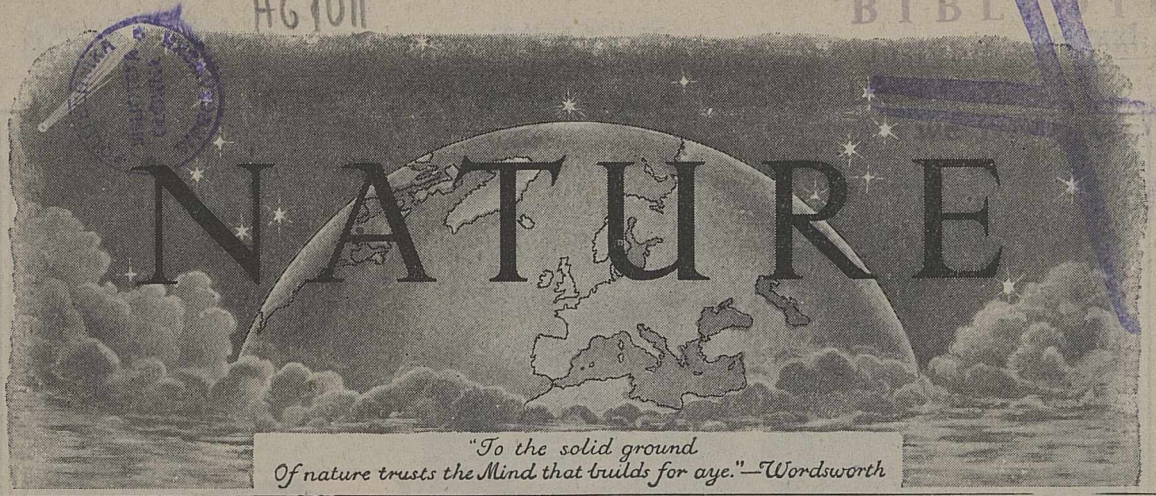


Vol. 153, No. 3879 SATURDAY, MARCH 4, 1944 ONE SHILLING & SIXPENCE

NATURE

No. 3879 SATURDAY, MARCH 4, 1944 Vol. 153

CONTENTS

	Page
Training for Citizenship	265
An Aristotelian on Logic and Geometry. By Prof. E. T. Whittaker, F.R.S.	268
Research in Social Organization. By Dr. M. L. Johnson	269
Chemistry of Large Molecules. By Dr. D. D. Pratt	270
Skokholm. By Sir D'Arcy Thompson, C.B., F.R.S.	270
Function and Future of Colonial Geological Surveys. By V. A. Eyles	273
Cancer Research in Britain during 1942–1943. By Dr. E. Boyland	276
Gyroscopic Principles and Applications. By Dr. Robert C. Gray	277
Obituaries :	
Dr. H. A. Mess. By Mrs. Gertrude Williams	278
Major H. J. L. Beadnell. By Dr. K. S. Sandford	279
Dr. Birkett Wylam. By Dr. John Hamilton	280
News and Views	280
Letters to the Editors :	
New Types of Optical Glass.—Dr. W. M. Hampton, R. E. Bastick and W. N. Wheat	283
Mathematics of Biological Assay.—D. J. Finney	284
Tautomerism of Cyanamide.—Dr. L. Hunter and H. A. Rees	284
Morphology of Mammalian Hair.—Dr. J. L. Stoves	285
Gamones from the Sperm of Sea Urchin and Salmon.—Prof. John Runnström, Sven Lindvall and Prof. Arne Tiselius	285
Blind Seed Disease of Rye-Grass.—E. L. Calvert and A. E. Muskett	287
White Plumage of Sea-Birds.—Dr. K. J. W. Craik	288
Analysis of Barley from King Tuthankhamen's Tomb.—Dr. E. C. Barton-Wright, R. G. Booth and W. J. S. Pringle	288
Biochemical Importance of Individual Amino-Acids. By Dr. T. F. Dixon	289
British Electrical and Allied Industries Research Association	289
Enemy Airborne Radio Equipment	290
Research and the Iron and Steel Industry. By Prof. F. C. Thompson	291
Treatment of Shock by Heat	291

Editorial and Publishing Offices
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.
Telephone Number : Whitehall 8831
Telegrams : Phusis Lesquare London
Advertisements should be addressed to
T. G. Scott & Son, Ltd., Talbot House, 9 Arundel Street, London, W.C.2
Telephone : Temple Bar 1942
The annual subscription rate is £4 10 0, payable in advance, Inland or Abroad.

TRAINING FOR CITIZENSHIP

WITH so much now being said and written about the future of education, goes the very serious query : Education for whom and for what ? Incorporated in any reply to this should surely be the conception of good citizenship ; and to-day, surveying the state of his country and the world, the enlightened citizen everywhere insists that much more shall be done in this direction. It was with this knowledge of the convictions of many thinking people that the Secretary of State for Scotland early in 1943 instructed the Advisory Council on Education in Scotland "to consider how the educational system of Scotland can most effectively contribute to training in the duties, rights and practice of citizenship, and make recommendations". The considerations and findings form the basis of a report* ; it has been written clearly and precisely, and will commend itself to men of science not only for its valuable subject-matter but also as an example of the way in which such reports should be written.

Before embarking upon its investigation, the Council considered the purpose of citizenship and concluded that its objects are fourfold. It should train young people : (1) to become good husbands and wives and fathers and mothers ; (2) to develop the spirit of responsibility and of tolerant co-operation with their fellows, in work or leisure activities ; (3) to take an intelligent and independent part in the affairs of the community, both local and national ; (4) to have a sense of membership of the world community.

The Council then states quite plainly that, under prevailing conditions, the practical application of citizenship training in many schools is hindered by home and social conditions over which the schools have no control. Until slums are abolished and housing conditions greatly improved, the schools cannot be blamed if the training for citizenship which they give does not produce the desired results. But no school must be allowed to relax its efforts because home conditions make training comparatively useless or ineffective. These conditions must rather be regarded as a challenge, and the vision of better conditions in the post-war world as an incentive to increased effort.

Two main recommendations are made by the Council which, in its view, should serve as the basis for immediate action. First of all, it is strongly recommended that "the next five years be set apart as a period of experiment and of deliberate striving towards a theory and practice in training for citizenship". Secondly, it is suggested that soon after the end of the second year of the quinquennium of experiment, the Scottish Education Department should publish a report indicating the plans and experiences of the schools, whether successful or not. During the remaining period of the experiment, further reports should be published annually, and should outline the more active and successful features of the school programmes, as well as experiments

* Training for Citizenship. A Report of the Advisory Council on Education in Scotland. H.M. Stationery Office. 6*d*. net.

which have not produced the hoped-for results, thus enabling schools to make such changes in their own schemes as the experience of other schools may indicate. At the end of the term of experiment, it might be possible to decide whether local autonomy and experiment might continue to serve as a national plan of training for citizenship, or whether the plan of training should be basically similar throughout Scotland.

These recommendations cannot fail to meet with approval, not least from men and women who use the experimental method as their basis for decision and judgment. Instead of the haphazard and slip-shod methods which have been the companions of educational reform, it is suggested that this controlled period of five years be used as a time of inquiry, observation and collation.

It is rightly recognized that the new importance which must be attached to training for citizenship "will involve some change of emphasis in the work of the schools. While they will continue to impart knowledge and to prepare children for life and work, they will, more than ever before, become the training ground where the future citizens will learn what they are expected to become as members of a free and democratic community; and from this point of view, what they are and what they become is more important than what they know. In our view it is not possible to adapt the present machinery of education effectively to these changed conditions without prior experiment."

The Council then discusses some of the methods by which the five-year experiment should be governed. Almost all the witnesses who were consulted consider it essential that a school should be regarded as a small community within the larger community. This is set out as the first proposal. Children should know and share in the duties and responsibilities of citizenship, and, as the child grows older, the more definite should training for citizenship become. In many schools a great tradition and a distinctive atmosphere have been built up, mainly by the personality and united efforts of successive headmasters and their staffs. The character of the future citizen and his philosophy of life will at many points be built upon the tone of his school and upon the influence and character of his teachers. This responsibility must be accepted in a very real way by the heads of the schools and must be willingly discharged by them and their colleagues. It is important, therefore, that authorities charged with making appointments to schools should secure men and women of the right personality and temperament. In order to ensure harmonious working of a school staff, governing bodies should take the heads of schools into closest consultation and endeavour to make new appointments of staff acceptable to them. Training colleges will need to exercise a more discriminating selection of intending students and should take steps to reject unsuitable students at any period of their training. Much misery would be prevented by these rejections.

The problem of backward children calls for more study, with the view of developing means of dealing with them other than by segregation. When segregation is found to be the only practicable method, this should be applied at an earlier stage than is at present customary. In the primary school, classes should be reduced to a maximum of thirty; but even under present conditions experiments should be made in handling the individual class as a small community within the larger community of the school.

In the junior and secondary schools, the present system of using specialist teachers for different subjects often means that these teachers do not see their pupils often enough to gain an intimate knowledge of them as individuals. It is suggested that the experiment be tried of appointing class masters or mistresses who would give the pupils sympathetic guidance both in and out of school. The more these teachers learn of the home conditions of their scholars the more effective would their influence be.

The appointment of prefects or monitors in senior secondary schools and the organization of a house or nation system have afforded opportunities for an excellent training in the responsibility of leadership. Experiments should now be made to cover such questions as the best methods of electing or appointing the prefects or monitors or other group-leaders. Classes might be divided for certain class-room or recreational activities into balanced groups, each with a leader and sub-leader. In all secondary schools and large primary schools which are co-educational there should be a woman superintendent; in all large schools the headmaster should be given adequate clerical assistance.

Although the boarding school is a comparative rarity in Scotland, its value as a training ground for citizenship is fully recognized by the Council. It is suggested that experiments should be made in sending secondary school pupils to such schools.

In order that school leavers may be more suitably placed in jobs, the Council recommends that the Scottish Education Department should consult with the Ministry of Labour as to what revision of the present system is needed to make it most effective. The appointment of careers masters and mistresses might be one of the means by which experiments could be conducted.

New school buildings should be functionally suitable for their purpose. They should be well equipped for the business of teaching and for those needs that may develop out of youth service and community movements of the future; where old buildings are to be retained they should be periodically revitalized.

The Council's second proposal for the five-year experiment is that there should be close and continuous collaboration between parent and teacher. A concerted plan must be evolved in which the schools, the homes, and all the other agencies concerned with children play their part. Although the parent-teacher association has not met with great success in Scotland, it is suggested that the movement be fostered and that other movements for collaboration be inaugurated.

The third proposal is concerned with moral and religious training. Experiments should be made in giving definite lessons in the principles of right and wrong conduct. The teaching of 'human relations', in the course of which every child considers the results of his own and other people's actions, good or bad, should be tried. This is already in vogue in the State of California and has given valuable results. An experimental schools code of good conduct, similar to scout law, could be produced and the effects of the code in schools carefully observed.

In the respective spheres of responsibility of the Secretary of State and of the Education Authorities for religious instruction, the Council considers that no change is desirable. The true Christian spirit should pervade the whole school and nothing should be done which might create the impression of hypocrisy. The practice of holding a morning service should be encouraged and on special occasions services in nearby churches should be encouraged. Definite periods should be set aside for religious instruction and should include periods other than those at the beginning or end of a meeting of the school. Close co-operation between the churches and the education authorities in each area should be constantly practised.

Special study and experiment is needed on the training of teachers for religious subjects. But the Council is unanimous in recommending that only believing Christians should be entrusted with the duty of giving instruction on religious subjects in schools. The qualifications of the teachers concerned will vary with the type and age of pupil; the Council proposes to issue a further report relating to this point.

Proposals for moral and religious training lead naturally to the fourth proposal, which deals with æsthetic training. Here it is emphasized that the appeal of beauty plays an important part in the building up of the good citizen. No education is considered complete unless an attempt is made to develop in the child some æsthetic appreciation of art, music and the beauties of Nature. Further experiments should therefore be made into the methods of teaching children how to appreciate line, form, colour, tone and rhythm, while every child should be given the opportunity of drawing and painting and practising the crafts for which he or she shows aptitude. Direct participation in musical activities should be encouraged, and the appreciation of good music should be taught at every opportunity. The facilities offered by the Council for the Encouragement of Music and the Arts and the British Institute of Adult Education in their presentation of good music, drama and art exhibits should be freely used. One must commend the Council for a proposal which, if generously interpreted and acted upon, might ultimately offer to many people the solution of their leisure problems.

Men of science will readily accept the next proposal, which deals with the promotion of good health. For the integration of the personality, bodily health is of prime importance. From their earliest years children should be taught the elementary facts of personal hygiene; physical training should form part of the daily routine of all schools and, so far as possible, should be carried out in the open air. Parents, too, should be reminded of the need for adequate sleep for their children.

Another proposal deals with the prevention of accidents. It cannot be too strongly stressed that the rules of safety are not inherent and must be taught. There is scope for further experiment and for co-operation between school, home and other agencies.

The Council regards it of first importance that all children should be instructed in the simple facts of sex, and suggests the appointment of a committee to investigate methods by which sex education might be introduced into schools. This committee, no doubt, will use much of the material and derive inspiration from the recent publication of the Board of Education on this important subject (NATURE, **152**, 582; 1943).

The eighth proposal towards the training of the good citizen is concerned with the contribution of the individual school subject. It is suggested that English, geography, history and civics each has a special contribution to make towards training for citizenship. No one would wish to deny the peculiar importance of the subjects mentioned; but the omission of any reference to the value of science as a social discipline must be strongly deprecated. The Council should seek further evidence and rectify this unfortunate omission immediately.

A knowledge of local history and tradition as preparation for citizenship is of special significance. Schools should be invited to concern themselves with local interests and the revival of historic ceremonies and festivals. This would encourage the growth of the community spirit and would do much to awaken in young people the desire to take part in the development of their own neighbourhood. Later the need for positive teaching would arise, and the child should be made aware, through facts within his personal observation, of the responsibility which local authority and the central government services are discharging for the health, convenience and security of the community. Many experiments could be undertaken to investigate the most suitable methods of teaching these positive aspects of civics.

The last proposal in training for citizenship relates to the contribution of the several parts of the educational system. Each type of educational organization, from nursery school to university, has its own peculiar part to play in the making of good citizens. The Council recommends, therefore, that comprehensive investigations be set in process to consider the special place of each type of educational organization in serving the needs of the future citizen; special attention should be given to mentally backward children.

The report concludes with a valuable statement about the real origins of juvenile delinquency and their amelioration. It is scarcely necessary to say

that there is no sovereign remedy which is likely to have an immediate and substantial effect on the problem of the young offender; but the Council rightly emphasizes that many of the suggestions which it has made cannot fail to take effect in the long term. The major cause of juvenile delinquency often lies in the home. With the coming of the educational facilities outlined in the Education Bill and the provision of better homes and healthier conditions of living, the evil of juvenile delinquency should be considerably reduced. Where delinquency is obviously not due to home conditions, the schools must do everything possible to alleviate the handicaps or maladjustments at the root of individual cases of delinquency. The problem of truancy should be attacked in its early stages; school attendance officers might profitably be replaced by school welfare officers. Children whose delinquency is due to inherent mental defect should be referred to child guidance clinics, the total number of which should be considerably increased.

Lack of opportunity for healthy exercise is a frequent cause of juvenile delinquency, and an extension of holiday facilities in the country for city children should be urgently considered, as should the provision of an increased number of playing fields.

Much of the material in this report is applicable to the educational organization in any country, and the people of England and Wales would do well to appropriate for themselves most of its spirit and many of its recommendations. A great deal is expected from the Advisory Councils for England and Wales, the constitution of which is adumbrated in the Education Bill. These Councils should copy their Scottish counterpart and direct their early attention to ways in which good citizenship can be developed. In their deliberations they should take pains to point out that, however paradoxical, good citizenship is not confined within national boundaries.

Recently there has appeared a number of White Papers on various aspects of education. Most of them have been concerned with pressing problems of current importance and have presented the problems with dignity and earnestness. Now, if one reads the signs of the times aright, the time has come when we have to decide one way or the other about issues like the one outlined in this report; and having made our decision, we must then translate it into action. Future developments must be planned so that the most needed requirements are given priority for action. Here we must be on our guard that the more intangible requirements like good citizenship shall not be shelved in favour of the more material and obvious aspects of reconstruction. If we decide now to institute adequate schemes of citizenship training along the lines indicated in this report and, equally important, inculcate a positive attitude towards world citizenship as set out in Brimble and May's recent book*, many of the other things will follow. The good citizen will see to that.

* Social Studies and World Citizenship; a Sociological Approach to Education. (Macmillan and Co., 1943.)

AN ARISTOTELIAN ON LOGIC AND GEOMETRY

(1) Études sur la connaissance mathématique
Par Prof. Thomas Greenwood. Pp. viii+112. (Ottawa: University of Ottawa, 1942.) 1 dollar.

(2) Essais sur la pensée géométrique
Par Prof. Thomas Greenwood. Pp. 100. (Ottawa: University of Ottawa, 1943.) 1 dollar.

(3) Prolégomènes à la théorie des quanta
Par Prof. Thomas Greenwood. Pp. 61. (Ottawa: University of Ottawa, 1943.) 60 cents.

THERE is now a great deal of coming and going between natural science and metaphysics. On the mathematical-physical side there is a succession of writers from Whitehead and Russell to Jeans, Eddington and Dingle, while professional philosophers such as the late Prof. Susan Stebbing have studied the new atomic and cosmic physics in order to find whether they have any metaphysical repercussions. The volumes under review, which are published by the French-Canadian University of Ottawa, witness to the interest that is now taken in these problems all over the world.

A worker of real eminence in one of the two fields is apt, when he crosses over into the other, to make mistakes. In view of the difficulty and importance of what he is trying to do, there will be general agreement that the proper attitude to take on these occasions is a charitable indulgence; and of this, it must be said, Prof. Greenwood is often in need so far as concerns one of these three books, namely, that on quantum theory; as the following quotations will show:

"Un corps noir à une température donnée émet une série de lignes coloriées qu'on nomme son spectre" (p. 10).

"La différence de fréquence de deux raies quelconques d'un spectre est la fréquence d'une autre raie du même spectre" (p. 10).

"Un corps noir . . . à 500° C. commence à donner des rayons monochromatiques; à 1200° C. le rayonnement est blanc; à 3,400° C. il atteint son intensité maximum" (p. 11).

"D'après le principe de la moindre action de Maupertius, l'action d'un électron vibrant avec une énergie E serait $\int mvds = E/\nu$" (p. 13).

"Les rayons-γ ne sont que des courants rapides d'électrons" (p. 15).

"Pour toute équation differentielle, on peut trouver des solutions finies, universelles et continués seulement si le paramètre contenu dans l'équation a des valeurs définies" (p. 25).

"Une matrice est *symétrique*, lorsque tous ses éléments situés symétriquement par rapport à la diagonale principale ont leurs suffixes égaux, mais intervertis" (p. 33).

It is to be regretted that the author did not submit his manuscript to some competent physicist before sending it to the printer.

