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HUMAN PROBLEMS IN THE DISPERSAL OF INDUSTRY

IN the White Paper on Employment Policy, as one method of dealing with the problems of local employment and securing a balanced distribution of industry and labour, the Government proposal is to exercise a substantial measure of control over the location of new industrial development, as is contemplated in the Barlow Report. The importance of such measures has been repeatedly emphasized in various connexions, particularly with reference to such regional proposals as the Greater London plan recently prepared by Sir L. P. Abercrombie, of which a limited working edition has been released to the Press and to the local authorities. Nevertheless, it is clear that so far there are no powers for giving effect to such regional plans ; nor, if and when such powers are forthcoming, is the regional planning machinery adequate for the purpose. Furthermore, it is by no means certain that public opinion is yet prepared to accept the limitations on personal freedom and initiative implied in any large-scale measure of regional or national planning.

It is this last point that may well prove a crucial difficulty. The agitation against controls in general, and the extravagant form which the recent protest against the transfer of Civil Servants involved in the proposed location of the Ministry of National Insurance at Newcastle-on-Tyne took, are pointers to which the planners must pay full attention. No blueprints or plans, on the regional, the national or the local scale, will have their full effect or be tolerated for long by the community, save in so far as they give expression and satisfaction to the hopes and needs of individual men and women, and secure the integration, and not the suppression, of the individual, with the purposes and needs of the community as a whole.

This individual and personal point of view is commonly overlooked in planning, and yet it is the one that is most vital if the plans are to be accepted and executed by the community and for the community. The report of the Social and Industrial Commission of the Church Assembly, in "The Church and the Planning of Britain", has commented on the failure of the most recent housing developments to provide adequate facilities for a natural community life, and on the social disintegration involved in enforced migration. The County of London Plan, for example, was prepared on the general assumption of the removal of about half a million people from the London County Council area, and the Greater London plan involves the resettlement of roughly a million people altogether from the County and from the first two rings—'suburban' and 'green belt'—around it. A quarter of those, it is suggested, should go to existing towns, and nearly 400,000 to eight entirely new satellite towns, mainly in the 'outer county' ring ; a further quarter of a million should go right off the map beyond the orbit of the plan ; while 125,000 would be accounted for by existing immediate housing schemes.

Population movements of this scale are quite impossible without a parallel and co-ordinated decentralization of industry; and in the Greater London plan great care has been taken to select the new sites with full reference to their industrial suitability. The choice of brand new towns as the main reception areas for decentralization is a bold feature of the plan; but the experience of the trading estates and of the Commissioners for the Special Areas shows how difficult it is to attract both industry and workers to new rather than to existing centres. Moreover, the experience of the compulsory uprooting involved in decentralization and dispersal from London under the emergency of war does not encourage excessive optimism as to the welcome which further uprooting and dispersal would receive generally. Willing acceptance will mean the clear and painstaking explanation and demonstration of the benefits to efficiency and welfare of firms and workers which will result.

The vital importance of such educational work clearly emerges from the important study of dispersal made by the National Council of Social Service at the request of the Bank of England, which has now been published*. This inquiry was concerned with the location of clerical and administrative staffs of considerable size, whether attached to industrial organizations or not. It is not concerned with industrial location as such, but this attempt to analyse the social advantages and disadvantages of dispersal as a permanent arrangement clearly has a close bearing on the centralization or decentralization of large scientific and technical organizations such as research institutions, as well as head-office administrative staff in the usual sense. The study covers the general national interest, the interests of the organization concerned and of the reception areas as well as of those vacated, but is of special importance for the prominence given to the point of view and interests of the staff affected, hitherto largely neglected in such discussions. To this the longest two chapters of the report are devoted, for that on educational and health services is essentially a further elaboration of a subject of special importance from the point of view of the staff.

So far as war-time experience is concerned, the Committee, of which the Right Hon. Walter Elliott was chairman, is convinced that dispersal is both desirable and possible. To secure a happier social life generally, the sundering of the family by the ever-lengthening daily journeys of its units and the growing concentration of population in and around a few large cities must be arrested. The war-time evacuation took place under unfavourable conditions, and many of the elements of the planning that was essential to full success were absent. It is the more important to see that the lessons to be learned are applied in preparing the basis of permanent schemes.

From the conflicting evidence, the Committee derives the impression that, of the reception areas, fairly large towns of 40,000–100,000 inhabitants, with good cultural facilities, usually gave most satisfaction. Except for a few quite small staffs, evacuation to villages or to large houses in open countryside has been unpopular. It allayed unrest if at least one director or other highly placed official lived on the spot; and it helped immensely to be within easy reach of the home city, and to have facilities for occasional visits to it.

While it is now proved that dispersal is a practical possibility, given sufficient incentive, it seems clear that the majority of heads of organizations regard evacuation as a war-time expedient and intend to return as soon as the War ends. There is little doubt that the majority of the evacuated staffs, too, would vote for a return after the War to London or whichever other city they left. It is something, however, that a substantial minority of the workers should no longer yearn for the city; and this minority may be an important factor in the success of that planned dispersal which is so overwhelmingly desirable in the national interest.

The selection of the town for dispersal is only the first factor requiring consideration, and in this selection regard should be had not only to the town as it now is, but rather to its future possibilities. Closely related is the question of re-housing, and here the report suggests the formation of a housing association to avoid the objections to company houses and to municipal houses. Again, it is pointed out that there is a strong case for widening the powers of borough councils under the Housing Acts already in existence.

Scarcely less important is the question of educational provision. Here the report notes that while under the Education Act a considerable improvement in the unequal distribution of the main types of educational provision may be expected, there may be a difficult transition period during which the most prudent selection of reception towns will be necessary in order to relieve the apprehensions of many employees with regard to education—and to medical and health services also. Many towns of moderate size offer satisfactory provision to parents of moderate means; but the town needs to be selected with care, and the most important consideration at present is that the local authority should be progressive and generous. Similarly with regard to medical and health services, disadvantages compared with the great cities need not be serious so far as most of the minor ills are concerned, but the existence of a well-managed hospital, with a number of private beds at a reasonable cost, is a matter of great importance. Fairly easy access to a great city or university town where there are medical schools and special facilities is also important.

Provision for the use of leisure is of great importance also, though here it is clear there are certain misconceptions and misunderstandings to remove Facilities for indoor recreation are usually much better and much dearer in great cities than in small and medium-sized towns. For outdoor recreation the reverse is generally true. Here the report, stressing the importance of good public libraries, urges the

* Dispersal: an Inquiry into the Advantages and Feasibility of th Permanent Settlement Out of London and other Great Cities of Offices and Clerical and Administrative Staffs. Made by the National Council of Social Service. Pp. x+96. (London, New York and Toronto: Oxford University Press, 1944.) 3s. 6d. net.

value of the greater opportunity for participation in communal and municipal life in the medium-sized town. This is regarded not merely as affording a way of self-expression and integration with the community; it is urged on employers that the scope provided in this way for young people to take an active part in the civic and social affairs of their neighbourhood will bring them experience which may enhance their qualifications as future managers and directors.

The relative advantages of provincial towns in this connexion, as compared with large cities, require further exploration before this argument can be used in favour of dispersal; but here, as elsewhere, the report indicates the factors which have to be taken into account and also some of the fallacies responsible for present preferences. This indeed is the main value of the report, which never suggests that the experience gained in the evacuation of the 200,000 or more employees with which it is directly concerned is all that is relevant. On the contrary, it points to other recent migrations, such as that into the Home Counties during the years 1927–39, the settlement of coal-miners in the new Kentish coalfield, the growth of new housing estates such as Becontree, and the settlement and development of Corby, which although not strictly parallel, represent experience from which, with due care, useful inferences can be drawn.

Assuming that dispersal is agreed upon as a policy, there are three phases to be distinguished: the first period of transition, possibly a year or more, when the actual transfer from the old to the new location is made; a second period, ending only when the generation of those transferred has passed; and the final settled period, when the staffs, or the overwhelming majority of them, had been recruited to serve in that locality. Only then will the considerable social stresses involved in dispersal disappear; and it is the existence of such inevitable social stress that gives enhanced importance to such questions as salaries and hours of work, and generous treatment in regard to removal expenses and housing, and prospects of promotion.

Finally, the report emphasizes the overwhelming case in the national interest for some measure of dispersal so far as London is concerned, and urges that the Government should assist by making it clear that it is in favour of such a policy and participating whole-heartedly in any general movement in respect of its own staffs. It should use its influence with large organizations to induce them to disperse. It should request local authorities to give all possible help in reception areas, and if local authorities need new powers to enable them to play their part adequately, as for example, in housing, the Government should see that the necessary legislation is introduced. Parliament may reasonably be asked to give financial assistance to local authorities to enable them to play their part.

As already indicated, it is as a stimulus to the further examination of the problems involved and for its welcome emphasis on the personnel factor that this report is most valuable. It never claims too much, but it does demonstrate that dispersal is practicable, and that it could be made a success if those concerned will give the necessary attention to the all-important details of planning, and above all to what may be best described as digging the channels of assent. Government support is essential, not the least because the full implementation of its expressed intentions as to the development of education, medical and health services and social insurance are vital factors in promoting mobility, while its powers with regard to building and other priorities could also be used constructively to give positive assistance to a dispersal policy and programme. The integration of the individual citizen affected into a new community, giving him or her full satisfaction, will never be achieved by direction from the top alone; the difficulties of personnel so lucidly outlined in the second appendix to this report must also be handled with sympathetic insight, with wisdom, courage and vigour. The support and co-operation of the staffs concerned must be secured by putting before them clearly and convincingly the national and communal reasons which make dispersal to-day imperative.

THE VAGABOND LIFE

Gypsies of Britain

An Introduction to their History. By Brian Vesey-FitzGerald. Pp. xvi+204. (London: Chapman and Hall, Ltd., 1944.) 15*s*. net.

READERS of *Nature* are probably familiar with Mr. Vesey-FitzGerald's name as a prominent naturalist and a distinguished chiropterist (he even shelters young bats inside his vest, feeding them with gentles held in his mouth). They may know further that he was for long the natural history editor, and is now editor, of *The Field*. But few know him as a writer of one brilliant story dealing with the episode of Sisera and Jael, and still fewer, until this year, knew that he is as much of a gipsy as anyone other than a pure Romany can be. Now he has given us a most interesting book on the gipsies of Britain. For the accuracy of this book I can vouch, because in the course of a medical experience of more than fifty years I, too, have studied gipsies and doctored all who came my way, in all sorts of conditions, from the heaths of West Cornwall to the open fairs of East London.

That the book is thorough no one opening its pages and looking at its table of contents could question. I have spoken of its accuracy. Its ultra-modesty is perhaps its only flaw. In his prefatory remarks, the author "acknowledges his indebtedness" to dozens of persons, not one quarter of whom could hold a candle as authorities to Mr. Vesey-FitzGerald himself. I am inclined to think that he has been rather taken in by fictitious pundits as to the nature of the Romany language, though he, himself, correctly uses and pronounces several words known to all true Romanies. I like him best when he talks really first-hand. He first read "Lavengro", that half-fictitious classic, when he was sixteen; but, he says, "I first knew a Gypsy when I was seven or thereabout. Then an itinerant harper came through the little country town where we lived. Father liked the harp and he liked characters too, and for several days the man came and played his harp outside our house. Father

talked to him and I would go out and listen, and the man would always talk to me also. . . . My father was a great walker. And from the time that I was eight he would take me with him on many of his walks. . . . Among the people we got to know on these walks were tramps and several families of Gypsies, who travelled the area. I had my first food in gypsy encampment when I was nine. I had my first meal alone in a Gypsy encampment when I was eleven".

People are apt to confuse real Romanies or such as carry on the true Romany tradition though not, perhaps, 'pure-bred' with all kinds of road travellers owning caravans or carts, with or without tents. Hence the bad repute into which the whole of gipsydom has fallen among the ignorant section of the public. The nearest approach to anything that can be called fraud which can be fairly attributed to gipsies are fortune-telling, and sometimes horse-coping. They are not thieves, though they may use some hazel-rods to make their tents with, or odd bits of wood lying about for their camp fires. They do not suck blood or run away with other people's children; they generally have quite enough of their own. They treat their animals well—indeed, almost as members of the family.

One of the most interesting chapters of this book is that devoted to gipsy marriages and marriage customs. The author has always found gipsy girls to be modest and chaste in their bearing, though, he says, this does not apply to their speech. Gipsies look upon marriage rather differently from ordinary conventional people in Britain. Quite often they are polygamists, as is illustrated in Borrow's writings. After all, gipsies are Oriental in origin. Mr. Vesey-FitzGerald gives an example, observed by himself, of the difference between the Oriental code and the English code. He tells us that, some years before the War, he was staying at the same hotel in France as was a very rich Oriental. "He had four wives (three of them English, and the fourth German) and they all lived together." Yet the gipsies are very keen on pre-nuptial chastity. At one time—not so very long ago—English gipsy girls used to wear a sort of girdle of chastity "made of wool mounted on catskin, from the age of twelve until the wedding day. It was fastened on by the mother every morning and removed by the mother every night, and was carried before the girl as a token of her maidenhood when she was married". According to Philip Murray, a friend of Prof. Sampson, it was then kept by the husband until it was required by the eldest daughter. Murray was an Irish tinker, who married into one of the many Gipsy Smith families. Of course, all these things have long disappeared; but a high degree of real modesty is still almost universal.

Very interesting chapters of this book are devoted to the early and the recent history of the gipsies in England and Scotland. We are told that James V signed a writ of the Privy Council of Scotland by which the gipsies were granted astonishing privileges. This writ was in effect a treaty between the King of Scotland and John Faw, a leading member of the tribe, whose name will be familiar to readers of S. R. Crockett's novels.

Interesting, also, is the chapter devoted to "Gypsy Waggons". Though not all gipsies own 'waggons', all seek their possession. The waggon is the gipsy's most valuable property. "It is home, and in it he carries his most treasured belongings—clothes, linen, china, a few photographs, perhaps medals won by himself or his family in the last war. But no true gipsy ever talks of a caravan—unless he means one of those luxurious edifices that in the piping days of peace we used to see trailing behind fast cars—he talks of a waggon or a van. And the word *vardo* really means living-waggon". In 1840, the year of publication of Dickens' "Old Curiosity Shop", we got a full description of Mrs. Jarley's waggon or caravan. That caravan is fundamentally like the caravan of to-day. The author of the present book gives a very complete and accurate picture of the typical living waggon now used. "It is a one-roomed house on rather high wheels, with windows at the back and sides and a door and detachable steps at the front. There is a rack (known as the *cratch*) at the back for carrying domestic articles of various kinds, and underneath the waggon at the back there is built a cupboard (known as the pan-box) which serves as larder and kitchen cupboard. Inside the waggon, behind the door, are a coal-stove, with a chimney projecting through the roof, a cupboard and a locker-seat. On the other side there is a corner cupboard for china, a chest of drawers in which is kept the family wardrobe and the family linen, and another locker. The whole of the back part is occupied by a two-berthed sleeping place. Naturally, just as there is some variation from waggon to waggon in external design, so all waggons are not fitted exactly in this way. But the variation inside is so slight that this description may truly serve as a standard."

Not all gipsies, however, possess or desire such a luxurious home as this. I well remember when I was in practice in Cornwall, a plot of heathland on which was a sort of permanent encampment, consisting of several caravans and tents, with fires burning, and every morning proceeding from it a little slim old lady, aged eighty-two or eighty-three, walking with a good stride and bolt upright, balancing on her shoulders two long poles from which were suspended baskets, and strings of clothes-pegs—two common products of gipsy industry—marching off to the neighbouring villages to offer her goods for sale. One day she confided to me that she was born under a hedge and, pray God, she hoped to die under a hedge.

But to return to Mr. Vesey-FitzGerald's book. There are chapters on gipsy medicine, fortune-telling, social organization, death and burial and other matters. It is to be hoped that this book will be widely read, and induce among hitherto prejudiced readers a little tolerance towards, and understanding of, gipsy ways and gipsy characters.

HARRY ROBERTS.

BRITISH ELECTRIC POWER STATION PRACTICE

Electric Power Stations

By T. H. Carr. Vol. 2. Second edition, revised and enlarged. Pp. xii+549. (London: Chapman and Hall, Ltd., 1944.) 32*s*. net.

IN the review of the first volume of the above work (*Nature*, 153, 729; 1944), attention was directed to the importance of electric power stations, and it is evident that public interest in these is increasing, partly due to certain controversies which have arisen regarding interference with amenities, but largely because of the growing realization of the value of electricity in everyday life.

The second volume now appears in its second

edition. It describes condensing plant, feed heating, and water treatment plants, and then deals with electrical machines and equipment. Supplementary chapters are devoted to plant-testing organization, station costs, fire-fighting and air raid precautions. It will at once be seen that the division of the material between Volume 1 and Volume 2 is illogical, as it would have been preferable to have had all the main steam and water components in one volume, leaving the second mainly for electrical plant.

It is doubtful if anyone inexperienced in power station practice could derive much benefit from reading this volume. Individual chapters are too elementary and inconsequential to be of value to well-informed specialists. Practically every one of them is a jumble of descriptive matter, empirical formulæ and so-called tables of data. The arrangement is haphazard, and it appears that the author merely introduced tables of data at random.

Power station engineers are, however, a class apart, and many of them may find the volume acceptable because of the numerous references to troubles which have been experienced, and the descriptions of means whereby their recurrence can be prevented. A certain pleasure is also to be derived from the evident enthusiasm and energy of the author which is revealed throughout the work. His benevolent interest in the humanitarian side of management is frequently brought out in a commendable manner.

Alternators, transformers and reactors, switchgear and cables, which constitute the main components of the electrical equipment of a power station, are described tolerably clearly, and are illustrated by familiar examples from everyday British practice. Station auxiliaries, their connexions and methods of supply, have constituted a subject of controversy for many years, and a good deal of useful information is provided regarding the numerous alternatives, but the author does not come to any specific conclusion as to order of merit.

Considerable emphasis is laid on electrical protective equipment for power station plant, and the chapter dealing with this subject would serve as a useful introduction to protective gear installation and maintenance.

Another subject of first-rate importance is commissioning and testing of plant. Here again, the relevant chapter provides good introductory matter.

Power station capital and operating costs reveal in condensed and generally understandable form the economic efficiency. The short chapter on this subject gives guidance as to the best subdivision of costs, and the examples provided are of value in that certain of them are related to definite and fairly recent years, so that anyone wishing to proceed further with the analysis can relate the costs to the appropriate basic prices of materials of construction.

Most of the illustrations are good and interesting. Many of the line diagrams in both the steam and electrical sections are clear, and provide the reader with much better information than does the context. This is particularly the case in regard to Fig. 386, in which a typical metering arrangement for a power station and its interconnecting circuits is given. This diagram is clear, but the associated descriptive matter is relatively inadequate.

Each chapter has appended to it an extensive bibliography; but the author has shown no discrimination in his choice of the material included in these bibliographies, and has not even taken the trouble to arrange the items in a logical, convenient manner.

After studying this volume, the reviewer was irresistibly reminded of occasional visits to the Caledonian Market. There one sees heterogeneous collections of more or less useful articles, and occasionally there is something to be found of real value. There is a place in the scheme of things for both Caledonian Markets and works of the type now considered.

C. W. MARSHALL.

A DICTIONARY OF PHILOSOPHY

The Dictionary of Philosophy
Edited by Dagobert D. Runes. Pp. viii + 343. (London: George Routledge and Sons, Ltd., 1944.) 27*s.* 6*d.* net.

THIS is a single volume, easy to handle and read, containing explanations of philosophical terms and outline accounts of schools of thought, special subjects and individual thinkers. It looks as though the efforts of a number of specialists had been put together in alphabetical order with little editing. Many of the articles are just right; for example, that on 'Hegelianism', and most of the definitions of Aristotelian terms. A few articles are too brief for clarity; many are too long and try to do too much.

