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SCIENCE IN THE FOREIGN SERVICE

THE departure of Prof. Eric Ashby for Moscow to take up his position as scientific attaché, with the rank of counsellor at the Australian Legation, to which he has been appointed, as recently announced (*Nature*, Jan. 20, p. 72), marks the first step in fulfilment of a proposal which has been increasingly discussed during the last two years. The interruption of communications by war conditions has of course made it necessary to improvise new organizations now that contacts of men of science are fewer and less easily arranged and even the publication of scientific and technical papers may require to be withheld temporarily or in part. Experience gained during the War with such organizations as the British Central Scientific Office in Washington, the American Scientific Office in London, the Anglo-Soviet Science Collaboration Committee, and the Scientific Co-operation Office of the British Council in China goes far to suggest that, even when normal means of communication and intercourse are fully restored, such organizations may still have a valuable part to play.

That much appears in the specific recommendations of the report of the British Commonwealth Science Committee, set up under the chairmanship of the President of the Royal Society in October 1941. Reporting in the summer of 1943, this Committee suggested the maintenance of permanent scientific and technical representation in London and possibly also in other capital cities of the English-speaking countries, in association so far as possible with representatives of the United States and others of the United Nations. This idea has since been further developed by Dr. J. Needham in his article on "An International Science Co-operation Service" (*Nature*, 154, 657; 1944), where the further suggestion is put forward that the proposed Service should have permanent representatives in all countries and regions, with diplomatic or 'League-official' status, and guaranteed Government facilities for communication and transport.

This line of thought goes far beyond that of the mere exchange of information or even of personnel. As Dr. J. Needham has pointed out, the staff of a Science Co-operation Bureau in its work of collecting and disseminating scientific information must be familiar with the conditions of scientific and technical life and thought in the country where they are stationed. They must possess the confidence of the resident diplomatic personnel and be competent to advise them authoritatively on problems relating to science and technology. They must be unfailingly at the service of the Ministers of the Government departments concerned with science.

It is at this point, where the advantages of diplomatic status as suggested by Dr. Needham are most apparent, whatever its disadvantages in other respects, that we meet another trend of thought which has also thrown up the idea of scientific

attachés. Despite the welcome which the Government's proposals for the reform of the Foreign Service received generally in 1943, there was widespread agreement that they did not provide sufficiently for the introduction of a scientific outlook into the Service or the capacity to appreciate the importance of scientific and technical questions. Lacking that capacity or outlook, diplomatists cannot function effectively as intelligence officers in the modern world, and Sir Victor Wellesley, who recognizes clearly that essential function among various constructive proposals in his recent book "Diplomacy in Fetters" (Hutchinson and Co., Ltd., 1944), says that: "Scientific, industrial, and mineralogical attachés may soon have to be added". In a close survey of some aspects of the work of the Foreign Service, Political and Economic Planning in a broadsheet "The Future of Foreign Publicity" pointed out that an ambassador or minister is responsible for all the official contacts between his country and that in which he works, and he cannot escape a measure of concern for many of the unofficial contacts as well, since they may react upon the international relations which it is his primary duty to oversee and conduct. For this reason P E P believes that after the War the number and range of specialist officials may be increased, particularly in the general field of economics, and attachés to Embassy staffs for nutrition, agriculture and labour are particularly indicated, and possibly other attachés concerned with the Colonies or colonial policy.

The suggestion which Lord Samuel threw out in the House of Lords' debate on scientific and industrial research on July 15, 1943, regarding the appointment of scientific attachés to the principal British embassies abroad, or that Great Britain should be provided with scientific liaison officers competent to bring to the notice of those interested at home the progress and methods which have been achieved or established in other countries, thus fell on well-prepared soil. It has been taken up by the Parliamentary and Scientific Committee, which has prepared a confidential memorandum on the subject in the light of views obtained from various sources. The memorandum, after reviewing existing arrangements, recommends a formal inquiry into the whole question by the Government with representation of the Foreign Office, the Fighting Services, the Departments of Overseas Trade and of Scientific and Industrial Research and the British Council. The memorandum was adopted by the Committee on December 12, 1944, and has been sent to the Secretary of State for Foreign Affairs.

While this idea of scientific attachés has been widely discussed from both points of view, no practical steps have so far been taken in the matter, though Great Britain has an agricultural attaché in Washington. Among scientific men it appears to find widespread approval, for it is recognized that if the common attack on some of the scourges of mankind is to be organized effectively on international lines, in the way in which Prof. J. M. Mackintosh, for example, suggested in his review of preventive medicine at the recent British Association meeting, some further means of integrating knowledge and power will be required. At a recent dinner at which Prof. Ashby was present, the whole question was discussed and his appointment stimulated much favourable comment.

It has been left, however, to Australia to give a lead to the British Commonwealth and Empire in this matter, but Prof. Ashby's short visit to Britain will have convinced him that he carries with him the keen interest and the good wishes of scientific workers here. As already indicated, his appointment in Moscow is for about a year, and it should be clear from the note that has already appeared in *Nature* how well qualified Prof. Ashby is to act as a pioneer in a matter of close concern to the whole scientific world. Obviously a scientific attaché must be prepared to move across the frontiers of many different branches of science and to concern himself with the interdisciplinary questions involved in team-work and the corporate attack with different techniques on a common problem. Prof. Ashby aims at working in a laboratory for a time, but the U.S.S.R. and Australia have many problems in common, especially in agriculture and animal husbandry. By concentrating more or less on these problems at the start, Prof. Ashby may well find it easier to gain the experience and the sympathy and understanding which will assist the handling of more general and perhaps more delicate questions, whether of co-operative research or the exchange of personnel.

This appointment is only a start, and it should be obvious that the appointment of scientific attachés can never be fully successful unless the traffic is in both directions. Prof. Ashby hopes that one result of his mission will be the visit of a Russian man of science to Australia, not as attaché, but to work in one of the laboratories and to study Australian science in general; he hopes also, if the U.S.S.R. approve, to arrange for an Australian man of science to pay a like visit to Russia. Whether in fact such interchange can be arranged remains to be seen, but Prof. Ashby can be assured that his work in Moscow will be closely and sympathetically followed by fellow men of science in Britain.

There can be no illusions as to the difficulties in this experiment or the demands it may make on Prof. Ashby's tact and scientific and organizing ability. Much may be learnt from it, but scientific workers in Great Britain will be at one not merely in wishing Prof. Ashby success but also in the hope that we will not be slow to follow the example and enterprise of the Commonwealth of Australia. Only if such steps are taken in the near future can we hope to be ready to organize effectively, on the world-wide scale demanded, for scientific and technical co-operation in the attack on the problems of the post-war world; and on the continuous application of scientific knowledge to problems of human welfare, on both of which the realization of a new world order of freedom from want, disease and fear depends.

MUCH ABOUT THE SOYBEAN

Soybean Chemistry and Technology

By Klare S. Markley and Warren H. Goss. Pp. viii+261. (Brooklyn, N.Y.: Chemical Publishing Co., Inc.; London: Macmillan and Co., Ltd., 1944.) 20*s*. net.

THAT versatile oriental bean, the soybean, has been a long time coming into its own among Anglo-Saxons. For many years it has been a staple product in China and Manchuria where, according to travellers' tales, all sorts of uses were made of it. After the War of 1914–18 it came to Britain in quantity, the beans having their oil 'solvent extracted', and uses were sought for the cake both as animal feed and as a source of protein for humans. A serious check was given to its use when cattle were injured by it owing to the presence of a poisonous glycoside. The oil was not too well liked by the soap-maker; it was not so 'soft', that is, unsaturated, as cotton seed oil, or hard enough to replace tallow, and the cost of hardening it by the catalytic process was not remunerative. Lastly, the growing of it was not understood either in Britain or in America.

During the last decade all this has abruptly changed, at least in the United States. It is stated that soybean now leads in the production of edible oil, having outstripped cotton seed oil, while the meal, as a superior protein ingredient for livestock and poultry food, has become of great utility. More important, soy flour in various forms is gaining in popularity: it is an ingredient of rations, included in bakery and other food products, and is sold direct to housewives. This latter applies to Great Britain also where soya flour, which we are beginning to learn how to use, has become a valued additional source of protein.

As protein shortage is one of the most serious deficiencies which ail the world of the future, the importance of the soya bean as an easily grown high-yielding source of it cannot be gainsaid. One question will be the nutritive value of this particular kind of protein, having regard to its constituent amino-acids.

There is thus considerable scope for a work on the chemistry and technology of soya, which this book seeks to provide: it is apparently sponsored by the Soybean Nutritional Research Council. Soybeans have fortunately proved to be a profitable crop in the corn belt of the United States; hence the willingness to extend their cultivation. During the last ten years, the acreage has increased tenfold, and the yield per acre has gone up by nearly 50 per cent; hence the production is almost fifteen times as great, the major extension taking place during the war years. A large amount of applied science has contributed to this result. There are many hundreds of types and strains, and the bean is peculiarly sensitive to changes in soil and climate; so that elaborate studies have been necessary to increase the yield and quality under local conditions.

The beans average 40 per cent of protein and 18 per cent of oil, with upper limits of 50 per cent and 24 per cent respectively. They are remarkable in being a rich source of the enzyme urease. The sugars include two of the rare ones, raffinose with 18 and stachyose with 24 carbon atoms. The glycosides comprise saponins, phytosterolins and *iso*flavone. The oil has about 2 per cent of phosphatides.

The first part of this book gives a useful summary of the chemical components of soy, and includes about five hundred references to the original literature. The second half deals in some detail with the processing mainly for oil, but contains also the most modern development of the production and refining of phosphatides. More than a hundred oil mills are listed as extracting the oil, an example of how quickly such an industry can be established. Soy flour is dealt with in a dozen lines only: it would appear that there is still much to do with it before it becomes a large-scale human food; one had expected to find much more under this head.

The book is probably mainly intended for practical use by those directly concerned with soybeans in one way or another, and as such is a model of what a really helpful text-book can be. It is easily written, concise and full of information not otherwise available.

There is no reason why Britain should not grow and process soybeans, provided a race can be found which fits in with the vagaries of our climate. Indeed, the Ministry of Agriculture ought to give direct encouragement to such work, for Britain just cannot afford to be left out of such modern progressive development. The day is definitely passed when we can be content to import the product of other men's enterprise and brains and stand still at home. If wool can be made from arachis protein, surely soya protein may prove an alternative source.

We can confidently recommend the book to those interested in the soybean. E. F. ARMSTRONG.

SINGING BREEZE

Wartime Harvest

Poems. By Marie Carmichael Stopes. Pp. 92. (London: Alexander Moring, Ltd., 1944.) 5*s*.

ALTHOUGH this choicely arranged volume of poems provides us with a further example of the author's versatility, I do not feel that Dr. Stopes is, as yet, sufficiently co-ordinated as a poet to be justly classified.

As Lord Alfred Douglas very rightly affirms in the preface to this collection—"adequate matter and form are here"—but despite this invaluable framework and a particularly fresh singing quality, there is often a falling-off of brushwork within the frame. "Instead of Tears", for example, dedicated to men who lost their lives on H.M.S. *Cossack*, containing as it does some of the finest lines in the volume, at the same time serves to illustrate the author's variability of treatment:

> "Brown berried sea-wrack tangles round your throat
> In festive chaplets where no fresh wreathed flowers
> Will reach you, and your resolute white limbs
> Are draped with laminarias crinkled strands."

A lovely stanza with an ease and flow of music possible only to the true poet, yet in the following stanzas we meet these all too familiar cliches: "this foul war"; "nightmare fiend"; "bright future full of happy toil". Surely a decline from the unobtrusive elegance of the quoted passage.

Thus we are borne along throughout the book in a series of such undulations between superb sweeps of melody, much admirable thought which, alas, often wilts into the banal.

I think, perhaps, the author's sustained lyrical vigour tends to obscure her critical faculty in this way. How else explain the inclusion of such verse as:

"You are
So far
I lie
And cry."