This unfortunate venture should not be allowed to prejudice the reception of the other two works, which contain much valuable and stimulating reading. The first of the "Études" is devoted to mathematical logic, where Prof. Greenwood is on his own territory and has many interesting things to say. He belongs to the conservative wing, and deplores the tendency of some writers to regard the Aristotelian-scholastic

logic as obsolete. To many it might seem as if the superiority of the new symbolism was now beyond all question : for it has triumphantly solved problems with which the traditional logic trifled impotently for two thousand years. There is, however, another side to the question ; it is necessary to distinguish between two different aims which the logician may propose to himself : he may wish to increase his power and facility in drawing inferences, or he may wish simply to investigate the theory of logic in itself. For the former purpose the advantages of the symbolism are indisputable ; but in regard to the latter, the Aristotelians do not admit inferiority. Perhaps their most vulnerable spot is the doctrine of relations ; more than eighty years ago they were teased about it by De Morgan, who issued challenges such as "To prove by traditional logic that *if cows are animals, the tails of cows are tails of animals*", and "To deduce the classes of men specified in *the non-ancestors of all non-descendants of Z*". Prof. Greenwood proposes to gather relations into the Aristotelian fold by considering the relation and the related predicate as *the* predicate, and the judgment as a declaration or denial of identity between this and the related subject, so that all relations are reduced formally to those expressed by *is* and *is not* ; working out this idea, he claims that the calculus of relations can be added "comme un nouveau chapitre à la logique classique, sans devoir le présenter comme une innovation exigeant une transformation complète des bases de cette logique".

The "Études" include interesting and learned discussions of the mathematical ideas of Aristotle and St. Thomas, and the "Essais" contain an entirely original treatment of the foundations of Euclidean geometry.

In conclusion, one may refer to an opinion of Prof. Greenwood's (in support of which he quotes St. Thomas), that "Le caractère purement formal des sciences mathématiques rend celles-ci bien plus faciles à étudier que les autres sciences : et par conséquent elles sont particulièrement avantageuses pour l'éducation des jeunes". It is interesting to speculate how St. Thomas would have handled the modern agitation to allow girls to learn botany instead of mathematics, because mathematics is too hard for them. E. T. WHITTAKER.

RESEARCH IN SOCIAL ORGANIZATION

The Peckham Experiment

A Study in the Living Structure of Society. By Dr. Innes H. Pearse and Lucy H. Crocker. (Published for the Sir Halley Stewart Trust.) Pp. 334+16 plates. (London : George Allen and Unwin, Ltd., 1943.) 12*s*. 6*d*. net.

THERE was a time I wished I lived in Peckham, for in 1926 the Pioneer Health Centre was opened there by a group of young people who set out to study health and to foster conditions in which it could be maintained. They offered to families the facilities of a well-provided social club, and a periodic health overhaul. It would have been nice to be one of their 'guinea pigs' ; the social experiment alone was commendable, and the possibilities of a new kind of medical research seemed enormous. The first two books published by the Peckham 'biologists', "The Case for Action" (1931) and "Biologists in Search of Material" (1938), were disappointing, but it was perhaps too early to decide whether they were a little 'cranky', or merely picturesque. To social biologists, however, "The Peckham Experiment" is even more disappointing. It gives a lengthy exposition of the experimenters' philosophy and descriptions of life at the Centre, but it reports very little advance on the results of research published in its predecessors. These results were certainly interesting and sometimes unexpected. For example, only about 10 per cent of the Centre members had no physiological defects, and about 68 per cent had some disorder but were seemingly well. The high incidence of worm infestation, reaching so much as 41 per cent in boys of 6–10 years of age, is surprising. Two further interesting findings published earlier but not unfortunately expanded in this book are the frequent occurrence of a state of mild chronic debility and the profound physiological effects of night work.

As is to be expected, the results of periodic medical examinations give the Peckham workers plenty of support for their belief that "nothing short of periodic health overhaul on a national scale can lead to the rational application of medical science for the elimination of Sickness". Health centres have the opportunity of studying groups of the population at present far too little known to medical science : the normal group, the group oblivious of organic disease in its early stages, and the group unpleasantly aware of clinically uninteresting chronic debility. The Peckham biologists have demonstrated something of the importance of these groups, but we still await indications of an intensive research programme designed to take advantage of their material. The newness and difficulty of research on the health and sickness of a whole population possibly makes impatience unfair. But most readers of this book will wonder whether they will ever feel satisfied that the research is on the right lines. It is difficult not to feel that their preconceived ideas about "the Living Structure of Society" stand in the way of the experimenters.

The authors say "We claim to have defined the unit of Living. It is not the individual, it is *the family*. This has opened up a new field for experiment into social organization. . . ." But they deliberately rejected necessary controls for their experiments on the "unit of Living", for they refused to consider the 'non-family' by making it a condition of membership of the Centre that the family should join as a whole. Thus their observations were limited to a selected population from which isolated individuals and broken families were excluded. Moreover, the experimenters threw away a unique opportunity for studying the effects of family disintegration (as well as those of other incidentals of war such as the blackout, air-raids, changes of diet), for "The Centre's activities were suspended at the outbreak of war, September 1939, owing to the inevitable dispersion of the family unit in war conditions".

Further, the Peckham biologists' concept of the family as a functional unity or organism leads them to deduce a new physiology. Some quotations will illustrate its unusual flavour : " . . . by the time fertilisation has taken place the blood of the mother has been sensitized and attuned to that of her mate, father of the embryo. Thus, from the moment the new individual begins to develop, there is already a *physical* basis for a 'functional organisation' between the three individuals of the growing family" (p. 34). When a couple announces that conception has

occurred the physical changes which take place in the pregnant woman are described to them: "Her tissues become fluid and softened so that, for instance, in some you can almost bend the bones under the finger. All the tissues undergo this change—liver, bones, hair, eyes, brain—all are flooded with the circulatory fluids of the body so that their essence seeps out and is carried round in the blood to the womb where the growing child can draw upon it for its nourishment and growth" (p. 87). It is perhaps not surprising that one of the very few research projects the authors mention is not of great practical importance: "Experiments were under way at the Centre, before war brought our work to a close, to find bio-chemical evidence in the father of parenthood occurring in the family".

In evaluating the work of the Peckham Pioneer Health Centre, a biologist is driven to judge the social and scientific aspects of the work very differently. There can be no doubt that the members of the Centre benefited socially and medically from its services; but the scientific results published in these books do not seem commensurate with the opportunities offered. I think it is important to indicate that the defect lies not in the nature of health centres, but in the preconceived ideas of these experimenters. While great credit must be given to the Peckham biologists as pioneers in the health centre movement, it would be a pity if further progress in such an important technique of medical research were prejudiced by their views and methods, which many people will find scientifically unacceptable.

M. L. JOHNSON.

CHEMISTRY OF LARGE MOLECULES

The Chemistry of Large Molecules

Edited by R. E. Burk and Oliver Grummitt. (Frontiers in Chemistry, Vol. 1, published under the auspices of Western Reserve University.) Pp. xii+313. (New York: Interscience Publishers, Inc.; London: Imperia Book Co., Ltd., 1943.) 3.50 dollars.

"THE Chemistry of Large Molecules" is the first volume of a new series entitled "Frontiers in Chemistry" and is composed of eight sections written by experts in the field of macromolecules. The first two sections, compiled by Dr. H. Mark, give a rather brief account of the kinetics of poly-reactions and of the mechanism of condensation, and a concise record of the information available from X-ray study of large molecules. Dr. Kraemer then discusses in the next section the colloidal behaviour of solutions of macromolecules with special reference to the relat onship between viscosity and molecular weight. The same author also contributes a good summary of the application of the ultracentrifuge to the study of large molecules.

Section 5, compiled by a team of three experts, is an advanced mathematical treatment of the elastic-viscous properties of long-chain molecules, while the electrical properties are discussed by Dr. Friess in Section 6. The work of Marvel and his collaborators on vinyl polymers is well known, and is here summarized in Section 7 by Dr. Mark himself. The last section in the book deals with the chemistry of cellulose and cellulose derivatives, and is written by Dr. Ott. Each section is supported by an adequate bibliography.

In a foreword the editors of this book explain that Western Reserve University conceived the idea of inviting scientific workers distinguished in particular fields of chemistry to give two lectures each on his particular subject, and the book is based on such lectures. As the title of this series of books suggests, the subject-matter is to be found on the "Frontiers of Chemistry". It is therefore definitely a book for the expert, and of particular value to those who are investigating the course of polymerization and the theory of the reactions.

Much publicity is given at present to macromolecular structures; but the reader will find in this book practically nothing of the spectacular industrial applications of these materials. Instead he will find fundamental mathematical and physico-chemical reasoning, and it would be true to say that without a good knowledge of these sciences the reader will find the book heavy reading.

D. D. PRATT.

SKOKHOLM

Dream Island Days

A Record of the Simple Life. By R. M. Lockley. Pp. 144+8 plates. (London: H. F. and G. Witherby, Ltd., 1943.) 10*s*. 6*d*. net.

FOR "some to discover islands" is a recognized career for men, like "some to the wars", or "some to the studious universities". Such islands are mostly far away; but to rediscover the forgotten and reoccupy the abandoned ones is work for R. M. Lockley, Compton Mackenzie, Fraser Darling, Seton Gordon, and other men of like calibre. For a man's island is his kingdom, and becomes his paradise; and a bird-lover among his own island-birds lives, as it were, in Eden.

This book is not a new one. It mostly repeats what Mr. Lockley wrote about his "Dream Island" some fifteen years ago; but he lived there for years after, until there was no more peace anywhere, and now he tells the 'simple story' of his island-life, with wife and child, among the wildfowl. The usual lover of birds has his life embittered by the sportsman and his game-keeper or 'vermin-killer', who spend their selfish lives slaughtering falcon and buzzard, crow and raven, merlin, jay and magpie, and many another beautiful creature which has its place in poetry and its corner in the kindly hearts of men. But on one's own island one lives at peace with all bird-kind, even—by a stretch of charity—with the great black-backed gull.

Mr. Lockley's book on "Shearwaters" was one of the great bird-books of our time. Now we may read again of that strange sea-fowl, which meets us in Homer and in Virgil and in Ovid; which is here by thousands; which flies from Pembroke to the Bay of Biscay for its dinner; which sits for two full months on its solitary, subterranean egg; which feeds its downy chicken for two months more, and then leaves it lonely and desolate (but a delicious morsel) until hunger drives it to seek the unknown sea. We walk round the little island; pass by 'Puffin-town' with its population of 40,000 puffin-souls; tread on wild-thyme, campion and sea-pink; watch the pair of ravens and the pair of peregrines, part-owners of the place; and see the few choughs and many carrion crows, the whin-chats and the meadow-pipits, perhaps the host of migrants in the spring; and the grey seals on the beach below the cliff. A wonderful place, and a delightful book—too good for anybody but a naturalist.

D'ARCY W. THOMPSON.

Mathematical Recreations

By Prof. Maurice Kraitchik. Pp. 328. (London: George Allen and Unwin, Ltd., 1943.) 12*s*. 6*d*. net.

THERE is reason to suppose that in at least some cases an interest in mathematics develops out of an interest in puzzles and problems, rather than from an interest in straightforward arithmetic. For those whose interests in mathematics have already been aroused, there are collections of mathematical recreations, of which the best known to the British reader are W. W. R. Ball's "Mathematical Recreations and Essays" and H. E. Dudeney's "Amusements in Mathematics". Ball's book, especially as revised by H. S. M. Coxeter, lays the emphasis on the mathematics. However apparently frivolous the starting point, the reader soon finds himself guided, gently but firmly, into an approach towards important mathematical principles. Dudeney's book, on the other hand, lays the emphasis on the amusements, and appeals more to the type of person who delights in listening to the "Brains Trust".

Prof. Kraitchik's book, based on a course of lectures delivered in New York, may be regarded as a revised edition of his "La Mathématique des Jeux" (Brussels, 1930), enriched by his nine years editorship of the periodical *Sphinx*. His treatment is something like Ball's, but not quite so serious, and with much more attention to problems connected with games, including not only chess, "checkers" (draughts), "craps" (dice) and dominoes, but also several games very little known in England. The discussion of the chess rook's moves leads to an introduction to the theory of groups. There are twelve chapters: mathematics without numbers, ancient and curious problems, numerical pastimes, arithmetico-geometrical questions, the calendar, probabilities, magic squares, geometric recreations, permutational problems, the problem of the (chess) queens, the problem of the (chess) knight, and games. The longest two chapters are on numerical pastimes, which contains a good deal about the theory of numbers, and magic squares. The chapter on geometric recreations contains several interesting diagrams of mosaics. H. T. H. P.

A German Physics Reader

By J. E. Calthrop. Pp. 83. (London and Toronto: William Heinemann, Ltd., 1943.) 7*s*. 6*d*. net.

THE steady growth of physics places a great strain upon students and teachers of the subject and a continual look-out is kept for means of lightening the work by omissions. Unfortunately, the study of German cannot be omitted. If no more physics were published in German, it would still be necessary for many years that the physicist should at least 'muddle through' a passage in German well enough to use the German handbooks and to read research papers in his subject. There are three minimum requirements. An elementary knowledge of the grammatical and constructional difficulties of scientific German, a basic vocabulary and a thorough knowledge of physics to make up for deficiencies in the first two.

The present volume can supply the second requirement—an excellent basic vocabulary. As the title implies, the book consists chiefly of passages in German on physics, and no help at all is given with grammar. Section 1 contains eleven extracts on the history of physics, ranging in subject from Brownian movement to radioactivity. A translation of each passage is given on the opposite page. Section 2 gives thirty passages, each with its own vocabulary. Section 3 reproduces more than thirty science German questions from University of London examination papers. There is no collected vocabulary or index at the end of the book and the beginner would need also such a volume as Wiener's "German for the Scientist" (Bell, 1943). The price seems rather high by comparison with Wiener's book, but there is no doubt that the selection of passages is the most comprehensive so far published for the physicist. Each extract is of interest for its content and is full of words commonly occurring in the literature. The book can be strongly recommended. W. H. G.

An Introduction to Pure Solid Geometry

By Dr. G. S. Mahajani. Second edition. Pp. xiv+104. (Poona: Aryabhushan Press, 1943.) 3 rupees.

THIS is the second edition of a book originally published in 1940. It is designed for intermediate and inter-science students at Indian universities. Its five chapters deal with lines and planes in space, the tetrahedron and parallelopiped, mensuration of prisms and cylinders, the sphere, solid angles and polyhedra. An appendix is provided in which the volume of a prismatoid is discussed. An excellent set of miscellaneous exercises then follows.

In order to clarify the subject and thus avoid any confusion in the mind of the student, the author has attempted to cover the essential subject-matter in the smallest number of theorems—and the attempt has been very commendably carried out. Many exercises are given which can be regarded as book-work, and to several of these, solutions are indicated. As with the author's "Elementary Analysis", the exposition is particularly lucid and should give the student a thoroughly clear perception of the fundamental principles of solid geometry. In this new edition, the text has been rewritten and rearranged. Several new paragraphs have also been added in order to render the relevant treatment self-contained. The number of exercises, too, has been increased. The book is a model of mathematical precision and clarity, and should be very useful as well as stimulating to all students of the subject.

Air-Borne Infection

Some Observations on its Decline. By Prof. Dwight O'Hara. Pp. x+114. (New York: Commonwealth Fund; London: Oxford University Press, 1943.) 8*s*. 6*d*. net.

CHANGE in virulence of certain diseases with the passage of years is a well-recognized phenomenon. Nowhere is this change so marked or, relatively, so rapid as in the diseases of the respiratory system. The last twenty-five years have seen a tremendous reduction in the mortality-rate from respiratory infections, and Prof. O'Hara has surveyed the possible explanations for this decline. He ascribes the decline to increased biological resistance rather than to any public health or therapeutic measures. Many will agree with the author in his contention that active immunity is better than passive, and that an otherwise healthy child should acquire its full immunity through having a disease such as measles rather than by being partially protected by convalescent serum. The observations on the common cold as an entity and as an abortive form of other respiratory diseases are of particular interest. The book as a whole is worthy of attention from specialist and general practitioner alike.

Lessons in Elementary Analysis

By Dr. G. S. Mahajani. Third edition. Pp. xiii+298. (Poona : Aryabhushan Press, 1942.) 6.4 rupees.

THIS useful book, first published in 1929, was reviewed in NATURE of November 7, 1936. Being designed to cover the analysis required for the bachelor's degree at most of the Indian universities, it has evidently well served its purpose, for a second edition was issued in 1934, and this third edition in 1942. There are twelve chapters devoted to the arithmetic continuum, the theory of limits, infinitesimals, continuity, mean value theorems, Taylor's theorem, integrals, including a treatment of mean value theorems and infinite integrals, uniform convergence, inversion of operations and Fourier series. While the general plan of the course remains unchanged, advantage has been taken in this edition to make several important additions. Thus, Landau's method of proving the second mean value theorem now appears, while a note on Frullani's integral is given in the addendum. Chapters 9 and 10, on infinite integrals and uniform convergence, have been rewritten, and the number of illustrative exercises at the end of each chapter has been increased.

The exposition is exceptionally clear and quite rigorous. While the lessons have been skilfully woven into a thoroughly coherent course, each chapter is almost a separate entity and can be studied as such. The sets of exercises also should serve to stimulate the student to further study.

Pasteurisation

By Harry Hill. Pp. viii+152. (London : H. K. Lewis and Co., Ltd., 1943.) 10*s*. net.

DESPITE its comprehensive title, this is not a treatise on pasteurization generally, but deals only with a relatively few, though important, aspects of the pasteurization of cow's milk. Nevertheless, the author goes outside his title to include sections on sterilization of milk, on homogenization and on ultra-violet irradiation of milk.

The value of this book lies, not in the first 34 pages, in which a case is made for compulsory pasteurization, but in two subsequent chapters, one on design of plant used for heat treatment of milk and the other on methods of control of the efficiency of such plant. Everyone dealing with the designing, erecting, licensing and management of plants for the commercial heat treatment of milk could read these pages with advantage. The book's appearance is particularly opportune for those who, if the recent White Paper "Measures to Improve the Quality of the Nation's Milk Supply" (Cmd. 6454) becomes law, will have additional duties to perform either of an advisory or control character in respect of heat treatment of milk.

Printing, paper and binding are all good; but it is to be hoped that the complete absence of diagrams will be remedied in the next edition.

Clubs and Club Making

By various Authors. Issued by the National Association of Girls' Clubs. Edited by Dr. J. Macalister Brew. Pp. 104. (Bickley : University of London Press, Ltd., 1943.) 2*s*. net.

THE launching of the Service of Youth movement soon after the outbreak of war has been followed by a growing interest in the means whereby adolescence could be most ably guided towards balanced maturity. There is an increasing number of people who are seeking to serve in this important and valuable work and the number will continue to grow with the birth of the new Education Bill. To help these potential youth workers the National Association of Girls' Clubs has produced this little book. It has been compiled from a series of pamphlets which have been previously issued by this and the corresponding boys' organization, the National Association of Boys' Clubs. The description of various club activities, as well as club administration, is presented with sympathetic understanding of beginners' problems, while the meticulous attention to detail on practical issues leaves little to be added. One readily agrees with the authors' conclusion that the book makes no claim to literary excellence, but that should in no way detract from its usefulness as a handbook for prospective and practising club leaders.

Aerodynamics of the Aeroplane

By W. L. Cowley. (Nelson's Aeroscience Manuals.) Pp. 201. (Edinburgh and London : Thomas Nelson and Sons, Ltd., 1943.) 5*s*. net.

ADMITTEDLY it is difficult to write an elementary book on a mathematical subject like aeronautics, to give the main principles and yet steer clear of the more difficult mathematics involved. The attempt to do this has been made in this book, and to give an elementary survey of present-day aerodynamic conceptions to students of matriculation standard.

The young student will find a great deal to 'bite' at, but on the whole he is likely to find it rather 'heavy going' to digest it. The presentation of the material might have been done in a more interesting and more inspiring manner. The beginner is made to realize that the subject is difficult (as it undoubtedly is), but it probably could be made to *appear* more simple by including many more diagrams ; simple diagrams mean much to a young student and are a great asset in a book of this type.

Some parts of the book are very readable and will be enjoyed by the serious student ; the pages devoted to the various systems of units are a useful feature. On the other hand, certain other topics, for example, the distinction between mass and weight, could probably have been disposed of in less space.