The article on 'Scholasticism' aims at stating the name of every writer, medieval and later, so that the subject-matter of their writing is completely lost. Worst of all, it gives no references. To allot six columns to Husserl's 'Phenomenology' as against three for 'Kantianism' is out of all proportion. Symbolic logic spreads all over the place. So much so, that if an innocent biologist (who spends his life classifying) were to look up 'Class' and 'Class Concept', he would find something he could not understand until he read the text-book. After he had read it, he would discover it was no use to him. There is not even a cross-reference to 'Kind', where Mill, who has something useful to say, is referred to. Political theory comes off badly. The article on 'Political Philosophy' tries to say everything and has no references; those on 'Duty', 'Right' and 'Natural Law' are scarcely adequate; that on 'Liberty' omits the political sense; there is nothing under 'Sovereignty'; nor under the names: Dante, Marsilius, Bodin, Hooker, Burke, Paine, Malthus. Most surprising of all, in a book from the United States, there is an article on 'Aristocracy' but none on 'Democracy'. The treatment of psychology is patchy.

Very few British philosophers appear to be known across the Atlantic. Of the thinkers of the seventeenth and eighteenth centuries, Cumberland, Joseph Butler and Richard Price are absent, and Cudworth is the only Platonist to appear. At least a dozen nineteenth and twentieth century British names are absent that are up to the standard of those included. The treatment of Greek thinkers, apart from Plato and Aristotle, is meagre and conventional. Aristippus, who is little more than a myth, appears, along with a wholly mythical grandson; but not Hippocrates, who profoundly influenced Greek and all subsequent thought. Euclid is there but not Aristarchus or Archimedes. Indian and Chinese philosophy are dealt with; how adequately the reviewer does not know. Casual inspection seems to show that in the matter of ambiguity of terms the Chinese have little to learn from Europeans.

A really ruthless editor could turn the material in this quite useful book into a very valuable work of reference.

A. D. RITCHIE.

PHOTOGRAPHY WITH THE ELECTRON MICROSCOPE

A MEETING was held on November 25 at the Royal Photographic Society's rooms in London to discuss the use of photographic materials in the electron microscope. The meeting was arranged jointly by the Scientific and Technical Group of the Royal Photographic Society and the Association for Scientific Photography.

The first speaker, Mr. G. Parr, gave a brief description of the principles of the electron microscope based upon analogy with the well-known optical microscope. Mr. L. V. Chilton, of Ilford, Ltd., followed with a paper written jointly by himself, Dr. E. M. Crooks and Dr. F. M. L. Sheffield, both of the Rothamsted Experimental Station, dealing with the behaviour of a range of photographic materials in the R.C.A. electron microscope Type B. The meeting was concluded by Dr. D. G. Drummond, of the British Cotton Industry Research Association, who showed a number of examples of the use of the electron microscope in cotton research.

Apart from early sporadic uses of photographic materials to record the variations of energies in electron beams, probably the first industrial use was in the continuously evacuated cathode ray tube. The type of tube employing a fluorescent screen is, however, much more popular, and while special problems occur, the behaviour of the photographic material is not dissimilar from its behaviour under ordinary conditions of light exposure. The photographically effective light emitted by the screen is usually blue or green, so that no abnormal problem arises in colour sensitization. A camera of the conventional type is usually used, and the only significant divergence from standard practice is the extreme shortness of exposure time which is inevitable in the photography of rapid transient phenomena. Exposure times may be as short as 0·00001 sec., and under these conditions the relative speeds of two materials may be reversed when compared with their relative speeds as measured at an exposure time of, say, 0·01 sec.

Little work seems to have been published on the behaviour of different photographic materials to the electron beam of the continuously evacuated cathode ray tube, and with the development of the electron microscope such an investigation has become more than ever necessary. A valuable contribution has been made by the authors of the joint paper read by Mr. Chilton, in which the results of tests carried out on a range of Ilford plates are described. Immediate application of the results was required for the photography of plant viruses, which give very poor contrast; and in consequence the range of materials tested was chosen for their relatively high contrast as normally measured by exposure to light.

It would be expected *a priori* that the density produced on a photographic material would depend upon the beam current and the accelerating potential. The beam current is analogous to the intensity of light and the accelerating potential to the colour. Exposures were made over a range of beam currents, and the logarithm of the value plotted against the density produced yields a characteristic curve for a given accelerating potential. By varying the accelerating voltage, a family of curves can be obtained which should show in what manner speed and contrast vary with voltage for each material. A difficulty arises which is peculiar to electron microscope technique; as the voltage is changed, the focal lengths of the 'lenses' change and this alters the current density. The correction is calculable, but the authors used a method originally due to the National Physical Laboratory in which the brightness of the image as seen on the willemite viewing screen is compared with a comparison patch of light projected adjacent to the screen through one of the viewing ports. This enables the magnification to be altered as the kilovoltage is altered to maintain equal visual activation of the screen for a constant beam current.

Several interesting features were revealed by the results. A voltage-range from 15 to 60 kv. was explored, and in all the plates tested there was a marked tendency for the contrast to rise as the kilovoltage was increased. Over the range examined the relation between kilovoltage and contrast was linear, though in some cases there was an indication that at high kilovoltages a limiting contrast was being approached, as would be expected. At low kilovoltages there is a tendency for the characteristic curve to decrease in contrast at medium densities as if a relatively low maximum density was being approached. Because the contrast increases with voltage, it must not be assumed that high kilovoltages should be used for objects showing low contrast. The effective contrast of the object may itself be dependent on voltage in much the same way that an object exhibits lower contrast the higher the voltage used in the tube in radiography. The analogy cannot be pushed too far and is only given as an example. The behaviour of objects under electron bombardment may vary, so no general principles can at present be formulated, though visual observation of the willemite screen suggested in the case of plant viruses that there is a small increase of contrast with voltage. It is suggested that the decrease of contrast at lower kilovoltages is caused by the increased absorption of electrons in the outermost layer of gelatin in the photographic plate, an absorption which will be more effective the lower the energy of the electron beam. This theory suggests that the special Schumann plates in which the silver bromide crystals project through the gelatin surface (probably with a very thin covering layer of gelatin) might be worthy of trial. These plates are used for ultra-violet spectroscopy in the region where gelatin has a very high absorption.

A comparison of the relative speeds of the various photographic plates examined also yields interesting data. The exposure time given in the electron microscope was 10 sec., this figure being chosen because of the difficulty of manipulating the shutter to obtain reproducible shorter exposures. At the same time serious difficulty was experienced in maintaining constant beam current during exposures due to mains fluctuations. Both these matters might well receive attention in the design of future instruments. In addition to the electron exposures, all materials were exposed to light of various intensities for 10 sec. under normal sensitometric conditions to obtain characteristic curves to light for comparison.

At any given kilovoltage the order of relative speeds, as measured by the exposure necessary to produce a density of 1·0, 2·0 or 3·0, was roughly the same for electrons as for light, except in one instance in which the sensitivity to light was substantially augmented by colour sensitization. The total range

of sensitivities to electrons was much compressed compared with the range to light. At a density of 2·0 the total range of speeds to light was 100 to 1, whereas to the electron beam at 45 kv. it was only 13 to 1. This is not surprising when it is remembered that the photographic materials in question were made primarily for exposure to light. Quite apart from colour sensitivity, the speed of a photographic emulsion to light depends on a number of factors. In general, the larger the silver bromide grains in an emulsion the greater the speed; but even at constant grain-size a wide range of speeds can be produced by the technique employed in making the emulsion. According to modern theory, the primary action of radiation in latent image formation is the release of electrons within the silver bromide crystals. Apart from the possibility of recombination, these electrons fall into 'traps' which become charged and can then hold and neutralize the mobile silver ions, thus forming specks of metallic silver in their immediate neighbourhood. When the specks have grown to a certain minimum size the grain is rendered developable. It is believed that the initial size of the specks or electron traps is determined by the emulsion-making technique; the larger the specks, provided they are not sufficiently large to render the grain developable spontaneously, the greater the sensitivity to light. A delicate balance in all grains is not possible, so if few are to be spontaneously developable, the majority will require a significant number of added silver atoms to raise them to the necessary size. It is therefore probable that the absorption of a number of light quanta is necessary to render a grain developable, and control of sensitivity can be effected over a wide range by adjustment of speck-sizes during making. When the same emulsions are exposed to X-rays or high-velocity electrons, the energy of the quanta being many thousands of times greater, it may be that the absorption of a single quantum is sufficient to provide enough electrons to enable even relatively insensitive specks to reach dimensions sufficient to render the grain developable.

This argument is necessarily only given in brief, but it suggests that sensitivity to light is much more dependent on the condition of the sensitive specks than is sensitivity to electrons or X-rays. Sensitivity to high-energy quanta would be expected to depend on the probability of a quantum being absorbed, and thus more on grain size. It is indeed possible to produce emulsions relatively very sensitive to X-rays and at the same time relatively insensitive to light, and such materials are marketed for use without fluorescent screens.

Returning to the results communicated by Mr. Chilton, he and his co-authors endeavoured to find the relation between photographic speed and kilovoltage of the electrons. This was complicated by the fact that the reference standard between the different kilovoltages was the brightness of the willemite viewing screen. Some idea of the efficiency of the screen in converting electron energy into light energy was obtained, and it was then possible to make a rough correction to the exposure axis so that direct comparison of speed at different kilovoltages was possible. This revealed that the variation with kilovoltage of speed as measured by the density produced by an arbitrary standard exposure was different for the various plates examined. In some there was little change over the range of kilovoltages used, in others the photographic speed increased with kilovoltage and reached a maximum near the upper limit of the range, and again in others there was a steady rise over the whole range.

These results show clearly the necessity for a fuller investigation, and it is to be hoped that the authors will be able to extend their work to cover a wider range of materials and conditions. Other workers have published results of a similar nature, some of which are in general agreement with the results discussed here. Substantial disagreement between results obtained by different workers is not unusual where photographic materials are concerned and should not be taken to indicate anything but the uniqueness of every photographic emulsion type. Special mention may be made of work published by von Borries (*Physikal. Z.*, 43, 190; 1942) using Agfa and Perutz plates, which shows substantial qualitative agreement in all points with the Ilford plates used in the tests described.

There is no doubt that there is much to be learned about the technique of electron micrography of different subjects, and the selection of the most suitable photographic material and its treatment. It must also be remembered that manufacturers have not yet made any attempt (or at any rate no outwardly apparent attempt) to make plates specially suited to the needs of electron microscopy. Such a development may be expected when more is known of the requirements and a demand is made for special materials, just as has occurred in the case of X-rays, and more recently in the photography of the cathode ray tube screen.

The authors of the papers who contributed to a well-attended and most successful afternoon meeting are to be congratulated on arousing interest in such an important subject, and making so valuable a contribution, which it is hoped will whet the appetite of other workers in the field who are fortunate enough to have the necessary equipment for further investigations. The full text of the papers is to be published in the *Photographic Journal* early this year.

STRUCTURE OF DIAMOND

DIAMOND is generally thought to be one of the most perfect crystals occurring naturally: its atomic structure was first investigated in the very early days of X-ray crystal analysis. It turned out that the atoms of the crystal were arranged on two interpenetrating face-centred cubic lattices, the corner of one cube lying one quarter of the way along the cube diagonal of the other. Whether the resulting crystal possessed full octahedral symmetry or was of the lower tetrahedral type, a question on which crystallographers were divided, could not be settled by the additional X-ray evidence. Some ten years ago, new interest in the structure of diamond was aroused by the work of Robertson, Fox and Martin[1], who showed that the infra-red absorption and ultra-violet transparency of diamonds placed them in two classes. Of the two types, the first and commoner was opaque to both infra-red and ultra-violet radiation, while the second, Type II, is rare and is transparent to these radiations. The more recent X-ray investigations of Lonsdale and Smith[2] have shown that although the two types are structurally identical on an atomic scale, there are abnormalities in the diffraction patterns of Type I diamonds which suggest some kind of 'mosaic' structural difference in the two

types. Dr. Lonsdale's observed effects are in fact very similar to the kind of abnormality observed in the X-ray spectra of age-hardened alloys and alloys with high magnetic coercivity; they suggest a laminated structure.

There has recently appeared in India a "Symposium of Papers on the Structure and Properties of Diamond" inspired by an idea due to Sir C. V. Raman[3]. The symposium runs to more than 150 pages and contains seventeen papers by Raman and his colleagues. The fundamental idea, contributed by Raman, is that there are four structurally possible arrangements of carbon atoms which are all in agreement with X-ray data. Two of these, which, following Raman, we may label *Td* I and *Td* II, will give a crystal with tetrahedral symmetry; and two, *Oh* I and *Oh* II, will produce the full octahedral symmetry. The two tetrahedral types are physically identical but geometrically different: the octahedral types are physically distinct and might have slightly different lattice parameters.

Raman then supposes that something in the nature of twinning or parallel growth of these different but closely allied types occurs. Twinning of the two *Td* types would be difficult to detect as it would produce little, if any, internal strain on the crystal. But union of a *Td* with either of the *Oh* types might be detectable as a result of strains due to slightly different lattice spacings. Twins of the two *Oh* types might also produce observable strains. Raman thus suggests that there are more than the two types recognized by Robertson, Fox and Martin, and that some diamonds may be 'mixtures' of the different types. The position can perhaps be best summarized in tabular form; the lower part of the table is derived from material taken from the Indian symposium.

Type I		Type II
Numerous. Infra-red absorption. Opaque to ultra-violet. Blue luminescent. Abnormal X-ray spectra.		Rare. Transparent to infra-red. Transparent to ultra-violet. Not luminescent. Normal X-ray spectra.
Tetrahedral. *Td* I or *Td* II, physically identical	Mixed. Twins of *Td* and *Oh*.	Octahedral. *Oh* I and *Oh* II, physically distinct.
Birefringence Patterns.		
Non-isotropic (but anisotropic according to R. F. and M.).	Related to structure.	Related to structure (but isotropic according to R. F. and M.).
Luminescence Pattern.		
Uniform blue luminescence.	Blue and yellow pattern of lines and dark patches.	
X-ray Topography.		
Uniform intensity of reflexion.	Mixture of uniform regions with streaks related to structure.	Parallel strips of low intensity.
Ultra-violet Transparency Patterns.		
Opaque with faint blue luminescence or partially transparent with strong blue luminescence.	Patches of opaque and transparent regions; related to structure.	Transparent.
X-ray Reflexion.		
Intensity increases with blue fluorescence.		Great intensity indicates small-scale mosaic structure.
Photoconductivity.		
Small.	Moderate.	Large.

The evidence in support of Raman's theory is really supplied by those experiments which indicate that a particular diamond is not homogeneous. These are the experiments on birefringence (where the results are at variance with the observations of Robertson, Fox and Martin), luminescence and ultra-violet transparency patterns. The item in the table "X-ray Topography" deserves some fuller explanation; under this title G. N. Ramachandran describes an ingenious method of obtaining an X-ray image of a crystal flake in which variations of reflecting power are recorded. Such variations appear to be related to the ultra-violet transparency and other properties of the diamonds.

The symposium is not wholly devoted to a demonstration that four different types of diamond do exist. There are several papers dealing with the properties without reference to the particular type. R. S. Krishnan contributes a paper on the Raman spectrum of diamond, based on Raman's interpretation of the dynamics of the crystal lattice, while B. Dayal applies the same ideas to the evaluation of the specific heat of diamond. An examination of the magnetic susceptibility by A. Sigamony shows that this property is not structure sensitive and that it does not change when a fluorescent diamond is irradiated with an intense beam of light.

The symposium concludes with an interesting paper by S. Ramaseshan describing the external form and surface markings of twenty-nine diamonds from Panna in their natural state. Considering the perfection usually ascribed to diamonds, the marked curvature of the faces of natural crystals is not without interest.

The authors who have contributed to the symposium have been fortunate in having at their disposal a collection of 310 diamonds made by Sir C. V. Raman. This wealth of material has been an undoubted help to them, and contributes effectively to the value of the work they have carried out. There is evidently an interesting problem here, not yet completely solved; one key to it lies in a more complete understanding of the abnormal X-ray reflexions recorded by Lonsdale and Smith.

G. D. PRESTON.

[1] Robertson, Fox and Martin, *Phil. Trans. Roy. Soc.*, A, **232**, 463 (1934); *Proc. Roy. Soc.*, A, **157**, 579 (1936).
[2] Lonsdale and Smith, *Nature*, **148**, 112 (1941).
[3] Raman and others, *Proc. Indian Acad. Sci., Bangalore*, 189–342 (1944).

SOIL CONSERVATION IN THE ANGLO-EGYPTIAN SUDAN

By E. N. CORBYN
Formerly Governor of Khartoum

IN December 1942, a committee was appointed by the Governor-General of the Anglo-Egyptian Sudan to consider the problem of soil conservation in the Sudan; it was constituted as follows: Dr. J. D. Tothill, director of agriculture and forests; Lieut.-Colonel C. P. Fisher, director of the veterinary service; Mr. J. Smith, chief conservator of forests; Mr. G. Andrew, Government geologist; and Messrs. G. M. Hancock and B. Kennedy-Cooke, Sudan Political Service. The Committee's report has just been issued*.

The terms of reference of the Committee were: (*a*) To report on the present situation in the Sudan with regard to soil erosion and desiccation and the

* The Report of the Soil Conservation Committee, Sudan Government, 1944. Pp. 161+12+2 maps. (Khartoum: McCorquodale and Co. (Sudan), Ltd.; obtainable from Sudan Government London Office, Wellington House, Buckingham Gate, S.W.1.) 2*s*. 6*d*. net.

availability of rural water supplies for the human and animal population. (*b*) To make recommendations in respect of any of the above matters and of any measures of legislation or taxation which may be required for the carrying out of such recommendations. (*c*) To draw up a programme of work covering a stated period of years for the implementation of the recommendations. (*d*) To provide estimates of the capital cost of carrying out the programme and of the future maintenance costs involved.

The findings of the Committee are securely based on the best expert scientific knowledge available to the Government, and the standard of the Sudan in such matters is high. This powerful effort to lay down the broad lines on which, over a territory of a million square miles out of the eleven and a half millions which constitute Africa, the three-fold dangers of soil erosion, devegetation and desiccation shall be met, deserves the flattery of imitation by every governmental authority in that continent. How widespread is the desire of African Governments to deal with these menaces adequately was shown by the success of the International Commission set up in London to study them in 1942 by the Royal African Society, under the chairmanship of Prof. E. P. Stebbing, in which the cordial co-operation was obtained of the French and Belgian African administrations, and to which the Dutch Government contributed the fruits of its Asiatic experience.

The Sudan is particularly well placed to state whether there is a 'desert creep' of the Sahara southwards in its area, as it borders upon the south-eastern portion of the great Libyan Desert. The findings of the Committee are on the whole reassuring on this point; but this may be due in this region to something of a piece of geological good fortune, namely, the deposit, from the Sahara southwards to about lat. 10° 30′ N., of a great 'blanket' of sand, dating from glacial times, which "has been static or fixed for several thousands of years . . . and is everywhere anchored or fixed by vegetation grading from light forest to heskanit [a tough grass] depending on local rainfall. . . . Being permeable in structure and fixed in position it prevents erosion from taking place". This sand forms, fortunately, a cultivable soil.

The clay plains south of this great area of 'continental' sand, and the clay plains of the major portion of the country in general, do not share the comparative immunity of the sand area from erosion, and their problem is similar to that of other parts of Africa.

The Committee does not consider that there has been any great alteration of climate in the direction of desiccation within historic times—say, the last 5,000 years. But it finds abundant evidence of alternations of both wet and dry periods in previous geological times. It concludes, therefore, that such desiccation and erosion as have taken place, and are taking place, are due to the activities of human beings and their animals, and can consequently be controlled by bringing about changes in these activities sufficient to restore damage and prevent further deterioration.