The strongest aspects of these poems are their directness of wording and vision, which make for easy reading; Dr. Stopes is never obscure, and whether it be a tribute to Homer or to a flower, she tackles her subject with fearlessness and generous sympathy. But in contrast one must again mention the admixture of quality, for there is an odd combination of highmindedness coupled with an almost youthful naïvety of emotional expression discernible in these poems at times. One is reminded somewhat of the patriotic fervour prevalent at the beginning of this age.

Nowadays, the 'singing' poet needs to be very much on his guard lest he strike a note which is ineffectual rather than false when attempting to reflect current thought and feeling. The younger poets with their sober metre appear to manage this with more firmness of touch than can a transitional writer diffused between two vastly differing periods of time.

The shorter poems "To the Beloved", "If", "Judas" and "Ode to the South Wind"—this latter being an especially well-balanced work—all avoid pitfalls, and serve as admirable examples of the author's possibilities.

In summing up, I would describe this book of Dr. Stopes as 'interesting'; and with her many advantages of masterly style and appropriate imagery, she will no doubt eventually make the necessary adaptations to place herself within a more definable radius as a poet. MARGARET HOWARD.

A SOUTH AFRICAN DIVINE RULER

The Realm of a Rain Queen

A Study of the Pattern of Lovedu Society. By Dr. E. Jensen Krige and J. D. Krige. (Published for the International Institute of African Languages and Cultures.) Pp. xvi+336+16 plates. (London, New York and Toronto: Oxford University Press, 1943.) 21*s*. net.

GENERAL SMUTS, in his foreword, commends this book as one of the most honest and penetrating researches into native life that he has come across. The tribute is well deserved. Dr. and Mrs. Krige selected a fascinating subject for study: the Lovedu, living among the mist-covered mountains of northern Transvaal. Insignificant as regards numbers and the extent of their territory, 33,000 tribesmen occupying a reserve of 150 square miles, their reputation was, and still is, great among the Bantu of South Africa; their queen was held to be the most powerful of all rain-makers, and even chiefs so distant and renowned as Chaka and Moshesh sought her aid in extremity. Many foreign ambassadors and potentates gathered at her court, bringing cattle or daughters or sisters to win the favour of "Transformer of the Clouds". To Europeans she was a mystery; was reputed to be very light-coloured (Was she really a white woman?) and to be immortal. Rider Haggard familiarized her as "She-who-must-be-obeyed". There is substance in the fantasies that gathered about her. She figures as one of the Divine Rulers of whom Sir James Frazer has written.

In 140 years there have been three Lovedu queens, the present Mujaji III having reigned more than forty years. The first king was a scion of the famed Monomotapa, mighty monarch of the Vakaranga, whose sons divided the realm among themselves after his death. By incestuous union with her brother, the daughter of one of these chiefs bore a son and fled the country, carrying off the rain charms and sacred beads, and in course of time gathered about her a new community in the south, the Lovedu, of various origin. The queen is neither a military nor a political leader. She is not primarily a ruler but a rain-maker; what authority she exercises derives from her divine appointment and her exclusive power of controlling the rain, ensuring its fall for her friends and denying it to her enemies. The tribe relies for security not on regimentation, armies and organization, but on this power of the queen.

The rain-cult is a whole complex of institutions with ramifications through many aspects of tribal life. It is perhaps scarcely accurate to describe the queen as a rain-maker; she is so intimately connected with the forces of Nature that her life seems to be continuous with them; anything that affects her affects Nature. She is the guarantor of the cyclic regularity of the seasons; when she dies the seasons are out of joint. She has a monopoly of magic; anyone who should presume to enter into competition with her by practising garden magic would incur the penalties of witchcraft. There are certain limitations to her power: no one would expect her to produce rain in the winter; she relies upon diviners to diagnose the causes of drought; people can thwart her by certain infringements of taboo; and ultimately, it is recognized, her power depends upon the divine ancestors. Dr. and Mrs. Krige insist that belief in her virtue is universal and unshaken among the Lovedu—the Christians rationalize their belief by saying that she produces rain by the help of God.

How exactly the rain-queen exercises her power is a secret known only to herself, but it is known that certain 'medicines' are employed. These are kept in earthenware pots; Dr. and Mrs. Krige never saw these, but learnt that among the contents are one or more human skulls and the skins stripped from the bodies of deceased chiefs and councillors. A black sheep, said to be a substitute for a human child, is sacrificed from time to time to reinforce the medicines. The queen has no husband but many wives, some of whom, after a certain period, are allocated to nobles, and by this means a network is formed radiating from the queen all through the community.

One effect of having a queen of such divine authority is the elevation of the status of women in this patrilineal society. Lovedu tradition is that the king or queen never dies a natural death: he or she commits suicide, not when their natural vigour fails, but at the end of the fourth initiation during the reign, and these initiation ceremonies are held at intervals of from twelve to fifteen years.

Dr. and Mrs. Krige provide a very full exposition of the social organization and activities of these people. Having been challenged for a long period by Western civilization and having been percolated for much longer by various Bantu cultures, the Lovedu are a fruitful field for the study of culture contact and culture change; and the authors' findings on this subject are an important part of a very valuable contribution to social anthropology.

EDWIN W. SMITH.

APPLICATION OF INFRA-RED SPECTROSCOPY TO CHEMICAL PROBLEMS

IT was once said that in planning its discussions the Faraday Society does not follow scientific fashion and need, but anticipates them. This comment would apply well to the symposium held at King's College, London, on January 2, on the "Application of Infra-red Spectra to Chemical Problems". The large attendance of physicists and chemists from both university and industrial laboratories, as well as the diversity of subjects discussed, showed that this is a field of considerable interest and potentiality both for routine and research purposes in chemistry.

The striking advances in the experimental technique of infra-red measurements during the past ten years were described in a joint comprehensive paper from the laboratories at Oxford and Cambridge, where Drs. H. W. Thompson and G. B. B. M. Sutherland with their colleagues have vigorously explored all aspects of the problem. As Sir Robert Robertson remarked, it is not many years since the difficulties of obtaining stable thermo-electric systems for the accurate measurement of infra-red radiation made it necessary to work at night ; and the exacting conditions were magnified, since many hours or weeks might be needed to cover a significant spectral range. Recent developments of prism spectrometers have been mainly directed towards greater speed of measurement, stabler and more sensitive detectors, and automatic recording of the spectral absorption. By incorporating new vacuum thermocouples of rapid response and high sensitivity, automatic continuously recording instruments have been developed which can be used in routine laboratories without elaborate experimental precautions or difficulty.

Single-beam recorders, however, suffer from the disadvantage that atmospheric water vapour and carbon dioxide give rise to an irregular background, which complicates the determination of percentage absorption in some spectral regions. The most recent refinement is to use a double-beam spectrometer, in which the energy of a blank beam of radiation is measured against that of a similar beam into which the absorbing substance has been placed. The two beams are focused separately on thermocouples, and the electromotive forces produced are fed, after amplification, into a quick-acting potentiometer recorder having a rapid speed of response. In this way the absorption spectrum can be obtained as a direct record of percentage absorption—or if required optical density—against wave-length, so that the arrangement becomes entirely automatic. While this type of instrument surpasses the hopes of a few years ago, still further improvements may eventually result from the use of bolometers.

Interesting exploratory work on a thermocouple-bolometer detector was described by Dr. G. K. T. Conn. Another noteworthy feature is the production, by cooling the molten solids, of large blocks of alkali halides having high optical quality and suitable for use as prisms.

Apart from the spectrometers themselves, development of the accessories has been marked. A convenient absorption cell for studying molten solids was described by R. E. Richards and Dr. H. W. Thompson, and several speakers outlined methods for the accurate determination of the thickness of such cells. The most favoured methods are based on interference phenomena using either infra-red, visible, or ultra-violet light, and examples were given by Dr. G. B. B. M. Sutherland, H. A. Willis and by Dr. W. C. Price. For many purposes, infra-red spectra of substances have to be measured in solution, and the solvent will have its own absorption bands which may mask those of the solute. In order to survey the spectrum of a given solute over a wide spectral range, it will therefore be necessary to use several solvents. P. Torkington and Dr. H. W. Thompson set out the spectral transmission curves of a large number of common solvents, which should serve as a useful reference in selecting the most convenient one for use for any particular spectral region.

Turning to the applications themselves, the infra-red absorption spectrum emerges as another physico-chemical tool for analysis in organic chemistry. This is perhaps the most significant general contribution from recent progress. Absorption bands arise from the absorption of molecular vibration frequencies the magnitudes of which depend upon the nuclear masses and the forces between them. Since no two molecules, other than a pair of optical isomers, have exactly the same nuclear structure and potential energy function, the vibrational spectrum will be a characteristic property of the molecule, and perhaps the most characteristic yet known. Drs. H. W. Thompson and G. B. B. M. Sutherland reviewed the principles by means of which these theoretical considerations can be applied to the practical problem of analysis, and examples of mixtures studied by their collaborators were given. A very striking case is the analysis of mixtures of the three isomeric cresols, which can be carried out rapidly with fairly high accuracy ; but from the varied assortment of examples given it was clear that the method can be used generally. It is very useful for determining small amounts of impurity in reagents, fine chemicals, solvents and important compounds of biological and pharmaceutical interest. Dr. Thompson mentioned a case in which a crude solid product containing four stereoisomers could be analysed with comparative ease in about half an hour. The factors which determine the sensitivity for detecting a particular component, and the accuracy obtainable in analysing a mixture, were discussed. As foreshadowed in his Tilden Lecture to the Chemical Society last year[1], it seems certain that infra-red analysis will soon become a standard method for the control of purity of organic substances.

Other applications of the infra-red are mostly connected with the elucidation of molecular structure ; but whereas past work has dealt almost exclusively with smaller molecules, the absorption bands of which could be resolved into rotational fine structure from which moments of inertia might be determinable, measurements have now been made with macro-molecules, and a wealth of information has been derived from them. Examples of many kinds were discussed. Thus, Dr. D. M. Simpson examined critically the infra-red data on ozone in relation to electron diffraction measurements, and tried to obtain an assignment of the normal vibration frequencies which is consistent with the spectral data, and which simultaneously gives plausible values for the apical angle and bond force constants on the basis of simple valency force field. As the author explained, the arguments and results obtained are not free from objection, and suggest that a more detailed analysis of the rotational fine structure of the infra-red and Raman bands should be carried

out; at the same time the way in which all the evidence has been correlated and examined provides a good example of this class of work.

In another paper dealing with the force fields within molecules, Dr. J. W. Linnett reported calculations on the variation of the force constants of C—H, N—H, O—H, S—H and other *M*—H bonds in series of molecules. The characteristic vibration frequency of such linkages is always much higher than those of other normal vibrations, since for practical purposes the light hydrogen atom oscillates against a much heavier effectively rigid residue. By virtue of this, it is possible to use simple formulæ for calculating the force constants of these links and still obtain results which must approximate closely to the true values. In this way Dr. Linnett has made a valuable compilation of the C—H force constants as affected by adjacent groups. In methyl fluoride the value is low as compared with methane, whereas in the other methyl halides it is normal. In methylamine and methyl alcohol, and even in ethane too, low values are found, and these are very well explained in terms of the contribution of different ionic structures towards a resonance hybrid. Dr. Linnett's analysis of the data shows that other factors affecting the force constants are the type of carbon bond orbitals used, namely, sp^3, sp^2 or sp, and the extent to which there is a positive charge located on the carbon atom. Analogous computations were made for the other *M*—H bonds, and the whole work should be of great value for future reference.