For a small book the index is very comprehensive, and there are two chapters at the end intended mainly for more advanced students.

Borderlands of Psychiatry

By Prof. Stanley Cobb. (Harvard University Monographs in Medicine and Public Health, No. 4.) Pp. xiv+166. (Cambridge, Mass. : Harvard University Press ; London : Oxford University Press, 1943.) 2.50 dollars.

THIS volume contains a series of essays on a variety of subjects, which, as the author says, are neither orthodox medicine, nor psychiatry, nor neurology. The psychiatric aspect of a number of nervous disorders is considered. These include disorders of speech, of emotion and of consciousness.

Apart from the primary concern with the importance of psychiatric treatment in these conditions, which is extremely interesting, the book is noteworthy for clear explanation of the anatomical relations, so far as they are known, of the diseases described.

FUNCTION AND FUTURE OF COLONIAL GEOLOGICAL SURVEYS

DURING the past few years, attention has been directed, from time to time, in NATURE and elsewhere*, to the importance of the work of geologists, to the widespread ignorance, in Great Britain, of geological science, and to the consequent lack of appreciation of the many services which geologists can and ought to perform for the common good. The immediate seriousness of the position lies not so much in the fact that this ignorance should prevail among the community at large, as in the realization that it extends into the administrative and governing classes, both civil and military. There is, it seems, a consensus of opinion that this is the existing state of affairs.

While it may be true that it is often recognized, if not very clearly, that there is a connexion between geology and the production of minerals, it is less commonly realized that geologists are able to render equally important, if less obvious, services in furtherance of other activities closely bound up with human welfare, such as agriculture, civil engineering and, not least, questions of water supply.

The discovery of valuable mineral deposits as a direct result of geological exploration provides from time to time a striking illustration of the importance of such a survey; but it is far from easy to demonstrate to the layman the potential value of the day-to-day work carried out by geologists, including the contributions to pure geology made by government servants. It is nevertheless true to say that the connexion between pure and applied geology is a very close one. The rare mineral of yesterday, the occurrence of which has been recorded for scientific reasons, in many cases has acquired later on an unforeseen commercial value. Similarly, the finding of some obscure fossil in the field, and its identification in the laboratory by a skilled palæontologist, may have important and perhaps immediate consequences in industry. The location of good water supplies, a service in many cases requiring the advice of a skilled geologist, is also work the value of which is not easily assessed. Of not less importance, too, is the fact that the geologist who knows his terrain thoroughly is not infrequently able to give advice that results in saving the community large sums of money that otherwise would have been wasted.

All these considerations suggest that a wise and foreseeing government would be well advised to establish and maintain properly staffed and equipped Geological Surveys, particularly in new and relatively little-known territories such as the British Colonies; and to ensure that the scientific side of the work is not unduly subordinated to the more immediate and obvious economic requirements.

Nevertheless, it still seems to be the case that, even in administrative quarters where there is some appreciation of the nature and functions of a Geological Survey, there is still incomplete realization of the purely economic value of the services such a Survey can render, and hence a lack of willingness to ensure that Geological Surveys under their control are adequately financed.

The repercussions of this state of affairs on the development of the British Colonial Empire were debated recently at a joint meeting of the Geological Society of London and the Institution of Mining and Metallurgy*, which had been specially convened to discuss the "Contribution of Geological Surveys to Colonial Development, and the Future of Colonial Geological Surveys". The debate centred round an address on this subject given by Sir Edmund Teale, formerly director of the Geological Survey of Tanganyika Territory. Prof. W. G. Fearnsides, president of the Geological Society, occupied the chair during the earlier part of the meeting, and his place was taken later by Sir Lewis Fermor, vice-president of the Institution of Mining and Metallurgy, and formerly director of the Geological Survey of India.

In his opening remarks, Prof. Fearnsides stated that the meeting had been arranged as a result of representations made to the Society by some of its fellows, resident abroad, who, being servants of the State, were dissatisfied with the conditions existing in certain Geological Surveys. In view of the economic functions of Geological Surveys, the Council had thought it desirable to seek the co-operation of the Institution of Mining and Metallurgy, as representing the metal-mining interests in Great Britain, and thereby to secure a much stronger and more professional representation at the meeting.

Sir Edmund Teale first of all pointed out that, in view of the attention now given to post-war planning, the time seemed opportune to discuss the extent to which Geological Surveys can play a part in the economic development of British Colonies. He then spoke at some length on the "complete misconception which seems to exist in high places concerning the purpose, scope, requirements and results of the work of Geological Surveys", in the following terms:

"Profound misconception exists, even among some of the highest of our Colonial officers, about the valuable work that has already been accomplished by these geological departments, and this misconception has resulted, even in the best periods, in the total inadequacy of the financial provision made for essential field work, in the reduction, in more critical times, of the existing staff, and in the failure to fill positions left vacant by the retirement of the heads of the Geological Surveys. The view is held by the officers in charge of the finances of the Colonies that Geological Surveys are not revenue-producing departments. This will appear strange to mining engineers and others familiar with the economic aspects of geological work; but there is abundant evidence of the almost complete unawareness among the chief officers of the Crown of the substantial revenue, besides other benefits, which is the direct result of discoveries of mineral deposits made by these Surveys.

"It is clear, as was shown in a short paragraph in an article in *The Times* of September 15, 1943, on tropical African Colonies, that in the view of high authorities the work of Colonial Geological Surveys finishes with mapping, and that that work is now nearly complete! Further, in certain Colonies, Geological, Mining, Survey and Lands Departments have all been merged under one Director, and he without any special training or experience in any of these subjects; many very unsatisfactory situations have thereby been created. In another Colony,

* See Boswell, P. G. H., "The Status of Geology: a Review of Present Conditions", *Proc. Geol. Soc., Q.J.G.S.*, **97**, xxxvi–lv (1941); "Geology and the Community", NATURE, **147**, 459 (1941). Read, H. H., "Geology and Geologists in the National War Effort", NATURE, **149**, 39 (1942); "Geologists in War Time", NATURE, **149**, 282 (1942); "Geology, Geologists and the War Effort", NATURE, **151**, 118 (1943); "Co-operation in Scientific Research in the British Empire", NATURE, **152**, 29 (1943). Bailey, E. B., "Geology in the War and After", NATURE, **152**, 728 (1943).

* *Abstr. Proc. Geol. Soc.*, No. 1399, 11 (Dec. 28, 1943).

mining and geological sections are combined under a non-technical director selected from the Administration Department. The mining community has never been satisfied with this arrangement nor has the geological section received the support and encouragement it merits. A great lack of uniformity of conditions prevails throughout the Colonies undertaking geological work, notwithstanding the existence of a professedly unified Colonial Geological Service.

"Water-supply investigation suffers from a wide divergence of control in the different Colonies and even a lack of consistent policy within a particular Colony. Thus at one period as many as six departments were engaged independently upon water-supply. The present policy, in general, is to use the Geological Survey to direct these activities, although in one Dependency control has recently been removed, first to the Railway Department and then to the Public Works.

"The temporary or intermittent character of some Geological Surveys, though often the result of varying financial conditions, is also partly attributable to this ignorance of the practical value of geological work. In British Guiana, Jamaica, Nyasaland, Tanganyika, and elsewhere geological work has been intermittent and the gaps have seriously retarded the systematic survey of these territories. In consequence, when certain economic demands arose, there was a lack of preparedness to meet them. Some countries, like Fiji, have never had a Geological Survey, while in others, like Kenya, there was undue delay in establishing one.

"This complete misconception of the purpose and results of geological work is also exemplified in the use of geologists for duties other than those for which they have been trained and which they are engaged to undertake: for example, the using of a geologist as an Inspector of Mines, as a District Commissioner or as an Agricultural Officer, and the overloading of him with routine clerical work or with an undue amount of topographical survey.

"A number of examples might be quoted in which the failure to obtain geological advice upon engineering problems, such as railways, bridge and dam sites, has been very costly, both financially and in the consequent interference with public services.

"A lack of continuity of policy regarding long-range systematic geological work has resulted in a lack of balance whereby an undue amount of attention has at times been given to one branch of survey work at the expense of other equally important branches."

Sir Edmund gave the accompanying statistics of the amount and value of the mineral production of the Colonial Empire.

Table 1 is of particular interest, since it shows the revenue accruing directly to the Colonial authorities through the exploitation of mineral deposits actually discovered by Colonial Geological Surveys. Sir Edmund pointed out that, while the total royalties received from the diamond industry alone in the Gold Coast, up to 1939, amount to £424,830, the annual expenditure on geological survey is only £7,000. In other words, this royalty alone would pay for the cost of the survey for sixty years. In the Colony and Protectorate of Sierra Leone the discrepancy, he stated, is even more striking. The Colony at present employs only one geologist, but the estimated value of the mineral production was more than 1½ million pounds, providing a direct revenue to the Colony of nearly £175,000.

TABLE 1.—PRODUCTION AND VALUE OF CERTAIN MINERALS RESULTING FROM THE DISCOVERIES OF COLONIAL GEOLOGICAL SURVEYS[1].

Mineral	Production	Value	Royalty	Remarks
		GOLD COAST		
Diamond	14,139,683 carats	£7,613,186	£424,830	Production represents exports to end of March 1939. Diamond export tax to end of December, 1939.
Manganese ore	5,341,308 tons	£10,062,594	—	Manganese ore is wet ore for the earlier years and dry ore for later years.
		SIERRA LEONE		
Iron ore	2,750,000 tons	£1,497,373[2]	—	Diamond profit tax 1935 to 1938.
Diamond	2,616,104 carats	£3,275,402[2]	£466,818	Quantity refers to production, value to exports. Values of production not available, but should not vary greatly from exports.
		NIGERIA		
Coal	5,546,000 tons	£1,860,000	—	To end of March, 1939. Coal mining being a Government industry, the value refers to expenses incurred in mining, no profit being added.

ESTIMATED RESERVES, NO PRODUCTION YET

GOLD COAST	Bauxite	250,000,000 tons.
NYASALAND	Bauxite	60,000,000 tons.

[1] Information supplied by the Mineral Resources Department of the Imperial Institute. Figures are cumulative from the earliest recorded production or export. Later figures are not generally available for publication.

[2] To end of 1940: iron ore £2,640,966; diamond £4,700,272.

TABLE 2. VALUE OF MINERAL PRODUCTION (IN £ STERLING) OF CERTAIN BRITISH COLONIES AND DEPENDENCIES DURING 1938.

Country	Value	Principal Minerals with their Values
Nigeria	2,100,000	Tin 1,685,000; gold 177,000; coal 180,000.
Gold Coast	6,267,000	Gold 4,811,000; manganese ore 908,000; diamond 548,000.
Sierra Leone	1,684,240	Diamond 818,925; iron ore 646,421; gold 216,793.
Kenya	633,388	Gold 499,601; soda 132,878.
Uganda	226,690	Gold 146,286; tin 78,483.
Tanganyika	712,730	Gold 588,679.
Northern Rhodesia	10,683,715	Copper 10,254,705.
Aden	120,971	Salt.
Ceylon	131,231	Graphite; excludes salt.
Palestine	330,000	Potash and bromine.
British Malaya	9,970,000	Tin 7,980,000; iron ore 920,000.
British Borneo (Brunei, Sarawak)	980,000	Petroleum 830,000; gold 130,000.
New Guinea (year June 1939)	1,700,000	Gold.
Fiji	632,000	Gold.
Trinidad and Tobago	2,765,680	Petroleum 2,654,492.
British Guiana	697,800	Bauxite 395,190; gold 226,337; diamond 74,273.

The information given above was supplied by the Mineral Resources Department of the Imperial Institute. Quarry products and salt are, in general, excluded. The following additional statistics have been derived from other sources.

Cyprus	1,495,000	Cupreous pyrite and concentrates 1,257,000; asbestos 88,291.
Ocean and Nauru Islands	850,000 (estimated)	Phosphates.
Bahrein Islands	2,050,000 (estimated)	Petroleum.
	44,030,435	

There was also a small production in other Colonies: for example, Bechuanaland (gold), Somaliland (salt), Swaziland (asbestos, gold), Papua (gold), Turks and Caicos Islands (salt).

These figures are but examples, and ignore the actual or potential value of Geological Surveys in other directions, notably in matters of water supply, a theme which Sir Edmund elaborated at some length. He stated that "Those who have not lived and worked in the tropical Dependencies do not, perhaps, realize the extent of country that suffers from the handicap of uncertain and seasonal rainfall. . . . Geological advice can in many cases provide a remedy and thus assist in a better distribution of the population and in the development of unused tracts of land."

As an example of one of the more indirect results of a Geological Survey, he remarked that in Nigeria the discovery of a coalfield resulted in the building of a direct railway linking the tin-fields with the coast and in the development of one of the best deep-water harbours in West Africa.

Referring to the Colonies of the British Empire as a whole, Sir Edmund said that "in very few cases has detailed systematic mapping of the standard adopted in Great Britain been attempted, and even in the countries with the strongest and longest established Surveys it can safely be asserted that the greater proportion of the geology shown on the published provisional geological maps is based on reconnaissance traverses. Shortage of staff and the absence of reliable topographical maps are two factors which have handicapped progress in systematic mapping. At the most, fewer than fifty geologists have been available, and at certain periods very many fewer, to deal with an area of about three million square miles—some thirty times the area of the Home Country. Compare this with the staff of over 5,000 trained geologists provided by the Soviet Government!" and, it may be added, with the fifty or so employed in Great Britain alone. As Sir Edmund remarked, the amount of money devoted to Colonial Geological Surveys is astoundingly insignificant in comparison with the benefits they have conferred upon the Empire. Accurate figures are not available, but they probably represent something of the order of a decimal of 1 per cent of the value of the mineral production.

The later part of Sir Edmund's address dealt with certain recommendations, put forward by members of the Institution of Mining and Metallurgy and fellows of the Geological Society, for securing for the Geological Surveys their rightful place in post-war Colonial development.

The meeting was then thrown open for general discussion, and a number of written contributions to the debate were received.

Sir Lewis Fermor, who spoke at some length, pointed out that the total area under the control of the Colonial Office is much smaller than Canada, and only of the same order of magnitude as the Indian Empire. Both these countries have found it advantageous to have unified Geological Surveys, yet each Colony, no matter how small, has its own Survey, or none at all; and this in spite of the fact that some of the Colonies occupy contiguous areas. He also directed attention to the fact that each Colony, no matter whether rich or poor, has to finance its own survey. This fact, combined with the lack of central co-ordination of the work of the several surveys, results in Colonial geological departments varying widely in size, whether expressed by number of personnel or the number of geologists per unit of area, and also in the salaries offered to geologists. Such conditions form a stumbling-block in the way of unifying the Colonial geological services. He suggested the grouping of the Colonies into larger units for geological purposes, and the establishment of a system whereby the emoluments of geologists were not directly related to the ability or otherwise of any particular Colony to pay an adequate salary. A move in this direction, he claimed, especially if it carried with it possibilities of promotion with transfer to other Colonies, would lead to an improvement in the morale of Colonial geological officers. It would also benefit not merely the officers concerned but, ultimately, the Colonies themselves.

A number of other points were raised during the course of the debate. One speaker directed attention to the tendency for the more ambitious and energetic geologists to leave government service to work for private mining companies, where better treatment and higher salaries were received; and another instanced the case of a highly successful Canadian mining company that thought it worth while to employ more geologists on its staff than the total number of government geologists in all our African Colonies.

A later speaker mentioned the Island of Trinidad, which, in spite of its valuable oil resources, has not been subjected to a general geological survey since 1860. As a consequence, when, during the present War, it became a base for American forces, and the question of water supplies for the northern part of the land arose, the Colonial authorities had no government geologist to advise them and had to turn for aid to the oil geologists. It was pointed out that the lack of a single government geological report on the geology of the oilfields there within the last thirty years indicated the lack of interest taken by the Colonial Department in these matters.

Sir Thomas Holland, in a written communication, made the following points. He disposed of the suggestion that the geological mapping of the Colonies might be nearing completion by pointing out that so long as geological science continues to progress and specialize, the geological map will never be finished. So long as mineral values continue to change, as they have done in the past, and no doubt will in the future, for a variety of reasons, so often, too, will parts of the geological map need revision. Sir Thomas also directed attention to the desirability that the information accumulated during the course of the Colonial Geological Surveys should be published in some systematic and organized way, so that it might become readily accessible to the outside geological world for reference and, if necessary, criticism.

Another speaker mentioned the importance of geophysical prospecting as an essential adjunct to a Geological Survey. This, he claimed, is insufficiently recognized, and Colonial Surveys should be adequately equipped in this respect, both instrumentally and in respect of suitably trained staff.

Another contributor to the debate made an eminently practical and valuable suggestion in connexion with the possibilities of air survey in the development of the Colonies. He mentioned that the R.A.F. has accumulated a large staff, highly trained in the modern technique of air photography, and in the interpretation of air photographs, the use of which in prospecting and the interpretation of geological structure is well recognized; in passing, it may be mentioned that a number of geologists are actually employed on this staff. It is incumbent on the Government, he suggested, and in particular the Colonial Office, when the War ends, to secure the service of these expert technicians and their

equipment for use in the development of the Colonies.

At the conclusion of the meeting the following resolutions were proposed and carried unanimously:

(1) That this Joint Meeting of the Geological Society of London and of the Institution of Mining and Metallurgy welcomes the attention now being given to the resources of the Colonial Empire and desires to stress the importance of Geological Surveys in the well-being of the Colonies, especially for the development of mineral resources and in connexion with water supply, public works, soil conservation, agriculture and forestry.

(2) That this Meeting views with concern the progressive deterioration of status of certain Colonial Geological Surveys and the discouraging conditions under which these Surveys are now functioning. It is also of opinion that Colonial Government Departments do not fully appreciate the practical value of geology to the community and the need for maintaining the individuality of the Surveys, under the direction of competent and experienced geologists.

(3) That this Meeting advocates: (*a*) the appointment by the Colonial Office of a Colonial Geological Surveys Advisory Board, (*b*) the appointment to the staff of the Colonial Office in London of a scientific Director-General of Colonial Geological Surveys, who should report periodically to the Advisory Board and should inspect the work of the Colonial Geological Surveys from time to time.

(4) That this Meeting urges that the deputation appointed by the Councils of the Geological Society and the Institution of Mining and Metallurgy jointly should wait upon the Secretary of State for the Colonies and submit their views with the object of increasing the scope and fostering the welfare of the Colonial Geological Surveys as an essential part of the post-war development programme for the Colonial Empire.

We are informed that the proposed deputation has since been favourably received by the Secretary of State for the Colonies.

While it seems clear that the action taken was well justified, in fairness to the Colonial Office it should be stated that a certain amount of attention has recently been given to the matter. Following on the passing, in 1940, of the Colonial Development and Welfare Act, a Colonial Research Committee was appointed, in June 1942, to advise upon the expenditure of the annual sum of £500,000 provided by the Act of 1940 as provision for Colonial research, and to assist in co-ordinating the whole range of research in Colonial studies. This Committee recently published its first progress report (see NATURE, **153**, 119; 1944). In this report it is pointed out that Geological Surveys would come within the Committee's purview, and it is also noted that they do not at present exist in certain Colonies. The Committee further directs attention to the fact that mineral development of Colonies is impossible without accurate topographical surveys. A grant of £7,000 to enable the Geological Survey of British Guiana to be carried on on a proper basis is recorded in this report; and, according to *The Times* of December 31, 1943, a further grant of £32,000 has been made for geological survey work in Nigeria.

The timely action taken by the Geological Society and the Institution of Mining and Metallurgy will, no doubt, serve a useful purpose in impressing on the Committee the urgent need for further action in this direction.