The Committee's survey of existing conditions in the Sudan showed many and serious examples of soil deterioration as at present taking place. Sheet erosion was found to be occurring in many places in the hill country of southern Kordofan and of Equatoria, and near the gullied land of the Blue Nile. Gully erosion was noted as common and locally important in Equatoria, along the banks of the Blue Nile, Dinder and Atbara Rivers, in the hills of Kordofan, and in the coastal range of Red Sea hills. Soil deterioration due to overgrazing, and overcropping was found to be common in all the thickly populated areas.

Deterioration of forest watersheds due to fires and grazing was observed as taking place in the Red Sea hills, in the hills of southern Kordofan and of the southern Fung and eastern Upper Nile districts, and in the hills and mountains of Equatoria, where it is sometimes also due to agricultural development of the heads of valleys.

Spoliation of agricultural land by silt dune formation was found to be taking place in the delta of the Khor (River) Baraka around Tokar. Spoliation of rain-watered agricultural land by out-of-season fires was noted as common on the clay plains of Kassala, Blue Nile, Upper Nile and Kordofan.

Finally, town and village peripheries were found to be deteriorating rapidly all over the country, owing to over-cultivation and over-grazing of the surrounding areas, and excessive cutting of trees for firewood in the neighbourhood of towns.

An extensive programme of more than fifty items, covering different danger-points spread over all the eight provinces of the Sudan, is put forward by the Committee, to some thirty of which a priority classification is given as matters of urgency.

The remedies recommended fall under main headings as follows:

(1) Methods of rain and flood-water control: gully plugging; contour terracing; protection of heads of catchment areas.

(2) Forest protection: reservation of forest areas to an increased extent; protection from fire; reafforestation; control of fire-wood supplies.

(3) Treatment of cultivable rain-watered grasslands: control of annual burning methods; fire protection.

(4) Control of town perimeters, including reservation of areas for the growing and supply of fodder for domestic animals, and for fire-wood, whether from near or distant sources; control of village planning, so far as necessary to ensure conservation and the best use of the soil of village areas; control of the grazing habits of nomads, so far as necessary to avoid deterioration in the soil of grazing areas.

Two great merits of the report are that its recommendations apply these remedies to definite schemes at definite places, and that financial estimates of the cost of these schemes on a basis of a five-year experimental period are worked out and provided, totalling in the first instance to a sum of £300,000, spread over five years, to be at the disposal of a board appointed for the purpose.

A considerable part of the Committee's recommendations falls under the heading of improvement of water supplies, a most important matter in so arid a country, and one which in itself will relieve the strain on soil surrounding the water-points which exist already in agricultural and grazing areas.

The Sudan Government has accepted the main recommendations of the Committee, and will make the necessary funds available for the five-year trial period envisaged. It has appointed a Water Supplies and Soil Conservation Board to administer the funds provided and to take executive action on the schemes proposed.

NEWS and VIEWS

Prof. Eric Ashby : Australian Scientific Attaché to the U.S.S.R.

PROF. ERIC ASHBY, professor of botany in the University of Sydney, has been appointed scientific attaché, with rank of counsellor, to the Australian Legation in Moscow, for about a year. Prof. Ashby's appointment has been made in order to establish contact with leaders of science in the U.S.S.R., and particularly with those working on problems of mutual interest to that country and Australia. Since Prof. Ashby's appointment to the chair at Sydney in 1938, he has established himself in Australia as a first-class man of science and organizer. He was chairman of the Australian National Research Council during 1940–42 and is honorary scientific adviser to the Australian Department of War Organization and to the Scientific Liaison Bureau. He is well acquainted with the scientific resources of Australia, for in 1942 he carried out a survey of them for the Prime Minister. In his own botanical researches he has made a special study of crop development. Therefore it is clear that the Australian Government has made a very wise choice for its first scientific attaché to the U.S.S.R. Prof. Ashby is now staying in Britain for a short time, before proceeding to Moscow. It is possible to get in touch with him by communicating with the Editors of *Nature*.

Tropical Medicine at Liverpool

LIEUT.-COLONEL B. G. MAEGRAITH, who is at present in charge of the Army Malaria Research Unit, has succeeded, at the age of thirty-seven, the late Prof. Warrington Yorke in the Alfred Jones chair of tropical medicine at the Liverpool School of Tropical Medicine. After graduating at the University of Adelaide in 1930, Prof. Maegraith went to Oxford as a Rhodes Scholar and there took his B.Sc., D.Phil. and M.A. He was awarded a Beit Fellowship and became fellow of Exeter College and tutor in physiology. Later, he acted as dean of the Oxford University Medical School. Earlier in the War he served as consulting physician and assistant director of pathology in the West African Command and there studied, with Brigadier G. M. Findlay and N. H. Martin, the factors present in tissues and blood which may produce or inhibit lysis of the blood cells. In Australia, Prof. Maegraith had made a hæmatological study of the aborigines, and later he studied hæmolysis.

Physical Anthropology at Oxford

DR. J. S. WEINER has been appointed to the readership in physical anthropology at the University of Oxford. Before the War he was engaged in a study of the physiological characteristics of the Bantu people, with special reference to heat tolerance and vitamin C nutrition. More recently he has been concerned with war-time problems of acclimatization. Dr. Weiner's appointment marks a new orientation in the development of physical anthropology in Great Britain. While in the past the subject has been mainly confined to the statistical study of purely morphological variations in skeletal dimensions, its future development is likely to be concerned with such practical problems as racial variations in physiological efficiency.

Harrison Memorial Prize for 1944

THE Selection Committee, consisting of the presidents of the Chemical Society, the Royal Institute of Chemistry, the Society of Chemical Industry and the Pharmaceutical Society, has awarded the Harrison Memorial Prize for 1944 to Dr. Leslie F. Wiggins, of the University of Birmingham, in recognition of his researches on transformation products of the hexose sugars. His originality and resource, combined with exceptional experimental skill in these investigations, have opened new fields of theoretical interest. Much of this work holds promise of practical development along novel lines.

U.S. National Academy of Sciences Elections

THE following elections to the U.S. National Academy of Sciences were made at the 1944 Annual Meeting :

Members. Prof. Thomas Addis, professor of medicine, Stanford University Medical School, San Francisco, California ; Dr. Charles Armstrong, surgeon in the United States National Institute of Health, Bethesda, Maryland ; Prof. Philip Bard, professor of medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland ; Prof. G. W. Beadle, professor of biology, Stanford University, California ; Prof. Hans A. Bethe, professor of physics, Cornell University, Ithaca, New York ; Prof. Edward U. Condon, Westinghouse Research Laboratory, East Pittsburgh, Pennsylvania ; Dr. George O. Curme, jun., Carbide and Carbon Chemical Corporation, New York, N.Y. ; Dr. Hugh L. Dryden, National Bureau of Standards, Washington, D.C. ; Dr. Carl O. Dunbar, Yale University, New Haven, Connecticut ; Prof. Vincent du Vigneaud, professor of biochemistry, Cornell University Medical College, New York, N.Y. ; Prof. James Franck, professor of physics, University of Chicago, Chicago, Illinois ; Prof. Reynold C. Fuson, professor of chemistry, University of Illinois, Urbana, Illinois ; Prof. Edwin Bret Hart, professor of agricultural chemistry, University of Wisconsin, Madison, Wisconsin ; Prof. Selig Hecht, professor of zoology, Columbia University, New York, N.Y. ; Mr. Alfred H. Joy, Mt. Wilson Observatory, Pasadena, California ; Prof. Esper Signius Larsen, jun., professor of petrology, Harvard University, Cambridge, Massachusetts ; the Rev. James B. Macelwane, *S.J.*, director of the Institute of Geophysics, St. Louis University, St. Louis, Missouri ; Prof. Leonard A. Maynard, professor of animal nutrition, Cornell University, Ithaca, New York ; Prof. Barbara McClintock, Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor, Long Island, New York ; Prof. C. R. Moore, professor of zoology, University of Chicago, Chicago, Illinois ; Prof. Alfred S. Romer, professor of zoology and curator of vertebrate palæontology, Harvard University, Cambridge, Massachusetts ; Prof. Louis B. Slichter, professor of geophysics, Massachusetts Institute of Technology, Cambridge, Massachusetts ; Prof. Lee I. Smith, professor of organic chemistry, University of Minnesota, Minneapolis, Minnesota; Prof. Don M. Yost, professor of inorganic chemistry, California Institute of Technology, Pasadena, California ; Prof. Oscar Zariski, professor of mathematics, Johns Hopkins University, Baltimore, Maryland.

Foreign Associates : Sir Edward Bailey, director of the Geological Survey of Great Britain ; Prof.

Leopold Ruzicka, Department of Organic Chemistry, Institute of Technology, Zurich.

Presentation of Medal and other Awards

At the same meeting, the following medal and other awards were presented:

Daniel Giraud Elliot Gold Medal and Certificate (awarded annually to the author of an outstanding paper, essay or other work on some branch of zoology or palæontology), to Prof. Malcolm R. Irwin of the University of Wisconsin, for his work "Immunogenetic Studies of Species Relationships in Columbidae" (*J. Gen.*) (for 1938); Prof. John H. Northrop, Rockefeller Institute for Medical Research, Princeton, New Jersey, for his work "Crystalline Enzymes: the Chemistry of Pepsin, Trypsin and Bacteriophage" (Jessup Lectures, Columbia University Press) (for 1939); Prof. William B. Scott of Princeton University, for his work "The Mammalian Fauna of the White River Oligocene. Part IV. Artiodactyia" (*Trans. Amer. Phil. Soc.*) (for 1940).

Mary Clark Thompson Gold Medal (awarded annually for the most important services during the period in geology and palæontology), to Prof. Edward W. Berry of Johns Hopkins University, for outstanding contributions to knowledge of the Mesozoic and Cenozoic floras of North, Central and South America, and the Antilles, in their relations to stratigraphy, the ecology and geographic distribution of past floras, and the evolution of the different groups of flowering plants (for 1942); Dr. George G. Simpson of the American Museum of Natural History, for his outstanding contributions in the field of vertebrate palæontology, including a study of the Mesozoic mammals, and distinction as a field collector, systematic palæontologist and original thinker on broad problems of evolution (for 1943); Dr. William J. Arkell, formerly of New College, Oxford, now with the Ministry of Transport, for his outstanding contributions to palæontology and geology, including intensive studies of stratigraphic units of different geologic age in widely separate regions, British Jurassic faunas, the history of the region of Great Britain in Jurassic times, palæoecology, the late Neogene history of the Nile region, and other services, all leading to important publications.

Ordnance Distinguished Service Award of the Ordnance Department, United States Army. This was presented to the National Academy of Sciences "in recognition of outstanding and meritorious scientific services, in war and peace, for the development, manufacture and maintenance of Ordnance material". The award was authorized on July 20, 1944, and was presented by Major-General G. M. Barnes, chief of the Research and Development Service Ordnance Department.

Textile Industries at the University of Leeds

THE steady expansion of the wool textile industry of Great Britain up to 1914 was based on the lead given by early textile inventors, aided by the unique skill acquired by successive generations of craftsmen. A great structure had been erected on a foundation of simple empiricism; but the industrialist was still applying imperfectly understood processes to a material of unknown composition and properties. As the training of textile technologists was in the hands of craftsmen with neither scientific training nor research experience, there could be no hope of breaking the vicious circle of empiricism until scientific workers were persuaded to make a study of textile materials and processes. A first step in this direction was taken by the Department of Textile Industries of the University of Leeds in 1919, when a lecturer in textile chemistry was appointed. From this small beginning it was hoped in time to build up such a body of knowledge that textile technology would be transformed into an applied science. This, in turn, was intended to provide the Department with a staff of technologists having scientific as well as technical qualifications; to create a bond between science and the industry by giving its recruits a combined training in science and technology; and to provide industrial research laboratories with scientific men trained in the methods of research on textile materials and processes.

All these aims have now been achieved, owing to the rapid expansion of the research section of the Department since 1928, when the Worshipful Company of Clothworkers made a grant of £3,000 a year for research purposes. The grant made it possible to appoint a lecturer (now reader) in textile physics (Dr. W. T. Astbury) and two research assistants, besides providing a number of scholarships and fellowships for research workers drawn from the science departments of the universities. Dr. Astbury's work has since been supported by the Rockefeller Trustees, and that of the Textile Chemistry Section by a number of organizations and firms. Both the Textile Physics and Textile Chemistry Sections have been responsible for important advances in pure and applied science, and, excluding staff, there are now twenty-seven research workers in the Department. Its interests cover the whole field of high polymers, from cellulose and the proteins to plastics and synthetic fibres, from biology to technology. A craft has been carried to the forefront of the applied sciences in a single generation.

Needless to say, such rapid expansion has brought difficulties in its train. In a Department which was originally non-scientific, the difficulty of providing accommodation for research workers was always acute, and is now intensified by the needs of the technological staff. Every spare room has been converted into a laboratory, an army hut has been brought into service, and temporary accommodation has been provided in one of the laboratories of the sister Department of Colour Chemistry and Dyeing. The time has now come to consolidate the position, to collect together scattered groups of research workers and to provide research facilities for the technological staff. Two schemes of reorganization are proposed at a total cost of £22,000, towards which Messrs. Imperial Chemical Industries, Ltd., Dyestuffs Division, and the Tootal Broadhurst Lee Co., Ltd., have each made donations of £2,500.

The International Setting of Reconstruction

UNDER the general title "Looking Forward", the Royal Institute of International Affairs is publishing a series of pamphlets on the international aspects of reconstruction, which are intended to stimulate thought and discussion, and to aim at presenting problems rather than to solve them. In the first of these, "Britain and the World" (Pp. 60. 1*s.* net), the Hon. H. A. Wyndham gives an outline of reconstruction problems; the general background in Europe and the Middle East, and such factors as freedom of trade and migration in the nineteenth century and up to 1939 are discussed in the first part, and Britain's position in the post-war world is considered in the

second part. Some home problems, such as industry and its organization and control, demobilization, exports, social insurance, housing and agriculture, health and educational services are briefly indicated in the third. The second chapter indicates some of the implications of the Atlantic Charter in such matters as relief and rehabilitation in Europe and the Middle East, the significance of the Hot Springs Conference, the potentialities of the Middle East Supply Centre, the problem of Germany and the special problems of the British Empire, such as the co-ordination of foreign policy and defence and trends in colonial welfare and development. Although necessarily sketchy, the pamphlet succeeds in indicating the relation of particular problems to the larger issues, and the problems of home and international policy, on the solution of which Britain's economic stability, social security and future prosperity depend.

Typhus in Guatemala

THE July issue of the *Boletín de la Oficina Sanitaria Panamericana* contains an account of an outbreak of typhus by Dr. Julio Roberto Herrera, head of the Section of Epidemiology of the General Health Office of Guatemala. He stated that he received on April 3, 1944, a notification of 198 cases of an infectious disease, which turned out to be typhus, in a home for the insane, a general hospital and a penitentiary. There were altogether 198 cases with 63 deaths. The case fatality for the home for the insane was 26·10 per cent. Preventive measures included quarantine of the foci, restriction of visits, disinfection and disinsectization of the hospitals, barracks, etc., verification of definite and suspected cases by public health laboratories, visiting of all contacts, immunization of exposed staff, examination of autopsy specimens, organization of a national disinfection station, education of the public by the Press, radio, etc., isolation of cases and supervision of hospitals and welfare stations.

British Dragonfly Records

MISS CYNTHIA LONGFIELD, British Museum (Nat. Hist.), Cromwell Road, London, S.W.7, writes: "As I shall be revising for publication, in the very near future, the records on distribution of all the British dragonflies, I shall be most grateful if all collectors, who have not done so already, will send me their lists of localities, including approximate status, of dragonflies identified up to the end of 1944. Observations on habitats, definite proof of breeding and methods of oviposition will be most valuable. All help will be gratefully acknowledged."

Royal Institution: Graduate Memberships

THE first three of the graduate memberships recently established by the Managers of the Royal Institution for recent graduates, of either sex, of any university in the British Empire who have obtained first- or second-class honours in any scientific subject, have just been awarded. The recipients are: Miss June M. Broomhead, who gained a major scholarship in 1941 and a research scholarship in 1944 at Newnham College, Cambridge, and was placed in Class II (1) in the Natural Sciences Tripos in physics, 1944; Mr. Robert B. Morrison, who took first-class honours in physics in the University of London, 1944, and is now University demonstrator at King's College; and Mr. Anthony P. Waterson, who took a first class in Part I of the Natural Sciences Tripos, Cambridge, 1943, and in Part II (biochemistry), in 1944. He is studying medicine at the London Hospital.

Royal Aeronautical Society: British Empire Lecture

THE Council of the Royal Aeronautical Society has recently completed arrangements for the founding of a British Empire Lecture. The Lecture, on any aeronautical subject approved by the Council, will be delivered annually in September in London, by a lecturer chosen in alternate years from the British Dominions and Colonies and Great Britain. The Society, by founding the Lecture, is anxious to encourage new ideas and new points of view from all parts of the British Empire, and to make the lecture second in importance only to the Wilbur Wright Memorial Lecture. The British Empire Lecture will have a premium of £50 attached to it, and in the case of lecturers coming from the Dominions and Colonies an allowance up to £100 will be paid towards the lecturer's expenses. It is proposed to hold the first lecture in September 1945, and suggestions for lecturers should be received by May 31, 1945, at the latest.

University of London Appointments

DR. L. S. PENROSE has been appointed to the Galton chair of eugenics tenable at University College. Since 1939 he has been attached to the Provincial Department of Health, Ontario, Canada, and in addition is a physician at the Ontario Hospital, lecturer in psychiatry in the University of Western Ontario, and medical statistician for the Province.

Dr. C. Rimington, who has been on the staff of the National Institute for Medical Research since 1937, has been appointed as from May 1 to the University chair of chemical pathology tenable at University College Hospital Medical School.

Announcements

WE regret to announce the following deaths:

The Earl of Balfour, P.C., chairman of the Cambridge committee of the Commission on the Universities of Oxford and Cambridge, on January 14, aged ninety-one.

Sir Thomas Barlow, Bart., K.C.V.O., F.R.S., president in 1910–15 of the Royal College of Physicians, on January 12, aged ninety-nine.

THE Committee of the Athenæum has elected the following, under the provisions of Rule II of the Club, which empowers the annual election by the Committee of a certain number of persons of distinguished eminence in science, literature or the arts, or for their public services: the Right Hon. Lord Catto of Cairncross, governor of the Bank of England; Sir Bennett Melvill Jones, Francis Mond professor of aeronautical engineering, University of Cambridge; the Hon. John Gilbert Winant, ambassador of the United States to the Court of St. James's.

DR. DELLEPIANE RAWSON, an eminent plastic surgeon in the Argentine, has arrived in Britain for a six months visit arranged by the British Council. Dr. Rawson, who is head of the special ward for plastic and restorative surgery at the Hospital Rawson, Buenos Aires, and associate teacher at the Faculty of Medicine, will be working with Sir Harold Gillies in the Emergency Medical Service Plastic Surgery Unit at Park Prewett Hospital, Basingstoke.

LETTERS TO THE EDITORS

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

Photographic Record of Follicular Keratosis

In the treatment of some types of skin disease, during which progress may be relatively slow, only slight changes in the appearance of the skin occur between successive examinations, even when these are spaced several weeks apart. This makes the effect of the treatment difficult to observe visually. It has been suggested that a photographic method of recording the progress in such cases may be of value.

In the study of follicular keratosis (folliculosis), a special photographic technique is required to give a sufficiently good rendering of the texture of the skin, as in this case the irregularities of the surface are small in size, and do not differ appreciably in colour from the surrounding area. It is also necessary to devise an apparatus which will enable such a technique to be applied with all conditions kept constant so that any changes in the appearance of the skin will be shown readily.

Various means of recording folliculosis photographically have been tried in this Laboratory, including the use of ultra-violet and infra-red; the most promising results so far have been obtained by the following methods:

(*a*) By illuminating the surface with a small point source, the light from which strikes it at a grazing angle of incidence, so that sharp shadows of the elevated areas on the skin are produced.

(*b*) By illumination at a more nearly vertical angle of incidence. In this case, as the shadows are much less pronounced, the film must be developed to a high degree of contrast to show the markings on the skin.