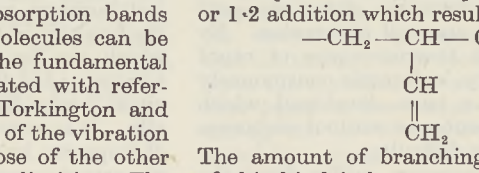
How the rotational contour of absorption bands of the vapours of relatively light molecules can be used with other data to determine the fundamental frequencies of a molecule was illustrated with reference to fluorinated ethylenes by P. Torkington and Dr. H. W. Thompson. A comparison of the vibration frequencies of vinyl fluoride with those of the other vinyl halides revealed unexpected peculiarities. The presence of the fluorine atom brings about a marked decrease in the values of the deformational frequencies of the C—H bonds at the other end of the molecule, whereas with the light fluorine atom the reverse might be expected. Similar effects are found with vinylidene fluoride, $CH_2 : CF_2$, and with $CH_2 : CFCl$. We can interpret these changes as arising from some electronic effect transmitted through the carbon-carbon double bond, or as Dr. Price put it, in terms of the contributions of ionic structures towards the molecular resonance hybrid. Related to this, too, are the alterations found in the C=C vibration frequency in the different compounds, for in passing from ethylene to vinyl fluoride there is a small increase, and when two fluorine atoms are attached to the same carbon atom, as in vinylidene fluoride or tetrafluoroethylene, it is even higher. Another feature is the very high intensity of absorption of vibrations due to stretching of C—F bonds, particularly when CF_2 groups are present, and this must again be connected with the variations of polar character of the linkages during compression. These data open up a new line of inquiry into the reasons for the well-known anomalous chemical and physical properties of compounds containing carbon-fluorine bonds.

With macro-molecules such as rubbers, plastics, and resins, which are nearly always examined in the solid state, the infra-red spectra consist of bands arising from absorption of the fundamental vibration frequencies, or overtones or combinations of them, and this is the only information about the molecule which the spectrum gives. It is therefore remarkable to find that a considerable amount of information about the structure of these molecules has already been derived. Dr. Thompson presented an extensive survey of the spectra of many classes of compound of high molecular weight studied with his collaborators during recent years, and illustrated by selected examples the sort of questions which can be answered by this approach. The primary aim of the work is to correlate internal molecular structure and the mode of packing of large molecules with their physical behaviour, particularly in regard to flow and electrical characteristics. The main principle is that while the complete spectra of two molecules should never be exactly the same, yet particular links, groups, or skeleton units may have a frequency or set of frequencies which persist almost unchanged through a large number of molecules in which they occur. If reference data on simple molecules are first obtained, it will then be possible to detect or estimate such groups, and if enough data of this kind are available, crucial information about the macro-molecule may be inferred.

Polythene, originally thought to contain a long chain of CH_2 groups, is found to contain a few pendent methyl groups, and weaker bands can be correlated with other unexpected units in the nuclear skeleton. When dienes such as 1·3 butadiene, or 2·3 dimethyl butadiene, polymerize to form the different varieties of rubber, 1·4 addition may occur leading to long 'straight' chains such as

$$—CH_2—CH=CH—CH_2—CH_2—CH=CH—CH_2—;$$

or 1·2 addition which results in pendent vinyl groups,



The amount of branching in a long-chain polymer of this kind is known to have a profound effect on properties such as ease of vulcanization or use as a lubricant. Chemical methods involving ozonolysis were worked out by Simonsen and others some years ago; but the infra-red method is both quicker and neater. It depends on the fact that different classes of olefines have spectral features which are characteristic for each type. There are key wave-lengths for (1) the vinyl compounds $R.CH : CH_2$, (2) the substituted *iso*butylenes $R_1R_2C : CH_2$, and (3) the *cis-trans* olefines $R_1CH : CH.R_2$, and estimates of the amount of each type can be made from measurements of the absorption intensity at the key wave-lengths. These principles were illustrated with reference to samples of buna and methyl rubber, and analogous correlations with other hydrocarbon polymers such as crepe rubber and polystyrene were outlined. The determination of 1·2 or 1·4 addition applies in a similar way to the interpolymerization of butadiene with acrylonitrile or styrene. In such cases, too, the proportions of the components in the interpolymer can be estimated, and minor changes in the structure of an interpolymer as the combining ratio changes can be explored by changes in the infra-red spectrum.

Another class of polymer discussed by Thompson and Torkington included the polyvinyl and polyacrylic esters, and the spectra of some of these compounds were considered in relation to such features as head to head or head to tail condensation. A comparison of the spectra of polyvinyl chloride, polyvinylidene chloride, and those of halothenes (chlorinated polythenes) seemed particularly interesting. As the percentage of chlorine introduced into the polymer

is increased, well-defined changes in the spectrum occur, and it may be possible to discover how the chlorine atoms are distributed along the long carbon chain. It is noteworthy that the spectra of polyvinyl chloride and polyvinylidene chloride differ from those of halothenes containing the same percentage of chlorine. Other compounds studied include polyvinyl alcohol, nylon, polyester waxes and novolac resins, and in each case structural features of value are obtained. Cellulose ethers and esters have also been examined, and in structural diagnosis the new method promises here to be an important supplement to X-ray work, while for practical purposes the identification and estimation of hydroxyl groups, aceto or butyro groups should be valuable.

Other general matters discussed by Thompson and Torkington included the differentiation of a polymer and its monomer, and the possibility of correlating spectrum with chain-length; and attention was also directed to the use of polarized infra-red radiation with oriented films of certain polymers.

Dr. Sutherland mentioned similar work on polymers carried out with Mr. Ramsay and Mr. Harding. Differences had been found between certain samples of polystyrene and of poly-*iso*prenes, and structural inferences had been made.

N. Sheppard and Dr. G. B. B. M. Sutherland described measurements on the spectrum of rubber after vulcanization and 'curing' by various reagents. The changes which occur during these processes can be followed by changes in the spectrum. Thus, if zinc oxide and stearic acid are used in the curing process, a band appears in the spectrum due to the stearate ion, which disappears again as the vulcanization proceeds. It is interesting also to find that, in the early stages of vulcanization at least, the band due to the carbon-carbon double bond in crepe rubber remains almost unchanged in intensity. The latter result was confirmed by Dr. Thompson in some similar studies in which rubber was treated with sulphur chloride vapour for different periods. In this case new bands were found in the spectrum which may be connected with sulphur-sulphur or carbon-sulphur linkages, and comparisons are required with the spectra of simple alkyl sulphides and disulphides.

Mr. C. G. Cannon discussed measurements on the infra-red spectrum of coal and coal extracts, and showed how various important groups may be identified in the samples. Although this work is so far exploratory in character, it indicates already that a new attack is possible on the differences between coals of varied origin.

Mr. H. A. Willis outlined similar measurements carried out with Dr. Sutherland on the infra-red spectrum of diamond, a subject investigated some years ago by Sir Robert Robertson and the late Sir John Fox. The new measurements suggest that another type of diamond has been found, and the authors stated that Sir C. V. Raman and his colleagues have recently misinterpreted Raman data. In the discussion, Sir Robert Robertson directed attention to the errors in measurement of the intensity of absorption bands which may be caused by scattering losses. Whatever the real explanation, it is clear that further measurements of this kind may lead to important knowledge about the different kinds of diamond.

The Faraday Society is to be congratulated on organizing this stimulating discussion.

[1] *J. Chem. Soc.*, 183 (1944).

GORDON COLLEGE AT KHARTOUM

UNIVERSITY COLLEGE STATUS

By E. N. CORBYN

Former Principal of the College

A FORMAL inaugural opening of the reconstituted Gordon Memorial College at Khartoum will take place on February 20.

When in 1898 Lord Kitchener had won the battle of Omdurman, which opened the Sudan to civilization, and then went home to receive the thanks of his grateful fellow-countrymen, his first action was to ask for and receive from them by public subscription £100,000 for the building and endowment of a college at Khartoum in memory of General Gordon, for the education of the Sudanese.

In 1902 his return from the South African war gave him the opportunity to open the fine buildings erected on the bank of the Blue Nile, not far from the Palace where Gordon died. Those whom he had left behind in the Sudan, General Sir Reginald Wingate, his successor as governor-general, his young brother-officers of the Royal Engineers who had taken charge of the new country's public works, Mr. (later Sir) James Currie, whom Lord Cromer had chosen as the first director of education, all had laboured to carry out the beginnings of his intention. What was his ultimate purpose he placed on record at the opening ceremony, when he said: "All I hope and trust is that it may be round this centre that development of higher education in the Sudan may be focused for all time".

The site allotted for the Gordon College was one of the best on the Khartoum river-front, and by far the most extensive. It covers many acres and includes, besides space for the buildings, ten football grounds intersected by avenues of shady trees. Its eastern boundary lies close to the Blue Nile Bridge, and along the road and railway embankment that makes a wide circular sweep round to the railway station behind the city of Khartoum. The main building, with a central block and two wings, is a large and impressive structure, the design making use of wide and lofty verandas, suitable to provide shade from the violence of the tropical sun. Inland from the playing-fields are large boarding-houses, and the grounds contain also other educational buildings and staff houses.

Currie's task, as the first director of education in the Sudan, was to inspire with the breath of life the bricks and mortar which Kitchener had provided. This he had to do by bringing into the Sudan an adapted blend of Western and Arab education. He had seen the blend as approved in Egypt during a short period of service under Dr. Douglas Dunlop in the Egyptian Ministry of Education, which had enabled him to form his own ideas. In the *tabula rasa* of the Sudan, where he arrived in 1900, his opportunity was unique, and nobly he took it.

It was Currie's view that, at all events in the early formative years, the director of education should be also the principal of the Gordon College. He held that thus the College could best be integrated with the general educational machinery of the country, which also he was devising and installing, so he was insistent on presiding over both.

Even when, in its beginnings, to the ordinary man the College seemed to consist of a few Sudanese boys

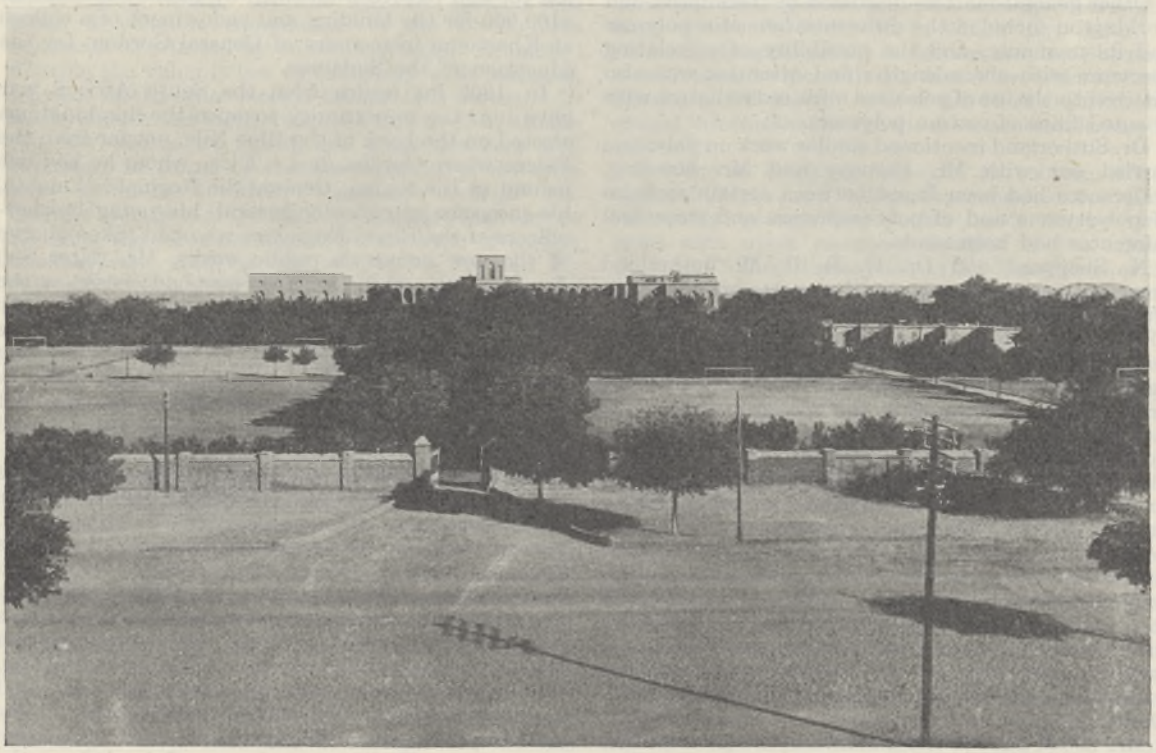
being taught by (at first) Egyptian teachers to become the future teachers of their fellow-countrymen (for so, of course, it had to start), Currie, with the eye of faith and imagination, saw it already as in part a university. He held that, if one side of his duties was to commence imparting instruction at the lowest level, another side was to have in the same buildings working examples of human knowledge at its highest level. So he gathered into his College all those branches of scientific research so necessary in a new land, but which, to be successful, must work in a congenial home. The new Government needed medical research, chemical research, entomological research, geological research. Currie opened to all of them his arms and his buildings. He grouped them under him as principal of an institution in which research of highest university standard could work and flourish. This was only not a university because its brilliant staffs were there to do their own work on the problems of the country, and not, at that stage, to teach or give diplomas or degrees.