V. A. EYLES.

CANCER RESEARCH IN BRITAIN DURING 1942–1943

THE twentieth annual report of the British Empire Cancer Campaign was presented recently at a meeting in London. In proposing the adoption of the report, Prof. E. C. Dodds dealt in a general way with the difficulties of presenting the results of scientific research on cancer to the public, and with the complexity of modern experimental biology. He made particular reference to the success obtained in the treatment of cancer of the prostate with synthetic œstrogens.

Clinical

Recently American clinicians have obtained good results in the treatment of cancer of the prostate with œstrogenic substances. Similar results have now been seen in Great Britain. In one case treated at the Middlesex Hospital, the results of the American observers have been completely confirmed in the twelve months that the patient has been under treatment. Seven cases have been treated with diethyl stilbœstrol at the Royal Cancer Hospital by Dr. J. Watkinson, in collaboration with members of the honorary staff. In five of these cases there was evidence of secondary deposits in bone and an increase in the acid phosphatase in the blood serum. In these five cases the treatment produced some regression of the primary growth, a fall in the serum acid phosphatase and a reduction in the pain due to metastases. In one patient regression of a lymph node deposit was observed. Two cases appeared to derive no benefit from the treatment, but on the whole the work is most promising.

The Clinical Cancer Research Committee gives an analysis of details of more than a thousand cases of intrathoracic cancer. The analysis in general is in agreement with existing knowledge. The incidence is high among painters, decorators, engineers and mechanics. It is low among clerks and typists. Although 74 per cent of the patients consulted a doctor within three months of the onset of symptoms, 90 per cent died within a year of the time when diagnosis was made.

Experience gained with the million-volt X-ray installation at St. Bartholomew's Hospital indicates that high-voltage therapy is particularly effective in the treatment of cancer of the rectum.

Carcinogenic Agents

Workers at the Royal Cancer Hospital have found that 1 : 2′-diamino 1′ : 2-dinaphthyl, which inhibits growth but has not produced tumours at the site of injection or application, induces multiple adenomas of the lung in mice. The substance thus has a remote carcinogenic action. Russian and French workers have obtained tumours in mice remote from the site of injection of extracts of human lung and liver. Many tumours have occurred at the site of injection of extracts of human organs, but such tumours have generally appeared at least twelve months after the beginning of treatment. The agents present in human organs appear to be weak and slow in action. As yet it has been impossible to ascertain before test whether a particular organ will give a carcinogenic extract, so that progress in this field has been slow.

Prof. H. N. Green and Dr. F. Bielschowsky have made further studies on the action of the carcinogenic insecticide, 2-acetylaminofluorene. When fed to male rats, this substance produces tumours of the liver

similar to those produced by 'butter yellow'. In female rats, it produces adenocarcinomas of the breast, although the substance itself does not appear to be œstrogenic. No other insecticides or phenothiazine derivatives have been found to have carcinogenic activity, but phenothiazone is toxic when fed in small amounts over a long period.

3 : 4-Benzpyrene was first isolated from coal tar ten years ago. Dr. I. Berenblum and Dr. R. Schoental, of Oxford, have recently investigated the carcinogenicity of fractions of coal tar separated by chromatographic methods. They find that the fraction containing the benzpyrene is less active than certain other fractions in producing cancer on the skin of mice and rabbits. American workers during the past year have published results showing that although benzpyrene is rapid in its action, the dose required to induce tumours in mice is much larger than the corresponding dose of 1 : 2 : 5 : 6-dibenzanthracene (W. R. Bryan and M. B. Shimkin, *J. Nat. Cancer Inst.*, 3, 503 ; 1943). In attempts to obtain new types of tumours in fowls at the Glasgow Royal Cancer Hospital, injections of benzpyrene and methylcholanthrene have failed to produce tumours. On the other hand, many tumours have been induced in chickens with dibenzanthracene. Experiments carried out at Sheffield suggest that cats are resistant to the action of benzpyrene and methylcholanthrene.

Dr. J. W. Orr has applied methylcholanthrene to the nostrils of mice from a strain (I.F.S.) in which breast tumours do not normally occur. No lung tumours were found, but of twenty-nine female mice treated in this way eighteen developed mammary cancer.

Metabolism of Carcinogenic Hydrocarbons

Dr. I. Berenblum and Dr. R. Schoental, working at Oxford, have found that benzpyrene is converted into 8-hydroxybenzpyrene, and that 1 : 2-benzanthracene is converted into 4′hydroxy 1 : 2-benzanthracene in the intestinal tracts of mice and rats. These phenolic substances which are formed are not carcinogenic. The Oxford workers have collaborated with scientific workers of the Royal Cancer Hospital in studying the growth-inhibiting power of these metabolism products and their derivatives. The metabolism products themselves have no growth-inhibiting activity, although some hydroxy derivatives, such as 4′hydroxybenzpyrene, are active growth-inhibitors. Some methyl derivatives of the metabolism products can inhibit the growth of tumours. The active substances of this type are all monomethoxy compounds, such as 4′methoxy 1 : 2-benzanthracene and 8-methoxy benzpyrene. The dimethoxy derivatives of carcinogenic hydrocarbons appear to be devoid of growth-inhibiting activity.

Bone Tumours in Mice

Some years ago Mr. F. C. Pybus and Dr. E. W. Miller of Newcastle-upon-Tyne developed a strain of mice in which bone tumours including sarcomas frequently occurred. In 1936, about one quarter of the mice which died had palpable osteomata or sarcomata, but since then the incidence of bone tumours has declined although the mice have been inbred. Over a ten-year period 21 per cent of females and 7 per cent of males of this strain died with bone tumours. The difference in incidence in the sexes suggests that œstrone might have some influence on the development of these tumours. Dr. J. W. Orr has studied the effect of œstrone on the histology of the bones of mice. The bones of female mice of this 'Newcastle bone tumour' strain are unusual in that there is a considerable amount of medullary bone and a mosaic appearance in the cortex. The bones of spayed females of this strain resemble those of normal mice. Treatment of mice of other strains with œstrone causes osteoclastic changes, including both resorption and production of bone. The mice of the Newcastle bone tumour strain are exceptionally susceptible to the action of œstrone. A sex hormone, in addition to other unknown factors, probably plays some part in causing the bone tumours that are found in this special strain of mice.

Filterable Agents

Experiments carried out at the Middlesex Hospital show that injection of either proflavine or 5-aminoacridine into the breast tissue will localize the Rous sarcoma virus. The localization of the virus leads to the formation of a tumour at the site of injection of the acridines. Kieselguhr is a localizing agent, but is much less effective than the acridine compounds. Methylcholanthrene is a very feeble localizing agent. The effect is probably governed by the type of tissue reaction resulting from the injection. The acridine compounds have a mild toxic action and cause proliferation of muscle nuclei.

Only a few of the topics dealt with in the report have been mentioned, but it is clear that progress has been made in the face of difficulties and many new facts have been brought to light during the year under review. With its coming of age, the British Empire Cancer Campaign is to be thanked for the way it has raised funds to support cancer research and for the care with which it has organized and correlated the efforts of many scientific men working in fields directly and indirectly bearing on the subject.

E. BOYLAND.

GYROSCOPIC PRINCIPLES AND APPLICATIONS

GYROSCOPY, since it belongs to classical mechanics, tends to be neglected by the modern physicist. We have now to depend on the engineers and applied physicists to maintain the teaching of the subject. Its applications cannot be ignored ; in the development of modern applied science we find many extremely important applications of gyroscopes ; and in the increased use of bodies rotating at angular speeds that are being continually increased from year to year, we find gyroscopic effects that must be taken into account in the design of the supporting structure whenever the rotating body, whether it be engine, wheel or propeller, has the direction of its axis of spin altered. When a motor-car turns to the left, the spin of the engine causes a transfer of load from rear axle to front axle, and the spin of the wheels gives a transfer of load from inner to outer wheels. When a single-engined aeroplane turns to the left, the nose tends to dip ; when the turn is to the right, the gyroscopic effect tends to raise the nose. When a twin-engined plane, with propellers turning in opposite directions, alters course, the leading edge of one wing tends to dip and the leading edge of the other tends to rise, so that additional stresses on the structure are intro-

duced. Jet propulsion will lead to the removal of the gyroscopic action of the propellers, and perhaps also to the removal of much of the gyroscopic action of the engines.

The subject is a difficult one; the mathematical treatment is not easy, and the translation of the mathematical results into application requires the powers of both mathematician and engineer. Prof. C. E. Inglis has both qualifications, and in the thirtieth Thomas Hawksley Lecture to the Institution of Mechanical Engineers*, he has given an excellent account of the theory of gyroscopy, and has detailed several practical demonstrations and applications, some new, all interesting. Usually the subject is approached from the idea of angular momentum, and the couple required to change the direction of this vector quantity. Prof. Inglis begins in a simpler way: if a point P is travelling with a speed v along a radius vector rotating with angular speed Ω, then P must have an acceleration $2v\Omega$ in a direction perpendicular to the radius vector. If now a gyroscope is spinning about a horizontal axis, and is being forced to precess about a vertical axis, every point in the upper half of the gyroscope requires an acceleration in a direction parallel to the axis of spin, and every point in the lower half requires an acceleration in the opposite direction. Hence the precession of the gyroscope about a vertical axis requires a couple about a horizontal axis perpendicular to the axis of spin. The simple working rule follows, that the axis of spin tends to turn towards the axis of the applied couple.

Excellent demonstrations by Prof. Inglis illustrate these points. A belt is running with velocity v between two vertical pulley wheels mounted on a horizontal platform that can rotate about a central vertical axis with uniform angular velocity Ω. Each horizontal part of the belt has to develop a horizontal acceleration $2v\Omega$, so that there is a transverse parabolic bowing of the belt, the upper part to one side, the lower part to the other side. A second demonstration of the same effect is given by means of a gyroscope, the disk of which is composed of several layers of paper. If the axis of spin of the gyroscope is horizontal, and the axis of the applied couple is vertical, the disk becomes warped about a horizontal axis perpendicular to the other two axes, and not about the axis of the applied couple.

In the next demonstration, a gyroscope spins about a horizontal axis, its axial supports being carried by a frame that is free to rotate, about a horizontal axis perpendicular to the axis of spin, in a second frame that is free to rotate about a vertical axis. A couple is applied, by means of a weight suspended from a point in the first frame, on the axis of spin produced. The axis of spin remains horizontal, but the gyroscope precesses about a vertical axis. In the demonstration, the gyroscope was a powerful one, of polar moment of inertia 25 lb.-ft.^{2} and of angular speed 3,000 r.p.m., and the couple of 150 lb.-ft. was produced by the weight of a man suspended at a point one foot from the centre point of the gyroscope; the man was carried through a complete rotation about a vertical axis in about $10\frac{1}{2}$ seconds. Hurrying the precession raised the man, retarding the precession lowered him. When the precessing frame of such a gyroscope hits a stop and is brought to rest, the gyroscope begins to tilt over; a very considerable couple is developed tending to remove the resistance to precession; this couple reaches a maximum at a tilt of about 35°, and decreases to zero at a tilt of 90°.

The general equations of motion of a precessing gyroscope are worked out in a mathematical appendix, and several important deductions are made. The frequency of nutation, in which there is a periodic interchange of kinetic energy between tilting and precession, is deduced, and emphasis is laid on the importance, for great stability, of a high natural frequency. In the paper a description is given of a new form of gyroscopic vibration damper, originated by Dr. R. N. Arnold, by means of which excessive chatter in a heavy armour-plate planing machine has been suppressed, the frequency of the gyroscope being tuned to the frequency of the chatter, and suitable fluid damping being applied.

The gyroscopic action of a pair of wheels of a locomotive or motor-car when the vehicle is rounding a curve is worked out; the load transferred from inner rail to outer rail for a typical pair of locomotive wheels and axle moving in a typical railway curve is shown numerically to be negligible. It is also shown that if one of the pair of wheels drops through a small distance at a rail joint on a straight part of the line, the resulting precession about a vertical axis is by no means negligible, and the practical conclusion is drawn that rail joints should be placed side by side, and not staggered.

Gyroscopic stabilization of a monorail truck is considered very fully, both in a second mathematical appendix and in descriptions of arrangements that lead up to the Brennan monorail stabilizer. The gyroscopic ship-stabilizer and the gyrocompass are treated in as simple a manner as the subjects will permit. The paper concludes with an explanation of the stability of a spinning top. Emphasis is given throughout to the principle, so valuable when appreciated and properly applied, that a spinning body can be given complete stability by hurrying the precession; the child's top rises to the sleeping vertical position because frictional forces at the peg hurry the precession; and the same principle leads directly to the realization of an artificial horizon for the navigator, and of a horizontal sighting platform for the bomb aimer. ROBERT C. GRAY.

* "Gyroscopic Principles and Applications". By Prof. C. E. Inglis. Being the Thirtieth Thomas Hawksley Lecture to the Institution of Mechanical Engineers, delivered on November 19, 1943. (Institution of Mechanical Engineers, Storey's Gate, London, W.C.1.)

OBITUARIES

Dr. H. A. Mess

HENRY A. MESS, reader in sociology in the University of London, whose death took place early in January, was one of the few men who have been fortunate enough to combine the academic life, which he loved, with very wide experience in the field of social administration. He came into the university world at a later age than is usual, but all his previous work was, in a sense, a preparation for his main interest and provided him with an inexhaustible supply of material on which to draw for his study of the structure of society.

Dr. Mess was born in 1884 in Stoke Newington and educated at Bancroft School, Woodford, but, owing to a decline in the family fortunes, he was not able to go to Oxford as he had hoped. While earning his living as a clerk in an insurance office, he attended evening classes and, in 1905, took first-class honours in modern languages as an external student of the

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.

THE UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

PROFESSOR OF PHILOSOPHY

Applications are invited for the appointment to the Chair of Philosophy. The Department of Philosophy at present provides courses in Ethics, Logic, Metaphysics and Political Philosophy, primarily for B.A. and Honours students, and a course in the History and Philosophy of Science for B.Sc. students. The staff consists of the Professor and a Lecturer.

Assumption of Duties.—January 1, 1945, or as soon as possible thereafter. Applications will be welcomed from candidates who, being engaged in military service or other national service may be precluded from assuming duties on the date mentioned. Steps will be taken by the University for the release of such a person if appointed.

Salary.—£860 per annum rising by annual increments of £30 to £1,100 per annum (plus temporary cost of living allowance). The salary is subject to 6 per cent deduction for Provident Fund Contributions, Government and University together contributing an equal amount. Half salary will be paid from date of embarkation to date of assumption of duties in Johannesburg.

Transport.—£100 will be contributed towards the cost of passage and first class rail fare will be refunded for the journey from Cape Town to Johannesburg.

Further information with reference to the University and living conditions in South Africa may be obtained from the University's London Representative, Dr. William Cullen, at 4 Broad Street Place, London, E.C.2, with whom applications (in duplicate) must be lodged not later than May 1, 1944.

BEDFORD COLLEGE FOR WOMEN

(UNIVERSITY OF LONDON)
REGENT'S PARK, N.W.1

The Council of Bedford College invites applications for the following posts in the DEPARTMENT of BOTANY, open to men and women equally:

(a) Vacant as from October 1, 1944:
LECTURER.—Candidates must have a Special Degree in Botany. Salary £350–£500 p.a. plus war bonus. Initial salary may be higher than the minimum of scale if warranted by candidate's qualifications.
DEMONSTRATOR.—Candidates must have a Special Degree in Botany. Salary £250–£300 p.a. plus war bonus.

(b) Vacant as from April 1, 1944:
MUSEUM ASSISTANT.—Candidates must have a Special Degree in Botany. Salary £250–£300 p.a. plus war bonus.

Last date for receiving applications March 8, 1944. For further particulars apply to the Secretary.

INSTITUTE OF MEDICAL AND VETERINARY SCIENCE, ADELAIDE, SOUTH AUSTRALIA

Applications are invited from medical graduates for the office of Director of the Institute of Medical and Veterinary Science, Adelaide, South Australia, under the Council of the Institute of Medical and Veterinary Science. The successful applicant will be appointed by the Council of the University of Adelaide to be Keith Sheridan Professor of Experimental Medicine in the University of Adelaide.

The salary is £1,500 (one thousand five hundred pounds) per annum, payable in Australian currency. If a candidate from Great Britain, Canada, or America is appointed the salary will commence from the date of his embarkation, and a first class fare to South Australia will be provided, and, if he is married, for his wife also.

Provision for superannuation will be made on the lines of the Federated Superannuation system for British Universities, i.e., 10 per cent annually in addition to salary plus 5 per cent paid by the beneficiary, to be applied in payment of approved life assurance premiums.

The duties are the following:

1. As Director of the Institute of Medical and Veterinary Science he will be the principal executive officer of the Council of the Institute and will be responsible for the control and management of the Institute.

2. As Keith Sheridan Professor of Experimental Medicine, he will engage in the Institute in the active study and investigation of diseases of human beings and animals, and into problems connected with such diseases, and in postgraduate teaching and examining as directed from time to time.

The appointment in the first instance will be for a period of five years, subject to the Institute of Medical and Veterinary Science Act, 1937. A medical certificate of physical fitness is to be forwarded with the application.

Further particulars may be had from the Agent-General and Trade Commissioner for South Australia, South Australia House, Marble Arch, London, W.1, England, who has reports of the Institute, copies of the calendars of the University of Adelaide and copies of the Institute of Medical and Veterinary Science Act, 1937, and regulations.

Applications from medical graduates in Great Britain, the United States and Canada, including among other particulars the approximate date on which the candidate could begin work, should be sent to the Agent-General for South Australia at the above address before May 31, 1944.

(Signed) C. T. CH. DE CRESPIGNY,
Chairman of the Council, Institute of Medical and Veterinary Science.

UNIVERSITY OF EDINBURGH

Applications are invited for the post of Senior Lecturer in Physiology Department. Applicant must be Member of the Royal College of Veterinary Surgeons, and/or a University Graduate. At least three years teaching experience in advanced Practical Biophysics and in Lecturing, both up to B.Sc. standard. The appointment will be on a temporary war-time basis with salary from £425 to £650 per annum with war bonus, depending on age, experience, and qualifications, except in the case of an applicant who is already a member of the F.S.S.U., where a scale of £475×25–760 plus war bonus and superannuation may be authorized. Applications to Secretary, Summerhall, Edinburgh, 9.

MANCHESTER UNIVERSITY AGRICULTURAL ADVISORY DEPT.

Applications are invited for the post of Assistant to the Advisory Chemist. Candidates should possess a degree in Agriculture and have a knowledge of Chemistry. Experience in soil analytical methods and laboratory technique is essential. The appointment is temporary and is not superannuated. Salary £275–£375 per annum plus bonus according to qualifications. Applications with copies of two recent testimonials should reach the undersigned by Saturday, March 18.

ARTHUR JONES,
Chief Advisory Officer.

PRINTED IN GREAT BRITAIN BY FISHER, KNIGHT AND CO., LTD., ST. ALBANS

University of London. All his spare time was given to teaching literature at the Mansfield House University Settlement in Canning Town, where he found himself becoming so absorbed by the social problems of the neighbourhood that, in 1912, he became secretary to the Settlement, a post which he held until 1919. This experience coloured his whole life and determined his future work for, on removing to the Settlement, he was immediately plunged into the distress connected with a great dock strike, and his first book, "Casual Labour at the Docks" (1916), was based on material collected in Canning Town. The conditions with which he was brought into such close contact convinced him of the need for a careful study of social organization if any constructive reform was to be achieved, and this remained the chief preoccupation of his life.

Further experience, first as social studies secretary of the Student Christian Movement, later as lecturer in social science to the Lancashire and Yorkshire Congregational Union, gave Dr. Mess greater opportunities for gathering detailed knowledge of social conditions and, after a period at the London School of Economics during which he wrote his "Factory Legislation and Administration", he began the work which was to prove his most outstanding achievement. In 1925 he was appointed director of the Bureau for Social Research for Tyneside and later director of the Tyneside Council of Social Service, and for ten fruitful years he identified himself with the life of a region that was suffering all the incalculable misery of prolonged industrial depression. True to his belief in the need for greater knowledge, he was not content to initiate and foster innumerable efforts to preserve and develop the community life of the area ; he also conducted a social survey, published as "Industrial Tyneside", which is a model of its kind.