The two methods appear to be complementary, as certain details are shown up in one case which may not be seen in the other.

A portable apparatus has been developed using a Leica camera fitted with an extension tube to enable close-up photographs to be taken, by both methods of illumination. While the apparatus has been designed to minimize the relative movement between the patient and the camera, nevertheless the exposure time should be as short as possible to prevent the definition from being impaired by any involuntary movements of the patient. The camera lens must also be stopped down to a small aperture to give an adequate depth of focus, as the surface of the arm or leg under observation is usually rounded. For both reasons, a high level of illumination of the skin is required.

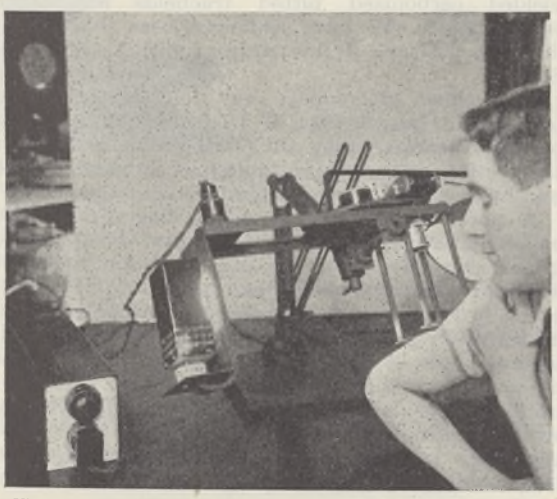

Fig. 1. APPARATUS FOR PHOTOGRAPHY OF FOLLICULAR KERATOSIS.

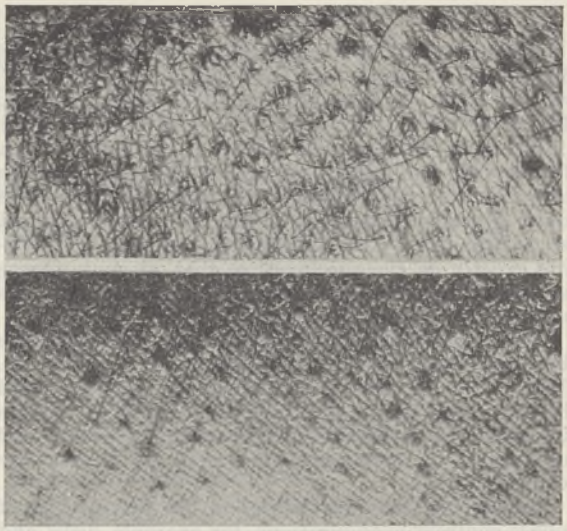

Fig. 2. PHOTOGRAPHS OF FOLLICULAR KERATOSIS ON DARK SKIN. ABOVE, FLAT LIGHTING; BELOW, OBLIQUE LIGHTING. × 1·6.

A Mazda 250-watt box type *ME* lamp (a mercury vapour lamp with a small source of high brightness) is used as the source for oblique illumination, while a 250-watt photo-flood lamp mounted in a reflector provides the illumination for the second method. Satisfactory exposures are obtained with 0·5 sec. at an aperture of *f*·18 with a panchromatic film having a speed of 23° Scheiner with oblique illumination. With the photo-flood lamp, which is about 6 inches from the surface of the skin, a similar exposure is quite satisfactory, using in this case Kodak Microfile film.

The conditions of lighting on the skin of the patient are kept constant by fixing the lamps in relation to the camera. A rectangular aperture covering the whole field of view of the camera is attached to it at such a distance from the lens that all within the field is in accurate focus. The lamps, camera and aperture are mounted on a framework which can be adjusted into any position. In using the apparatus, it is arranged so that the aperture surrounds, and its sides touch, the area of skin which is to be photographed.

The apparatus is shown in operation in Fig. 1, and some typical photographs taken with the two methods of lighting are shown in Fig. 2.

The experiments have been carried out at the request of Dr. Magee in collaboration with Dr. Hawes and Dr. Stannus, working for the Ministry of Health, who have kindly allowed the photographs to be published. Acknowledgement is also due to Mr. H. Warren, director of research, B.T.H. Company, for permission to publish this note.

H. K. BOURNE.

Research Laboratory,
British Thomson-Houston Co., Ltd.,
Rugby. Nov. 10.

Phase Difference Microscopy

I HAVE read with much interest the description by Mr. O. W. Richards of his own and his colleagues' recent work on Zernike's phase contrast method. Everyone who is interested in the microscopical observation of living cells should be grateful to him for having once again directed attention to its value as applied to microscopy. It possesses the advantage over ordinary trans-illumination that fine unstained structural detail is seen in greatest contrast by focusing exactly *on* the specimen, so that we may expect a closer geometrical correspondence between the appearance seen and what is 'really there'.

During the past eight years, Zernike's method has been regularly used in this Laboratory by Dr. C. R. Burch and by others whom he has interested and helped, both as a test for the accuracy of mirrors intended for astronomical and other purposes[1], and as applied to microscopy, including the microscopy of living cells[2].

Interesting new possibilities in the preparation of phase-contrast configurations, for example disks and strips, have lately been opened up by the development of the modern technique of controlled evaporation *in vacuo*. By this process, a transparent layer can be deposited on a thin glass plate of such a thickness as to increase by one quarter of a wave-length the retardation of yellow light passing through the plate. By drawing a fairly sharp stylus across this layer, we can remove the soft coating from a narrow strip of the glass without damaging the glass surface. The result is a 'phase-advancing strip' which can be used for phase-contrast testing in the same way as the phase-retarding disks and strips so ingeniously prepared by Dr. Burch.

A relatively easy way of producing such coatings is to leave the glass plate in a lens-blooming chamber, such as is now used by some optical firms, during five or six consecutive runs. This builds up a layer of approximately the desired thickness.

In an investigation into phase-contrast diffraction theory which I hope to publish shortly, I have shown that considerable variation can be allowed in both the thickness of the layer and the width of the strip without seriously reducing the efficiency of the method. No doubt this is one reason why the method is so successful in practice.

E. H. LINFOOT.

H. H. Wills Physical Laboratory,
University of Bristol.
Dec. 1.

[1] Burch, C. R., "On the Phase-Contrast Test of F. Zernike", *Mon. Not. Roy. Ast. Soc.*, **94**, 384 (1934). "On a Zonal Zernike Test for Paraboloids", *Mon. Not. Roy. Ast. Soc.*, **95**, 548 (1935).
[2] Burch, C. R., and Stock, J. P. P., "Phase-Contrast Microscopy", *J. Sci. Instr.*, **19**, 71 (1942).

Age of the Saline Series in the Salt Range of the Punjab

OUR evidence for the post-Cambrian age of the Saline Series, based upon microfossils in the rock-salt and marl, was already clear and ample[1,2]. It has since been greatly reinforced by the discovery, both at Khewra and Warchha, of similar fossils in dolomites, dolomitic limestones and shales belonging to the Series, which do not admit of the remotest suspicion that any foreign matter was washed in, faulted in or caught up by later earth movements.

Some of these more recent finds were reported to *Nature* in a communication dated July 21, but on the receipt, soon afterwards, of the issue containing the interesting note by Dr. G. M. Lees[3], we withheld publication until we should be in a position to offer fuller data, if possible after examining the Persian material kindly sent by him. These specimens have not yet arrived, but meanwhile the *in situ* nature of our Khewra and Warchha material has been fully confirmed by Dr. H. L. Chhibber, who very kindly accompanied us to the Salt Range early in October this year, and who proposes to write a geological note on the localities in question.

(*a*) *Rock-salt and kallar.* Of the samples of rock-salt plus kallar newly collected, only two have yet been examined (coll. Sahni, Oct. 3, 1944, Mayo Mine Khewra): *K*4, from the Middle Pharwala seam in Chamber 19, showed several pieces of conifer wood with well-defined bordered pits, and some woody fibres; *K*5, from the Buggy seam in Pillar 47–48, 43 Incline, 2nd Sub-level North, brought forth a cuticle with two stomata, several shreds of wood and some chitinous remains.

The winged insect from the Warchha marl, mentioned in a previous communication[4], has since been identified as a new extinct species of *Chironomus*, *C. primitivus* M. S. Mani[5]. This genus of Diptera had not so far been found in the Indian strata.

(*b*) *Dolomites and dolomitic limestones.* From the Warchha mine Mr. B. S. Lamba had sent to one of us a specimen of compact saline dolomite (Lamba, No. 7, Warchha, July 1944) taken from a stratum within the Saline Series as exposed in the New Low Level Tunnel, at least 1,500 ft. from the entrance. Treated with dilute hydrochloric acid, it released numerous shreds of pitted woody tissues, among them two pieces of conifer wood with bordered pits and medullary rays. A little dilute safranin placed on a thin slice of the rock at once picked out numerous specks of organic matter scattered through the crystalline matrix. During our recent visit the position of this dolomite within the Lower Gypsum Stage of the Series was confirmed. Specimens collected by ourselves are now being examined.

A piece of compact dolomitic limestone collected for us by Mr. Lamba from a stratum exposed in the New Low Level Tunnel at Khewra, 1,335 ft. from the entrance (Lamba No. 3, Khewra, July 1944), has yielded carbonized pitted tracheids and other woody tissues. We have, as before, been able to confirm the position of this stratum within the Saline Series.

A specimen of compact grey dolomitic limestone (coll. Sahni, Oct. 5, 1944, *W* 15) from the main body of the Warchha valley Oil Shale group exposed in the section figured as an 'anticline' by Reed, Cotter and Lahiri[6] has revealed several woody fragments.

A finely laminated but compact grey dolomite collected last year from the outcrop of the Oil Shale group near the confluence of the Jarhanwala and Jansukh streams (Sahni, Oct. 13, 1943, *S* 21/1) was specially rich in angiosperm remains; for example, a beautifully preserved grass cuticle, shreds of wood, several types of pollen and a stellate hair, besides organic membranes of unknown affinity. This dolomitic band is an integral part of the Oil Shale series, with a dip and strike conformable with the rest of the strata in the group. Further specimens, taken last October, are being analysed for their fossil content.

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 Royal Institute of Chemistry of Great Britain & Ireland

(Founded 1877)
(Incorporated by Royal Charter, 1885)

APPOINTMENTS REGISTER

A Register of Chemists (Fellows, Associates and Senior Registered Students), who are available for appointments or who are seeking to improve their positions, is kept at the office of the Institute. The facilities afforded by this Register are available (free) to Companies and Firms requiring the services of chemists, and to Universities, Colleges and Technical Schools requiring Teachers of Chemistry and Technology.

Particulars of the Regulations and Examinations of the Institute can be obtained (free), on application to The Registrar, the Royal Institute of Chemistry, 30 Russell Square, London, W.C.1.

UNIVERSITY OF DURHAM

KING'S COLLEGE, NEWCASTLE UPON TYNE

Departments of Physics and Medicine

A series of lectures on Radiation Physics and its Applications to Medicine will be given during the Epiphany term, in the New Lecture Theatre of the Royal Victoria Infirmary, on Wednesday evenings at 6 p.m. The subjects to be dealt with are: January 31, "Waves and Atoms—the Elements of Radiation Physics," by J. M. A. Lenihan; February 7, "The Physical Basis of *X*-Ray Therapy," by F. T. Farmer; February 14, "The Physical Basis of Radium Therapy," by F. T. Farmer; February 21, "*X*-Rays as a Diagnostic Instrument," by H. J. Johnson; February 28, "Biological Effects of *X*-Rays and Gamma Rays," by C. J. L. Thurgar; March 7, "Ultra-violet and Infra-red Radiations as Therapeutic Agents," by D. Ramage; March 14, "Nuclear Physics and its Applications to Medicine," by J. M. A. Lenihan.

The Lectures are intended primarily for students and graduates in Physics and in Medicine, but the course is open to all who are interested.

G. R. HANSON,
Registrar of King's College.

THE CENTRAL COUNCIL FOR HEALTH EDUCATION

The Central Council for Health Education invites applications for the undermentioned appointments. The principal duties will be to lecture to doctors, teachers, nurses, youth leaders, etc., throughout England and Wales, and first-class travelling and maintenance allowances will be paid when necessary. A high standard of lecturing ability is essential. Further particulars can be obtained from the undersigned to whom typed and tabulated applications stating sex, age, education, qualifications, experience, and position regarding National Service should be sent to reach him not later than Monday, Jan. 29, 1945.

SOCIOLOGIST (Male or Female)

Salary £600 per annum. Candidates should be University Graduates holding a Diploma in Sociology or Social Studies. Experience in Social Welfare or Youth Work essential. Knowledge of anthropology and social statistics desirable.

EDUCATIONAL PSYCHOLOGIST (Male or Female)

Salary £600 per annum. Candidates should hold an Honours Degree in Psychology, and should have had at least two years' practical experience, including six months training at a Child Guidance Clinic.

ROBERT SUTHERLAND,
Medical Adviser and Secretary,
Central Council for Health Education,
Tavistock House, Tavistock Square,
London, W.C.1.

By permission of the Ministry of Labour and National Service under the Employment of Women (Control of Engagement) Order, 1943.

LEVERHULME RESEARCH FELLOWSHIPS, 1945

Application is invited for Fellowships and Grants in aid of research. The Fellowships and Grants are intended for senior workers who are prevented by routine duties or pressure of other work from carrying out research. They are limited to British-born subjects normally resident in Great Britain. In exceptional circumstances the Trustees may waive the condition as to residence.

The Trustees are also prepared to consider applications from groups of workers engaged upon co-operative programmes of research, particularly from those engaged upon long-distance programmes or in institutions in which the normal facilities for research have been curtailed by the war.

The duration of the awards will not normally extend over more than two years or less than three months, and the amount will depend on the nature of the research and the circumstances of the applicant.

Forms of application may be obtained from the Secretary, Dr. L. Haden Guest, M.C., M.P., Leverhulme Research Fellowships, Unilever House, Blackfriars, E.C.4.

Applications must be received on or before March 1, 1945. Awards will be announced in July and will date from Sept. 1, 1945.

CITY OF LIVERPOOL

APPOINTMENT OF DIRECTOR OF MUSEUMS

(Comprising the following Departments each under a Keeper: Geology, Botany, Vertebrate Zoology, Invertebrate Zoology, Ethnology, Shipping, and Archaeology.)

The Council of the City of Liverpool invite applications for the appointment of Director of Museums at a salary of £900 per annum, increasing to £1,000 per annum after two years' service.

The age of applicants must not exceed 50 years.

Applications submitted by persons at present engaged on national service and unable to take up the post immediately will receive consideration.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the Standing Orders of the City Council, and will be determinable by three calendar months' notice on either side.

Forms of Application and particulars of the Duties and Conditions of the Appointment may be obtained from me, and applications, accompanied by copies of three recent testimonials, must be addressed to me, endorsed "Director of Museums," and received on or before Wednesday, February 28, 1945.

W. H. BAINES,
Municipal Buildings, Town Clerk.
Dale Street, Liverpool, 2.

ESSEX EDUCATION COMMITTEE

SOUTH-EAST ESSEX TECHNICAL COLLEGE AND SCHOOL OF ART

Longbridge Road, Dagenham

Principal: N. M. H. Lightfoot, M.A.

DEPARTMENT OF SCIENCE

Applications are invited for the post of Head of this Department rendered vacant by the appointment of the present holder of the post to a Principalship. The Department comprises the subjects of Chemistry, Physics, Mathematics, and Biology. Candidates should have appropriate qualifications in the necessary subjects, together with substantial teaching experience.

The salary scale is £600 per annum rising by annual increments of £25 to a maximum of £800 per annum, and the commencing salary will be fixed by the Committee having regard to the experience of the candidate appointed.

Application forms and further particulars obtainable by sending stamped addressed envelope, and should be returned to the undersigned by Jan. 27, 1945.

B. E. LAWRENCE.
County Offices, Chief Education Officer.
Chelmsford.

UNIVERSITY OF LONDON

GRANTS FOR RESEARCH

Applications are invited from members of the University for grants from the Central Research Fund for assisting specific projects of research and for the provision of special materials and apparatus.—Application forms (which must be returned by March 31, 1945) and further particulars may be obtained from the Academic Registrar, University of London, at Richmond College, Richmond, Surrey.

UNIVERSITY OF SHEFFIELD

The Council of the University invites applications for the CHAIR OF GEOLOGY about to become vacant owing to the retirement of the present Professor.

Salary £1,150 per annum, plus wartime allowance in respect of marriage and children.

The successful candidate will be expected to enter upon his duties on Oct. 1, 1945, or as soon as possible thereafter.

In order to allow time for candidates now abroad or in H.M. Forces to apply, the last date for the receipt of applications has been fixed at March 31, 1945.

Applications, with the names and addresses of referees, should be addressed to the undersigned (from whom further particulars may be obtained).

A. W. CHAPMAN,
Registrar.

UNIVERSITY OF SHEFFIELD

The Council of the University invites applications for the CHAIR OF GEOGRAPHY about to become vacant owing to the retirement of the present Professor.

Salary £1,150 per annum, plus wartime allowance in respect of marriage and children.

The successful candidate will be expected to enter upon his duties on Oct. 1, 1945, or as soon as possible thereafter.

In order to allow time for candidates now abroad or in H.M. Forces to apply, the last date for the receipt of applications has been fixed at March 31, 1945.

Applications, with the names and addresses of referees, should be addressed to the undersigned (from whom further particulars may be obtained).

A. W. CHAPMAN,
Registrar.

UNIVERSITY OF BIRMINGHAM

DEPARTMENT OF METALLURGY

A Mathematical Physicist is required to join a small research team working on problems connected with welding; the work will be both theoretical and experimental, and will deal with the investigation of stresses in metal lattices. The investigator will be permitted to use his research results in applying for a higher degree. A salary of about £300 is offered.—Applications, with references, should be sent before Jan. 20 to the undersigned.

C. G. BURTON,
The University, Secretary.
Edmund Street, Birmingham, 3.

UNIVERSITY OF BIRMINGHAM

DEPARTMENT OF METALLURGY

Applications are invited for the post of Lecturer in Metallurgy, at a salary up to £450 per annum, according to qualifications. The appointment will be temporary in the first instance. Consideration will be given to graduates in Chemistry or Physics who have had some metallurgical experience.—Applications should be made to the undersigned before Jan. 30, 1945.

C. G. BURTON,
The University, Secretary,
Edmund Street, Birmingham, 3.

DERBY TECHNICAL COLLEGE

NORMANTON ROAD, DERBY

The Governors of the College will proceed to the appointment of the HEAD OF THE PHYSICS DEPARTMENT. Salary scale £480—£25—£630, plus £52 war bonus.

Further particulars and application forms may be obtained from the undersigned, to whom they should be returned not later than Monday, Jan. 22, 1945.

W. ALFRED RICHARDSON,
Principal.

Wanted: A Lady Assistant with an Honours Degree in Chemistry;

for office duties in organization dealing in chemical products with wide applications in the horticultural, textile, chemical, and plastics industries. She should preferably, but not necessarily, have some commercial experience in one of the above fields. The work is diverse, interesting, and well remunerated, and offers excellent prospects.—Write, giving fullest details, to the Staff Department, Technical Products Ltd., St. Helen's Court, Great St. Helen's, London, E.C.3.

Applications are invited for the post of ASSISTANT SECRETARY jointly to the Glass Delegacy of the University of Sheffield and to the Society of Glass Technology. A University Degree is desirable though not indispensable. Commencing salary £450 per annum, but a higher initial salary might be offered to a candidate of special qualifications and experience. It is hoped that the successful candidate would commence duties not later than the first week of April, but special consideration will be given to candidates at present filling Service or Government appointments.—Applications, with the names and addresses of referees, should be sent to the Registrar, The University, Sheffield, from whom further particulars may be obtained.

Photomicrography, a specialist service for essential work.—Enquiries to Box 278, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

University of London. The Senate invite applications for the University Readership in Entomology tenable at the London School of Hygiene and Tropical Medicine. Salary £1,050. —Applications must be received not later than first post on July 31, 1945, by the Academic Registrar, University of London, Richmond College, Richmond, Surrey, from whom further particulars should be obtained.