Such was Currie's conception. It was not always understood, even by fellow-workers in different spheres of the Sudan's administration. But what mattered was that he had brought it to birth and it existed, and it made the Gordon memorial buildings on the Blue Nile a centre of light and learning from the very start of the great enterprise for which they had been designed.

Meanwhile the early stages of education for the Sudanese went steadily forward. Currie was quick to seize on one indigenous branch as already of university standard—the study of Mohammedan law for the staffing of the Mohammedan law courts which the first Legal Secretary, Mr. (later Sir) Edgar Bonham Carter, was in process of establishing. These were to deal with matters of the personal law of the Sudanese (marriage, divorce, inheritance, etc.), who in the Arabic-speaking parts of the country are almost universally Mohammedans. Soon learned Sheikhs from the ancient University of El Azhar in Cairo were teaching promising classes in the study of their own religious law. The religious law courts of the Sudan have thus come now to be presided over by Sudanese 'Kadis', or judges.

At the lower levels the College housed at first what had to begin as education of the primary school stage. This developed into secondary school education, with vocational courses in the latter stages for engineers, teachers, and clerical Government staff. When the numbers in the secondary school grew so as to fill the buildings, the primary school was extruded and became the Khartoum primary school, housed elsewhere. Similarly, other primary schools were established in the other larger towns of the country, and became feeders for the secondary school in the Gordon College. This was often spoken of as though it alone was the Gordon College; but, as will have been seen from the details given above, the College was much more.

Such was Currie's Gordon College when he retired in 1914, and in essence it remained the same under his immediate successors. I was myself the third principal and director of education during 1926–27. My own suggestion for the next stage was to extrude the junior two years of the secondary school, by developing the four-year-course primary schools which fed it into six-year-course intermediate schools, and then to add two more senior years to the secondary school course, thus taking it two years further on



THE GORDON MEMORIAL COLLEGE FROM THE SOUTH (INLAND) SIDE, SHOWING PLAYING-FIELDS AND THE BLUE NILE BRIDGE IN RIGHT BACKGROUND.

into higher education. Changes remained in abeyance, however, until the whole Sudanese system of education was considered and reported on in 1937 by the De La Warr Commission. This Commission went further and recommended the extrusion of the whole four years of the secondary school course, and the transfer of the secondary school or schools elsewhere; so that the way might be clear at the Gordon College for the establishment of education at a post-secondary, or university college, stage.

Such was the programme which Mr. Christopher Cox, the sixth principal, taking up the De La Warr Commission's recommendations with admirable zeal and skill, was able to lay before the Sudan Government. In spite of the impact of the War on the country's finances, the Government decided to carry it out. The design included two (at first) secondary schools, placed in different parts of the country outside Khartoum, to which the secondary school in the Gordon College would be transferred. The buildings for the first of these, at Wadi Seidna on the Nile north of Khartoum, were just being completed as the War began. These buildings and the buildings of the Gordon College itself had then to be requisitioned for military purposes. The secondary school, instead of going to Wadi Seidna, had to find temporary accommodation opposite Khartoum in the big native city of Omdurman, where it still remains until Wadi Seidna is free for its occupation.

The Gordon College buildings were released in 1944, thus removing the structural bar on the constitution of the new University College, the plans for which now took final shape. The early vocational courses had been developed into schools for education at a professional level. It was the grouping of these schools that was designed to constitute the University College.

In November 1944 there took place at Khartoum the first formal meetings of a Council set up to administer the College in that capacity. This Council becomes the authorized delegate for that purpose of the Executive Committee of the Gordon Memorial College in London, under powers given to that Committee by the trust deed made when Lord Kitchener collected the endowment.

Included in the new College are six post-secondary schools—the School of Arts (which includes a School of Law), the School of Science, the School of Engineering, the School of Agriculture, the Khartoum Veterinary School, and the School of Administration and Police. This new united body of post-secondary schools now takes over the name, the buildings and the endowments of the Gordon Memorial College.

The reconstituted College will still leave outside its present framework two Sudanese educational institutions of post-secondary rank, the Kitchener School of Medicine at Khartoum, and the Institute of Education at Bakht er Ruda, which is in a rural setting on the White Nile about 120 miles south of Khartoum. The Kitchener School of Medicine, founded in 1924, though linked also with the Executive Committee of the Gordon Memorial College in London, has endowments subscribed in the Sudan and a constitution of its own. In addition to the income of its own endowments, it receives an annual subvention of a thousand guineas from the Lord Kitchener National Memorial Fund in London. The Institute of Education is established and administered by the Sudan Education Department. Both will be brought into organic relationship with the new University College in due course.

The College now, as a university college, will have a principal of its own, other than the director of education, and Dr. J. D. Tothill, recently director of agriculture and forests in the Sudan, has been nominated as the first holder of that post. The constitution devised for the College on university lines gives to its Council a large measure of independence from the Sudan Government. It is the Government's desire and purpose to grant to it, as soon as the money can be made available, ample endowments of its own, for which a figure of £3,000,000 is aimed at.

It remains to give some brief account of the details of the Schools of the College, which branch respectively from the School of Science and the School of Arts.

The School of Science has preparatory courses for the Kitchener School of Medicine, the Veterinary School, the School of Agriculture, the School of Engineering, and for teachers of science going to the Institute of Education. In 1945 it will commence also a three-year diploma course of its own.

The School of Medicine has a six-year diploma course, the School of Engineering a four-year one, and the Veterinary School and the School of Agriculture grant their diplomas after three years.

The School of Arts has a four-year diploma course in law, and three-year diploma courses in history, English, Arabic and geography. A two-year course is the condition for entry to the arts teachers' section of the Institute of Education, or to the School of Administration and Police, or to certain government employments.

Members of the new Gordon College inherit the fine hostels and beautiful playing-fields established in the past. These fortunate young Sudanese will have at their disposal all that is necessary for the building up of healthy minds in healthy bodies. The educational history of the Sudan in the past forty-five years leaves little doubt that they will rise to their opportunities.

THE PEATS OF NEW JERSEY

TWO recently published bulletins[1] provide a broad picture of the peat bogs of New Jersey. If these are read in conjunction with other publications[2], one is given a wide purview of American east-coast peat bogs from Maine to Florida. In these various bulletins there is in particular very detailed information about the maritime peats, both the salt marsh and the mangrove types. One is chiefly impressed, however, by the scale upon which this study of the New Jersey peats was carried out. The investigation was treated as an official Work Projects Administration project, and fifteen to twenty-five field-crews of five men each were engaged upon it in addition to office and laboratory staff, so that the total number employed was at one period about 150 persons. There is still scope for investigations on this scale in the British Isles, and it is to be hoped that the end of the War may see similar projects in being. In particular, British peat bogs or salt marshes would be eminently suited to this type of treatment, and in view of the possible value or use of such land for agricultural purposes there would seem to be a strong case for Government support of any such research programme on a commensurate scale.

The first bulletin is introductory in nature, and provides a general survey of peat as a whole. The

terminology associated with peat is discussed in some detail, especially the use of the word 'muck', which is employed for certain important agricultural soils in the United States. This word appears to have two meanings; in one case it refers to a mixture of decomposed peat and mineral soil, while in the other case it is used commercially for non-acid or low-moor peat. Four classes of peat are recognized: (*a*) hochmoor, (*b*) lowmoor (including salt marsh peats), (*c*) swamp or forest peat, and (*d*) aquatic or alluvial peats, though these latter contain such a high percentage of sedimentary material that their claim to be termed peat may be questioned. In discussing the factors influencing peat formation, insufficient attention has perhaps been paid to correlations between pollen analysis and the historical development of the region. Godwin and his co-workers in Great Britain have shown how much can be achieved in this direction. The pollen diagrams are indeed inadequate and disappointing, and it is to be hoped that a further bulletin may be devoted to this important aspect. It must, however, be admitted that the survey was largely undertaken with the agricultural possibilities of the peat soils as the pervading background. Similarly, in discussing the microbiology of the peats, there is little or no mention of the part played by the mycorrhiza which are associated with many bog plants.

While the first bulletin contains much information that is of great value, it is largely a summary of existing information as applied to New Jersey peat bogs. The second and more substantial bulletin gives an account of the actual results obtained by the field parties and the laboratory analysts. This information is given in considerable detail, and after perusing it we are left with an extensive picture of the characteristics of the principal areas and peat bogs throughout the State.

Hochmoor or blanket bog peat is practically unknown in the State, and there are very few bogs composed of sphagna remains. Out of 91–114 million acres of peat bogs in the United States, the State of New Jersey claims about 500,000 acres. In the areas surveyed the proportions of the different types were more or less as follows: lowmoor or fen peat, 20,961 acres; salt marsh peat, 100,725 acres; swamp or forest peat, 56,241 acres; fresh water alluvial peat, 28,357 acres. Topographically, New Jersey can be divided into four regions, the Appalachian Valley, the Highlands, the Piedmont plateaux and the Coastal Plain. In the lower part of the Appalachian Valley the bogs frequently rest on Kittatinny limestone and they differ from those elsewhere due to the influence of this substratum. It can also be shown that many of the bogs have developed in depressions associated with the terminal moraine of the Wisconsin ice-sheet; but there are others, especially smaller bogs, which are associated with the numerous 'Kame' moraines.

The pollen analysis diagrams indicate that peat formation commenced in the boreal period. This was followed first by a *Pinus* era and then by oak and hemlock. For purposes of description, the State is divided into twenty-one drainage areas each with its own system of bogs. These bogs formed approximately 60 per cent of the areas surveyed, and the average size of a bog was about 9,800 acres, but they ranged from 241 to 35,711 acres.

The northern peat bogs are all of the lowmoor or fen type, though one large forest (cedar) swamp is described from the Hackensack region. *Carex* is the principal peat-forming plant in these bogs at the present day, but the numerous sections through the bogs show that two general types of deposition have occurred. In one case there is a sedimentary layer at the base, while in the other there is a shell marl from a relict *Chara* phase. On these basal layers there is commonly a *Phragmites* peat followed by a *Carex* peat with a further zone of decomposed *Carex* peat on top. The *Phragmites* and non-decomposed *Carex* layers may contain the remains of tree stumps.

The other three types of peat bog are primarily confined to the coastal plain region. Some of these peat bogs are of very considerable size; for example, the great cedar swamp six miles long and two miles wide at its broadest, and the salt marsh peat area at Great Egg Harbor thirteen miles long and six miles wide. The salt marsh peats have average depths of 3·4–15 ft. with maximum depths of 16–34 ft. The maximum tidal ranges along this stretch of coast, as given by the U.S. Coast and Geodetic Survey, vary from 1 ft. to 6 ft.; since the depth of the peat commonly exceeds the maximum tidal range, subsidence of the coastline must have taken place during the formation of many of the marshes[3]. These salt marsh peats usually possess three well-defined zones: a basal *Zostera* zone, a middle *Spartina glabra* zone and an upper *S. patens* zone. In spite of continual flooding by salt water it was found that the peats tended to have an acid reaction, said to be due to the reduction of sulphates to sulphides by bacteria. This is in distinct contrast to the alkaline peats of the southern mangrove swamps of Florida and the West Indies. If this is indeed true, one may question whether the salt marsh peats should be classified with the lowmoor or the fen peats, as is suggested in the first bulletin.