In 1935 Dr. Mess was appointed reader in sociology at Bedford College (University of London), and for the first time had the leisure to devote himself more fully to research ; but he was by no means cut off from other activities. He sat on many advisory bodies, acted as University Extension lecturer and gave many broadcasts, the most notable of which was a series of talks on "Social Groups in Modern England", which was later published in book form. In 1942 the College gave him part-time leave of absence to enable him to act as director of studies to the National Council of Social Service, and at the time of his death he was engaged in a number of extremely important inquiries, in which the combination of sociological technique with his wide knowledge of contemporary economic and social conditions was of inestimable value.

By temperament, Mess belonged to that breed of Nonconformist Liberal whose contribution to social reform in Great Britain has been so striking and, indeed, through his mother's family he had direct links with the early Independents. He was a sincere Christian with a profound belief in the dignity and powers of the common man, given the right social environment. It was from this faith that all his work drew its inspiration. As a sociologist, he was just beginning to see his way clear, and there is no doubt that, had he lived, his wide knowledge and humane sympathies would have enabled him to make a real contribution to this youngest of university disciplines. English sociologists can ill afford to lose so valuable a member of their small band.

GERTRUDE WILLIAMS.

Major H. J. L. Beadnell

HUGH JOHN LLEWELLYN BEADNELL died suddenly on January 2. He was born in 1874 and was educated at Cheltenham College, King's College (London) and the Royal College of Science. He had a long and vigorous career, and his name is linked above all with the geology and water resources of the Libyan Desert. He joined the Geological Survey of Egypt in 1896, and his early work included the geology of the Abu Roash dome near the Pyramids of Giza : soon, however, he was sent westward to the Libyan oases of Farafra, Dakhla, and Baharia, and then to the Faiyum. His report on the last of these was a remarkable achievement, and it provided a solid basis for the specialized work of those who followed more than twenty years later with advantages of transport and equipment which were unheard of in his day. From his Faiyum investigations, moreover, came the discovery, in which C. W. Andrews of the Natural History Museum shared, of the highly important Eocene and Oligocene mammalian remains (Eosiren, Moeritherium, Palæomastodon, Arsinoitherium and others) which are known to palæontologists throughout the world. In 1905 he investigated the relations of the Eocene and Cretaceous beds between Esna and Aswan, in Upper Egypt.

In 1906 Beadnell's interest in the Libyan oases took him into the scheme for the reclamation of Kharga oasis, and he left Egyptian Government service. He was concerned with this project, which did not realize expectations, until 1910, and he published the well-known book "An Egyptian Oasis" in 1909.

The next phase of his life was varied, and typical of him. He went ranching in British Columbia (1912–15), enlisted in the Artists Rifles in 1916, served with the Egyptian Expeditionary Force (1916–19), and completed his service with the acting rank of lieutenant-colonel : he was mentioned in dispatches and received the Order of the Nile. After the War he was engaged in the search for oil, was surveying in Central Sinai and on the Red Sea coast during 1921–25 (in Egyptian Government service once more) and wrote "The Geology of the Red Sea Coast between Qoseir and Wadi Ranga" (Petroleum Research Bulletin No. 13, 1924). Two years later his delightful book "The Wilderness of Sinai" was published.

In 1927 Beadnell returned to official work in the Libyan Desert and for two years he was actively employed, especially with the work on wells in remote parts of the desert. Too little has been written of what he achieved in those two years and in his last period in the Libyan Desert, during 1930–32, when he was resident engineer of the Qattara Depression hydro-electric project of the Egyptian Government. The scheme aimed at running water from the Mediterranean to turbines at a site below sea-level in the depression.

From about 1932 Beadnell was seriously ill and spent much of his time in London : active still, he maintained his lifelong interests and took up gemmology. His last years were clouded by the death of one of his two daughters, then of his wife, who had been his companion since the early days in Egypt (they married in 1904). In 1940 he was engaged by the War Office with the rank of temporary major in the Royal Engineers, which he held at the time of his death.

In addition to his two books and to his official

reports, Beadnell contributed to scientific publications, and especially to the *Geographical Journal*. He was awarded the Barlow-Jameson Fund of the Geological Society of London in 1904 and received the Cuthbert Peak Grant of the Royal Geographical Society in 1931. K. S. SANDFORD.

Dr. Birkett Wylam

BIRKETT WYLAM, chief inspector for Scotland under the Alkali, &c., Works Regulation Act and Rivers Pollution Prevention Acts, died suddenly at his home in Edinburgh on January 15. While Dr. Wylam had not been in his usual vigorous health for some time, the news of his untimely death came as a shock to his many professional friends.

A native of County Durham, Dr. Wylam was a graduate of the University of Durham, where he took the degrees of B.Sc. in 1921, M.Sc. in 1922 and Ph.D. in 1925. He became an associate of the Royal Institute of Chemistry in 1924 and was elected to the fellowship in 1935. He was an active member of the Council of the Institute during 1938–40, and was a prominent figure in the Edinburgh Section, of which he was chairman. He also took an active interest in the Society of Chemical Industry. In 1936 he became a member of the Institution of Chemical Engineers.

Dr. Wylam began his professional career as research chemist to Morton Sundour Fabrics, Ltd., and later was research chemist and process manager at Scottish Dyes, Ltd. (I.C.I.), Grangemouth. He left this post to take up his official duties with the Department of Health for Scotland in 1931. During the War of 1914–18 he served with the Royal Garrison Artillery in France.

I have been privileged to know Dr. Wylam for some eight years, during the last five of which I have been his colleague. He was a delightful person to work with, always thorough, sympathetic and helpful. He was a fair man, his standards were high, and he was incapable of being mean. His chief interest was in doing things, and an idea had no sooner crystallized in his mind than the machinery was set in motion to effect its realization. He never sought praise; it was sufficient for him to experience the pleasure of a job well done.

In his dealings with the chemical industry in the execution of his official duties he earned the respect of all as a competent chemical engineer, and he carried into this sphere his personal characteristics of fairness, high standards, and ever-readiness to help. For reasons of national security I cannot give details of his war-time activities; it is sufficient to say that his whole energy was directed into channels calculated to shorten the duration of the present conflict.

Dr. Wylam truly lived and enjoyed every moment of his life, at work, at home and at play. His hobbies were all constructive as well as artistic. He had a wide range of engineering and woodworking tools, which he put to no mean use. He was a keen photographer, a collector of commemorative medals, and a very wide reader. Science in Scotland has lost a man who, by virtue of his wide practical experience and acute mental alertness, was at his prime. To Mrs. Wylam and her children we offer our most sincere sympathy. JOHN HAMILTON.

WE regret to announce the following deaths:

Dr. L. H. Baekeland, the distinguished plastics chemist and inventor of 'Bakelite', on February 23, aged eighty.

Mr. H. H. Brindley, fellow of St. John's College, Cambridge, and during 1926–34 University demonstrator in zoology, on February 19, aged seventy-eight.

Prof. J. W. H. Eyre, emeritus professor of bacteriology in the University of London, on February 17, aged seventy-four.

Prof. Yandell Henderson, professor of applied physiology at Yale University, on February 18, aged seventy.

Mr. J. Reid Moir, F.R.S., president of the Ipswich Museum, on February 24, aged sixty-four.

Prof. H. F. Newall, F.R.S., emeritus professor of astrophysics in the University of Cambridge, on February 21, aged eighty-six.

Dr. E. O. Ulrich, formerly geologist in the U.S. Geological Survey, known for his work in invertebrate palæontology, aged eighty-seven.

Mr. S. E. Winbolt, formerly of Christ's Hospital, Horsham, who was an authority on Roman antiquities in Great Britain, on February 16, aged seventy-six.

NEWS and VIEWS

Edinburgh Medical Men and the Great Adventure

THE spirit of adventure as it has been exemplified by graduates of the University of Edinburgh was the theme selected by Prof. James Ritchie for his 'Promotor's' address at the Medical Graduation at the University of Edinburgh last July. It was, Prof. Ritchie pointed out, the Edinburgh medical graduate Mungo Park who discovered and traced the greater part of the course of the River Niger. Another medical student, Laing, discovered its source. Yet other Edinburgh medical men completed the Niger adventure, for Oudney discovered Lake Chad and Baikie led the last Niger expeditions sent out by the British Government. All these pioneers died in Africa. But, even before Park's day, men from the University of Edinburgh had been active in Africa. James Bruce re-discovered the sources of the Blue Nile, while Joseph Thomson, a pupil of T. H. Huxley, has been described as the last, and one of the most successful, of the great geographical pioneers in Africa. Other Edinburgh medical men have carried the spirit of adventure to geographical discoveries in India, Australia and America, and these men studied at the same time the natural history of the lands wherein they pioneered. On the seas the spirit of adventure is exemplified by Scoresby, the Whitby lad who became a world authority on the life of whales. To the Edinburgh naturalists Sir John Richardson, Harry Goodsir and John Macgillivray, the Franklin Arctic expedition owed much.

No doubt the graduates of Edinburgh or of other universities will be interested to learn that Edward Forbes, who founded the science of oceanography, left that University in his ninth year as a medical student without a degree, to return fourteen years later to do brilliant work as its professor of natural history. Wyville Thomson, another medical, also left without a degree, but because his health was not

good: twenty years later he became professor of natural history and planned and carried out the *Challenger* expedition. Another great oceanographer, Sir John Murray, continues the list of Edinburgh medicals who left without completing their degrees, a list which W. S. Bruce, who led the Scottish National Antarctic expedition, continues into the present century. Here is a record which will inspire the Edinburgh graduates of to-day, secure in the knowledge that they have got their degrees, to even greater achievements. As medical men they will do well to preserve in their minds Prof. Ritchie's reminder that there are Dark Continents of disease and suffering in all grades of modern society. The discovery, investigation and removal of these is especially the job of the modern medical man.

Mathematics as a Compulsory Examination Subject

MR. D. BROWNLIE, who is an organic chemist and chemical engineer, has published a pamphlet strongly advocating the abolition of compulsory mathematics in university matriculation examinations, even for degrees in engineering or science. He claims that "the very great majority of candidates, say about 90–95 per cent, have no particular aptitude in the subject of mathematics, which is almost universally detested. . . . Actually, mathematical proficiency above the normal is no indication of superior intelligence. . . . It would, in fact, not be difficult to make out quite a good case for the contention that in a considerable proportion of cases proficiency in mathematics is actually a sign of mental deficiency. . . . My experience with Euclid or geometry, or whatever it is now termed, had the natural result, as in the case of most other students, of regarding it as a pest to be learned by heart and forgotten completely as soon as the Matriculation examination was over." At a time like the present, when the educational system of Great Britain is being reconstructed, there is a place for a careful inquiry into the validity of the claims for the traditional subjects and methods of instruction. The use of wild and exaggerated language is not helpful in such an inquiry. A more useful step is the attempt, now being made by a committee representing all English School Certificate examining bodies and also the Mathematical Association, to provide an alternative course of mathematics, more closely allied to its applications, which can be followed by those who find the present school mathematics too abstract.

Refugees in Great Britain

POLITICAL AND ECONOMIC PLANNING (P E P) in a recent broadsheet (No. 216, January 14, 1944) gives a useful review of the present position of refugees in Britain and of the changes which have taken place during the War and since the appearance of Sir J. H. Simpson's report "The Refugee Problem" in 1939. The present number of civilian refugees is estimated at 139,430, including 50,000 Germans and Austrians, and 20,000 Allied seamen, a total which differs from that of the Prime Minister's statement of April 7, 1943, in allowing for those who have left or died since the beginning of the War. Considerable progress has been made in utilizing the services of aliens with special professional, technical or academic experience. According to the Minister of Labour's statement of September 23, 1943, shortly after the 1941 registration 82·5 per cent of the men and 60 per cent of the women were in employment, and since 1941 the opportunities open to aliens to engage in war-work have increased, so that the number who now remain unemployed is negligible.

The economic absorption of pre-war refugees has broken down their isolation, removed prejudices and enabled them to become acquainted with the British way of life. By and large, they have proved a valuable element in society: they have made contributions to the national life in industry, in the universities, in the arts and in science, and have acquitted themselves well during the War. The number of those who will wish to remain in Britain is estimated as roughly 40,000, a figure which is much smaller than in other countries before refugee emigration began in 1933. This number should be absorbed without difficulty after the War: a full employment policy for Great Britain should mean the disappearance of the refugee problem as we knew it before the War; but the refugees must be given a fair chance of sharing both the rights and obligations of British citizens.

Technological Museum of New South Wales

THE annual report of the curator of the Technological Museum of New South Wales for the year ended December 31, 1942, states that the scientific work of the Museum has been placed on a war footing without necessitating any reorganization of laboratory work. Chemical investigations of national importance have included the recovery of by-products from charcoal burning, dyeing of khaki cloth, preparation of coloured flashes and composition of flash powders and smoke screens from motor exhausts, fireproofing paper and 'Cellophane' gas respirators, Australian essential oils as mosquito repellents, rot-proofing of sandbags, strength of laminated plastics for aircraft, production of lactic acid and lactates from waste whey, and sources of quinine and similar alkaloids in Australia. Work has also been done on synthetic wax, fire-proofing fabrics for camouflage purposes, synthetic rubber from acetylene, production of drugs and natural dyes from Australian plants, camouflage materials, especially paint, wax from sugar-cane, and the relative humidity for controlling the development of moulds likely to attack silk parachutes in Queensland. Botanical investigations into the cultivation of the tung oil tree in Australia, as well as on suitable Australian fibres to relieve the shortage of imported material, and the important research on the cytology of the eucalypts and other genera, were continued. Much time has been devoted to the study of rot-proofing problems in the preservation of jute hessian, canvas and manilla, hemp and cotton rope and to the waterproofing and rot-proofing of canvas duck. Lists of lectures, etc., delivered, papers read before scientific societies, exhibits and publications are included.

Performance of Generating Plant

A PAPER read in London on February 3 before the Institution of Electrical Engineers by R. W. Biles and G. W. Maxfield reviews the performance of a group of generating stations over a five-year period, commenting upon coal qualities, thermal efficiency, analysis of the different classes of breakdown with deductions as to probable operating life between breakdowns, plant availability and the effects of loading. The plant under review is divided into three groups: pre-1930, 1930–1937 and 1938–1942.

From the results, curves for maximum probable availability are deduced. The suggestion is made that 'operating efficiency' should be calculated on a uniform basis and included in station records. The need for an overall standard by which the performance of generating stations can be judged is discussed, and the term 'standard merit', based upon operating efficiency and plant availability, is suggested.

It is concluded from the analysis that pre-1930 plant should not be operated at above 45 per cent average running plant load-factor if good availability is to be consistently maintained; marked improvements are to be noted in availability of the most recent plant installed since 1938 at 80 per cent average running plant load-factor; the lower breakdown rate per plant item of the pre-1930 group is notable when compared with that of the later plant groups. Good quality and grading of fuel supplies are needed, particularly for the pre-1930 plant, if maximum outputs are to be obtained. With larger units of plant, greater outputs between breakdowns have been possible; but it is not safe to conclude that larger units still would be to the general benefit of the supply industry. Size of unit required is related to the load curves and security needs.

Economic Rating of Motors and Transformers

IN a paper read by Mr. D. J. Bolton before the Institution of Electrical Engineers on December 2, physical and economic ratings of motors and transformers respectively are compared, and the scope and limits of economic choice are discussed and illustrated. A method of economic selection is proposed through the use of larger standard machines, and a technique is developed for investigating the economy of changes in rating. Tables of data and results are given at the end of the paper, and the methods employed in these tables are explained in some detail. The results are expressed in the form of an 'economic advantage' obtainable through under-running or over-running, and show the former to be highly advantageous in a large number of cases. Methods of implementing the results are discussed.

Canadian Mortality in War Years

ACCORDING to an annotation in the September issue of the *Statistical Bulletin*, the health of the Canadian people has remained at a very favourable level during the four years of the present War, the mortality in this period being the lowest on record. The improvement in mortality has been particularly marked in the diseases most prevalent among the young. Not only has the death-rate decreased among the communicable diseases of childhood, but also there has been an increased fall in the mortality among the large number of young adults in training camps. Diarrhœa and enteritis, which have always been important causes of death among Canadian children, have also shown considerable improvement in recent years. The rate of decline in tuberculosis is illustrated by a new minimum of 47·1 per 100,000, which is about one fifth below that for the period 1934–36. In contrast with the catastrophic influenza epidemic towards the close of the War of 1914–18, there has so far been no cause for serious concern, although there was a mild epidemic of influenza in Canada late in 1940 and early the following year, the favourable result being mainly due to the use of serum and chemotherapy in the treatment of pneumonia. Chemotherapy has also succeeded in reducing the mortality from appendicitis and the diseases incidental to child-bearing. On the other hand, there has been an increase in the mortality from cancer, diabetes, diseases of the heart and arteries, and from accidents.

Announcements

PROF. A. R. TODD, Sir Samuel Hall professor of chemistry in the University of Manchester, has been appointed professor of organic chemistry in the University of Cambridge.

PROF. ANTON J. CARLSON, chairman of the Department of Physiology in the University of Chicago, has been elected president of the American Association for the Advancement of Science.

THE title of professor emeritus of bacteriology in the University of London has been conferred on Sir John Ledingham, on his retirement from the professorship of bacteriology at the Lister Institute of Preventive Medicine. The degree of D.Sc. has been conferred on Mr. B. Prasad (University College), Dr. E. C. Barton-Wright (Birkbeck College and Chelsea Polytechnic), Mr. A. G. McDonnell Weddell (St. Bartholomew's Hospital Medical College), and Mr. George King.

THE Edison Medal for 1943 of the American Institute of Electrical Engineers, one of the highest honours in the field of electrical science and engineering, has been awarded to Dr. Vannevar Bush, president of the Carnegie Institution of Washington and director of the Office of Scientific Research and Development of the U.S. Office of Emergency Management, "for his contribution to the advancement of electrical engineering, particularly through the development of new applications of mathematics to engineering problems, and for his eminent service to the nation in guiding the war research program". Dr. Bush has also just received the Holly Medal of the American Society of Mechanical Engineers, for his work as a leader of engineering education and in scientific research, and in particular for his work on calculating machines.

OWING to the generosity of the Rockefeller Foundation of New York, which has for the fourth year in succession provided a grant for the purpose, the Royal Society is in a position to give some assistance to scientific societies and associations which, as a result of war conditions, are experiencing financial difficulties in the publication of scientific journals.

THE following appointments to the Colonial Service have recently been made: E. Dixon to be veterinary officer, Nigeria; W. J. J. Filkins to be physiological laboratory superintendent, Uganda; J. S. Groome to be forest officer (temporary), Tanganyika; G. W. P. Streeton to be deputy government chemist, Jamaica.

ERRATA.—We are asked by Dr. A. Hunter to make it clear that the experiments on exposure-time effects in photographic photometry attributed to him in NATURE of February 26, p. 242, were planned and carried out by Prof. W. M. H. Greaves, Astronomer Royal for Scotland. Furthermore, the microphotometers he described at the symposium give intensity traces direct, not merely density records, as stated.

LETTERS TO THE EDITORS

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

New Types of Optical Glass

IN view of the interest shown in new optical glasses recently produced in Great Britain and in the United States, we wish to summarize the present position and to indicate probable lines of development.