Personal Secretary required for research director in medical research institution. Knowledge of office routine, medical and scientific terms, and ability to translate medical French and German.—Write, Box 295, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Laboratory Assistant requires Senior Post in Zoological Laboratory.—C. Barker, Esq., 4 Crabtree Lane, Fulham, S.W.6.

ANALytical Balance by Griffin & Tatlock, to 0.1 mg. Never used.—Best offers to "Springdene," Springfield Lane, Irlam, Lancs.

For Sale: Mercury Vapour Lamp, Phillips Valve Model Rectifier, 3 Resistances, Choke Coil, Ammeter, vibrationless teak and oak table, specially fitted for above, with metal screening for micro-photography.—Apply, St. Andrew's Hospital, Dollis Hill, London, N.W.2.

Wanted: One copy of "Nature" for April 17, 1937.—Replies to Wallace & Tiernan, Ltd., Power Road, London, W.4.

Microscopes, of all descriptions, only a few available, second-hand, perfect condition. Send details of your requirements, enclosing 3d. stamp.—Telephone or correspondence only, Chards, Forest Hill, S.E.23 (Spring Park 1628).

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Oil Shale. From an outcrop near the same locality came a piece of dark grey Oil Shale (*S* 20), also collected in October 1943. It contained, among many other woody shreds, a gymnospermous tracheid with large elliptic bordered pits. This rock does not effervesce with hydrochloric acid; when heated it smells of petroleum and if kept longer in a flame it ignites, keeping alight even when removed. This particular bed could not be located last October, but other specimens of dark grey shales collected from within the Warchha valley Oil Shale series are being examined.

Some of the fossils here mentioned have been briefly described and figured elsewhere[7,8]. In a separate communication one of us hopes shortly to discuss the wider implications (practical as well as purely scientific) of the present work. Some of these conclusions, already suggested on independent grounds, have been set forth in important recent communications by Col. Davies[9], Dr. A. Lahiri[10], and Mr. Lamba[11].

The simple approach which the microfossil technique offers to some of the intricate and long-standing problems of Salt Range geology lays bare in a striking manner its possibilities as an aid to stratigraphical work in general.

B. SAHNI.
B. S. TRIVEDI.

Department of Botany and Geology,
University of Lucknow.
Nov. 6.

[1] Sahni, B., *Nature*, **153**, 462 (1944).
[2] Sahni, B., and Trivedi, B. S., *Nature*, **153**, 54 (1944).
[3] Lees, G. M., *Nature*, **153**, 654 (1944).
[4] Sahni, B., *Nature*, **153**, 462 (1944).
[5] Mani, M. S., *Ind. J. Entom.*, in the press; see (7).
[6] Reed, Cotter and Lahiri, *Rec. Geol. Surv. Ind.*, (4), **72**, 415, plate 11, fig. 1 (1930).
[7] Sahni, B., *Proc. Nat. Acad. Sci. India*, **14** (1 and 2), 49 (1944).
[8] Sahni, B., and Trivedi, B. S., *Proc. Nat. Acad. Sci. India*, **14** (1 and 2). "Palæobotany in India", V, 86–87, plate 4, figs. 38–40 (1944).
[9] Davies, L. M., *Nature*, **153**, 53 (1944).
[10] Lahiri, A., *Nature*, 153. 654 (1944).
[11] Lamba, B. S., *Current Science*, 258 (1944).

Chromatographic Separation of Coal Bitumens

INTEREST has long been focused on the so-called soluble coal bitumens, since Bone and Fischer demonstrated their influence on the coking characteristics of bituminous coals. Attention was specially directed towards the Fractions III and IV (Bone) of the high-pressure benzene extracts from coals. We need not recount the literature existing on the subject: but it is well known that there is no definite knowledge about the molecular nature of the coal bitumens except that they are complex mixtures. Recently, interest has been revived in the subject by Prof. H. L. Riley. From X-ray diffraction studies he suggests[1] that "the bitumen of the coal is responsible for the systematic variation in the *c* dimensions of the crystallites formed during carbonisation", and "It is therefore possible that the systematic variation of the *c* dimension is connected in some way with the coking phenomena". His researches have led him to investigate the carbonization characteristics of substances of known polycyclic structure. However that may be, it is clear that investigations on the constituents of the coal bitumens themselves would lead to a greater understanding of the subject if it were possible to isolate or at least resolve them into groups of substances of similar nature. Orthodox chemical methods have so far failed to resolve the components of coal bitumen. Although adsorption methods have been tried by some workers, it appears that no systematic application of the chromatographic technique (with all its vast elasticity) has yet been carried out. The only published example is recorded by Zechmeister and Frehden[3], who isolated a substance of the triterpene class from the light petroleum extract of a Hungarian lignite.

The chromatographic technique was tried and successfully applied by us in an effort to separate the high molecular weight oxidation products of oils. As many of the properties of these substances appeared to be similar to those of coal bitumens, samples of high-pressure benzene extracts of some coals were obtained from H.M. Fuel Research Station at Greenwich, and the fractions were subjected to chromatographic analyses. Results from preliminary experiments suggest that the problem of resolution of the bitumens into their components would yield to a systematic application of the ultra-chromatographic technique. The technique is simple and is as follows.

The sample (in this case Fraction IV of Mitchell Main Dull—the part soluble in boiling benzene) is dissolved in the solvent and a chromatogram is developed on a column of suitable adsorbent, and the zones eluted by means of selective eluants. In the chromatography of bitumen, development of a liquid chromatogram is by far the most satisfactory technique, as several members of a homologous series may be present showing no interspace on the chromatogram. In the chromatography of Fraction IV, we used silica gel as the adsorbent. Sorbsil Gr. A (8–12 mesh) gel was crushed, treated with concentrated nitric acid for two hours on a steam bath, washed free from acid, graded by elutriation to 100–200 mesh size and cleaned with hot distilled water until completely acid-free. The gel was then dried at 110° C. in shallow dishes and activated for two hours at 250° C. before use. The adsorptive on the chromatogram has a uniform brown colour in ordinary light, and no recognition of zones is possible. Separation of the zones is, however, easily done by using ultra-violet radiation (364–400 A.), when distinctly different fluorescences of the adsorbate both on the column and in the eluate can be observed. Eluants of Analar quality and 'chromatographically' purified are used for development and elution. The fluorescence in the eluate is best observed in very dilute solutions, as concentration tends to quench the fluorescence. For record purposes we take natural-colour photographs in ultra-violet light.

In the development of a liquid chromatogram, selection of the eluants is, of course, the most crucial point. In the chromatography of Fraction IV of Mitchell Main Dull, for example, we have used the following solvents in the order stated: petroleum ether 60°–80° C. (aromatic-free); petroleum ether plus 10 per cent benzene, benzene, benzene with 1 per cent ethyl alcohol, benzene with 5 per cent ethyl alcohol, benzene with 20 per cent methyl alcohol, chloroform, carbon disulphide saturated with methyl alcohol, and a 50 : 50 mixture of pyridine and carbon disulphide with 10 per cent methyl alcohol. In other cases, ethyl ether, carbon tetrachloride, cyclohexane and, for more strongly adsorbed substances, methylene chloride and tetrahydrofurane are good eluants. Of

other adsorbents (specially for rechromatography) activated alumina and magnesia are suitable media. Fullers earth (several types have been tried), florodine, etc., are not suitable media, for besides effecting polymerization of the resinous substances, they adsorb coloured substances too strongly.

Fifteen different fractions were separated with the first seven eluants in the case of Fraction IV (part soluble in boiling benzene): two fractions, first, resinous substances with very strong bluish-yellow fluorescence, and second, a substance with strong powder-blue fluorescence with petroleum ether, and petroleum ether plus 10 per cent benzene; three fractions with benzene, having bluish, greenish and milky yellow fluorescence; six fractions with benzene plus 1 per cent ethyl alcohol, including three brown rings (non-fluorescent) at regular intervals; one fraction with benzene plus 5 per cent ethyl alcohol; one with benzene plus 20 per cent methyl alcohol; one with chloroform; one with carbon disulphide plus methyl alcohol. At the end of elution with these solvents, the chromatogram is completely stripped of adsorbate, except for a black ring on the top, part of which can be dissolved in a mixture of pyridine and carbon disulphide. (The fluorescence colours noted are all ultra-violet fluorescence colours.) Each of these fractions can be further resolved into several fractions by rechromatography on aluminium oxide and magnesium oxide.

Applying similar technique, Fraction III of a Warwick Slate Bright coal sample has been separated into eleven fractions.

The behaviour of the fractions on the chromatogram indicates that the elution of the zones is a 'stripping' effect on the parts of a colloidal system, interspaces occurring between three groups which can be likened to the dispersing medium, protective colloids and micells of highly condensed carbonaceous substances. Interfacial tension is probably the main factor in the assembly, and therefore separation, of these substances.

Spectroscopic and other relevant data on the separated fractions are being collected and the complete analytical data will be published elsewhere in due course.

We wish to thank the Director of H.M. Fuel Research Station and Dr. H. L. Horton for making the benzene pressure-extracts available to us and Prof. W. F. K. Wynne-Jones for his helpful criticism and interest in the work.

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Nov. 9.

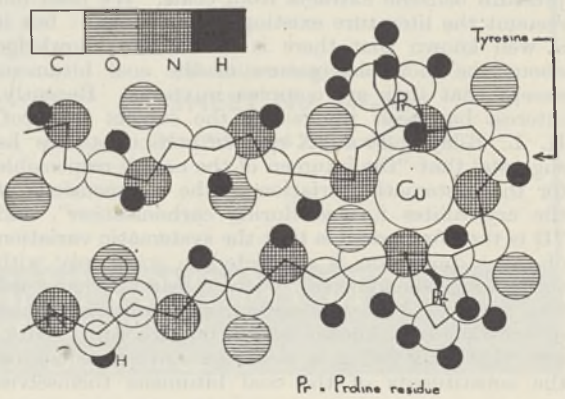
[1] *Proc. Roy. Inst. Chem.*, Pt. IV, 127 (Aug. 1944).
[2] *Nature*, **144**, 331 (1939).

Denaturation and Renaturation of Proteins

DESPITE the considerable advances that have been made in our knowledge of protein structure, the problem of denaturation remains somewhat obscure. A general theory of the phenomenon has been developed, which, although rough in its definition and speculative in character, is acceptable with varying degrees of qualification to most protein chemists. This theory supposes the uncoiling of a polypeptide chain (see, for example, Astbury and Lomax[1]); but so far direct evidence in support of it has been meagre and confused by experimental results that reflect chemical and physical reactions of secondary importance. These reactions may be avoided to a large extent by the examination of a protein of the greatest possible simplicity of structure. Silk fibroin, which is free from sulphur and contains a negligible number of amino- and carboxyl-groups, offers possibilities in this direction.

An earlier communication in *Nature*[2] indicated the possibility of renaturing silk fibroin, which normally occurs as a highly insoluble, fibrous protein. We have since found that the process of dissolution of fibroin in cupri-ethylenediamine, neutralization of the solution and dialysis, is attended, under suitable conditions, by complete renaturation of the protein. The optical activity, osmotic pressure, alkali-combining power, viscosity and tryptic digestion of the aqueous solution have been investigated, films of soluble fibroin have been prepared and examined by X-rays, and the analytical data for its constituent amino-acids have been extended. The results obtained lead to the following tentative conclusions.

The molecules of fibroin consist of long chains (length about 1300 A.; wt. 33,000) orientated parallel to the fibre axis. In its natural state the chains are in the almost fully extended configuration, corresponding to Astbury's β-keratin. They do not possess the regular periodicity of amino-acid distribution suggested by Bergmann and Niemann[3]; the greater part of the chain shows a regular periodicity, but there appear to be two regions, relatively small and symmetrically placed in the chain, that are rich in tyrosine, and include all of the four proline residues (Abderhalden and Bahn[4] isolated serylprolyltyrosylproline from fibroin). Adjacent chain molecules are linked by hydrogen bonds between opposing : CO and : NH groups of the peptide linkings. On dissolution of fibroin in cupri-ethylenediamine, these bonds are broken and each of the Cu-en groups combines with two proximate : NH groups along practically the whole length of the chain so that the whole molecular complex has a Cu : fibroin-N ratio of nearly 1 : 2 (the non-peptide-N in fibroin is very small). This complex formation occurs very rapidly and is followed by a slower reaction in which the chain folds back on itself at the two proline-containing centres to give a 3-limbed configuration (either as a lamina or a prism of axial ratio approx. 20 : 1). The extent of the folding is dependent on time and concentration of the cupri-ethylenediamine. This folding is probably due to a swivelling of the molecular parts at a prolyltyrosylprolyl grouping in the two tyrosine-rich regions of the chain.



A possible structure of the hinge is shown in the accompanying diagram, in which there are four donating nitrogen atoms (all in one plane) for one copper atom, the co-ordination number of six for the Cu being completed by two water molecules in place of ethylenediamine; the four nitrogen atoms are due to two proline, one tyrosine and one other amino-acid. The resemblance of this structure to hæmoglobin will be apparent. Neutralization of the cupri-ethylenediamine complex liberates the fibroin either in the completely renatured form (for which the name 'fibroinogen' is suggested) or as a mixture of renatured and denatured forms (both of molecular weight approximately 33,000) according to the conditions of dissolution. In the former case, dialysis affords a water-clear solution that gives no immediate precipitate on acidification and from which protein separates as a gel in the course of two or three days; in the latter, the solution is more opaque and stable for periods up to fourteen days, and acidification to *p*H 3 causes immediate precipitation of the denatured portion. It follows that the process of denaturation of fibroin is essentially an unfolding of molecular chains, which, in appropriate circumstances, is followed by their subsequent aggregation.

One point of special interest in the above folded chain is that apparently the β-keratin configuration of the chain itself is retained. For example, careful evaporation of a layer of aqueous solution of renatured fibroin leaves a water-soluble 'Cellophane'-like film that can be stretched when moistened to about three times its original length. The stretched film is completely insoluble in water and strongly birefringent, and gives X-ray diagrams (β-keratin structure) identical with that of the unstretched film and that from fibroin powder. This is contrary to the theory of Bailey, Astbury and Rudall[5] that denaturation (at least in a 'configurational' sense) is the conversion from the α- to the β-structure.

The degradation products of relatively high molecular weight, obtained by mild alkaline hydrolysis of fibroin, are insoluble in water and dilute acids and alkalis; they may be 'regenerated', however, to give water-soluble products. Should this regeneration involve a folding mechanism, then it follows that these degradation products exhibit true denaturation. On the other hand, it is possible that regeneration here implies merely a separation of molecular aggregates.

Fibroin thus provides an example of reversible denaturation in which not only is complete renaturation unequivocally demonstrable for the first time, but also the freedom from ancillary changes gives a clear picture of a molecular change that may serve as a basis for the general study of denaturation. With fibroin, denaturation consists simply of the unfolding of a molecular chain. The forces holding the folds in position are weak, and the unfolding readily occurs in aqueous solution. The straight chains thus formed are intrinsically soluble in water but, being no longer stabilized by intramolecular hydrogen bonds, they can only form hydrogen-bridges intermolecularly, that is, coagulation readily occurs. It is probable that this simple picture is not directly applicable to all proteins, the denaturation of most of which is attended by secondary reactions associated with thiol groups, extension of the molecular chain (α—β-keratin transformation), and other phenomena. The study of fibroin has, however, provided an explanation that, while admittedly not entirely novel, is in accord with the general theory of the solubility of macro-molecules (see Lieser[6]) and removes much of the vagueness that has been associated with a phenomenon of common occurrence and outstanding importance in protein chemistry.

A full account of this work will be published elsewhere in the near future.

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Nov. 21.

[1] *J. Chem. Soc.*, 846 (1935).
[2] *Nature*, **146**, 301 (1940).
[3] *J. Biol. Chem.*, **122**, 577 (1938).
[4] *Z. physiol. Chem.*, **210**, 246 (1932).
[5] *Nature*, **151**, 176 (1943).
[6] *Cellulosechemie*, **18**, 121 (1940).

Deaf-Mutism and Low Iodine Content of Water

THE association of congenital deafness or mutism with districts where endemic goitre and cretinism are prevalent is well known[1–5]. It is now generally accepted that endemic goitre and cretinism occur among inhabitants of areas where the iodine content of the water is low, provided no other rich source of iodine such as sea fish is utilized[6]. Russell Brain[7] considered that many hereditary factors influence iodine utilization and that in congenital cases what is inherited is not goitre, cretinism or deaf-mutism as such, but rather some defect in iodine utilization. Hallpike[8] has pointed out that congenital deafness does not necessarily involve a congenital anatomical defect, but may depend on an inherited predisposition to degeneration of certain tissues and be precipitated by biological factors, which are identifiable and subject to control.

A considerable amount of information has now been collected about the position of areas where the iodine content of the water is low, and the occurrence of endemic goitre in Great Britain[9]. During these clinical investigations on the distribution of thyroid enlargement, the highest incidence of deaf-mutism was found in districts where endemic goitre is prevalent and cretinism exists. In contrast with the incidence of goitre, men are affected with congenital deaf-mutism as often as women. In some cases deaf-mutes show enlargement of the thyroid gland; in others there is a history of goitre in some other member of the same family.

Stocks[10], working on the records of the Board of Education Goitre Survey of 1924, found goitre markedly prevalent in north Oxfordshire, with a very high incidence for enlargement of the thyroid gland among children aged twelve in rural areas, for boys 11·39 per cent, for girls 37·22 per cent. He classed Berkshire as a non-goitrous county and recorded the low rates of enlargement of the thyroid gland among rural children aged twelve, for boys 0·83 per cent, for girls 3·88 per cent.

The Rev. H. M. Ainger, working for the Association for the Deaf and Dumb of the Oxford Diocese, which also includes Berkshire, has made personal inquiries about the place of birth, age and residence of deaf-mutes in these districts. Using the records of the above Association, it is possible to compare the incidence of deaf-mutism in different areas and

correlate it with the iodine content of the water supply.

In three districts of Oxfordshire, namely, Banbury, Chipping Norton and Woodstock, which comprise one area, there is endemic goitre, the water supplies are low in iodine (1·4–3·0 μgm. per litre), and the records showed 28 deaf-mutes in a total population of 36,653. In three districts of another area, Henley and Goring in Oxfordshire and Windsor in Berkshire, where endemic goitre is not prevalent and the iodine content of the water is moderate to high (10·1–52·2 μgm. per litre), there were five cases of deaf-mutism in a population of 38,910.

We have records of endemic cretinism in certain Oxfordshire villages; in two instances two members of the same family. Goitre existed in other members of these families. Ten deaf-mutes from low-iodine areas in Oxfordshire were examined radiologically, four men and six women of ages between 16 and 61 years. These people showed bone changes in the skull, but of no consistent pattern. In some the deviation from the normal in the skeletal architecture was marked. The association of deaf-mutism with endemic goitre and cretinism in England supports clinical observations in other parts of the world.

It is suggested that a biological factor such as a low amount of available iodine, if associated with inherited defect in iodine utilization, may contribute to the incidence of congenital deafness. For such families the provision of an additional source of iodine, such as iodized salt, is indicated.

We are indebted to Miss B. W. Simpson, Rowett Institute, for estimation of the iodine content of drinking waters, and to Dr. F. H. Kemp, Radcliffe Infirmary, Oxford, for radiological observations.

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[1] Bircher, H. (1883), quoted by Joll, C. A., "Diseases of the Thyroid Gland" (Heinemann, London, 1932).
[2] McCarrison, R., *Lancet*, ii, 1275 (1908).
[3] Nager, F. R., quoted by Fischer, J., and Wolfson, L. E., "The Inner Ear" (Heinemann, London, 1943).
[4] Stott, H., and Gupta, S. P., *Ind. J. Med. Res.*, **21**, 655 (1934).
[5] Census of India, 1931.
[6] Young, M., Crabtree, M. G., and Mason, B. M., *Spec. Rep. Ser. Med. Res. Coun. London*, No. 217 (1936).
[7] Brain, W. Russell, *Quart. J. Med.*, **20**, 303 (1927).
[8] Hallpike, C. S., *Brit. Med. Bull.*, **2**, 119 (1944).
[9] Goitre Subcommittee, Medical Research Council, *Lancet*, i, 107 (1944).
[10] Stocks, P., *Quart. J. Med.*, **21**, 223 (1928).