The freshwater alluvial peats are mainly restricted to the Lower Delaware basin, and are found north and west of a line joining Asbury Park, Colts Neck, Farmingdale, Clarksburg, New Lisbon, Berlin, Malaga, Millville, Delmont and South Dennis. While the salt marsh peats are a prominent feature of the coastal plain region, the forest peat swamps of the New Jersey pine barrens are of equal importance. Two types of forest peat bog can be distinguished: there is first the cedar swamp type with *Chamæcyparis thuyoides* as the dominant tree and, secondly, the deciduous swamp type with pitch pine and white oak as the dominants. The profiles of the bogs show that whole regions of the coastal plain have been covered in the past with forests of white cedar and that these forests have been submerged by the sea, have then emerged and been submerged again. Many of the forest swamps are juxtaposed to tidal marshes which in their turn generally lie behind protective barrier beaches. The balance between the forest swamps and the tidal marshes is delicate, and one passes readily to the other or vice versa, depending on the upward or downward movement of mean sea-level. Sufficient data should now be available to make it possible to determine whether such sea-level movement is in fact taking place at present. The forest peat is underlain either by sand or by sedge and reed peat or by *Carex* peat, the lower layers often containing numerous tree stumps.

This second bulletin is profusely illustrated with profiles across bogs of all types from the many different regions and with the relevant analytical soil data. It is to be hoped that the latter, which are not as extensive as one could wish, will be augmented in a further bulletin. There is no doubt that

the organization and scope of this study should prove a model upon which investigations in other parts of the world might well be based.

V. J. CHAPMAN.

[1] Waksman, S. A., Bull. 55. Part A. Dept. of Conservation and Development, New Jersey (1942). Waksman, S. A., Schulhoff, H., Hickman, C. A., Cordon, T. C., and Stevens, S. C., Bull. 55, Part B, Dept. of Conservation and Development, New Jersey (1943).

[2] Shaler, N. S., Ann. Rep. U.S. Geol. Survey I (1884–5). Davis, J. H., State of Florida Dept. of Conservation, Bull. 25 (1943). Johnson, D. W., "The New England Acadian Shore-line" (New York, 1925).

[3] Chapman, V. J., *Proc. Geol. Assoc.*, 49, 373 (1938).

OBITUARIES

Sir Thomas Barlow, Bt., K.C.V.O., F.R.S.

THOMAS BARLOW, who died in London on January 12, was within eight months of his hundredth birthday, which he would have well liked to see. Brought up in the cotton belt of Lancashire, in a household where character—rough hewn but solid—was the ruling factor, he was endowed with a good memory and a power of observation that has made famous naturalists; and his span covered a century in which medicine has progressed geometrically. If the wattage of life may be taken as a multiple of duration, brilliance and worth, no wonder Barlow has left a mark on his contemporaries. His middle period as popular consultant and physician to three reigning sovereigns—Robert Bridges said he knew no medical man with a more intimate personal sympathy with his patients—was preceded by a period in which he traced a common childish disorder to its origin as a deficiency disease, and was succeeded by an Indian summer in which he used his experience and still abounding energy to guide a benevolent fund which gave a sense of security to the declining days of less successful practitioners.

The early period is the one which deserves elaboration here. In 1874, when Barlow became registrar to the Hospital for Sick Children in Great Ormond Street, the hand-feeding of infants had taken a turn towards artificial foods and sterilized milk, with the result that what was called 'acute rickets' began to come to the notice of clinicians. Barlow's colleague, W. B. Cheadle (following Ingerslev in Sweden), suggested that here was scurvy grafted on the familiar tokens of rickets; but when Barlow came to make his classical study of thirty cases, published in 1883, it was evident rather that here was a clear-cut deficiency disease, namely, infantile scurvy, due simply to exclusion from the diet of something essential to healthy growth and development. It took another fifty years for the nature of scurvy to become generally recognized and the appropriate vitamin supplied. But for the first step which counts so highly, Barlow earned his election to the Royal Society in 1909 and the less glittering reward of having the disease he had described known abroad as *die barlow'sche Krankheit*.

E. C. M.

WE regret to announce the following deaths:

Dr. G. D. Elsdon, chief inspector of the Lancashire Rivers Board and formerly chief county analyst for Lancashire, on January 18, aged fifty-six.

Prof. C. B. Lipman, professor of plant physiology in the University of California, on October 22, aged sixty-one.

NEWS and VIEWS

Galton Chair of Eugenics at University College, London: Dr. L. S. Penrose

DR. L. S. PENROSE, who has just been appointed to the Galton chair of eugenics at University College, London, studied philosophy at Cambridge and proceeded to Vienna in 1923 for postgraduate work in psychology. On returning to England he took a medical degree, and during 1930–39 was research medical officer to the Royal Eastern Counties Institution at Colchester. His report on 1,280 mental defectives and 28,921 of their relatives has put the whole problem of mental defect on a new basis. Congenital mental defect may be due to single dominant genes such as that for epiloia, to single recessive genes such as that for phenylketonuria, or to numerous partially dominant genes, in which case it is inherited like other quantitative characters studied by Pearson. There are probably hundreds of types, each ultimately distinguishable clinically, with its characteristic mode of inheritance. He has paid particular attention to pre-natal environment in connexion with mongolism, placenta prævia and pyloric stenosis, and was the first to estimate the mutation-rate of an autosomal human gene. Since 1939 he has worked in London, Ontario, particularly on the genetics of insanity and on personnel tests for the Canadian Army.

Pearson and Fisher, the first occupants of the Galton chair, came to eugenics from mathematics, via statistics; Prof. Penrose comes from psychology via medicine. If his views are accepted, the eugenic movement will become a good deal more concrete. It may be no more possible to wipe out mental defect than to abolish fever; but appropriate eugenic measures might reduce certain types of defect as drastically as hygiene has reduced typhoid fever, while other types would not be reduced. Prof. Penrose will use the statistical methods developed by his predecessors, but he will use them on data which have been provided by up-to-date clinical and psychological methods.

Botany at University College, Nottingham

DR. C. G. C. CHESTERS has been recently appointed to the chair of botany at University College, Nottingham, in succession to Prof. T. A. Bennet-Clark. Prof. Chesters graduated in the University of Glasgow where he received his botanical training under the leadership of Prof. Bower and took up an appointment at Birmingham in 1927. From 1930 onwards, when he became lecturer, his energies were devoted mainly to the study of mycology, and he became reader in mycology in 1942. During this period, Prof. Chesters built up a flourishing school of mycological research. His chief mycological interests have been in the Pyrenomycetes and Phycomycetes. His work on British Pyrenomycetes, published in a series of papers from 1935 onwards, must rank as an important contribution to the study of the life-histories and taxonomy of the group and he is justly recognized as an authority in this field. More recently, Prof. Chesters has been experimenting with new methods of approach to the difficult problem of the study of the fungus flora of the soil, and he has designed special 'immersion tubes' whereby fungi can be directly isolated from the soil. Prof. Chesters' mycological activities are by no means confined to the university, for he is a prominent and active

member of the British Mycological Society, serving as secretary during the period 1936–42 and becoming a vice-president in 1942.

Botany at University College, Leicester

MR. T. G. TUTIN has been appointed lecturer in charge of the Department of Botany, University College, Leicester. Mr. Tutin obtained his degree at Cambridge (Downing College) in 1930. He was demonstrator in botany at King's College, London, during 1938–39, and assistant lecturer in botany at Manchester during 1939–42. Recently, he has been working for the Admiralty. He visited British Guiana in 1933 and was a member of the Percy Sladen Trust Expedition to Lake Titicaca, Bolivia, in 1937.

Military Health Services in the U.S.S.R.

STRIKING figures in regard to the decreased death-rate among wounded Soviet soldiers were given by Dr. S. A. Sarkisov, professor of neuropathology at the Moscow Institute of the Brain, in the course of an address to the Pharmaceutical Society of Great Britain on February 8 on the health services of the Soviet Union. He said that modern warfare, involving huge armies, with its extreme mobility, its complicated tactics and strategy, and its swift wedges driven into almost completely devastated areas, has changed the whole structure of the organization of the medical service and lays entirely new demands on it, especially where first aid is concerned. Further complications are added by the use of new and powerful weapons such as mines, splinter bombs and so on. Whereas in the War of 1914–18 the majority of wounds were caused by bullets, in the present War they are due to mine and other splinters. These provoke grave wounds, extremely susceptible to infection. Despite all this, important progress in wound treatment has been made. During this War there have been only isolated cases of gas gangrene; the percentage of amputations is considerably lower than during 1914–18; the death-rate caused by bladder wounds has been reduced to a very great extent. Further improvements have resulted in a remarkable decrease of the death-rate among wounded men in the hospitals. This rate is now only 1·1 per cent, and the percentage of wounded men who have returned fit to the front is now 73 per cent. During 1914–18 it was 40 per cent. In addition, there have been no epidemics in the U.S.S.R. This is all the more significant when it is remembered that the considerable medical problems connected with the large-scale transfer of industries to the eastern parts of the country took place in the early stages of the War.

The Cinematograph Film in Medical Education

IN a leading article on the uses of the film for medical education, the *Lancet* (601, Nov. 4, 1944) reminds us that Dr. Braun filmed the mammalian heart in 1897 and, in that year also, Schuster, of Berlin, filmed the abnormal gait of some of his patients. The first surgical operation was filmed by the famous French surgeon, Doyan, in 1898. Yet in 1941, the *Lancet* directed attention to the fact that academic circles in Great Britain had then scarcely noticed "this new weapon". Those who were medical students in Manchester in the days of that great and progressive teacher of physiology, Prof. William Stirling, will remember the thrill they had when Stirling returned one day from Paris, to which he was a frequent visitor, with a film of trypanosomes in the blood. This must have been about 1906–10.

Since those days the film has become a different thing. How valuable it may be we may learn from the articles by C. J. Longland and Ronald McKeith and by B. Stanford in the *Lancet* (*loc. cit.*, pp. 585 and 588). Longland and McKeith deal with the present use of the film for medical education, and the supply of films and information, giving a valuable list of organizations from which medical films can be obtained. They also discuss the use of medical films abroad, the question of how they can help medical education, plans for their use and the job of their production. Stanford gives his article to this problem of production and to the scope of the medical film. In the same issue of the *Lancet* (p. 615) is a note on the apparatus used in one of the laboratories of Imperial Chemical Industries, Ltd., for cinemicrography, and on another, more elaborate apparatus for high-power cinemicrography designed by R. McV. Weston (see also *Nature*, November 4, 1944, p. 573).

The Research Defence Society

THE annual report of the Research Defence Society, published in the *Fight Against Disease* (32, 2; 1944), records further progress during 1943 and a gratifying response to the appeal for funds made in 1943. This has given the Society an additional £140 a year and an addition of £530 to its invested reserve, which now stands at its highest figure in the Society's history. But its total annual receipts of about £1,000 compare sadly with the statement also made, that opponents of animal experiments have spent, during the last thirty-two years, some £750,000 of charitable money in their efforts to stop experiments requiring the use of animals. The Society hopes, nevertheless, to resume its full activities after the War, under the presidency of Lord Hailey, who succeeds the late Sir William Bragg. The annual report directs attention to the success of diphtheria immunization and to the importance of vaccination in the control of smallpox demonstrated by the recent outbreaks in London and Glasgow. The Society's publications on these and similar subjects are being used to counter systematic efforts to prejudice mothers against protection of babies against smallpox and diphtheria by sending them misleading pamphlets at hospitals and nursing homes.

The present issue of the *Fight Against Disease* contains, in fact, short articles on the part played by animal experiments in the study of various grave diseases, which should be valuable in countering anti-vivisection propaganda. The late Sir John Ledingham contributed a list of important advances due to, or greatly helped by, experiments on animals, among which are the prevention of diphtheria, tetanus (the menace of which has been virtually excluded from the British and American Armies during the present War), typhoid, cholera, plague, rabies and smallpox; the diagnosis of syphilis, typhoid and paratyphoid, typhus, tuberculosis in cattle and such virus infections as influenza and yellow fever also require the use of animals; the sera for the detection of human and animal blood stains in criminal and other investigations are obtained from specially immunized animals; and animals also provide the sera used for the treatment of diphtheria, tetanus, gas gangrene, dysentery, typhus and other diseases.