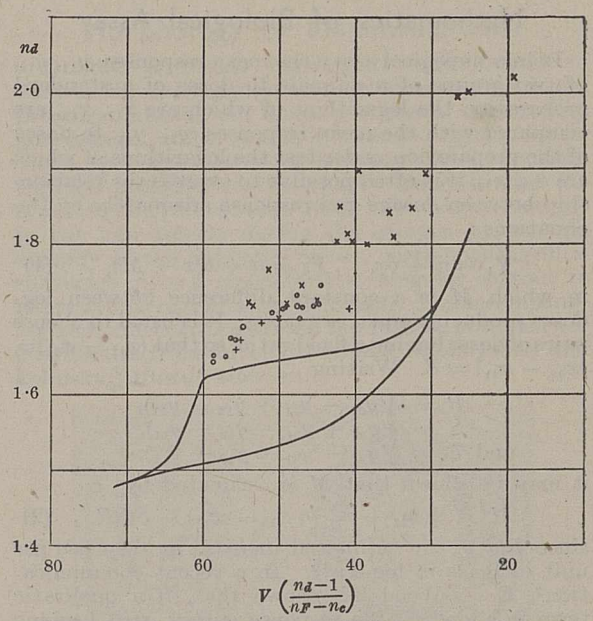
Advances in lens design have led to a demand for new glasses with optical properties different from those available hitherto as outlined in a recent paper by B. K. Johnson[1], who mentions glasses with high refractive index and low dispersion. Non-silicate glasses of this type containing rare earth oxides in high proportions and with optical properties ranging from 1·71 to 1·97 in refractive index and from 54 to 19 in V value have been described in the patent literature[2], but so far as we are aware, only one of them has been made available in Great Britain, namely, one with refractive index $nD = 1·745$ and with $V = 45·8$.

Examination of the well-known nD–V diagram for optical glasses shows that there is a large field for exploration, and it is desirable that the glass-maker should have some guidance as to the requirements for lenses of various types. On the other hand, without definite information that new glasses are available, the computer does not wish to spend time on designs which utilize optical properties for which there may be no corresponding glasses. It is our hope that this short account of new glasses developed by this Company will be of interest to designers and serve to stimulate experiments in lens design.

The new glasses contain appreciable quantities of silica and boric acid as the network formers, and their exceptional properties depend on the addition of the oxides of barium, lead, zinc and certain other metals. Their optical properties are plotted in the accompanying graph, and they lie between the limits of V value of 60 and 40 and have refractive indexes greater than $(1·860–0·004\ V)$. The American and some new German glasses[3] are included for comparison. The partial dispersions of the new glasses have not yet been determined for all the types, but it is interesting to note that the glass *SBF* 717480 has relative partial dispersions almost identical with those of the standard Telescope Flint 525512[4]. In the diagram, two bold circles indicate the main types on which production is concentrated. Other types not shown may be obtained by interpolation, but it is obviously advantageous to limit the number as there may be developments in another region in the nD–V diagram. The glasses are divided into two general types, those with V values greater than 55 being called Special Barium Crowns (*SBC*) and those with V values less than 55, Special Barium Flints (*SBF*).

The vitreous stability of the glasses, that is, their resistance to devitrification during melting, moulding and annealing, is as good as, or better than, that of the normal types of optical glass, and the compositions and melting technique are such that a high degree of homogeneity can be obtained.

Having regard to their extreme optical properties, the glasses can be considered as substantially free from colour, particularly those with high V value. The transmissions in the near ultra-violet (3650 A.) are generally higher than those for ordinary flints of the same index. Preliminary results indicate that their resistance to weathering is not less than that of normal flint glasses.



The curve encloses the area covered by Chance standard glasses. ⊙, Chance silicate glasses. ×, Kodak glasses, U.S.P. 2150694 and 2206081; and B.P. 462304 and 534680. +, Schott glasses, U.S.P. 2297453.

The method of melting is by electric heating in platinum pots; Faraday seems to have been the first to use platinum crucibles in his classical experiments to produce homogeneous optical glass[5], followed later by Vernon Harcourt, but electricity was not then available to provide accurate control and application of temperature.

Owing to the chemical nature and high cost of the raw materials used, it is not possible to make the glasses on the scale of normal optical glass manufacture, and the process has been limited to small-scale meltings. The manufacture of optical glass on this scale to give freedom from striæ and bubbles has required the development of a new technique such as was not previously possible. The degree of control which can be exercised results in more closely repeatable properties than is possible with large-scale manufacture. While glass of useful size can be obtained on the present scale, the plant is undergoing development to enable larger meltings to be made.

The methods for the development of new glasses are now well established as a result of this work, and we would welcome the views of computers on requirements in optical design.

We have been encouraged to pursue this work by the active interest shown by the Admiralty and the other Service Departments, working through an Interdepartmental Committee under the chairmanship of the Director of Scientific Research, Admiralty.

W. M. HAMPTON.
R. E. BASTICK.
W. N. WHEAT.

Chance Brothers, Limited,
Glass Works, Smethwick. Jan. 31.

[1] Johnson, B. K., *Proc. Phys. Soc.*, **55**, 291 (1943).
[2] Brit. Pats. 462304 and 534680. U.S.P. 2150694 and 2206081. *J. Sci. Instr.*, **19**, 94 (1942).
[3] U.S.Pat. 2297453.
[4] See Chance-Parsons Optical Glass Catalogue.
[5] Bakerian Lecture, *Phil. Trans. Roy. Soc.*, **120**, 1 (1830).

Mathematics of Biological Assay

IF in a biological assay the mean responses, y_{11}, y_{12}, of two groups of n animals to doses of a standard preparation the logarithms of which are x_{11}, x_{12}, are compared with the mean responses, y_{21}, y_{22}, to doses of the preparation under test the logarithms of which are x_{21}, x_{22}, it is often possible to express the relationship between dosage and response adequately by the equations :

$$Y_1 = a + bx, \qquad Y_2 = a + b(x - M), \qquad (1)$$

in which M is a constant difference between log-doses producing equal responses. It is usual to choose pairs of doses having a fixed ratio, so that $(x_{12} - x_{11}) = (x_{22} - x_{21}) = d$. Writing

$$R = \tfrac{1}{2}(y_{22} - y_{21} + y_{12} - y_{11}),$$
$$S = \tfrac{1}{2}(y_{22} + y_{21} - y_{12} - y_{11}),$$
$$\text{and } T = \tfrac{1}{2}(y_{22} - y_{21} - y_{12} + y_{11}),$$

it may be shown that M is estimated by

$$M = \tfrac{1}{2}(x_{22} + x_{21} - x_{12} - x_{11}) - Sd/R, \qquad (2)$$

since R/d is the estimated increase in response per unit increase in log-dose[1]. In a recent communication[2], E. C. Wood has shown that, if a quadratic term is added to the response curves, still keeping the condition that there shall be a constant ratio between equally effective doses, so that

$$Y_1 = a + bx + cx^2, \quad Y_2 = a + b(x - M) + c(x - M)^2, \quad (3)$$

equation (2) still estimates M.

It would be unfortunate if this interesting fact were allowed to conceal the limited applicability of the four-point assay. Equations (1) express the hypothesis that the responses are related to the log-doses by two parallel straight lines, and the data themselves provide a test of the adequacy of this hypothesis. T is a measure of the departure from parallelism of the straight lines connecting the responses to the pairs of doses ; if s is the residual standard error in an analysis of variance of the responses by the $4n$ animals (differences corresponding to doses and to litters or any other relevant classification having been eliminated), the standard error of T, as also of R and S, is $s/\sqrt{n}$, and the significance of T may then be judged by a t-test.

Equations (3) express the hypothesis that the responses are related to the log-doses by quadratic curves, still with the condition that the curves are identical save for a constant ratio of potencies ; the four parameters, a, b, c and M, may be determined so that equations (3) reproduce the experimental mean responses exactly, leaving no degrees of freedom for assessing the adequacy of the hypothesis. There may sometimes be strong *a priori* reasons for believing that the standard and test preparations have response curves of identical form, in spite of a difference in potency ; a quadratic equation such as (3) may then be a sufficiently good approximation, even when a linear is unsatisfactory, and the relative potency is estimated as the antilogarithm of the expression in equation (2). Without this belief, it is unjustifiable to assume the existence of a constant relative potency, and the four-point assay cannot give a valid result unless a low value of T indicates the adequacy of the hypothesis expressed by equations (1). In all cases of uncertainty it is desirable to test at least three doses of both preparations, so that more information on the response curve may be obtained. Without such precautions, a spurious simplicity may appear in the results of an assay, a single figure being said to represent the potency of a test preparation relative to a standard, when, in fact, the relative potency depends on the level of response at which a comparison is made.

The standard error of M, as given by equation (2), is[1]

$$s_M = \pm \frac{sd}{R^2}\sqrt{\frac{R^2 + S^2}{n}}.$$

For any chosen level of probability a value of t may be obtained corresponding to the number of degrees of freedom on which s is based ; provided that $g = t^2 s^2 / nR^2$ is small, the fiducial limits to M are $M \pm ts_M$, but when g is large the precise formula

$$M - \frac{g}{1-g}\frac{Sd}{R} \pm \frac{tsd}{R^2(1-g)}\sqrt{\frac{R^2(1-g) + S^2}{n}}$$

must be used.

D. J. FINNEY.

Rothamsted Experimental Station,
Harpenden, Herts.
Feb. 4.

[1] Bliss, C. I., and Marks, H. P., *Quart. J. Pharm. Pharmacol.*, **11**, 192 (1939).

[2] Wood, E. C., NATURE, **153**, 84 (1944).

Tautomerism of Cyanamide

THE constitution of cyanamide, since its first synthesis in 1851, has been the subject of a very large number of publications. Whereas the chemical properties of this substance point to the structures NH_2CN and NH : C : NH, its physical properties are held[1] to favour the former. The modern tendency is to regard cyanamide as a mixture of these isomers in tautomeric equilibrium[2], with the position of equilibrium considerably in favour of the cyanide structure.

The equilibrium $NH_2CN \rightleftharpoons NH : C : NH$ is a special case of amidine tautomerism, and the tautomeric behaviour of amidines has already been correlated[3] with their associated (hydrogen-bond) structure. Since many of the physical properties of cyanamide are consistent with a high degree of molecular association, it appeared of interest to examine the molecular condition of cyanamide and its N-substituted derivatives to see whether a similar correlation prevailed. A sufficient number of cyanamide derivatives has now been examined to provide overwhelming support for this suggestion, namely, that the tautomerism of cyanamide and its mono-substituted derivatives ($RNHCN \rightleftharpoons RN : C : NH$) is due to their molecular association.

Molecular weight measurements have been made cryoscopically in benzene solution, or, in cases where the solubility was too low at the freezing point of benzene, in naphthalene. Cyanamide itself was not sufficiently soluble in either solvent to give reliable results, and was measured cryoscopically in nitrobenzene solution. In spite of the donor character of this solvent, and its consequent tendency to simplify the solute molecules, a 2 per cent solution of cyanamide in nitrobenzene showed an association factor of well over 2·0. Molecular weight determinations have been made on more than a dozen N-substituted cyanamides, which are found to fall into two distinct classes : those possessing an unsubstituted hydrogen atom ($RNHCN$) are markedly associated, their molecular weight rising rapidly with

increasing concentration, whereas those in which there is no free hydrogen (R_2NCN) are substantially unimolecular. It seems clear, then, that the former class owe their associated character no less than their tautomeric behaviour to molecular union through hydrogen bonds (N–H–N), the imino-hydrogen atom of one molecule being shared with the cyano-nitrogen atom of a second.

No conclusions can be drawn from the molecular weight evidence as to the type of associated molecules, for the molecular weight – concentration curves show little or no falling off in slope with increasing concentration. This may indicate linear polymers, and regarding the hydrogen bond as a resonance phenomenon[4], a linear polymer of the cyanamide *R*NHCN containing $x + 2$ molecules is depicted in Fig. 1, in which (*a*) and (*b*) are the unperturbed forms of the resonance hybrid.

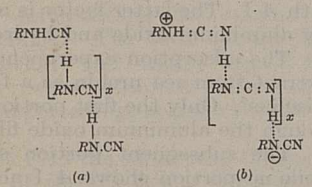


FIG. 1.

Cyclic polymers are not excluded, and a practically strainless trimer (Fig. 2) involves no separation of charges in the resonating forms (*a*) and (*b*).

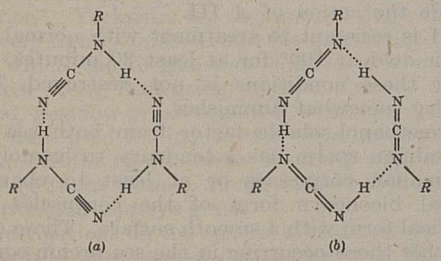


FIG. 2.

Chemical polymerization with formation of substances of the melamine type was, of course, excluded, the cyanamides being recoverable unchanged from the cryoscopic solvent.

Polymers such as those depicted above will possess all the properties attributed previously to the two tautomers *R*NH.CN and *R*N : C : NH, but since the polymeric resonance hybrid is neither of these, no separation of tautomers can be expected. Tautomerism owing its origin to resonance polymers of this kind has previously been named *mesohydric tautomerism*[5], and there seems little doubt that cyanamide and its monosubstituted derivatives provide further examples of this phenomenon.

A detailed account of these measurements will be published elsewhere.

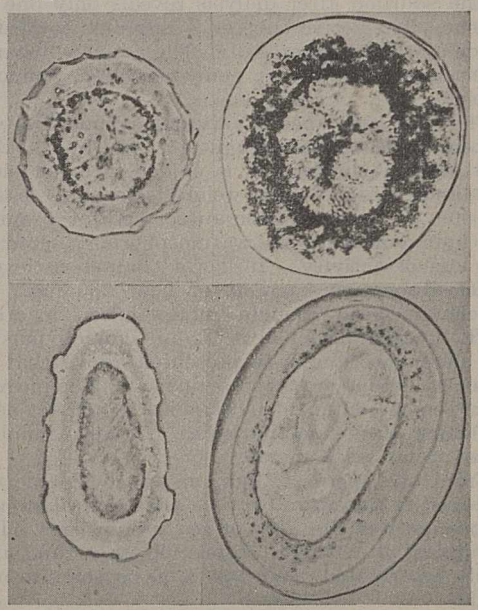
L. HUNTER.
H. A. REES.

University College and
City Boys' School,
Leicester.
Jan. 21.

[1] Colson, *J. Chem. Soc.*, 554 (1917).
[2] See Schmidt's "Textbook of Organic Chemistry" (trans. Rule, 3rd edn., 1936), 71.
[3] Hunter and Marriott, *J. Chem. Soc.*, 777 (1941).
[4] Sidgwick, *Ann. Rep. Chem. Soc.*, **30**, 112 (1933).
[5] Hunter, *Chem. and Ind.*, **60**, 32 (1941).

Morphology of Mammalian Hair

DURING a recent histological examination of keratin fibres, transverse sections were made through proximal, medial and distal portions of mammalian guard-hairs. The results obtained support earlier views upon the nature of hair growth[1,2]. Sections through proximal regions clearly demonstrated the alteration in fibre contour which follows upon changes in the hair follicle during the catagen phase. As atrophy of the hair root occurs, corresponding fibre shrinkage gives a characteristic irregular contour to the proximal region of the hair shaft. The accompanying reproduction illustrates the results obtained for guard-hairs from silver fox (*Canis vulpes fulva*) and kolinsky (*Mustela sibirica*).



ABOVE : *C. vulpes fulva*. PROXIMAL REGION (left). ×480. MEDIAL REGION (RIGHT). × 480.
BELOW : *M. sibirica*. PROXIMAL REGION (LEFT). × 650. MEDIAL REGION (RIGHT). × 380.

This variation in fibre contour is accompanied by changes in surface structure. Photomicrographic examination of cuticular-scale structure showed the presence of different scale types in the proximal and medial portions of guard-hairs; for example, kolinsky : proximal region, spinous type ; medial region, irregular annular.

A detailed account of the investigation of hairs from members of Carnivora and Rodentia will appear elsewhere.

J. L. STOVES.

University, Leeds.
Jan. 25.

[1] Dry, J. W., *J. Genet.*, **16**, 287 (1925).
[2] Wildman, A. B., *Proc. Zool. Soc.*, 257 (1932).

Gamones from the Sperm of Sea Urchin and Salmon

Hartmann and Schartau[1] have introduced the term 'gamone' to denote substances which are carriers of the interactions between the gametes at the fertilization. Androgamones (*A*) are those carried by the sperm. Hartmann, Schartau and Wallenfels[2] separated two factors : *A* I is present in the methanol

extract of the sperm, whereas *A* II is insoluble in methanol. We have carried out some further studies on the androgamones from *Echinocardiium cordatum*, *Psammechinus miliaris*, *Strongylocentrotus droebachiensis* and *Echinus esculentus*.

The undiluted sperm from the testes was frozen in carbon dioxide snow or in a mixture of this and acetone, and was dried in the frozen state by the 'Cryochem' method of Flosdorf and Mudd[3]. The dried sperm was extracted with methanol. The residue was suspended in sea water and subjected to a temperature of 85–90° for 3–5 minutes. The insoluble part was centrifuged off. A clear liquid was thus obtained. This contains *A* II, which precipitates and agglutinates the jellies. Electrophoresis of the solution after dialysis reveals only one component. The active substance migrates towards the anode at *p*H less than 4·0[4]. The active substance is precipitated by 75 per cent saturated ammonium sulphate.

The *A* II substance is very quickly inactivated by trypsin (in less than 5 minutes at 20° by 0·0025 per cent trypsin Merck). It is evidently a protein-like substance. Its molecular weight is probably less than 10,000[4]. It has even been autoclaved for 30 minutes at 1 kgm./cm.^{2} more than atmospheric pressure without loss of activity. It has a characteristic ultra-violet absorption band at or near 260 mμ. Jelly which has been brought into solution inactivates *A* II. Clupein acts like *A* II, but it is obvious from the electrophoretic data presented above that *A* II is not of histone or protamine nature. The individual amino-acids contained in clupein do not act as precipitating agents on the jellies, nor do a number of other amino-acids tested.

From the sperm of salmon an *A* II fraction is obtained in the same way as that described above. It precipitates the jelly of sea urchin eggs. It has a similar ultra-violet absorption spectrum and is easily inactivated by trypsin, as is the sea urchin *A* II.

The methanol extract was evaporated and the residue was extracted with sea water at 85–90° for 3–5 minutes. A faintly yellow solution resulted. This solution contained *A* I. A drop of sperm was introduced between cover-slip and slide and an equal drop of the extract was added. The *p*H of this was adjusted to about that of sea water. The sperm was immobilized. In other experiments, the dried sperm was extracted directly with warm sea water without previous treatment with methanol (Frank's method[5]). The opalescent extract was as active as *A* II, but no *A* I activity could be demonstrated. It seems doubtful whether fraction *A* I takes any part in Psammechinus or Echinocardium sperm. In undiluted suspensions obtained from the testis, the sperm is very active at the boundary of a drop, where oxygen uptake and outward diffusion of carbon dioxide are sufficient. The *A* I fraction seems in our species to be liberated in sufficient quantities only after extraction with methanol. Nevertheless, *A* I plays an important part in the salmon. The immobilization of the sperm in dense suspension is due to *A* I. On dilution, the sperm becomes mobile, but addition of a solution containing *A* I from the sea urchin or from salmon immobilizes the sperm in a reversible manner. It was found for the salmon *A* I that it diffuses through 'Cellophane'. This is probably true also for sea urchin *A* I. Neither the salmon nor the sea urchin *A* I is inactivated by trypsin.