Sources of London Honey

As a perfumery research chemist and also as a London beekeeper for some eighteen years, I would like to point out critically but constructively that there is but little relationship between the several pollens found in a honey and the bulk of the nectars from which the honey is derived. I have samples of London honeys going back for about five years. These all exhibit the peculiarities mentioned by Dr. Melville in his communication[1]. But as I have pointed out on several occasions in the lay press and elsewhere, from observation—and this will be endorsed by other London beekeepers—the bulk of the *main* honey flow from London (in particular the parks) is derived from the limes (*Tilia Europea*) and the privet hedges (*Ligustum vulgare*). Since the War, however, the prevalence of willow herb (*Epilobium angustifolium*) has served to modify the blend, producing ultimately a paler and sweeter honey. Some years there is also a substantial honey flow from horse-chestnut, sycamore and maple; but coming early in the year, these nectars are mainly consumed in brood-rearing and not stored.

My research into the flavours of honeys brought me into contact some ten years ago with Mr. E. K. Nelson, of the Bureau of Chemistry and Soils, Wood Research Division, Washington, who was able to establish the presence of methyl anthranilate in orange blossom honey and thus to identify a definite flavour. More recently, Mr. Pryce Jones and I have been investigating the peculiar bitterness of lime nectar. The cat-like odour referred to by Dr. Melville, which is also associated with the flowers and leaves of *Ribes*, is, I think, unquestionably due to privet, since it can be readily detected in country-gathered honeys when privet or wild privet prevails in the vicinity, but where *Ailanthus* is usually absent. Moreover, in Marketing Leaflet No. 31 (Ministry of Agriculture and Fisheries), "Honey-Grading and Marketing", privet is given specific prominence as an unpleasant natural *taint* to be guarded against. Incidentally, *Ailanthus* (*glandulosa*) smells of mice. I have had some experience with this tree as I grew quite a lot of it both outside and under glass at Purley Park, Berks. It is the natural food plant of the Chinese ailanthus silkworm (*Philosamia Cynthia*) which I reared in large numbers before my unsuccessful endeavour to acclimatize it in Battersea Park fifteen years ago. The larva does not smell, but the newly emerged moth smells strongly of mice. The *Ailanthus* by no means always flowers successfully, and according to Wedmore, even in California it is only considered of secondary importance for honey, and even that is of a poor flavour.

My present apiary, consisting of twelve stocks in the Gardens of the Zoological Society, Regent's Park, furnished me with a crop which, as a beekeeper, I am quite sure was gathered from horse-chestnut, willow herb, privet and lime; and yet a pollen analysis by Mr. Yate Allen revealed the following bewildering variety:

Red or black currant (*Ribes rubra vel nigra*)	20
Lilies (Liliaceæ)	15
Aubretia (*Aubretia*)	7
Laurel (*Prunus Laurocerasus*)	7
Poppy (*Papaver*)	6
Hyacinth (*Hyacinthus*)	6
Tulip (*Tulipa*)	6
Asters (Compositæ spp.)	6
Lime (*Tilia*)	5
Willowherb (*Epilobium*)	5
Hollyhock (Malvaceæ)	5
Indeterminate—other flowers	12
	100

In a private communication received from Mr. Yate Allen in October, he says: "As I have pointed out on many occasions in lectures or writing, there are all sorts of pollen which get into the honey which have no relation to the nectar, such as the pollen from grass, poppies, plantain, etc., which produce no nectar at all. Then again, there are a lot of nectar-producing flowers which produce very little pollen, while others produce it copiously. Limes, partly due to their pendulous position, produce very little pollen. Hence if bees also had access to some of the cruciferous flowers, one might find a sample of nearly pure lime honey to contain the largest percentage of grass, Plantago and crucifers."

Todd and Vansell[2] have shown by a series of experiments by collecting nectar from flowers with a pipette and also by analysis on the contents of the bee's honey stomach that not only do the number of pollen grains vary enormously with each species of plant, but also that they are in a large part removed while still in the honey sack of the bee by the action of the honey stopper into the ventriculus. The quantity removed depends on the length of time the bee spends on its gathering trip.

In conclusion, it may be said that whereas a pollen analysis of honey usually reveals its country of origin, only a chemical analysis can hope to reveal the sources of the nectars in its composition. I have a honey produced this summer in Hertfordshire showing a pollen count of 81 per cent *Castanea sativa* (sweet chestnut), if this should be of interest.

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[1] *Nature*, **154**, 640 (1944).
[2] *J. Econ. Entom.*, **35**, 728 (1942).

Honey from *Ailanthus*

THE attraction of hive-bees to the flowers of the Tree of Heaven, recorded by Dr. R. Melville in *Nature* recently[1], has also been noted by me in Oxford. On July 14, 1944, I was awakened at dawn by a continuous high-pitched whining hum, like that of a dynamo, in the tall trees outside this Museum, and found it to be caused by thousands of *Apis mellifica* which were visiting the male flowers. The latter are obscure and small-petalled, in large panicles, and give off a strong musky scent. Dr. Nicholas Polunin, who kindly identified the flowers as *Ailanthus altissima* (Mill.) Swingle, remarked that this kind of disagreeable smell is more commonly associated with fly-pollinated flowers such as certain Umbelliferæ. But I searched several branches at different times of day, and found practically no winged insects on the flowers except hive-bees, apart from a few small ladybird beetles.

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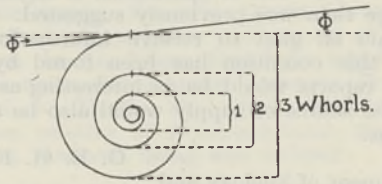
[1] *Nature*, **154**, 640 (1944).

Classification of Spiral Foraminifera

THE members of certain pairs of foraminiferal genera (*Nummulites* and *Operculinoides*, *Assilina* and *Operculina*, etc.) with flat spiral tests are distinguished from each other only by the rates (or angles) of opening of their spires. It therefore seems anomalous that no ruling exists as a guide in separating forms after this manner; for although the right allocation is often obvious, there are intermediate forms which might, at present, be as legitimately referred to one genus as to the other, in each of these pairs.

In order to suggest a criterion, I propose that a spire should be regarded as wide-angled if it doubles its diameter with each revolution. This criterion is easily applied when examining sections (whether equatorial or meridian), and represents a roughly intermediate degree between forms now separated by spiral angles alone. If this criterion (or some other, for the one proposed has no inherent virtue beyond the convenience of the round figure 2) were generally adopted, it would secure more precision than now exists. I would also suggest, for this proposed critical rate of opening, the symbol $2d$, as signifying its doubling of the diameter with each revolution. An illustration of a uniform spire with this rate of opening is reproduced herewith.



All other rates could be similarly defined: thus spires would have the symbols $1{\cdot}7d$, $2{\cdot}5d$ or $3{\cdot}2d$ if, and so long as, their diameters increased by 70 per cent, 150 per cent or 220 per cent respectively, with each whorl.

Again, since foraminiferal spires are seldom constant for long, this convention would also enable one to define their variations, whether individual or ontogenetic. Thus one could say, of a certain species, that the rate of opening of its spire, at a given radius, varied from $1{\cdot}5d$ to $1{\cdot}8d$, and closed to about $1{\cdot}4d$ at a later stated radius. It would thus be possible to give actual values to what at present can only be suggested in general terms—'very variable', 'becoming more crowded', etc.—besides enabling one to define the differences between spires better than has hitherto been possible.

I understand that, so long as a given rate of diameter increase is maintained, the outline of the whorls concerned may be represented by the equation $r = ce^{\alpha\theta}$, where r is the length of the radius vector, drawn from the centre of the spiral, c is the length of some initial radius also drawn from that centre, α is the index of the rate of opening, e is the base of Napierian logarithms, and θ is the angle made by the vector with the initial radius. The 'opening angle' (Φ in the diagram) is then $\tan^{-1}\alpha$, and either Φ or α may be taken as characteristic of the degree of openness of the spiral.

If the rate of increase is 2, then $\alpha = \log_e 2/2\pi = 0{\cdot}1103$, and Φ is approximately 6·3°. Thus the critical rate of opening, for a wide-angled flat spiral whorl, could be taken as 6·3°, the practical test for that rate being the doubling of the diameter by the whorl.

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Specimens of *Asterias rubens* L. with Ten Tiedemann's Bodies

IT is well known that, in *Asterias rubens* L., nine Tiedemann's bodies are normally found. Elsewhere[1] I have previously recorded the occurrence of specimens with ten of these bodies, and have shown that the absence of the tenth (the presence of which makes the arrangement quite regular) cannot be accounted for by supposing that it is suppressed in order to 'make way for' the stone canal.

Since my previous note, the specimens of *Asterias rubens* used in the ordinary classwork of this Department have been carefully examined to see if further examples occurred and several have been found.

In my first note I recorded two out of twenty-five specimens which had this abnormality, and since then another eighty specimens have been examined of which four had ten Tiedemann's bodies. It would appear, therefore, that this condition may be expected in about 6 per cent of specimens, a slightly lower percentage than was previously suggested.

I should be glad to receive information as to whether this condition has been found by others. Negative reports would be as interesting as positive ones. The source of supply would also be a matter of interest.

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[1] *Ann. Mag. Nat. Hist.*, xi, 8, 61 (1941).

Observations on Bird Behaviour

WITH regard to the letters about birds pecking at windows and apparently attacking their own reflexions, it seems, judging from the reports of Dr. Britton, Messrs. Stephenson and Stewart, and Miss Frances Pitt, that this behaviour is considered to be confined mainly, if not entirely, to cock birds. At least, no mention is made in the correspondence of females behaving in this manner.

At present, there is a hen chaffinch in my garden that frequently pecks at the dining-room window. She has been doing this for five days now, and her pecking periods are astonishingly regular: 8.45–9.5 a.m., 11.30–11.50 a.m., 3.10–3.20 p.m., 3.45–4 p.m.; during these periods, but not of course continually during the period, she will peck at the window. At other times, even though she may be at the bird table near the window, she ignores the glass. The dining-room is a long room with three big windows, each latticed. The same window and the same pane of glass is chosen each time. There can, in this case, be no question of territory defence.

The habit is widespread among birds. I have records of its occurrence in blackbirds, song-thrushes, missel-thrushes, house-sparrows, robins, chaffinches, greenfinches, pied wagtails, grey wagtails, blue-tits, great-tits, cole-tits, spotted flycatchers, starlings and jackdaws. Miss Pitt's record of a dipper is most interesting.

I can offer no explanation of the behaviour. I do not think that territory has anything to do with it—at least in the vast majority of cases. In one case, however, I think the tapping was intelligent behaviour designed to attract the attention of the humans in the room. During the very cold spell of early 1940, we would put food out on various tables round the house (I was then living near Winchester) and especially on a long plank running outside the billiard room. A great-tit frequented this 'table' and would drive all other birds, including a robin, away. If the plank was bare, he would stand and chirp and then fly at the window, striking it sharply, then back to chirp, then fly to strike, and so on. When food was put out he stopped. This particular bird was very tame—tamer than any of the others, most of which would feed from the hand—and would fly to and sit on my shoulder, remaining there even if I walked indoors, but leaving if anyone approached.

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E. M. Stephenson and Chas. Stewart describe certain actions of a sparrow in what many students of animal behaviour would call somewhat anthropomorphic terms[1]. They then remark that: "It is usually stated that all bird behaviour is instinctive. Much of it can, of course, be adequately described by this term. It seems inadequate, however, to speak as though the whole of animal behaviour . . . can be classified under one of two terms—instinct or intelligence. Such stultified and obsolete terminology has long since been advanced upon by the psychologist dealing with human behaviour." But, by most modern animal psychologists such stultified and obsolete terminology is not employed. It seems, moreover, doubtful whether the study of animal behaviour would necessarily be advanced if, as suggested, investigators used "terms for all the grades of specific psychic phenomena", whether the word 'psychic' be used 'legitimately' or not.

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[1] *Nature*, 154, 801 (1944).

Open Packing of Spheres

SOME automatic and continuous coal-weighing apparatus make use of the experimental fact that graded-to-size coal weighs the same per unit volume whatever the size of the lumps; hence a cubic foot of large lump coal weighs the same as a cubic foot of small lump coal.

This is easily proved. Let n be the number of spheres in one foot length; then if there are n^2 spheres in each layer, the total number of spheres in 1 cub. ft. is n^3 and the radius of each sphere is $\frac{1}{2n}$ ft. and its volume is $\frac{4}{3}\pi\left(\frac{1}{2n}\right)^3 = \frac{\pi}{6n^3}$ cub. ft., and as there are n^3 spheres, the total volume of the spheres in 1 cub. ft. is $\frac{\pi}{6} = 0{\cdot}524$; that is, a little more than half is coal, and less than half is voids. As neither n nor r occurs in the expression for the volume, the number and size of the spheres do not affect the weight per cubic foot. This holds good only for the packing implied. If the closest packing is adopted, then the percentage of solids (density) increases as the size of the spheres decreases.

If the packing is such that one sphere touches eight others, then it can be shown that for spheres 1 in. in diameter, the total number in a 10-in. cube is 1,205, and the ratio of the volume of the spheres to a 10-in. cube is 0·631; while if the spheres are 2 in. in diameter, the total number is 132 and the density is 0·553; and if there are 40 spheres in the 10-in. edge, the total number of spheres is 87,388 and the density is 0·715.

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RESEARCH ITEMS

Preparation of Epidemic Typhus Vaccine

A. P. BERKOWITZ (*S. Afric. J. Med. Sci.*, 9, 109; 1944) has investigated the suitability of duck and turkey eggs for the large-scale preparation of epidemic typhus vaccine. Duck embryos live longer (8–9 days) after inoculation than chick embryo do (6–7 days). The growth of rickettsiæ in the yolk sac of the duck egg is far more prolific than in the yolk sac of the hen's egg; and the duck egg's yolk sac at the stage used (15–16 days old) is about twice as big as that of a 13–14 day hen's egg. Duck eggs inoculated by Cox's method gave, on the 7–8th day after inoculation with a South African strain of epidemic typhus, an average yield of 100–200 c.c. of vaccine, which is about five times the yield of hen's eggs. Stained smears show, in a high percentage of yolk sacs, an almost confluent sheet of rickettsiæ, "quite beyond anything seen even in the most heavily infected hen's eggs". Because the yield per yolk sac is so high, the residual proteins are correspondingly diluted, so that processing is easier. Preliminary protection tests in guinea pigs have indicated that the protective value of the duck egg vaccine is at least equal to that of the hen egg vaccine. A Middle East strain of epidemic typhus gave a similar extremely prolific growth in duck eggs. In turkey eggs the growth was just as prolific, and the yield of vaccine as great. It was found that the best conditions for primary incubation of duck eggs were a temperature of 102° F. in a completely humid atmosphere.

Biology of a Hymenopterous Parasite

THE *Journal of Agricultural Research* (69, Aug. 15, 1944) contains a paper by D. W. Clancy of the U.S. Department of Entomology and Plant Quarantine dealing with the parasite *Allotropa burrelli* Mues. This insect is a member of the family Platygasteridæ and parasitizes the mealy bug known as *Pseudococcus comstocki* (Kun.), which has recently become a serious pest of apple in parts of Virginia, West Virginia and Ohio. The parasite was introduced into the United States from Japan in 1939 with the object of aiding the control of the pest already mentioned. It appears that the development of the parasite in the host is normally monoembryonic, although twinning may rarely occur. There is only a single larval instar and the larva bears but one pair of spiracles which is located on the first segment. Three twin embryos were found out of the hundreds that were examined. Two of these were early morulæ each with a separate trophamniotic layer, tightly enclosed in a membrane probably derived from the surrounding tissues of the host. The third pair was more advanced, and since both embryos were enclosed in a single trophamnion there seems no doubt in this case that they were derived from a single egg. It appears, therefore, that a very simple type of polyembryony may occur in rare circumstances. The details of the process are very much the same as have been described by Leiby and Hill in *Platygaster hiemelis*.

Characin Fishes from Venezuela

LEONARD P. SCHULTZ has recently reviewed the catfishes of Venezuela. The present report is a companion to this work, being the second contribution on the fishes of Venezuela resulting from the author's expedition to that country to study the fish fauna, mostly of the Maracaibo Basin, during February–May 1942 ("The Fishes of the Family Characinidæ from Venezuela with Descriptions of Seventeen New Forms", *Proc. U.S. Nat. Mus.*, 95, No. 3181, Washington, 1944). The previous report (*ibid.*, 94, No. 3172; 1944) gives details of stations, etc., where specimens were collected. This family consists of freshwater fishes found in both Africa and South America, and is most closely related to the Nematognathi or catfishes and to the Cyprinidæ. An artificial key is given to the many genera and also in most cases keys to the species. Recently, George Sprague Myers has described a new genus and species of Characid fishes from the Rio Negro, Brazil, for which he proposes the name *Rhinobracyon negrensis* (*Proc. Calif. Acad. Sci.*, iv, 23, No. 39; 1944). This he regards as a close relative of *Bryconamericus*, the generic characters, however, being well defined.

Vegetation of the South Brazilian Plains

AN interesting paper, "Profundidade dos solos e vegetação em campos cerrados do Brasil meridional", by Felix Rawitscher, Mario G. Ferri and Mercedes Rachid (*An. Acad. Bras. Cien.*, 15; 1943), is a continuation of studies published in the same journal in 1942. An examination of the water balance of *campos cerrados* (the fields in Emas, near Pirassununga, present the typical vegetation of the *cerrados*) led to the following conclusions: (1) The water content of the soil is high, as a number of tables show, and the underground water-level occurs at a depth of 17–18 metres. (2) The vegetation consists of plants which grow only during the rainy season, and Gramineæ with superficial roots which wither when there is a lack of water. There were also shrubs and smaller trees with very deep roots, many of which remain green during the whole dry period. (3) A number of experiments in rapid weighing, infiltrations, etc., showed that the stomata were open during the whole day and that the saturation deficit of the leaves was always small. The behaviour of the plants was not that of xerophytic vegetation, a fact in accordance with the great water reserves available to the plants. (4) The daily values of transpiration and evaporation are smaller than has been generally supposed, and the "campos cerrados" of the type studied do not present arid conditions, as is usually implied when they are included among the savannas. The arid appearance is due to annual fires, and the effects of dryness are limited to the surface only.

Diazocyanides

As is well known, Hantzsch regarded the isomeric diazohydroxides, sulphonates, and cyanides as *syn*- and *anti*-geometrical isomers. H. H. Hodgson and E. Marsden (*J. Chem. Soc.*, 470; 1943) showed that the so-called *syn*- and *anti*-diazosulphonates are not geometrical but structural isomers, namely, diazosulphites and diazosulphonates, respectively. The same authors (*J. Chem. Soc.*, 395; 1944) have now presented evidence indicating that the aryl so-called *syn*- and *anti*-diazocyanides are also structural isomers, namely, *iso*nitrile and nitrile structures, containing N—N and N—C bonds in the molecule. The conversion of the non-coupling *p*-nitrobenzenediazocarbonamide with a stable C—N bond, by reaction with bromine, into an N-bromocarbonamide, which will then couple with α- or β-naphthylamine in non-aqueous media, as also with β naphthol in aqueous alcoholic and alkaline solution, indicates that Hofmann reaction has occurred, and that the intermediate

diazotate with its easily ruptured N—N bond will couple. Other lines of evidence in support of their view are given by the authors. Hantzsch's formulation of the aryl *syn*-diazocyanides as NR=N—C≡N is regarded as correct, but the supposed *anti*-form is the *iso*cyanide $NR{=}N{-}\overset{+}{N}{\equiv}\bar{C}$, the two thus containing central N—C and N—N links, respectively, as stated above. The correctness of Hantzsch's formulation has, of course, been questioned many times before, but the new evidence is interesting.