Sir William Savage discusses the relation of animal experiments to the control of typhoid and other

infectious diseases, tuberculosis, venereal disease and to other problems of public health and nutrition. Prof. J. H. Burn discusses their relation to the standardization of such therapeutic substances as insulin, neoarsphenamine and various antitoxic sera. Dr. J. W. Trevan further discusses physiological, immunological and therapeutic researches done with animals for the control of human and animal diseases, instancing diabetes, rickets, beriberi, pellagra, diphtheria, gas gangrene and, in veterinary medicine, lamb dysentery (which used to kill hundreds of thousands of new-born lambs each year) and louping ill of sheep. He states that tuberculosis has been virtually eliminated from cattle in the United States by the use of tuberculin for its diagnosis. We also owe the sulphonamides entirely to work done with animals, and many other drugs cannot be standardized without the use of them. Prof. George Wooldridge discusses the relief of pain and suffering in animals themselves due to experiments done on animals.

Tyndall's Library

MESSRS. H. SOTHERAN of 2 Sackville Street, Piccadilly, W.1, have just issued an annotated catalogue of works on physics comprising the library of John Tyndall (1820–93), professor of natural philosophy at the Royal Institution, and including also other items. Of special interest are such unique items as a manuscript catalogue of the library with nearly two thousand entries, together with numerous scientific notes of Prof. Tyndall and short autobiographical details of his boyhood. Another note-book of seventy pages contains notes of his original drafts of papers and reviews with suggestions of experiments to be made. A great deal consists of personal notes, not without their humorous aspect. Of Forbes he writes, "The late Principal J. D. Forbes was a man not slow to anger. He was so sensitive as to his fame, and so eager to secure it that honest criticism was regarded by him in the light of personal attack"—typical English understatement remembering the Forbes–Rendu–Tyndall glacier controversy. Other notes connected with Ruskin and Prof. Tait include "I have heard Prof. Tait described as a rude overgrown schoolboy". The same note-book contains the first draft of his sensational presidential address at the Belfast meeting of the British Association. The catalogue of more than a thousand items includes many volumes with Tyndall's pencilled notes. Such rare works as a first edition of Huygens "Traité de la Lumière" with the full name on the title-page also appear.

Industrial Safety in Spain

A PAPER by Luis Ruiz-Castillo Basala entitled "Eliminación de accidentes en la 'Industria de la Construcción' por el conocimiento del factor humano" appears in *Revista De Formacion Y Documentacion Profesional* (3, No. 9. Madrid, 1944), dealing with the problem of obviating accidents to those included in the category of the "Industria de la Construcción". The investigation was conducted for this class only, which includes twenty-four different forms of employment, constituting about 70 per cent of the manual workers in Spain (agricultural workers are excluded). Each of the occupations is examined separately, and the most relevant conditions which characterize them are given under the headings of physiology, psychology, hygiene and other factors. It is believed that accidents could be eliminated to a very large extent in the branches of industry referred to by attending to certain points, among which may be noticed the following. (1) Selection of those most adaptable to the particular type of work. This could be effected by a physico-technical examination of special type, starting with a study of the characteristics enumerated for the various forms of employment. (2) Psychological influence by means of conversation, etc., on those who come under examination, to help each one to make use of his psychological qualities in the fulfilment of his daily occupation. (3) Propaganda by means of posters, handbills, and so on, having the special object of eliminating accidents. These would teach people the most convenient positions to adopt at their work and the most rational methods for proceeding with it, and would also show the necessity for remembering on all occasions the attitudes of security most fitted to avoid foreseen risks.

Announcements

THE Buchan Prize for 1945 of the Royal Meteorological Society has been awarded to Mr. E. L. Hawke, secretary of the Society.

THE Secretary of State for the Colonies has made the following appointments to the Colonial Products Research Council: Mr. J. C. F. Fryer, secretary of the Agricultural Research Council, in succession to the late Dr. W. W. C. Topley; Prof. H. V. A. Briscoe, head of the Department of Inorganic and Physical Chemistry, Imperial College of Science and Technology, in succession to the late Sir John Fox, Government chemist.

THE Council of the University of Sheffield has made the following appointments: Mr. J. H. Read, to be lecturer in chemistry; Dr. E. F. Finch, to be honorary lecturer in the history of medicine, in succession to Mr. George Wilkinson; Mr. J. Carson, to be honorary lecturer in psychology in the Faculty of Medicine, in succession to the late Dr. E. F. Skinner.

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

A WHOLE-DAY conference of the Nutrition Society will be held on February 24, beginning at 11 a.m., at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1. The subject of the conference will be "Factors Affecting the Nutritive Value of Bread as Human Food". Further details of the Nutrition Society can be obtained from the Hon. Secretary, Dr. Leslie J. Harris, Nutritional Laboratory, Milton Road, Cambridge.

WE have received from Messrs. Griffin and Tatlock, Kemble Street, Kingsway, London, W.C.2, particulars of some apparatus and materials, including a neat balance desiccator, polishing alumina for metallography, an anti-vibration balance table, a Kjeldahl apparatus for determining nitrogen in steel, and several other types of analytical apparatus. Publications on these may be obtained on request.

LETTERS TO THE EDITORS

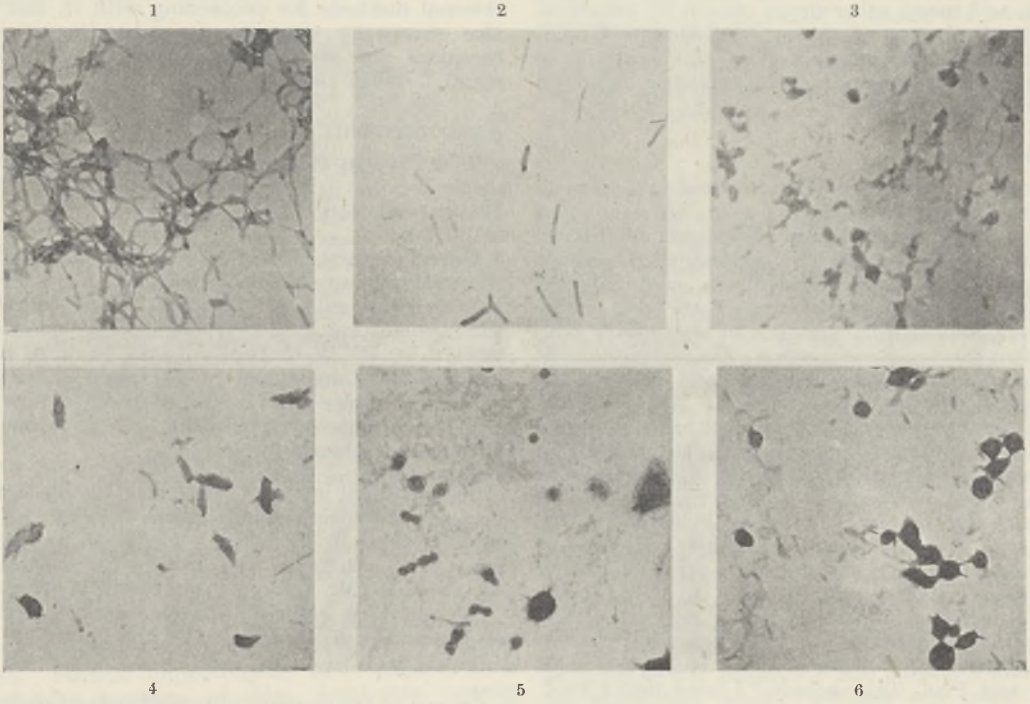
The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

Electron Microscopic Investigation of Precipitates of Cellulose Nitrates

THE preparation of cellulose for electron microscopy is very difficult, because it implies the necessity of disintegrating the fibres to very thin fragments (10^2–10^3 A.). Different mills combined with swelling agents have been used, but the difficulties are not overcome by these methods. The results obtained do not always agree, and different conclusions have been drawn on the structure of the cellulose[1]. Of great value are the comparisons with light and electron microscopy made by Eisenhut and Kuhn[2], Barnes and Burton[3] and others. Good pictures have also been published by Husemann and Carnap[4]. In the investigations reported hitherto, preparations have been made by disintegrating fibres. Preparation by precipitating cellulose from cuprammonium solution has been used only in one case[5]. Precipitations of cellulose derivatives for electron microscopy do not seem to have been used at all. We have tried to get electron microscopic preparations of cellulose nitrates precipitated from acetone solution by water. The following is a preliminary report on these experiments.

The cellulose nitrates investigated were nitrated by a mixture containing phosphoric acid[6], and they contained about 13·8 per cent N. The precipitation was performed from a dilute acetone solution (0·02 gm./100 ml.). If the water was added slowly at about 50° C., with vigorous shaking, the cellulose nitrate formed an opalescent sol showing a distinct Tyndall effect. It was stable for many hours at a water concentration of 80 per cent. After standing for one or more days, the sol partially coagulated to filaments or lumps without definite shape.

In the electron microscopic investigation we used object membranes of nitrocellulose lacquer (cellulose nitrate containing about 12 per cent N dissolved in amyl acetate) of a thickness of about 50 A. We worked at a magnifying power of 20,000 (electron microscope with magnetic lenses from Siemens and Halske A.G.). The preparations were made by drying up a drop of the opalescent solution on the object membrane.



1. Sulphite cellulose (spruce), bleached and treated with strong alkali, α-content 98 per cent (Mo och Domsjö AB).
2. Sulphate cellulose (pine), bleached 'Kraft' pulp (Uddeholms AB).
3. Sample removed from a sulphite cellulose cooking (spruce) 9 hr. 45 min. after start (the cooking was completed in 19 hr.). Lignin content 16·6 per cent before nitration. The nitrate was completely soluble in acetone.
4. Russian raw cotton linters, not extracted or treated in any way, α-content 96 per cent. The nitrate dissolved to 96 per cent in acetone.
5. Sulphite cellulose (spruce), bleached to extremely low viscosity by hypochlorite.
6. The cellulose from Fig. 1, depolymerized to half the original intrinsic viscosity by the 'ageing' of alkali cellulose in the viscose process.

In these preparations there were different structures of the particles, and we have tried to classify them. As a preliminary description, the three main types of structures may be characterized as follows.

1. *Micellar structure*, that is, straight rods or threads of rather uniform thickness and definite shape, sometimes lying free from one another but often crowded like a net over the membrane (length ~ 2000 A. and thickness ~ 100 A.). See Figs. 1 and 2.

2. *Amorphous structure*, that is, lumps or clods without definite shape and magnitude. See Figs. 3 and 4.

3. *Fine-grain bottom- or understructure*, that is, extremely thin formations, sometimes lying as a net but not so strictly ordered as the micelles. The

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

UNIVERSITY OF LONDON

MATRICULATION AND SCHOOL EXAMINATIONS

The Senate will proceed shortly to appoint Chief Examiners for the year 1946 in the undermentioned subjects:

MATRICULATION EXAMINATION: Botany, Chemistry, English, French, General Science, Greek, Latin, Logic, Mathematics, Modern History, Physics, Religious Knowledge.

HIGHER SCHOOL EXAMINATION: Accounting, Botany, British Constitution, Economics, English, French, Geography, German, Latin and Greek, Mathematics, Modern History, Music, Physics.

GENERAL SCHOOL EXAMINATION: Ancient History, Art, Botany, Chemistry, Domestic Subjects, English, English Literature, French, General Science, Geography, German, Handicraft, History, Latin, Logic, Mathematics, Music, Physics, Physics with Chemistry, Religious Knowledge.

Application forms and particulars of the remuneration and duties are obtainable from S. H. Shurrock, M.A., Secretary of the Matriculation and School Examinations Council, at Richmond College, Richmond, Surrey, to whom applications should be forwarded not later than March 5, 1945. If testimonials are submitted, one copy only of each is required, and original testimonials should not be sent.

The Senate desire that no application of any kind be made to individual members.