The methanol extract contains still another factor which may be designated as *A* III. It is active on the surface of the egg. Its presence is demonstrated by the following test[4]. Unfertilized eggs deprived of their jelly are placed in a hypertonic solution (2 ml. sea water + 0·6 ml. 2·5 *N* sodium chloride). When the eggs shrink in this solution, the surface acquires numerous small wrinkles. In the course of about an hour the surface becomes smooth (the duration of the wrinkled state is subject to variations according to the material and the conditions). Unfertilized eggs pretreated for 20–30 minutes with sea water containing *A* III shrink with a smooth surface. In eggs transferred from a hypertonic solution containing *A* III a fairly vivid streaming of the cytoplasm occurs. The action of *A* III may be interpreted as a liquefaction of the cortical layer[6]. *A* III of sea urchin sperm dialyses through 'Cellophane'. It is seemingly not attacked by trypsin. *A* III is not identical with *A* I. The latter factor is more strongly adsorbed by aluminium oxide and hydroxide than is the former. The adsorption experiment was carried out with extract from sea urchin as a front analysis following Tiselius[7]. Only the first portion of the fluid pressed through the aluminium oxide filter is devoid of *A* III. The subsequent portion shows *A* III activity, while no portion shows *A* I activity. Displacement and elution experiments also prove that *A* III is more loosely bound to aluminium oxide or hydroxide than is *A* I.

The solution containing *A* I and III acts as an inhibitor to *A* II, while this latter factor does not impede the action of *A* III.

A I is resistant to treatment with normal hydrochloric acid at 100° for at least 30 minutes. *A* III under these conditions is not destroyed, but its activity somewhat diminishes.

A methanol-soluble factor from both sea urchin and salmon sperm has a tendency to hæmolyse red mammalian corpuscles or at least to change the normal biconcave form of the corpuscles into a spherical form with a smooth surface. These changes resemble those occurring in the sea urchin egg under the action of *A* III. In view of this and other facts, the change of the red corpuscles may be ascribed to *A* III.

Besides the agent which changes the form of the corpuscles, the methanol extract seems also to contain a factor which causes agglutination of the corpuscles.

For a more complete review of literature see refs. 4 and 8. Further details of the results will be published elsewhere.

JOHN RUNNSTRÖM.
SVEN LINDVALL.

Wenner Gren's Institute
for Experimental Biology,
University of Stockholm.

ARNE TISELIUS.

Institute for Physical Chemistry,
University of Uppsala.

[1] Hartmann, M., and Schartau, O., *Biol. Zentralbl.*, **59**, 511 (1939).
[2] Hartmann, M., Schartau, O., and Wallenfels, K., *Biol. Zentralbl.*, **60**, 388 (1940).
[3] Flosdorf, E. W., and Mudd, S., *J. Immun.*, **34**, 469 (1938).
[4] Runnström, J., Tiselius, A., and Vasseur, E., *Arkiv för Kemi* (Stockholm), **15** A, Nr. 16 (1942).
[5] Frank, J. A., *Biol. Bull.*, **76**, 190 (1939).
[6] Runnström, J., Monné, L., and Broman, L., *Arkiv för Zoologi* (Stockholm), **35** A, Nr. 4 (1943).
[7] Tiselius, A., *Arkiv för Kemi* (Stockholm), B **14**, Nr. 22 (1940). Tiselius, A., and Claesson, S., *Arkiv för Kemi* (Stockholm), B 15, Nr. 18 (1942). Tiselius, A., *Koll. Z.*, **105**, 101 (1943).
[8] Hartmann, M., "Die Sexualität" (Leipzig, 1943).

Blind Seed Disease of Rye-Grass

INVESTIGATIONS on blind seed disease of rye-grass have been continued in Northern Ireland since 1940[1]. In agreement with Neill and Hyde[2,3], and Wilson, Noble and Gray[4], sporodochia producing endogenous microspores have been observed on affected seeds and also in culture.

Inoculation experiments were carried out during the summer of 1941, using the same technique as in 1940. Again *Pullularia pullulans* proved to be non-parasitic. Using the blind seed fungus (*Phialea temulenta* Prill. and Delacr.) and employing suspensions of ascospores and macrospores, heavy infections with the disease were obtained at flowering time with one commercial type and two indigenous strains of perennial rye-grass and one commercial type of Italian rye-grass. When inoculations were made after fertilization, the amount of infection rapidly declined. The seed produced was tested for germination and highly significant negative correlations were obtained between percentage infection and percentage germination for each variety used.

In August 1942 the blind seed fungus was isolated from seeds of sheep's fescue (*Festuca ovina*), bent-grass (*Agrostis canina*), fiorin-grass (*Agrostis palustris*), smooth-stalked meadow-grass (*Poa pratensis*), Yorkshire fog (*Holcus lanatus*) and crested dog's-tail (*Cynosurus cristatus*), by plating out infected kernels on a suitable medium after surface sterilization and bisection[2]. Yorkshire fog and crested dog's-tail were only very lightly infected and the percentage of seeds from which the fungus was isolated was very low. Cultures from bent-grass, sheep's fescue, smooth-stalked meadow-grass together with one from rye-grass were used for inoculation experiments in 1943, and successful results were obtained with meadow fescue (*Festuca elatior*), rough-stalked meadow-grass (*Poa trivialis*) and rye-grass.

Investigations on the control of the disease by seed disinfection were carried out during 1940–43. These included laboratory, pot and field tests. Dry and short-wet treatments with seed disinfectants, including organo-mercury compounds, were not altogether satisfactory. Treatment with hot water for fifteen minutes at 50° C. following pre-immersion for four hours in tepid water, or for thirty minutes at 50° C. without pre-immersion, gave full control of the fungus. There was little, if any, reduction in germination following upon this treatment when the drying of the seed was carried out immediately. These results were confirmed in pot and field experiments, where apothecia were collected from all plots except those sown with seed subjected to the hot-water treatment. It was also observed that, after the hot-water treatment, infected seeds decayed readily in the soil whereas in other cases they remained firm and unchanged.

In a field experiment in 1941, where the plots were separated by paths two yards wide, it was found that no treatment reduced the amount of infection present in the seed produced. This was due to the fact that ascospores were carried from plot to plot to bring about primary infection. In order to overcome this difficulty, small plots, well isolated from rye-grass crops, were sown with infected seed subjected to the hot-water treatment, which was shown by laboratory tests to be completely effective in killing the parasite. Similar plots in other districts were sown with untreated seed. Examination of the seed produced showed that the percentage infection in ten of the plots sown with untreated seed varied from 0 to 38 with a mean of 8; in the case of fifteen plots sown with treated seed the corresponding range was from 0 to 55 with a mean of 11 per cent. These results suggest that infection from a source other than the seed sown had occurred, probably through apothecia produced on infected seed from plants in hedgerows, untopped pastures and waste-ground. Such being the case, seed treatment cannot be expected to provide satisfactory control except under conditions of perfect isolation.

Since 1939 a large number of seed samples have been examined and the results indicate clearly that strains of indigenous perennial rye-grass are more susceptible to blind seed disease than commercial types. The amount of infection has varied from year to year and, since these observations were commenced, serious infection has been recorded only in 1939 and 1943. During the years 1940–42 only occasional samples examined showed heavy infection. In 1941 the seed from one field of indigenous rye-grass, sown with disease-free seed in the spring of 1940, showed infection ranging from 31–55 per cent for six samples examined. In the seed from several other crops, produced from the same parent seed, the disease was absent or present only to a very small extent. On investigating the crop rotations it was discovered that in the former case rye-grass had followed a four-year lea, while all the other crops had been sown on land which had been in arable crops for from three to four years. It seems clear that the amount of infection had been influenced by the previous cropping. Much of the seed produced from these crops was sown in the spring of 1942 and about 160 samples from the resultant crops were examined in 1943. The amount of infection varied and in some cases it was so high as 70 per cent, probably as a result of the suitable weather conditions for infection which prevailed during May and June. A significant result which emerged from this examination was that the seed samples from fields sown with the heavily infected seed did not, on the average, show a higher percentage infection than those from fields sown with practically disease-free seed.

Since rye-grass is of primary importance as a forage crop and as the use of the seed is largely limited to the propagation of the species, too much importance could be placed upon reduced germination due to the incidence of blind seed disease. Until evidence has been produced to show that the causal parasite affects the value of the crop in some other way, it must be assumed that the damage is confined to an attack upon the seed. The seed from indigenous strains is certainly more liable to heavy infection than that from commercial types; but if, on the other hand, the crops from indigenous strains are of much greater feeding value, then a certain reduction in the percentage germination of the seed would appear to be of secondary importance. In Northern Ireland there would be very few, if any, seasons when, by proper blending, the seed could not be brought up to a standard of germination suitable for incorporation in mixtures intended for pasture establishment in non-seed-producing areas. The best seed should be reserved for distribution in seed-producing areas. By this means a supply of seed of the valuable indigenous strains already in existence would be made available until such time as leafy strains resistant to blind seed disease can be introduced.

The occurrence of seasons at irregular intervals when

the germination of rye-grass seed is below average is common knowledge, and all available evidence indicates that this reduced germination is due to the incidence of blind seed disease. The disease must, therefore, be regarded as of long standing, attention having been focused on it in recent years due to the susceptibility to attack shown by indigenous strains of rye-grass.

It is not unlikely that the natural susceptibility of such strains to the disease coupled with their shyness in seed production has operated as a primary factor in bringing about their general elimination from commerce. The continuous harvesting of the seed without sufficient reference to the strain of the grass would operate automatically in the same direction, and the forage value of the crop which, after all, is of the greatest importance, may have suffered in consequence.

E. L. CALVERT.
A. E. MUSKETT.

Plant Disease Division,
Ministry of Agriculture,
The Queen's University,
Belfast. Jan. 18.

[1] Muskett, A. E., and Calvert, E. L., NATURE, **146**, 200 (1940).
[2] Neill, J. C., and Hyde, E. O. C., *N.Z. J. Sci. and Tech.*, **20**, 281A (1939).
[3] Neill, J. C., and Hyde, E. O. C., *N.Z. J. Sci. and Tech.*, **24**, 65A (1942).
[4] Wilson, M., Noble, M., and Gray, E. G., NATURE, **146**, 492 (1940).

White Plumage of Sea-Birds

IT is often considered that the white plumage of gulls, terns, gannets, etc., in temperate climates is in contradiction to the principle of protective and adaptive coloration, and survives only because these birds are relatively safe from attack and able to protect themselves. Thus Cott[1] remarks that "in any normal surroundings" they are "positively conspicuous" but considers that their strength and pugnacity protect them.

As is now well known, aircraft of Coastal Command on anti-submarine patrol are painted white on their undersides. This treatment was devised by Merton of their Operational Research Section on theoretical grounds, to render them less visible to submarines. Since any natural object is less bright than the sky, it will appear dark when seen from below against the sky, though at long distances the contrast will be slight, due to the great amount of scattered air-light between observer and object. Merton showed that a white object will have a smaller contrast against the sky than a darker one, even at ranges of several miles, and that white paint should therefore decrease the range at which the submarine look-outs spotted the aircraft and gave warning to submerge. Surely the same end may have been achieved, by natural selection, in the white coloration of the undersides of many sea-birds which depend for their food on spotting and catching fish very near the surface. If the bird is white its contrast against the sky will be smaller and the fish will be less likely to see it in time to dive beyond the bird's reach. As the visual acuity of fish is much poorer than that of man the ranges involved are short and the reduction of contrast by scattered light negligible; hence the benefit of white coloration will be greater than in the case of aircraft.

The majority of sea-birds (apart from shore-feeders) which have dark plumage, like cormorants and guillemots, are diving birds which swim at considerable depths; it should therefore matter little to them whether fish dive deeper at their approach—perhaps indeed they see fish from below in silhouette, in which case their own dark coloration would be an advantage.

K. J. W. CRAIK.

Psychological Laboratory,
Cambridge.
Nov. 24.

[1] Cott, H. B., "Adaptive Colouration in Animals" (Methuen 1940).

Analysis of Barley from King Tuthankhamen's Tomb

THROUGH the kindness of Mr. J. Philp, chief botanist of the Ministry of Agriculture, Egypt, we recently obtained a small sample of ancient Egyptian barley from the Museum of Antiquities, Cairo, which came originally from the tomb of Tuthankhamen (*c.* 1350 B.C.). The barley is extensively carbonized, but its structure is sensibly undamaged and the germ, for example, with its scutellum and embryo components, is still intact. It has, however, apparently lost a considerable amount of weight and its density is only about two thirds that of fresh English barley.

No vitamin B_1 could be detected in the grain, even in the dissected scutellum. On the other hand, the contents of riboflavin and nicotinic acid, as determined by microbiological assay, were found to be 0·85 μgm. and 28 μgm./gm. respectively: the corresponding values for fresh barley average 2·5 μgm. and 90 μgm./gm.

The total phosphorus in the barley was found to be 414 mgm. per 100 gm. and the phytate phosphorus 0·4 mgm./100 gm. Average values for fresh barley are 370 and 249 mgm./100 gm. respectively. There has, therefore, been practically complete hydrolysis of the phytic acid originally present in the grain, but no trace of an active phytase can now be found. Likewise the grain gives no reaction for phosphatase.

It is surprising to find that a molecule so complex as riboflavin could survive for such a long period. Part of the explanation is to be found in the very low relative humidity in the tomb, while we have also observed that the barley has increased in acidity, a 1 per cent suspension giving a *p*H value of 4·1 as against 6·25 for fresh barley. We have no information on how the barley was stored; but it is possible that its preservation was helped by an oxygen-free atmosphere created by its own respiration and the oxygen uptake of other products stored with it.

Although the germ was intact, it was found to contain a number of well-defined crystals, and these are being examined by our colleague, Dr. Hinton, in an attempt to establish their chemical identity. It will also be of interest to know if the crystals are composed of a product with a very small velocity of crystallization.

E. C. BARTON-WRIGHT.
R. G. BOOTH.
W. J. S. PRINGLE.

Cereals Research Station,
Ministry of Food,
St. Albans.
Feb. 10.

BIOCHEMICAL IMPORTANCE OF INDIVIDUAL AMINO-ACIDS

THE biological importance of a protein is dependent on the extent to which it is able to supply the amino-acids which the animal cannot synthesize for itself. Willcock and Hopkins (1906–7) showed that young mice, fed on a diet in which zein was the sole protein, lost weight and died in about 17 days. The addition of tryptophan to the diet enabled the mice to survive for longer periods, although they continued to lose weight. In 1914, Osborne and Mendel repeated the experiments and found that, in growing rats, the addition of tryptophan enabled the animals to maintain their normal weights, and that with the further addition of lysine normal growth was restored. Tryptophan and lysine were therefore regarded as essential amino-acids, the list of which was afterwards extended to include histidine, threonine, valine, phenylalanine, leucine, *iso*leucine and methionine or possibly cysteine. The discovery of threonine by Rose (1931) was the direct outcome of experiments involving the feeding to rats of synthetic mixtures of all the amino-acids known at that time. The rats failed to grow, and Rose concluded that proteins probably contain an unknown amino-acid, which was afterwards isolated and identified as α-amino-β-hydroxy-*n*-butyric acid (threonine).

Essential amino-acids then, in common with vitamins, cannot be synthesized in the mammalian body and have to be supplied in the diet. Unlike vitamins, which are present in small quantities in the tissues, amino-acids, combined in proteins, form a large part of the total mass of the body, and the quantitative requirements of essential amino-acids are therefore considerably greater than those for vitamins. The deleterious effect of a dietary deficiency of a particular amino-acid will be less marked and sudden, therefore, in the adult animal, due to the great store of amino-acids which the body has in its proteins.

Essential amino-acids may have different biological functions. One may be needed only as a building material for the synthesis of protein, in which case a lack of that amino-acid in the diet will result only in an inhibition of protein synthesis, the severity of the symptoms from which will depend on the quantitative requirements of the body relative to its stores of that amino-acid. Another may be indispensable because of its role as a precursor of, for example, a ductless gland secretion, such as adrenaline, which is probably derived from phenylalanine. Cysteine or methionine are the principal sources of sulphur to the animal body, and are probably precursors of glutathione, taurine, insulin, keratin, etc. Valine deficiency in rats produces characteristic nervous symptoms, involving extreme sensitivity to touch and severe lack of co-ordination of movement, suggesting a special role of this amino-acid in the central nervous system. The precise part played by tryptophan is still a matter of conjecture, but from the severe effects which follow its removal from the diet, it seems evident that it has some special function to perform apart from protein synthesis. Its effect on the growth of one of the simpler invertebrates, Obelia, suggest that it may control the speed of metabolism. Histidine is probably the precursor of histamine, ergothionine, carnosine and anserine (found in goose muscle). Lack of lysine produces no specific symptoms apart from cessation of growth, although animals kept on lysine-deficient diets are not static as regards the development of individual tissues and organs. Thus body, tail and leg bones increase in length, and organs such as eyes and kidneys increase in weight, while others, such as muscle, decrease. Although male genital organs are unaffected, the œstrus-cycle may be suspended. Lysine is thus probably required as a purely passive material for the synthesis of protein.

H. A. Harris, A. Neuberger and F. Sanger (*Biochem. J.*, 37, 508; 1943) have recently shown that lysine deficiency in rats produces cessation of growth and hypoproteinæmia. The number of red cells and the amount of hæmoglobin per unit volume of blood are slightly less than in the controls, and this is interpreted as indicating not so much an anæmia proper as a retarded development of the hæmopoietic system. A comparison of the radiographs of the control and lysine-deficient rats showed great differences in the bodily dimensions. Normals are well covered with subcutaneous fat and muscle as compared to the lysine deficients, in which the degree of calcification in all bones is generally reduced. The epiphyseal cartilage of the long bones is barely visible and histological examination reveals considerable reduction in the number of chondroblasts in the first zone of proliferating cartilage. In the zone of calcified cartilage, the trabeculæ of calcified matrix are heavier in the deficient animals than in the controls. Mitotic figures in the testes are reduced as compared with controls.

The changes observed are assumed to be due to a general inhibition of protein formation, leading to reduced growth of some organs which develop at the expense of others not unlike the picture produced by ordinary starvation. Protein is transferred according to a fixed system of priorities, and the sum total of these changes is constant body weight, although the animal is no longer the same animal. It is noteworthy that lack of one essential building unit in the diet produces essentially the same symptoms as underfeeding, and if only one essential amino-acid is missing from a protein then that protein is rendered unsuitable as the sole source of nitrogen in the diet of the young or adult animal. Cadet de Vaux in Paris during the French Revolution tried to persuade the poor that gelatin soup was a satisfactory and nutritious diet. The poor refused, and their attitude has since been shown to have been amply justified, as gelatin contains no valine, *iso*leucine or tryptophan.

T. F. DIXON.

BRITISH ELECTRICAL AND ALLIED INDUSTRIES RESEARCH ASSOCIATION

THE twenty-second annual report of the British Electrical and Allied Industries Research Association (E.R.A./T341) summarizes the work which has been carried out during the year ended September 30, 1943, and again lists, by titles, the various research reports which have been issued during the year. The work is reviewed under the same eighteen major classifications as last year, among which dielectrics, cables and overhead lines, electric control apparatus, and magnetic materials figure largely.

The report shows that the work of the Association has been carried on during the year by 108 active technical sections, sub-committees and panels formed from workers in industry and academic institutions.

Seventy-five technical reports on various subjects have been issued during the year, as compared with fifty-seven in the previous year.

The Information Bureau has accorded significant help, not only to members but also to Government and Service departments. Many inquiries for translations have been received from members, and these have met with prompt response. The rate of preparation of translations now averages about one a week, and in future a six-monthly list will be distributed to members showing the translations completed during the period. The list will also include bibliographies which have been prepared from time to time in response to particular requests. A complete revision of the annotated list of reports is nearly completed and progress has been made on the complete analytical index to E.R.A. reports. The section on overhead lines will be distributed shortly, and as soon as possible a consolidated index to the complete sections on materials covering all reports to date will be issued. A corresponding issue for technical subjects will follow later.