Stability of Ascorbic Acid

An investigation of the effect of conditions of storage on the stability of ascorbic acid in various foods, etc., carried out by J. B. Marshall, J. W. Hopkins and G. A. Young (*Canad. J. Res.*, **22**, 39; 1944), showed that jams to which ascorbic acid had been added after processing, and a natural orange concentrate, retained 70–80 per cent of the ascorbic acid on storage for periods up to a year when protected from moist conditions. 'Fortified' jams retained 75 per cent after six months at 23·9° C. When exposed to conditions of high relative humidity and temperature the products became objectionable from the point of view of physical appearance before the ascorbic acid losses became excessive.

Impedance Measurement at High Radio Frequencies

At a meeting of the Radio Section of the Institution of Electrical Engineers on December 6, L. Essen read a paper describing methods and apparatus, developed in the Radio Department of the National Physical Laboratory, for the measurement of both balanced and unbalanced impedances at frequencies between 375 and 750 mc./s. The equipment consists of an air-spaced concentric line for unbalanced impedances and a screened twin line for balanced impedances. The method is based on the principle described by R. A. Chipman in 1939, and consists in varying the length of line by means of a movable bridge carrying a thermojunction unit to determine the positions of current resonance. The component to be measured is connected to the open end of the line, and the impedance is evaluated from the readings of resonant length and the width of the resonance curve. Convenient working equations are developed by Dr. Essen, who also describes the results of a number of measurements made to check the validity of the assumptions involved. The main application of the apparatus has so far been to the determination of the propagation constants of radio-frequency cables, these constants being deduced from the values of the input impedance of a length of the cable under different conditions. By a suitable choice of the conditions of measurement, the effect on the input impedance of the discontinuity at the junction of the measuring line and the cable can be measured and practically eliminated. From the considerable experience obtained in the use of these methods during the past three years, the accuracies achieved for a wide range of reactance and resistance values are found to be ± 2 per cent and ± 5 per cent respectively.

Long Duration of the Balmer Spectrum in Excited Hydrogen

Current theories nd experimental determinations of the time of relaxation of the hydrogen atom lead one to expect that in about 10^{-8} sec. the intensity of light of a condenser discharge through hydrogen emitting the Balmer series of lines would diminish in the ratio $e : 1$. Lord Rayleigh (*Proc. Roy. Soc.*, A, **183**, 26; 1944) reports experimental determinations in which hydrogen, made luminous by a powerful discharge, is blown out of the electric field by thermal expansion. In some experiments the time in question is one thousand times greater than the expected value. As the discrepancy is not cleared up, the results are reported in sufficient detail for critical examination.

Molecular Structure of Dielectrics

In a paper entitled "An Elementary Description of Some Molecular Concepts of the Structure of Dielectrics" (*J. Inst. Elec. Eng.*, **91**, Part 1, No. 48; Dec. 1944), E. B. Moullin gives an account of some of the atomic and molecular concepts necessary for the formation of a model that will give a rational description of certain behaviour of dielectrics. The dielectric constant of many materials is found to depend on the radius of the molecule, and the phenomenon of permittivity can be included in the inverse-square law of force between charges if the molecules can be supposed to exhibit an effect equivalent to that of electrostatic induction. Dr. Moullin gives an outline of the Bohr atom and the electronic theory of valency, and this provides a mechanism equivalent to induction as well as one whereby it is to be expected that certain molecules possess a permanent electric moment, which molecules are shown by direct experiment to be electric dipoles. A graphic description is given of the manner in which dipoles must produce heat when the dielectric is in an alternating electric field. The paper closes with a brief description of certain experiments which have been designed and made to show that molecular dipoles are a cause of dielectric losses, and a brief discussion of whether they are the main cause of the losses experienced in the insulating materials commonly used in electrotechnology.

Division Errors of a Reversible Transit Circle

Sir Harold Spencer Jones, the Astronomer Royal, and R. T. Cullen have determined the division errors of the fixed circle of the reversible transit circle of the Royal Observatory, Greenwich (*Mon. Not. Roy. Astro. Soc.*, **104**, 4; 1944). The fixed circle was not divided on an automatic dividing machine, as is usual with large circles, but by a new "method of division by generation" which was devised by Messrs. Cooke, Troughton and Simms, Ltd., and this method was expected to give smaller division errors. In the case of circles divided on automatic dividing machines, it has generally been assumed that division errors could be represented as a sum of periodic terms; but as such an assumption would not necessarily be valid for the new method, a programme was arranged to determine the error of each division without any assumptions. A full description of the method, which occupies eighteen pages, is given. It was found that the analysis of the division errors showed a cyclic but irregular variation of $2\frac{1}{2}°$ period and that the form depended on the position in the circle. The 0°–90° section resembles the 90°–120° section, and the 30°–60° resembles the 60°–90°. When the $2\frac{1}{2}°$ variation was removed, periodicities of 15°, 30° and 60° appeared, and it is possible that the remaining fluctuations were due to accidental errors of detection or of dividing. The error of each of the 5′ graduation marks over an arc of 120° was determined with a probable error of $\pm 0{\cdot}028''$.

ELECTROCHEMICAL PROPERTIES OF SILICIC ACID SOLS

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THE properties of silicic acid sols have been studied by several investigators[1-10]. Differences of opinion[1,2,3] have been expressed as to whether the sols possess any intrinsic acid character. In a number of publications from this laboratory the interactions of silicic acid sols with bases[11,12,13,14], neutral salts[15,16] and acids[17,18] have been discussed. The sols even after purification by prolonged electrodialysis have free acidities of the order of 10^{-4} N. Their ultra-filtrates have a practically neutral reaction showing that mobile H^+ ions associated with the colloidal particles give rise to the observed free acidity of the sol.

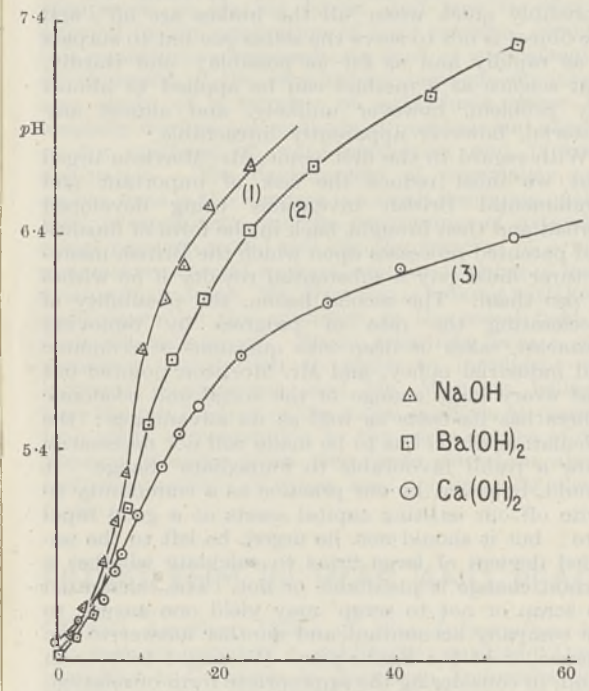

Fig. 1. SILICIC ACID SOL M.

The titration curves (Fig. 1) of the sols with dilute bases show an inflexion (first inflexion) in the acid region[12,13] at pH 4·5–5·5. This inflexion cannot be referred to the neutralization of any dissolved acid present in the sol, as the ultrafiltrate has negligible free and total acidities. The total acid neutralized by several dilute bases at this inflexion point is a constant quantity. The slopes of the titration curves, however, indicate the order $Ca(OH)_2 > Ba(OH)_2 > NaOH$ of the intensity of reaction of the various bases with the sol. The 'irregular or specific' cation effect observed with hydrogen clays[12,20] is indicated by this order.

With increasing concentrations of caustic soda a continued buffer action beyond the first inflexion point takes place, and a second inflexion (Fig. 2) between pH 11·0 and 11·7 corresponding to the formation of $NaHSiO_3$ is observed[13]. An inflexion at pH 11·8 in the titration curves of silicic acid sol with concentrated alkali has been observed by Treadwell and König[4]. The plot of the buffer capacity $\beta \left(= \frac{\Delta B}{\Delta p\mathrm{H}} \right)$ against the concentration of the alkali shows a maximum near the point of half neutralization, indicating that up to the second inflexion only the first stage of neutralization of H_2SiO_3 is reached. The maximum value of the buffer capacity does not occur exactly at the point of half neutralization.

The sol behaves as a strong acid as judged from (*a*) the form of the titration curves with small additions of very dilute bases; and (*b*) by the manner of variations[14] with dilution and temperature of the free acid and the total acid at the first inflexion point. The free and total acids decrease almost linearly with dilution (from 0·3 gm. per litre to 0·04 gm. per litre) and do not materially change with temperature within the range 1°–50° C. A weak acid character of the sol is indicated (*a*) by the buffering in the range pH 6–8 beyond the first inflexion; (*b*) by the comparatively low ratio (0·5–0·8) of the free acid to total acid at the first inflexion, which is of the order of 10^{-4} N; and (*c*) by the manner of the variation of the pH of the sol on the addition of acids. A smaller lowering in the pH is observed[18] on the addition of a given concentration of an acid to the sol than when added to hydrochloric acid of nearly the same pH as the sol.

The dissociation constant calculated from different points of the titration curve with a dilute base on the basis of the total acidity at the first inflexion

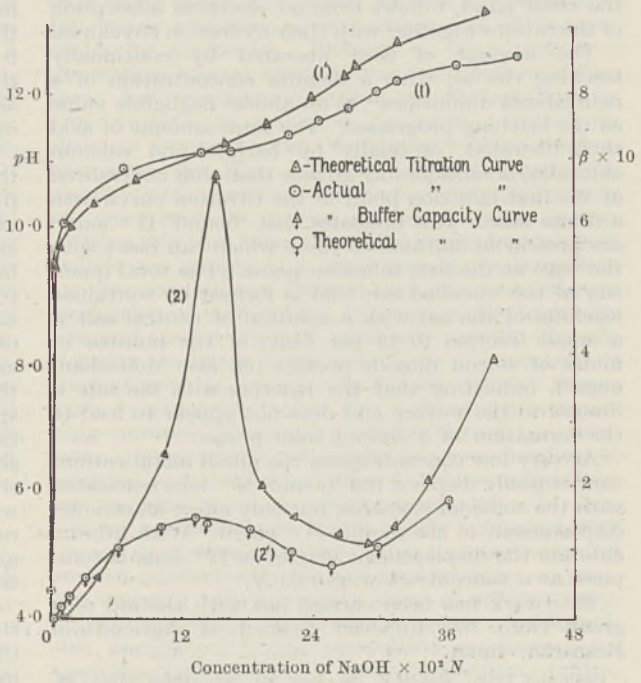

Fig. 2. SILICIC ACID SOL I'. THE THEORETICAL CURVES REFER TO THOSE OF A HYPOTHETICAL ACID HAVING THE SAME TOTAL ACTIVITY (OR SECOND INFLEXION) AND pK AS THE SOL.

point has different values[13]. The *p*K values calculated from the *p*H at the point of half neutralization in the titration curves with concentrated alkalis decrease with a decrease in the silica content of the sol. The dissociation constant calculated from the *p*H at the second inflexion and from a consideration of the solubility of silicic acid varies from $4{\cdot}4 \times 10^{-10}$ to $5{\cdot}9 \times 10^{-10}$ with different sols and is found within the range (10^{-9}–10^{-10}) observed by previous workers[5,6,7,8].

The amounts of acid liberated from the sol by neutral salts as shown by the diminution in its *p*H[15,16] on the addition of salts and by the total amount of acid[16] found in the salt extracts are in the order: $Ba^{++} > Ca^{++} > K^{+} > Na^{+} > Li^{+}$, which follows the lyotrope series and illustrates what has been designated[12,20] as the 'regular cation effect'. The greater relative effect of Ba^{++} ions compared with Ca^{++} ions is definitely against the explanation that the development of acidity is due to the formation of insoluble silicates[9,10], since calcium silicate is more insoluble than barium silicate. The order, on the other hand, follows from an electrical adsorption of the cations together with their hydration envelopes.

The amount of acid liberated by continually leaching the sol with a definite concentration of a neutral salt diminishes[16] to an almost negligible value as the leaching progresses. The total amount of acid thus liberated, especially by barium and calcium chlorides, is considerably greater than that neutralized at the first inflexion point in the titration curve with a dilute base. This indicates that 'bound' H^{+} ions[19] are present in addition to those which can react with the base at the first inflexion point. The total quantity of the so-called salt that is formed by continued leaching of the sol with a solution of neutral salt is a small fraction (0·13 per cent) of the number of moles of silicon dioxide present (cf. also Moltschanowa[10]), indicating that the reaction with the salt is limited to the surface and does not appear to lead to the formation of a second solid phase.

At very low concentrations the alkali metal cations cannot easily displace the 'bound' H^{+} ions associated with the colloidal particles, but only effect an osmotic displacement of the mobile H^{+} ions[16]. With lithium chloride the displacement of mobile H^{+} ions is complete at a concentration of 0·01 *N*.

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SCIENCE IN THE MODERN STATE

MR. H. S. MORRISON'S L. T. Hobhouse Memorial Trust Lecture, which was read on his behalf by the Provost of University College, London, at Cambridge on May 9, 1944, has now been published under the title "Science and Administration in Modern Government" (London: Oxford University Press. Pp. 20. 2*s*. net). The lecture is concerned mainly with the part which science can and must play in our affairs after the War if we are to survive and progress as a community, and more especially with social research or social engineering. Mr. Morrison emphasized first the speed of scientific development at the present time and the scale upon which much of it proceeds. War-time experience seems to have established that there is no reason in the nature of things why Britain, admittedly a leader in fundamental research, should be any less good in the sphere of development and application; secondly, progress in the theoretical and practical solution of specific problems can be incredibly quick when 'all the brakes are off', and the object is not to serve the *status quo* but to surpass it as rapidly and as far as possible; and thirdly, that science as a method can be applied to almost any problem, however unlikely, and almost any material, however apparently intractable.

With regard to the first point, Mr. Morrison urged that we must reduce the risk of important and fundamental British inventions being developed abroad and then brought back in the form of finished and patented processes upon which the British manufacturer must pay a substantial royalty if he wishes to use them. The second lesson, the possibility of accelerating the rate of progress by removing obstacles, takes us deep into questions of economic and industrial policy, and Mr. Morrison pointed out that every large change in the social and economic sphere has its costs as well as its advantages; the calculation which has to be made will not necessarily show a result favourable to immediate change. It should, however, be our practice as a community to write off our existing capital assets at a good rapid rate; but it should not, he urged, be left to the unaided devices of large firms to calculate whether a certain change is justifiable or not. The calculation 'to scrap or not to scrap' may yield one answer to the company accountant and another answer to the Chancellor of the Exchequer. We ought to bear in mind, in considering the appropriate form of relationship between the State and industry after the War, the importance of ensuring that public policy is effectively operative when great and vital decisions affecting our industrial progress are being taken.

After referring here to the possibilities of scientific development of the supplies of coal, oil and sugar within the British Commonwealth, and to the possibilities of biological development as indicated by penicillin, biological control of plant, insect and animal life, including the biological use of X-rays, Mr. Morrison illustrated the third lesson from the work of the Research and Experiments Department of the Ministry of Home Security in the application of scientific methods to problems of civil defence, such as the evaluation and development of types of shelter. Such methods have obvious application in building, and one of the first-fruits of such operational research has been the preparation of more than a score of monographs on the technique of building structures. Lord Portal's temporary post-war dwelling-house is

a further example of the practical application of research techniques and a precursor of greater things to come.

Such social research is part of a distinctive tradition of British social science, and Mr. Morrison expects a great extension of the techniques of exact quantitative study on society, social groups and their environment on one hand, and on the other the extension of social research into the qualitative field. In regard to the first, Mr. Morrison urged the importance of a study of social mobility—the rate and machinery of transfer from one social class or group in one society to another. He suggested that a study in Great Britain might show the universities acting to some extent as engines of social mobility, and to a greater extent as instruments of individual economic advancement. Again, the problem of marriage and the question of actual geographic mobility requires investigation. In spite of their increasing importance in the age structure, we know little about the old as a social factor beyond their numbers. We know little about the factors that shape the choice of occupation on leaving school, and how far this is affected by the occupation of their parents. Besides this quantitative approach, we need as supplement a development of the case-history method—an intensive study of a number of individuals either by specially worked out methods of question and answer or by methods of word-association and picture-association. The development of personality and ability tests in the Services is a small beginning of this kind of approach, but the programme of extended social research would call for the creation of a new generation of social workers, and the training of large groups of students. Mr. Morrison is looking with keen anticipation to the extension in the social field of scientific techniques. Social scientists have a tremendous contribution to make to intelligent enlightened government, and Mr. Morrison believes that the full fruition of the social sciences, at present in a stage corresponding to the early phases of the physical sciences when they were uncertain about their explanations of cause, may not lie so far ahead of us.

PETROLEUM IN WAR AND PEACE

THE American Office of War Information has recently received a publication entitled "Developments and Trends in American Industries (Oil Mining and Refining ; High Octane Gasoline)" which is in fact a collation of excerpts from trade magazine articles and other sources. It covers practically every activity of the American petroleum industry to-day, and gives some striking pointers as to the way in which war-time scientific discoveries will be harnessed to meet peace-time requirements.

Driven by the necessity for producing high-quality aviation fuels in enormous quantities, research workers, sponsored by the Petroleum Industry for War Council and the Aviation Gasoline Advisory Committee, have made startling progress. Until recently, 100-octane gasoline was regarded as an optimum fuel ; but it has been superseded as a standard. There is a new 'Supergas' called triptane (paraffinic-trimethyl-butane), which is 50 per cent superior to *iso*-octane from which 100-octane gas is obtained ; its anti-knock qualities are such that no commercial engine has been built which is capable of utilizing its full power. There is 'Dynafuel', which is also 50 per cent more powerful than standard 100-octane fuel, and there are no doubt other fuels of similar calibre which will become commercially available in peace-time. One is tempted to forget that the use of 100-octane spirit or super-gasoline for post-war motoring purposes implies the evolution of a 'super-car'. It is, in fact, unlikely that such fuels will be used in motor-cars for some long time to come, but it is interesting to note that petroleum chemists do envisage the production of a 70-mile-to-the-gallon motor spirit, not to mention 100,000-mile tyres, and 20,000-mile lubricating oils.

Second only to aviation gasoline in war-time importance is the production of toluene for T.N.T. (trinitrotoluene). During the War of 1914–18, practically all the toluene used was produced from coal tar ; but to-day, although more toluene is being manufactured in that way than ever before, the greater part is being supplied from petroleum oil refineries. Indeed, the capacity of hydroformer installations and attendant toluene extraction and purification plants has been so increased that it has been found possible to divert some of the toluene to 100-octane activities, after fulfilment of all requirements for explosives. Toluene in peace-time is a commercial solvent used in dyes and paint manufacture ; but quantities required are not in any way proportionate to war-time demands. Petroleum chemists foresee a sharp decline in toluene production after the War, but they equally foresee the possibility of converting toluene-manufacturing plants into machinery for making gasoline-blending agents.

Other war-time activities of the petroleum industry include the supply of a large part of the butadiene for the production of Buna-*S* type synthetic rubber ; production of high-quality lubricating oils, hydraulic oils, and special types of lubricants capable of withstanding the bitter winter conditions of Greenland or alternatively the heat of the Sahara desert. Waxes more moisture-proof than tin, rust preventives, deicing materials, fireproofing compositions for soldiers' tents, preservatives for mosquito nets, medicines, anæsthetics and a host of other war-time commodities are prepared from petroleum derivatives. In fact, refining has become so highly skilled compared with the old days when cuts were made to satisfy demand for one product only that its repercussions on post-war industry will be nothing short of revolutionary. To-day the petroleum chemist is master of a formidable number of highly specialized processes ; for example, hydrogenation, dehydrogenation, hydroforming, reforming, alkylation, polymerization, isomerization, catalytic cracking, aromatization, cyclization, etc., and he literally tears apart (cracks) the petroleum molecule and reassembles it into the pattern he desires.