H. CLAUGHTON,
Principal.

University of London,
at Richmond College, Richmond, Surrey.

BIRKBECK COLLEGE

(University of London)

AUTUMN TERM BEGINS ON MONDAY, SEPTEMBER 24

Applications for admission from men and women who desire to read as part-time Internal Students of the University for degrees in the Faculties of Arts and Science, or for the Diplomas in Geography and Psychology, should be addressed to:

THE CLERK,
Birkbeck College, E.C.4.

CHELSEA POLYTECHNIC

Manresa Road, S.W.3.

A course of four lectures on "The Structure of Synthetic Polymers and Its Relationship to Their Application" will be given by J. K. Aiken, Esq., Ph.D., on Thursday Evenings from 6.30 to 7.30 p.m., commencing Thursday, Feb. 22, 1945. Fee for the Course 10s. Particulars on application to the Principal.

CHIEF SUPERINTENDENT (RADAR RESEARCH)

Applications are invited for the post of CHIEF SUPERINTENDENT in a Government establishment concerned with the development of Army Radar up to the stage at which equipments go to production; with research work connected with Radar, and with the development of certain other special equipments, including searchlights.

The Chief Superintendent is technically and administratively responsible for the efficient working of the establishment.

Applicants should have good educational qualifications with a University Degree and practical experience in research and design. They should also have experience in the planning and management of research and development and knowledge of the electrical and radio industries.

The normal salary will be at the rate of £1,400 per annum, but a higher rate would be considered in the case of an applicant with exceptional qualifications.

Applicants should write, quoting D.1082A, to the Ministry of Labour and National Service, Appointments Department, Central (Technical and Scientific) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, for the necessary forms, which should be returned on or before March 3, 1945.

For Sale: Watson's "Fram" Model Petrological Microscope, complete with all accessories. Perfect condition.—Inquiries to Beck, 30 West End Lane, London, N.W.6.

UNIVERSITY OF DURHAM

King's College, Newcastle upon Tyne

LECTURESHIP IN METALLURGY

The Council of King's College invites applications for the above post, for which graduates in Physics and Chemistry who have had metallurgical experience will also be eligible, at a commencing salary of not less than £500 per annum, according to qualifications and experience. Duties to commence July 1, 1945.

Further particulars may be obtained from the undersigned to whom four copies of application, together with the names of not more than three persons to whom reference may be made, should be sent not later than Saturday, March 10, 1945.

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

UNIVERSITY OF DURHAM

I.C.I. FELLOWSHIPS

Applications are invited for Research Fellowships founded by the Imperial Chemical Industries Limited and tenable at this University.

The Fellowships have been established for research in Chemistry, Physics, and other allied subjects.

The normal stipend will be £600 (or £550 for member of F.S.S.U.) and the Fellowships are tenable in the first place for three years, commencing, if possible, in Michaelmas Term, 1945.

Detailed conditions of award may be obtained from the Acting Registrar, University of Durham, 46 North Bailey, Durham.

UNIVERSITY OF DURHAM

Applications are invited for the PROFESSORSHIP OF MECHANICAL AND MARINE ENGINEERING, tenable at King's College, Newcastle upon Tyne. The candidate appointed, if now on National Service, will not be expected to take up appointment until his release. The salary will be according to qualifications and experience, but will not be less than £1,500.

Further particulars may be obtained from the undersigned, by whom applications should be received not later than April 30, 1945.

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

KING'S COLLEGE OF HOUSEHOLD AND SOCIAL SCIENCE

(University of London)

Temporary Address:
c/o University College, Leicester

Applications are invited for appointment as HEAD of the DEPARTMENT of HOUSEHOLD ARTS, to date from Oct., 1945. Preference will be given to candidates who have a University Degree in addition to experience in the teaching of Domestic subjects.

Applications, together with copies of three testimonials, should reach the Secretary (from whom further particulars may be obtained) not later than April 14, 1945.

DERBY TECHNICAL COLLEGE

NORMANTON ROAD, DERBY

Applications are invited for the post of a further full-time LECTURER in the Department of Chemistry, to commence after the Easter vacation. Candidates must have a good honours degree in Chemistry of a British University, industrial and/or research experience would be an advantage.

Salary according to Burnham Scale, plus bonus.

Application forms and further particulars may be obtained from the undersigned and should be returned by March 5, 1945.

W. ALFRED RICHARDSON,
Principal.

BEDFORD COLLEGE FOR WOMEN

(University of London)

REGENTS PARK, N.W.1

The Council of Bedford College invites applications for the post of Laboratory Assistant in the Department of Botany. Salary £4 to £6 per week, according to qualifications and experience. Appointment to be made as soon as possible. Applications to the Secretary.

Skilled Laboratory Assistant required at once for Physiology Department. Wages £3 to £5 per week, according to experience, etc.—Applications to be sent to the Vice-Dean, St. Bartholomew's Hospital Medical College at Queen's College, Cambridge.

Applications are invited for posts of chemist in the Directorate of Food Inspection in India. Applicants should hold a degree in Chemistry and/or Associateship Royal Institute of Chemistry. Experience in food industry (especially dehydration, canning, pickle manufacture or meat processing) preferable but not essential. In addition there is one vacancy requiring above qualifications and knowledge of methods of estimation of vitamins, especially vitamin B. Selected candidates will be appointed to Emergency Commissions in the Royal Indian Army Service Corps with the acting rank of Major. Pay admissible under Indian regulations and after arrival in India is at present equivalent to approximately £88 per mensem for unmarried officers, plus family allowance for married officers. —Applicants should write, quoting F.3592A, to the Ministry of Labour and National Service, Appointments Department, Central (Technical and Scientific) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, for the necessary forms, which should be returned completed on or before March 1, 1945.

Is there an ex-service or otherwise exempt young technologist, with a flair for expressing himself (or herself) on paper, who would jump at the opportunity of becoming personal assistant to principal of leading technical and engineering publicity firm? Education to degree standard, professional outlook and determination in due course to qualify in advertising technique essential. Main work, production of technical publicity matter for British manufacturers, involves ability quickly to grasp technical possibilities, to formulate ideas, and to write matter which artists and others can work up into advertisements, brochures, etc. The advertiser's firm is old established, and a suitable applicant (not too old to learn) will be offered a permanent and progressive post.—Apply in first case by letter to Bertram Ward, Aldwych House, London, W.C.2

Required for service with large Company operating in the Middle East, FOOD AND DRUG ANALYST. Should possess a Degree in Chemistry and, if possible, the F.R.I.C. Food and Drugs, together with several years' practical experience with a Public Analyst; consultative experience an advantage. Age 25 to 35. Total emoluments, including salary, not less than £700 per annum, together with free accommodation, medical attention, and kit allowance. Applicants should write, quoting F.2894XA, to the Ministry of Labour and National Service, Appointments Dept., Central (T. & S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, for the necessary forms, which should be returned completed on or before March 12, 1945.

The National Institute of Agricultural Botany, Huntingdon Road, Cambridge, invites applications for the posts of Crop Recorder at the Institute's Substations in Shropshire and Northumberland. Applicants should have had a sound agricultural and/or botanical training, and preference will be given to those with experience of field trials and advisory work. Salary scale £400 to £650 (plus war bonus), according to qualifications.—Full particulars can be obtained on application to the Secretary at the above address.

Young qualified Chemist (male or female) required by Genatosan Ltd., for organic micro-analytical laboratory. It is preferable that candidates should have had some experience in standard micro determinations or in precise macro-analysis. They should be definitely interested in micro-analysis. Salary according to experience.—Apply, Chief Chemist, Genatosan Ltd., Loughborough.

Zoologist (woman) is required by large firm of Chemical Manufacturers in Scotland for the assay of the physiologically active substances. Applicants should have University Degree. Age under 35 years. Commencing total emoluments £290 upwards, according to age and experience. —Apply, Box 302, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Young lady wanted for secretarial work in Electrical Research Department of industrial establishment in North-West London. Shorthand and typing required for technical reports and correspondence. Knowledge of physics and of patent procedure, and ability to abstract from technical journals would be advantageous.—Box 307, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Liverpool School of Tropical Medicine. Department of Chemotherapy. Research Assistant, with medical qualifications, or degree in a biological subject. Commencing salary £250 to £500, according to experience, etc.—Applications to Laboratory Secretary, School of Tropical Medicine, Pembroke Place, Liverpool, 3.

Physicist wanted by Radiotherapy Dept. to undertake a specific research for one year in the first case. The work will provide good experience in Hospital Physics. Candidates must be able to commence duties in the near future. Salary rising to £350 per annum.—Applications to House Governor, London Hospital, E.1, not later than March 10, 1945.

Physicist (B.Sc. Spec. Hons. London), specializing in Heat Transfer and Fluid Flow, three years' industrial research experience, seeks progressive position in London area. Good salary and post-war prospects essential.—Box 309, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Biochemist, 39, British, reserved, M.Sc., Ph.D., F.R.S.E., experienced in Research, in physiological and medical chemistry, bacteriology, microrespirometry, and in staff control, desires post, research or otherwise, in public health hospital or industry.—Write, Box 310, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Boots Pure Drug Co., Ltd., require the services of a physiologist to undertake research in their Pharmacological Laboratory. Post-graduate research experience desirable. Salary according to qualifications and experience.—Applications to Personnel Manager, Boots Pure Drug Co., Ltd., Station Street, Nottingham.

Analyst required for the permanent Laboratory Staff of a large glass works near Birmingham. Degree in chemistry or equivalent experience in inorganic analysis. Salary according to age and qualifications.—Chance Brothers, Smethwick.

Physicist required for the Research Staff of an expanding laboratory in a large glass works near Birmingham. Degree in Physics or Mathematics. Salary according to age and qualifications.—Chance Brothers, Smethwick.

Microscope, Beck, "London 29B". Black-chromium; recent; practically absolutely new. Exchange for low power binocular microscope.—H. O. Wood, Seawood, Grange-over-Sands.

Book Urgently Wanted: "A Monograph of the British Lichens," by A. L. Smith, Part I, 2nd Ed., 1918.—R. Lewis, "Fiddler's Elbow," Staunton Road, Monmouth.

Wanted: Ring Index (A.C.S. Monograph No. 84), either new or secondhand. £8 for first copy offered.—Write, Genatosan Limited, Loughborough, Leicester.

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bottom-structure was often to be seen, together with the amorphous structure. See Figs. 5 and 6.

Using the method described, we have found that celluloses of extremely high molecular weight ($DP >$ 5,000 from sedimentation and diffusion measurements) give mainly amorphous structure (type 2, see Figs. 3 and 4) and no, or very few and irregular, micelles. Celluloses of moderate molecular weight ($DP \sim 1{,}000$) have a definite tendency to form micelles (Figs. 1 and 2); sometimes all the precipitate was of type 1. We have not been able to obtain micellar structures of this type from celluloses depolymerized in different ways to very low molecular weight ($DP \leqslant 300$); they form precipitates of type 2 and 3, often mixed, but sometimes thin and irregular micelles were observed in the bottom-structure.

The lengths of the micelles observed are about 50 per cent of those computed from DP (sedimentation and diffusion measurements) for straight molecules. The lengths agree rather well with those of the molecules computed from the frictional ratio according to the formulæ given by Burgers[7] (cf. ref. 8). The frequency curves of the lengths are narrow and show only one peak; the mode of the lengths varied from 1000 A. to 3000 A. for different samples.

We believe that the micelles observed are crystallites, and it is possible that they are identical with the micelles proposed for the structure of cellulose and its derivatives in the solid state.

There are celluloses with only small differences measured by the general methods of analysis (viscosity, content of α-cellulose, pentosans, lignin, ash, extractive matter and so on) but of very different value for technical use. By using the precipitation method described, we have found distinct differences between such pulps, too. Possibly the method may be used for the characterization of technical celluloses. Further experiments are in progress and the results will be published elsewhere.

We wish to thank the director of the Institute, Prof. The Svedberg, for his interest in this work and for helpful criticism. We also thank the Mo och Domsjö AB and the Uddeholms AB for financial support.