During the year there has been a further increase in the amount of direct assistance to the war effort given by the Association. The British Coal Utilization Research Association having secured a site near Leatherhead railway station offered part of it to others, as a result of which the E.R.A. decided to negotiate the purchase of an adjacent site and co-operate with the other interested associations in order to secure joint action in matters of common interest and the sharing of common facilities and amenities. It is likely that this will lead to an important group of industrial research laboratories being developed in the area.

Regarding insulating materials, during the year the E.R.A. alone has issued reports representing an expenditure of upwards of £10,000 on the properties of insulating materials. The importance of skilled methods of manufacture, testing and selection has been emphasized under war conditions, and the value of statistical methods of assessment of quality is receiving increasing attention. Now that industry has provided adequate testing facilities for making performance tests on circuit breakers at full power, the study of arcing phenomena and parallel commercial developments are now leading to general development of air-blast circuit breakers for service for which this type is appropriate. A successful application to the High Court by the E.R.A. for extension of the life of its principal patent in this field presented novel features. The special committee established to apply scientific methods to the study of electricity supply technology shows promise of increasing importance, and the willingness of supply engineers to attend committee meetings dealing with important aspects of this matter provides adequate proof of the interest these subjects have aroused.

For many years the Association has sought to secure that attention should be given in Great Britain to the improvement of magnetic sheet steel commensurate with its importance in the design of electrical plant, and during the year all the interests have been brought together and the problem is receiving detailed consideration. The study of surge phenomena constitutes an important section of E.R.A. work. It is interesting to note the work on development of methods of assessing the liabilities of a given overhead line in relation to lightning based on statistical study, and the application of the theory of development of the lightning stroke. Both the requirements of war-time and prospective post-war needs serve to emphasize the importance of the applications of electricity to food production. Having made timely provision for the study of rural electrification problems and all that arises therefrom, the Association continues to conduct and co-ordinate much useful work in this important field.

ENEMY AIRBORNE RADIO EQUIPMENT

AT a meeting of the Wireless Section of the Institution of Electrical Engineers held on November 24, C. P. Edwards, of the Royal Aircraft Establishment, South Farnborough, presented a paper entitled "Enemy Airborne Radio Equipment". This paper, to be published in due course in the *Journal* of the Institution, contains descriptions, with more than twenty photographs and diagrams, of the most widely used radio-communication installations and aids to navigation found in German military aircraft, with a brief mention also of Italian and Japanese practice. At the meeting, the author demonstrated a complete reassembly of the general-purpose communication installation used in all German bombers, twin-engined fighters and certain flying boats, this whole equipment weighing approximately 360 lb. This installation includes separate transmitter and receiver units for each of two wave-bands, the medium-frequency covering the range 300–600 kc./sec. and the high-frequency units 3·0–6·0 Mc./sec. The equipment is noteworthy for the fact that the number of types of valves required has been reduced to the minimum: in each of the two transmitters, three valves all of one type are used; while the twenty-five valves used in the two receivers and also in the intercommunication amplifier and miscellaneous valve circuits are all of one type.

An advanced type of rotating-loop direction-finder is incorporated in the installation, with provision for aural reception and visual indication of the direction of the incoming signals. The loop itself is of considerable interest, being of a radically new shape with an iron-powder core, and mounted inside the fuselage under a shallow, protecting stream-lined blister. The loop is turned by the aid of a rotary flexible shaft, and the remote scale is mounted concentric with a repeater compass scale, so that radio bearings may be read off directly, either relative to the aircraft axis for homing purposes, or relative to true or magnetic north and corrected for quadrantal error. An additional receiver with visual indicator is provided for use with the Lorenz system of beam approach towards beacons emitting on frequencies in the region of 30 Mc./sec.

The paper next describes the somewhat simpler radio-telephone installation used in the single-seat fighter, giving one spot frequency in the band 2·5–3·75 Mc./sec. The operational frequency requires to be set up before the aircraft leaves the ground, since no remote tuning control is provided. Production of this equipment probably started in 1935, and it is still in general use. Certain aircraft of the single-engine dive-bomber type are fitted with a remote-controlled medium-frequency homing device in addition to the communication equipment. This comprises a fixed iron-cored receiving loop connected to a receiver covering one frequency band of 250–400 kc./sec.

Other German equipment described and illustrated

in the paper comprises transmitter-receiver units for the frequency range 38·5–42·3 Mc./sec. for air-to-air and short-range air-to-ground telephonic communication, and somewhat similar units as fitted in Army co-operation aircraft and covering the range 42·1–47·9 Mc./sec., with additional facilities for telegraphic signalling.

A brief description is also given of the installation, now known to be obsolete, used in an Italian bomber which was shot down on the east coast of England in 1940. As examples of Japanese practice, brief accounts are given of the equipments used in the "Zero" fighters and certain types of Navy bomber.

The paper concludes with a short commentary on the design and lay-out of the various installations examined, and of the materials and components used. Much of this development and production work is undoubtedly very advanced, and the information which the author has collected and reproduced should prove of value to those responsible for the design and manufacture of radio equipment for aircraft.

RESEARCH AND THE IRON AND STEEL INDUSTRY

SINCE the Heterogeneity of Steel Ingots Research Committee started its work in 1924, this aspect of the interests of the Iron and Steel Institute and the British Iron and Steel Federation has progressed continuously. At present, there are in being some twenty-three such research committees of one kind and another, of which the main, in addition to the Ingots Committee itself, are those concerned with the Alloy Steels (1934), Corrosion (1928), and Steel Castings (1934). A review of their work over a period of twenty years was initially prepared by the late Dr. W. H. Hatfield, and has now been issued*. Hatfield's tragic death has removed the one around whom, more perhaps than any other, these committees and their work have revolved.

The data which have been collected during this time have resulted from the joint efforts of the industry itself, the university, governmental and similar institutions, and affords an outstanding example of the fruitfulness of such an association. The present writer, in the past, has not been uncritical, but this publication provides undoubted evidence of the existence of a far more healthy spirit than obtained until comparatively recently, and, further, one which may be believed to be permanent. The ready willingness of so many industrial research establishments to assist in, and to further, the work being done in academic laboratories, is also deserving of special mention. In any future developments envisaged for the encouragement of research into the particular problems of the iron and steel industry, it is a matter of first-rate importance that this collaboration should be maintained, and that no aspect of research activity should be neglected.

The essential purpose of the present report, to give a fairly detailed summary of the work already accomplished by the various committees, is very well done, and a most substantial addition to our knowledge of the nature of steels, their manufacture and properties, has resulted. How widespread have been the interests of these bodies, especially in more recent years, may be illustrated from some of the researches of the Ingots Committee or its offshoots. These have ranged from studies of slag equilibria to the effect of casting speeds; from the use of radioactive materials in the examination of inclusions, to rimming steels. All these are clearly of fundamental importance from the point of view of the technology of the industry, but many are making a by no means unimportant contribution to scientific knowledge in general. In this connexion, it may be sufficient to cite the work on the accurate measurement of the very high temperatures employed in steel-making.

An interesting aspect of the report is the survey of further work already commenced or contemplated. As, from some points of view, the whole scheme has become more and more interesting as time has gone on, these researches will be looked forward to with keen anticipation. F. C. THOMPSON.

* Iron and Steel Institute. Special Report No. 29: Review of the Work of the Joint Research Committees 1924–1943 of the Iron and Steel Institute and the British Iron and Steel Federation. Pp. viii +176.

TREATMENT OF SHOCK BY HEAT

THE principle of treating traumatic shock by the application of heat has become so well established and has been so much emphasized in first-aid services during the War that the investigations done by A. W. Kay, of the University of Glasgow (*Brit. Med. J.*, 40, Jan. 8), will interest many besides the medical profession.

Mr. Kay has studied the effects of heat on healthy young adults, and he points out that the results cannot be properly applied to patients suffering from traumatic shock; but he thinks that they do suggest that we should study more carefully the effects of heat on shocked people. While the condition known as shock is not yet fully understood, it has been believed, as Mr. Kay points out, that heat helps recovery from shock mainly by relieving the vaso-constriction of the cutaneous blood-vessels and so helping the venous return of the blood. It has only recently been suggested that this vaso-constriction may be a compensatory mechanism and that heat may therefore be harmful.

Mr. Kay's subjects were heated in a hot-air cradle to 38–40° C. for one hour, ten of them receiving normal saline intravenously and five of them receiving plasma intravenously throughout this period. Three experiments had to be abandoned because of the severe symptoms (headache, nausea, exhaustion) and anxiety produced. Nine cases showed evidence of dehydration (dry tongue, weakness and thirst) and all cases showed general perspiration and increased pulse-rate. Nausea occurred in six cases.

The essential factor suggested as the cause of these troubles is general peripheral dilatation, which caused a lowering of the arterial blood pressure and a rise of venous pressure. Since most accepted forms of treatment of shock aim at raising the blood pressure, and since the subjects of these experiments showed a constant and progressive lowering of the blood pressure, the *prolonged* use of heat for the treatment of traumatic shock would appear, in Mr. Hay's opinion, to be contraindicated.

An annotation in the same issue of the *British Medical Journal* gives other references to work on this subject done on man and animals. Further work is clearly required, and it is suggested that intracardiac catheterization might open up a new era in the study of cardiodynamics.

FORTHCOMING EVENTS

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

Saturday, March 4

BRITISH ASSOCIATION OF CHEMISTS (LONDON SECTION) (at the Chemical Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Dr. T. J. Drakeley: "Training for the Chemical Industries".

GEOLOGISTS' ASSOCIATION (at the Geological Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Prof. H. H. Read, F.R.S.: "Meditations on Granite", Part 2 (Presidential Address).

Monday, March 6

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Sir William T. Halcrow: "Natural Resources of Great Britain", 3: "Hydro-Electric Power" (Cantor Lectures, 3).

SOCIETY OF CHEMICAL INDUSTRY (LONDON SECTION) (at the Chemical Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Mr. C. M. Whittaker: "The Applications of Dyestuffs to the Newer Synthetic Fibres".

ROYAL GEOGRAPHICAL SOCIETY (at Kensington Gore, London, S.W.7), at 8 p.m.—Mr. K. de B. Codrington: "Valleys of the Hindu Kush".

Tuesday, March 7

ROYAL ANTHROPOLOGICAL INSTITUTE (at 21 Bedford Square, London, W.C.1), at 1.30 p.m.—Prof. Tadeusz Sulimirski: "Some Remarks concerning the Problem of the Origin of the Slavs".

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY (at the University, Manchester), at 5 p.m.—Mr. P. D. Mehta: "Asoka, the Philosopher Emperor".

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 5.15 p.m.—Prof. A. R. Todd, F.R.S.: "The Mode of Action of some Vitamins", 1.*

ROYAL PHOTOGRAPHIC SOCIETY (SCIENTIFIC AND TECHNICAL GROUP) (at 16 Princes Gate, South Kensington, London, S.W.7), at 6 p.m.—Mr. H. D. Murray and Dr. G. W. W. Stevens: "Theory and Practice of Reflex Copying".

Wednesday, March 8

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Mr. J. Paley Yorke: "Education To-day and To-morrow", 5: "Technical Education".

PHYSICAL SOCIETY (COLOUR GROUP) (in the Physics Department of the Imperial College, Imperial Institute Road, London, S.W.7), at 2.30 p.m.—Fourth Annual General Meeting; at 2.45 p.m.—Dr. J. H. Saxby: "The Sub-Committee on Colour Deficiency in Industry; a Progress Report".

INSTITUTION OF ELECTRICAL ENGINEERS (TRANSMISSION SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Mr. E. C. Neate and Mr. W. F. Bowling: "Reinforced Concrete Transmission Line Supports".

Thursday, March 9

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 2.30 p.m.—Sir Jack Drummond: "Food Fads and Food Fallacies".*

INSTITUTION OF ELECTRICAL ENGINEERS (INSTALLATIONS SECTION) at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Mr. Hamlyn Drake: "The Influence of Maintenance Requirements on the Design of Electrical Installation Equipment".

Friday, March 10

ROYAL SOCIETY OF ARTS (INDIA AND BURMA SECTION) (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Mr. Maurice S. Collis: "The Achievement of Burma".

PHILOLOGICAL SOCIETY (at the School of Oriental and African Studies, University of London, Malet Street, London, W.C.1), at 4.15 p.m.—Mr. A. S. C. Ross: "A Finnougrian-Indoeuropean Loanword Problem".

ROYAL ASTRONOMICAL SOCIETY (at Burlington House, Piccadilly, London, W.1), at 4.30 p.m.—Discussion on "Solar Phenomena" (to be opened by Mr. H. W. Newton, Mr. C. W. Allen, Mr. M. A. Ellison and Mr. H. A. Brück).

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 5 p.m.—Prof. D. M. S. Watson, F.R.S.: "Habit and Evolution".*

UNIVERSITY OF DURHAM PHILOSOPHICAL SOCIETY (in the Physics Lecture Theatre, King's College, Newcastle-upon-Tyne), at 5.15 p.m.—Dr. M. P. Applebey: "The Future of Research".*

APPOINTMENTS VACANT

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

LECTURER IN ELECTROTECHNOLOGY in Santa Maria, Chile—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Advertising Section, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. D.763.XA) (March 8).

LECTURER (man or woman) IN BOTANY, a DEMONSTRATOR (man or woman) in BOTANY, and a MUSEUM ASSISTANT (man or woman)—The Secretary, Bedford College for Women, Regent's Park, London, N.W.1 (March 8).

ASSISTANT TEACHER (man or woman, temporary) OF MATHEMATICS at the York School of Commerce—The Secretary for Education, Education Offices, York (March 11).

ASSISTANT MASTER (graduate) TO TEACH MATHEMATICS principally, at the Sheffield Junior Technical School for Boys—The Director of Education, Education Office, Leopold Street, Sheffield 1 (March 11).

SENIOR MATHEMATICS MISTRESS at the Middlesbrough High School for Girls—The Director of Education, Education Offices, Middlesbrough (March 11).

LECTURER IN MATHEMATICS AND MECHANICAL ENGINEERING—The Principal, Derby Technical College, Normanton Road, Derby (March 13).

DEPUTY WATER ENGINEER AND MANAGER on the established staff of a large County Borough in Surrey—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Advertising Section, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. E.887.XA) (March 15).

CHIEF ENGINEER, Port of Basrah, by the Government of Iraq—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Advertising Section, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. E.756.AX) (March 17).

ASSISTANT TO THE REGISTRAR AND SECRETARY—The Registrar, Royal Institute of Chemistry, 30 Russell Square, London, W.C.1 (March 18).

PSYCHIATRIC SOCIAL WORKER (Woman) for Child Guidance Clinic at Harrow—Mr. C. W. Radcliffe, "R.2", Clerk to the Middlesex County Council, Middlesex Guildhall, Westminster, London, S.W.1 (March 18).

ASSISTANT TECHNICAL OFFICER, ASSISTANT DRAINAGE OFFICERS (2), and an ASSISTANT HORTICULTURAL OFFICER, to the Essex War Agricultural Executive Committee—The Executive Officer, Essex Institute of Agriculture, Writtle, Chelmsford (March 20).

LECTURER IN MECHANICAL ENGINEERING—The Clerk to the Governors, Heanor Mining and Technical School, 30 Mansfield Road, Heanor, Derbyshire (March 22).

METALLURGIST (well-qualified) to take charge of Research and General Laboratories, Heat Treatment, etc., in Sheffield Steel Works—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. F.2048.XA) (March 31).

PROFESSORSHIP OF CHEMICAL TECHNOLOGY—The Vice-Chancellor, University of Madras, Triplicane P.O., Madras, India (March 31, by cable; at the same time advise the Office of the High Commissioner for India, General Department, India House, Aldwych, London, W.C.2).

UNIVERSITY LECTURER IN ANTHROPOLOGY—The Secretary of the Appointments Committee, Faculty of Archæology and Anthropology, Museum of Archæology and of Ethnology, Cambridge (April 15).

DRUMMOND PROFESSORSHIP OF POLITICAL ECONOMY—The Registrar, University Registry, Oxford (May 13).

HEADMASTER OF THE PARK HIGH SCHOOL FOR BOYS, and an ASSISTANT MASTER OR MISTRESS (temporary) to teach SCIENCE and MATHEMATICS—The Director of Education, Hamilton Square, Birkenhead.

ASSISTANT TIME STUDY ENGINEER—The Ministry of Labour and National Service, Appointments Office, 2 Calthorpe Road, Five Ways, Birmingham (quoting Reference No. 691).

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Department of Scientific and Industrial Research. Index to the Literature of Food Investigation. Vol. 14, No. 4, March 1943. Compiled by Agnes Elisabeth Glennie, assisted by Catherine Alexander. Pp. iv+227-304. (London: H.M. Stationery Office.) 4*s.* 6*d.* net. [241

Geological Survey of Britain: Scotland. Wartime Pamphlet No. 27: The Oil-Shales of the Lothians—Structure. Area 4: Philpstoun. By Dr. W. Q. Kennedy. Pp. 34. (London: Geological Survey and Museum.) 1*s.* 9*d.* [251

Memoirs of the Cotton Research Station, Trinidad. Series A: Genetics, No. 20: The Efficiency of Progeny Row Breeding in Cotton Improvement. By J. B. Hutchinson and H. L. Manning. Pp. 16. (London: Empire Cotton Growing Corporation.) 2*s.* 6*d.* [271

Office Organisation and Practice. (Office Aid to the Factory Series.) (B.S.1100, Part 10, 1943.) Pp. 64. (London: British Standards Institution.) 2*s.* 6*d.* [271

Department of Industry and Commerce: Geological Survey of Ireland. Emergency Period Pamphlet No. 1: A Short Review of Irish Mineral Resources. By D. W. Bishop. Pp. 20. (Dublin: Stationery Office.) 9*d.* net. [281

Other Countries

Research Council of Alberta. Report No. 34: Geology. Part 1: General Geology of Alberta; Part 2: Rock Salt Deposit at Waterways; Part 3: Geology of Alberta Soils; Part 4: Relief Model of Alberta and its Geological Application; Part 5: Coal Areas of Alberta. By Prof. John A. Allan. Pp. 202. (Edmonton: Research Council of Alberta.) 1.50 dollars. [181

Annals of the New York Academy of Sciences. Vol. 45, Art. 1: The Relation between Centriole and Centromere in Atypical Spermatogenesis of Viviparid Snails. By Arthur W. Pollister and Priscilla F. Pollister. Pp. 48. (New York: New York Academy of Sciences.) [201

Cooper Union for the Advancement of Science and Art. Eighty-fourth Annual Report for the Year ending June 30, 1943. Pp. iii+147. (New York: Cooper Union.) [201

U.S. Department of Agriculture. Technical Bulletin No. 854: Life History and Habits of the Peachtree Borer in the Southeastern States. By Oliver I. Snapp and J. R. Thomson. Pp. 24. (Washington, D.C.: Government Printing Office.) 10 cents. [201

U.S. Department of Agriculture. Circular No. 684: Studies on Nicotine Fumigation in Greenhouses. By Henry H. Richardson, J. W. Bulger, R. L. Busbey, R. H. Nelson and C. A. Weigel. Pp. 16. Circular No. 687: The Hessian Fly and its Control by Late Sowing of Wheat in Oklahoma and Arkansas. By J. R. Horton, E. T. Jones and F. M. Wadley. Pp. 10. 5 cents. (Washington, D.C.: Government Printing Office.) [241

Printed in Great Britain by FISHER, KNIGHT & CO., LTD., The Gainsborough Press, St. Albans, and published by MACMILLAN & CO., LIMITED, at St. Martin's Street, London, W.C.2, and THE MACMILLAN CO., 60 Fifth Avenue, New York 11, N.Y., U.S.A.—Saturday, March 4, 1944.