But it is not only the petroleum chemist who has forged ahead. Other branches of the industry have made parallel advances. In 1922 the deepest producing well in the world was in the Orange Field, Texas ; it reached a depth of 5,490 ft. To-day a well in the Terrebone Parish Field of Louisiana has been drilled to, and is producing at, a depth of 13,475–90 ft. A new era in the art of exploration and discovery began with the use of the torsion balance and the seismograph. To-day gravimetric methods, electrical measurements, aerial mapping, geochemical and radiation techniques are all available to assist in the search for oil. Before the entry of the United States into the War, practically all the petroleum and petroleum products consumed in the

Atlantic Coast States were transported there by tanker. Now the "Big Inch" pipe-line is delivering more than 300,000 barrels of crude oil daily to refineries on the Atlantic seaboard, while the "Little Big Inch" delivers domestic fuel oil to the New York Harbour area. The "Big-Inch" main line is 1,254 miles long and the "Little Big-Inch" 1,475 miles.

SOUTH AFRICAN INSTITUTE FOR MEDICAL RESEARCH

THE annual report for 1943 of the South African Institute for Medical Research, Johannesburg, is a record of valuable war and other work. The work of the South African Medical Corps Establishment is directed from the Institute and is organized into eight sections. Their work includes the supply and administration of the seven large and fifteen small laboratories situated at military hospitals all over the Union and the two mobile laboratories based on the Institute; training of personnel in tropical medicine and laboratory work, which has been extended to naval medical officers; a military blood transfusion service, which has developed considerably; the supply of glucose saline and other fluids for intravenous use; a snake-catching unit, which caught an average of 50–75 cobras and puff-adders a month to provide venom for the manufacture of antivenene by the Institute (a larger and more permanent snake farm at Barberton is being planned and a valuable agreement has been made with the director of the Pasteur Institute, Brazzaville, French Equatorial Africa, for the supply of venoms from equatorial snakes); and a unit for catching gerbils for the use of the typhus-vaccine department, which catches about 1,000 gerbils a month. Assays of vitaminized foodstuffs have been done by the biochemical department for the Director of Supplies, the Red Cross Prisoner-of-War Parcels Section, and other authorities. The Institute is at present the only laboratory in South Africa able to undertake the assay of vitamins in foods. An important part of the war effort has been the continued production of typhus and yellow fever vaccines and other curative and protective sera for military use, and also the building up of a reserve of anti-gas-gangrene serum.

Research work has been done on pneumonia, meningitis, diphtheria, tuberculosis endotoxoid vaccine, tetanus, whooping cough, dysentery, plague, syphilis and other diseases. The enzyme purification and concentration of tetanus and diphtheria antitoxin, anti-gas-gangrene serum and polyvalent antivenene has made such progress that it is possible to plan large-scale manufacture of various antitoxins by this process. The susceptibility of various South African rodents to vole acid-fast mycobacterium of tuberculosis has been studied. Gerbils dying after a dose of 0·0001 mgm. had lesions with a histological appearance between those of tuberculosis and leprosy. Much work has been done on anti-typhus vaccines. It is claimed that experiments with the intradermal injection of typhoid vaccine have given satisfactory results; with this method less vaccine is required and there are no local or general reactions.

Considerable research work has been done on gas gangrene, one interesting result of which has been that, among eleven samples of sera of wild animals examined, the sera of two zebras, one inyala, four impala and four kudu contained *Cl. welchii* antitoxin.

It has been shown for the first time that epidemic typhus in the Transkei Territory is transmitted by lice. Murine typhus and tick-bite fever also occur in this territory. By serological tests, using pure Rickettsial suspensions, it has been found possible to differentiate between epidemic typhus, murine typhus and tickbite fever.

Entomological work has included a study of the distribution of sandflies; species which transmit kala-azar have been found in Southern Rhodesia; this discovery is important because troops returning from areas in which kala-azar is endemic may bring home this disease. A survey of the fleas of the South African Union is also being made. Other subjects of study have been rat-mite dermatitis, due to *Liponyssus bacoti*, which is very common on rats in Johannesburg, intestinal myiasis due to Dipterous larvæ, the toxin found in the eggs of ticks which causes tick-paralysis and the fungal and nematode parasites of mosquito larvæ.

The Biochemical Department has done work on human nutrition, the nutrition of mosquito larvæ, carbohydrate metabolism and the mechanism of the sulphonamide methæmoglobinæmias.

The routine work of the Institute has again increased, although the military laboratories have taken over some of this. Further expansion of the Serum Production Department has been necessary. The large-scale serum-drying and freezing plant, the cost of which was borne by Sir Ernest Oppenheimer, has been completed and is in use. Very large quantities of vaccines have been produced. Typhoid endotoxin immunization in the Witwatersrand mines has reduced the annual incidence of typhoid since 1934 from 5·26 to 0·25 per 1,000 and the annual mortality from 1·18 to 0·05 per 1,000.

The reports of the branch laboratories at Port Elizabeth and Bloemfontein indicate that these also are vigorously developing the work of the parent Institute.

G. LAPAGE.

AERIAL SYSTEMS FOR SHORT RADIO WAVES

A RECENT meeting of the Radio Section of the Institution of Electrical Engineers was devoted to the presentation of two papers dealing with the theory and experimental performance of special aerial array systems for short and ultra-short radio waves.

The first paper was by E. B. Moullin and was entitled "Theory and Performance of Corner Reflectors for Aerials". For wave-lengths of about one metre, a convenient arrangement comprises a pair of reflecting sheets inclined to one another to form a V, with a single aerial on the bisector. Dr. Moullin shows that the field from such a system can be calculated by image treatment and that an algebraic formula can be found when the angle of the V or corner reflector is a proper fraction of 180°. A numerical example given in the paper illustrates the convenience of the Fourier series for evaluating the radiation pattern when the aerial is sufficiently distant from the apex to make the main beam much sharper than a sinusoid, and concurrently to produce side-lobes.

This paper also describes an experimental investigation at a wave-length of about 1·25 m. of the radiation pattern produced by a half-wave-length aerial in a corner reflector with angles of 90°, 60° or 45°. Using sheets one and a half wave-lengths high and two wave-lengths wide, it was found that the radiation distribution is not appreciably modified if the apex of the reflector is amputated and the resulting hole closed by a flat sheet. Such a modified reflector affords a saving in space and also shows that the pattern is insensitive to the shape of the back of the reflector. Other experiments showed that the performance of this type of aerial system was inappreciably affected if the continuous reflecting sheets were replaced either by wire netting with a mesh about one fortieth of a wave-length inside, or by a comb of open rods about half a wave-length long.

In the course of the second paper, H. Page described some measurements of the performance of various horizontal dipole arrays operating on wave-lengths in the region of 15–20 metres as used at stations of the British Broadcasting Corporation. The main method of measurement adopted consisted in elevating a calibrated frame receiving aerial by means of a captive balloon ; by varying the height and position of the balloon, the field strengths in different directions from the transmitting array were determined. In a second method, a frame aerial at ground-level was used ; this gave only relative values of field strength and was used mainly to determine variations in the performance of the aerial array as the radio frequency in use was altered over a small band.

It was found that for an aerial array radiating over a flat site free from obstacles, there was good agreement between the theoretical and measured performance : the maximum field strength was of the order of 0·8–0·9 of the theoretical value. A sloping site or the existence of other nearby arrays may, however, cause appreciable departures from the theoretical characteristics. In particular, it was found that the loss of power in radiating through other aerial array systems may be as much as 40 per cent in some cases ; and this loss is not necessarily associated with a resonant condition in the obstructing array.

It is concluded from this work that, in order to obtain the best efficiency in short-wave transmitting aerial arrays, these should be erected on as flat a site as possible and should be arranged to avoid radiation through other arrays ; distant obstructions which intercept part of the main lobe of radiation should also be avoided.

'MINOR' ELEMENTS IN PLANT NUTRITION

OUR knowledge of the precise physiological functions of the so-called 'minor' elements in plant nutrition has not kept pace with the growing realization of their importance in agricultural and horticultural practice. A number of papers in the *Proceedings of the American Society of Horticultural Science* report the effects of certain minor elements on crop growth and behaviour. R. D. Dickey and M. Drossdoff (42, 74 ; 1943) show that 2 lb. of manganese sulphate per tree applied to the soil cured frenching of the leaves of the tung (*Aleurites fordii*), due to manganese deficiency. The same authors (42, 79 ; 1943) describe a 'cupping' of the terminal leaves of the tung, which are reduced in size and show an interveinal chlorosis and sometimes an apical and marginal browning. This may be followed by leaf abscission and shoot die-back ; the condition can be cured by applying copper sulphate (1/16 oz. per tree) to the soil. That the disease is due to copper deficiency and the ameliorative effects of the soil dressings of copper sulphate are not due to any indirect effect, is shown by the fact that spraying with copper sulphate is equally effective in curing the disease.

J. G. Maclean, W. C. Sparks and A. M. Binkley (44, 362 ; 1944) in a manurial experiment with potatoes in an alkaline soil (*p*H 8·5) supplied the sulphates of iron, copper, zinc and manganese (25 lb. per acre) alone and in all possible combinations, in addition to adequate dressings of nitrogen, potash and phosphate. Besides noticeable effects on crop yields due generally to effects on tuber size rather than the number of tubers, all the treatments, except copper + iron + zinc, copper + zinc + manganese, iron + zinc, copper + manganese, and zinc + manganese, increased the thickness of the periderm of the tuber significantly. Whether or not a thickened periderm will reduce tuber damage during harvest and marketing remains to be seen, but the possibilities in this direction need no stressing. Effects of minor elements on skin colour of tuber of Red McLure potatoes are reported by W. C. Sparks (44, 369 ; 1944), who found that all combinations of minor elements tried increased tuber colour in the field, but the effect was greatest when iron, alone or in combination with copper or copper and manganese, was supplied.

Significant effects on carrots and turnips of application of borax, copper sulphate, manganese sulphate and zinc sulphate, to soils in which the crop showed no deficiency symptoms, are described by G. H. Harris (43, 219 ; 1943). The effect varied on the different soils (but copper always increased root yield) and yield, sugar content and keeping qualities of the roots were all affected by the treatment.

CYTOPLASM, VACUOLE AND CELL-WALL MAGNITUDES IN DIPLOID AND TETRAPLOID BARLEY

IN the larger cells of a 'gigas' or 'semi-gigas' allotetraploid, is the increase due to proportionate increases in the cytoplasm, the vacuoles and the cell-walls, or is it mainly due to an increase in one alone or in two of these ? By careful analyses of the water, ash, sugar, 'protein', nitrogen, etc., contents of diploid and tetraploid plants of a single variety of barley, *Hordeum vulgare*, grown under constant nutrient conditions in photothermostats, I. Ekdahl (*Arkiv för Botanik* (Stockholm), 31, No. 5, 1 ; 1944) is able to draw some interesting conclusions. Tetraploid leaves assimilate more slowly but have a higher proportion of their dry weight as sugar and ash than diploid leaves, but if this extra sugar and ash is deducted from the total dry weight, a 'residual' dry weight for 'protein', cell-wall, etc., is obtained which is the same in both tetraploid and diploid leaves. Calculated on the residual dry weight, fresh tetra-

ploid leaves contain about 30 per cent more water than the diploids; the roots, on the other hand, have approximately the same composition in tetraploids and diploids, whether calculated on fresh weight or residual dry weight. Thus, "The difference between the leaf structures of tetraploid and diploid barley, apart from the difference in volume, appears to be that the tetraploid leaf cells contain comparatively more water, sugar and ash, while the amounts of cytoplasmic substances are proportionally the same. In the root cells it is mainly only the cell volume which is changed."

By correlating the analyses with measurements of the cell dimensions in a number of organs and tissues, it seems that when the cell volume increases as a result of doubling the number of chromosomes, in the leaf, the 'thickness' of the cytoplasmic layers and cell walls is uniformly increased but not to the same extent as the cell dimensions, that is, the cells have a larger proportion of their volume as vacuole. In the roots, however, the 'thickness' of the cytoplasmic layers and cell-walls increases to the same degree as the general cell dimensions.

FORTHCOMING EVENTS

Monday, January 22

INSTITUTION OF ELECTRICAL ENGINEERS (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Discussion on "Applications of Electricity to Water Supply" (to be opened by Mr. J. F. Shipley).

Tuesday, January 23

INSTITUTION OF CIVIL ENGINEERS (at Great George Street, Westminster, London, S.W.1), at 5.30 p.m.—Mr. S. R. Raffety: "Rural Water Supplies".

ROYAL AERONAUTICAL SOCIETY (at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1), at 5.30 p.m.—Discussion on "Civil Aviation".

Tuesday, January 23—Wednesday, January 24

IRON AND STEEL INSTITUTE (joint meeting with the LINCOLNSHIRE IRON AND STEEL INSTITUTE) (in the Technical School, Cole Street, Scunthorpe), at 7.30 p.m.—Mr. G. D. Elliot: "Ironmaking at the Appleby-Frodingham Works of the United Steel Companies, Limited".

Wednesday, January 24

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Mr. James B. Firth: "Forensic Science".

SOCIETY OF CHEMICAL INDUSTRY (joint meeting of the PLASTICS GROUP with the BRITISH RHEOLOGISTS' CLUB and the FARADAY SOCIETY) (at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1), at 2.30 p.m.—Dr. G. W. Scott-Blair: "The Rheology of Plastics".

TELEVISION SOCIETY (joint meeting with the RADIO SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS) (at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Mr. Donald G. Fink: "American Television Broadcasting Practice, 1927–1944".

BRITISH ASSOCIATION OF CHEMISTS (BIRMINGHAM SECTION) (in the Large Hall, Chamber of Commerce, New Street, Birmingham), at 6.30 p.m.—Discussion on "Social Security for Chemists".

Thursday, January 25

LONDON MATHEMATICAL SOCIETY (at the Royal Astronomical Society, Burlington House, Piccadilly, London, W.1), at 3 p.m.—Prof. J. Hadamard: "Psychological and Personal Recollections of a Mathematician".

Friday, January 26

INSTITUTION OF MECHANICAL ENGINEERS (at Storey's Gate, St. James's Park, London, S.W.1), at 5.30 p.m.—Mr. J. Foster Petree: "Mechanical Engineering in the Shipyard" (Seventeenth Thomas Lowe Gray Lecture).

INSTITUTE OF FUEL (SCOTTISH SECTION) (at the Royal Technical College, Glasgow), at 5.45 p.m.—Dr. J. M. Ferguson: "The Insulation of Open-Hearth Furnaces and Blast-Furnaces".

Saturday, January 27

ASSOCIATION FOR SCIENTIFIC PHOTOGRAPHY (at Caxton Hall, Westminster, London, S.W.1), at 2.30 p.m.—Mr. H. K. Bourne: "Electric Discharge Lamps for Photography".

APPOINTMENTS VACANT

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

SENIOR EXECUTIVE ENGINEER by the Public Works Department, Trinidad—The Ministry of Labour and National Service, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. E.1304.A) (January 24).

ENGINEER for the Public Works Department, Government of Trinidad—The Ministry of Labour and National Service, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. E.1299.A) (January 25).

HEAD OF THE DEPARTMENT OF SCIENCE of the South-East Essex Technical College and School of Art, Dagenham—The Chief Education Officer, County Offices, Chelmsford (January 27).

PLANT ENGINEER (must have general scientific educational background, degree in physics or mechanical engineering; some precision engineering experience essential) by a firm in Middlesex—The Ministry of Labour and National Service, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. C.2321.XA) (January 27).

CONTROLLER OF MATERIALS in the Directorate-General of Aircraft in India—The Ministry of Labour and National Service, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. C.2430.A) (January 30).

ASSISTANT TO THE ADVISORY CHEMIST for the South Eastern Province under the scheme of the Ministry of Agriculture and Fisheries—The Acting Principal, South-Eastern Agricultural College, Wye, Ashford, Kent (January 30).

SENIOR RESEARCH CHEMIST with experience in manufacture of or research on petroleum products (Reference No. F.2777.XA), a RESEARCH CHEMIST with chemical engineering qualifications (Reference No. F.2778.XA), and a RESEARCH CHEMIST with laboratory experience in petroleum or heavy chemicals (Reference No. F.2779.XA), in the Research and Development Department of a British Oil Company at its Refinery in N.W. England—The Ministry of Labour and National Service, Central Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting the appropriate Reference No.) (February 12).

ASSISTANT ENGINEERS (temporary) by the Kenya Government Public Works Department, for water supply schemes—The Ministry of Labour and National Service, Appointments Department A.3.(B.), Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No.E.1317.A) (February 12).

UNIVERSITY READERSHIP IN LOGIC AND SCIENTIFIC METHOD, tenable at the London School of Economics and Political Science—The Academic Registrar, University of London, c/o Richmond College, Richmond, Surrey (February 26).

LECTURER IN VETERINARY PARASITOLOGY—The Registrar, The University, Liverpool (February 28).

DIRECTOR OF MUSEUMS—The Town Clerk, Municipal Buildings, Dale Street, Liverpool 2 (February 28).

CHAIR OF GEOGRAPHY, and the CHAIR OF GEOLOGY—The Registrar, The University, Sheffield (March 31).

UNIVERSITY READERSHIP IN ENTOMOLOGY, tenable at the London School of Hygiene and Tropical Medicine—The Academic Registrar, University of London, c/o Richmond College, Richmond, Surrey (July 31).

ASSISTANT (medical graduate) IN ANATOMY—The Secretary, The University, Aberdeen.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Scheme for a Degree Course in Chemical Engineering. Pp. 28. (London: Institution of Chemical Engineers.) [101

Ministry of Labour and National Service. Higher Appointments: Report of the Committee appointed by the Minister of Labour and National Service in July 1943. (Cmd. 6576.) Pp. 62. (London: H.M. Stationery Office.) 1s. net. [101

Other Countries

Bulletin of the Bingham Oceanographic Collection. Vol. 9, Art. 2: Studies on the Marine Resources of Southern New England, 1: An Analysis of the Fish Population of the Shore Zone. By Herbert E. Warfel and Daniel Merriman. Pp. 92. (New Haven, Conn.: Peabody Museum of Natural History, Yale University.) 1.50 dollars. [2812

Annual Report of the Imperial Council of Agricultural Research for 1943–44. Pp. ii+44. (Delhi: Manager of Publications.) 2 rupees; 3s. [2812

Republica Argentina: Ministerio de Agricultura, Direccion de Meteorologia, Geofisica e Hidrologia. Serie E, No. 1: El Tercer Centenario del Barometro. Pp. 12. (Buenos Aires: Ministerio de Agricultura.) [2812

Indian Forest Leaflet No. 65: Conditioning Chamber for Plywood. By M. A. Rehman. Pp. ii+3. (Dehra Dun: Forest Research Institute.) 6 annas; 7d. [2812

Food is Where you Find It: a Guide to Emergency Foods of the Western Pacific. By Lucy M. Cranwell, Josiah E. Green and A. W. B. Powell. Pp. 72+4. (Auckland: Auckland Institute and Museum.) [41

Seventeenth Annual Report of the Council for Scientific and Industrial Research, for the Year ended 30th June 1943. Pp. 76. (Canberra: Commonwealth Government Printer.) 3s. 4d. [41

Papers of the Michigan Academy of Science, Arts and Letters. Vol. 29 (1943). Pp. xiii+606. (Ann Arbor, Mich.: University of Michigan Press; London: Oxford University Press.) 5 dollars; 28s. net. [51

New Zealand: State Forest Service. Annual Report of the Director of Forestry for the Year ended 31st March 1944. Pp. 38. (Wellington: Government Printer.) 1s. [51