GUNNAR HAMBRAEUS.
BENGT RÅNBY.

Institute of Physical Chemistry,
University of Uppsala. Dec. 11.

[1] Ruska, *Kolloid-Z.*, **107**, 2 (1944).
[2] Eisenhut and Kuhn, *Die Chemie*, **55**, 198 (1942).
[3] Barns and Burton, *Ind. Eng. Chem.*, Ind. Ed., **35**, 120 (1943).
[4] Husemann and Carnap, *J. makromol. Chem.*, 1, 16 (1943) and 1, 158 (1943).
[5] Ruska and Kretschmer, *Kolloid-Z.*, **93**, 163 (1940).
[6] Davidson, *J. Textile Inst.*, **29**, *T* 195 (1938).
[7] Burgers, *Proc. Nederl. Akad. v. Wetensch.*, **44**, 1045, 1177 (1941).
[8] Gralén, Dissertation, Uppsala (1944).

Action of Penicillin on the Rate of Fall in Numbers of Bacteria *in vivo*

DURING work on the use of penicillin pastilles in oral infections, of which a preliminary report has been published[1], numerous experiments have been undertaken in order to determine the total and differential fall in numbers of different species of bacteria in the mouth and the rate of this fall, under the influence of penicillin. This rate of fall is of particular interest, and as it appears that certain deductions on the mode of action of penicillin can be drawn from the experiments, it is considered that it is worth directing attention to them in a separate publication. The technique of determining the rate of fall was as follows:

0·1 c.c. of saliva was added to a measured quantity of normal saline. 1/50 c.c. of this mixture was then inoculated on to a blood agar plate. This was incubated at 37° C. for twenty-four hours, when the number of colonies was counted. From this figure the approximate number of bacteria per c.c. of saliva was calculated.

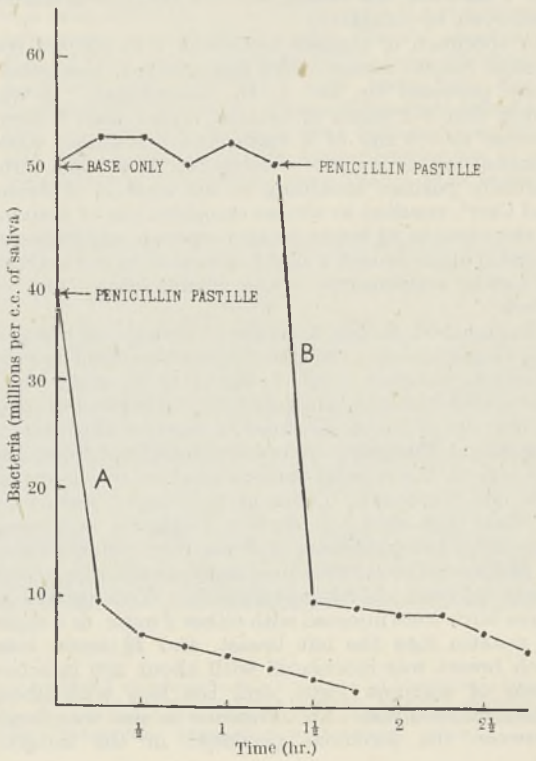
Immediately the first specimen of saliva had been obtained, a 500-unit penicillin pastille was placed in the buccal sulcus between the cheek and the teeth, and allowed to dissolve without sucking. A fresh pastille was inserted every thirty minutes. At fifteen-minute intervals further specimens were taken, and the number of bacteria later estimated in the manner described.

In these experiments saliva diluted with normal saline was used as the inoculum; it was therefore possible that the penicillin present in the saliva and transferred to the plate might be sufficient to inhibit growth: to guard against this action penicillinase was added to the medium.

The results of these experiments are shown in graph *A*, which represents the mean of three, though the findings have been constant in a far larger series of experiments using pastilles of different strengths.

It will be seen from this graph that the maximum fall in the total number of organisms occurred within the first fifteen minutes after the application of the penicillin.

Increased salivation due to the presence of a pastille in the mouth could have been a factor in this rapid fall, and in order to exclude this possibility the experiments were repeated using pastilles made of base alone, without penicillin. Pastilles of this type were maintained in the mouth for one and a half hours, and estimations on the total number of organ-



isms in the saliva carried out as in the previous experiments.

At one and a half hours, pastilles of the same base, but containing 500 units of penicillin each, were inserted and maintained for an equal period of time. The results expressed in graph *B* show that the pastille base alone produced no reduction in the total number of organisms, but substitution of the pastilles containing penicillin caused a fall in numbers comparable with the results shown in graph *A*. The possibility of the mechanical effect of salivation causing a reduction in numbers of organisms could therefore be excluded.

Consideration of the results shows that the most rapid fall in the total number of bacteria occurred in the first fifteen minutes after application of the penicillin. This rapidity of action is difficult to explain on the current hypothesis that penicillin is bacteriostatic, and would suggest that *in vivo*, when conditions of temperature, etc., are favourable, it may have a true bactericidal action.

ALEXANDER B. MACGREGOR.
DAVID A. LONG.
Hill End Hospital and Clinic,
(St. Bartholomew's),
St. Albans,
Herts.
Jan. 11.

[1] MacGregor and Long, *Brit. Med. J.*, ii, 686 (1944).

Action of Notatin on the Rous No. 1 Sarcoma Virus

As notatin exerts its antibiotic activity by virtue of the hydrogen peroxide produced by its oxidation of glucose to gluconic acid[1], it seemed worth while to try the action of this material upon the Rous No. 1 sarcoma, the causative virus of which is readily destroyed by oxidation[2].

A specimen of notatin, active at 1 in 500,000,000 against *Staph. aureus* when last assayed, was generously provided by Dr. J. H. Birkinshaw. It was found that 0·2 mgm. of notatin, added with 2 mgm. glucose to 0·5 ml. of a suspension containing 1,000 minimal infective doses of Rous No. 1 sarcoma virus partially purified according to the method of Amies and Carr[3], resulted in almost complete loss of activity of the virus in 1½ hours, in two separate experiments. Notatin alone caused a slight reduction in the activity of similar suspensions, while glucose alone had no effect.

In contrast to the activity of notatin *in vitro*, it was found to have no action upon the virus *in vivo*. Amounts ranging from 2 mgm. to 5 mgm. were inoculated into one tumour of six fowls bearing three or four Rous No. 1 sarcomas in various sites, but it was found that all tumours continued to grow, and the size of the treated tumour relative to the others was not decreased. Doses of 8–10 mgm. were fatal to the nine-week-old Brown Leghorns employed. Similarly, pre-treatment of fowls with notatin failed to influence the tumour-producing action of sarcoma virus injected shortly afterwards. Two groups of three birds were injected with either 2 mgm. or 5 mgm. of notatin into the left breast, and 1½ hours later each breast was inoculated with about 200 infective doses of sarcoma virus, and the legs with about 10 infective doses. No difference in size was found between the sarcomas produced in the notatin-treated breast and those induced in the untreated side; and the small dose injected into the legs produced tumours in all birds, indicating that a systematic reduction in infectivity of all virus injected into notatin-treated birds had not occurred.

All expenses in connexion with this work were borne by the British Empire Cancer Campaign.

J. G. CARR.
Institute of Animal Genetics,
University, Edinburgh, 9.
Dec. 14.

[1] Schales, O., *Arch. Biochem.*, 2, 487 (1943).
[2] Gye, W. E., and Purdy, W. J., *Brit. J. Exp. Path.*, 11, 282 (1930).
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Thromboplastic Activity of Placenta Extract

IN the course of an investigation of hormones of human placenta, we came across a substance which showed strong blood-coagulating properties. Fresh-water extracts of placenta contain this factor. Their activity diminishes when they are kept at room temperature or in a refrigerator. It is not removed from the extracts by dialysis at 0° C. On filtration through a Seitz filter, the active substance remains on the asbestos fibre. By extracting the filter with distilled water or saline, we obtained a solution possessing the properties of thromboplastin. The resulting slightly opalescent solution is more stable and can be stored for at least one month in a sealed container in a refrigerator without loss of potency. It gives a weak positive reaction with sulphasalicylic acid.

It is of interest that our preparation does not lose its thromboplastic activity when heated for five minutes on a boiling-water bath. This activity is manifested on recalcified oxalated plasma (prothrombin time test[1]) as well as on fresh whole human blood. The above holds true only for tests carried out with fresh plasma. With plasma stored for some days in the refrigerator a different result is obtained. As is well known, the prothrombin time test depends on the age of the plasma, being prolonged as the plasma is stored. Our placenta extract, too, shows this phenomenon. Towards stored plasma the boiled extracts become totally inactive (see table). Thus both our unheated and heated preparations show typical differences in behaviour towards fresh and aged plasma respectively.

EFFECT OF BOILED AND UNBOILED THROMBOPLASTIN ON THE 'PROTHROMBIN TIME' OF FRESH AND STORED PLASMA.

Age of plasma	Prothrombin time	
	Unboiled thromboplastin	Boiled thromboplastin
1 hour	12 sec.	12 sec.
1 ,,	13 ,,	13 ,,
1 ,,	15 ,,	18 ,,
2 days	18 ,,	23 ,,
3 ,,	21 ,,	28 ,,
7 ,,	42 ,,	185 ,,
28 ,,	70 ,,	more than 10 min.

Prothrombin time is the clotting time of 0·1 c.c. oxalated plasma mixed with 0·1 c.c. thromboplastin and 0·1 c.c. 0·02 *M* calcium chloride at 37° C.

Extraction of ox lungs and brain has yielded a substance with similar properties, but preparation from placenta is technically easier. (Recently, Reichel[2] reported a thermostable blood-coagulating

substance from placenta, using a different method of preparation. Because of war conditions, I have not been able to secure a copy of this paper.)

Quick[3] has shown that prothrombin is composed of two components, *A* and *B*, the former of which disappears when blood is stored. This observation offers a possible explanation of our findings. It is assumed that our thromboplastic substance, too, is composed of two parts, one of them thermostable and acting on component *A* but not on component *B* of prothrombin. From stored plasma component *A* is lost. For this reason the boiled thromboplastin does not act on such plasma.

A full report will be published elsewhere.

My thanks are due to Prof. B. Zondek for suggesting this work and for the interest taken in its progress, and to Drs. Bromberg and Polishuk for their kind help.

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[1] Quick, A. J., *Amer. J. Clin. Path.*, **10**, 220 (1940).
[2] Reichel, C., *Klin. Wochschr.*, **21**, 862 (1942); *Chem. Abstr.*, **38**, 2669 (1944).
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Inhibition of Bone Calcification by Sulphonamides

THE recent demonstration by Golding and Silver[1] that certain sulphonamides act as inhibitors of phosphatase *in vitro* has led us to present a preliminary report of our investigations on the effect of sulphonamides on bone formation *in vivo*.

These experiments were designed to test a hypothesis which arose from the findings of Benesch *et al.*[2] that sulphonamides with a free $-SO_2NH_2$ group (for example, sulphanilamide) inhibit shell formation in the domestic fowl, whereas sulphonamides in which the $-SO_2NH_2$ is substituted (for example, sulphapyridine) do not. The former type of compound is a powerful inhibitor of carbonic anhydrase, while the substituted type does not have any effect on this enzyme, as was shown by Keilin and Mann[3]. It was therefore concluded that carbonic anhydrase is active in shell formation by catalysing the rate of formation of the carbonate anion of the calcium carbonate shell material.

Since bone also contains considerable quantities of carbonate, it was thought that carbonic anhydrase, in addition to phosphatase, may play a part in bone formation. In order to test this hypothesis, a calcification mechanism had to be selected which, like shell-formation, would be rapid enough to reveal the influence of sulphonamide levels compatible with life on the rate of calcification. It was therefore decided to use the calcification of the developing embryo for this purpose.

Pregnant mice and rats were used in these experiments. The mice were divided into two groups which received sulphanilamide and sulphapyridine respectively in doses of 300 mgm./kgm. a day. The drugs were given *per os* in three equal doses daily during the last 7–10 days of the gestation period. The rats were similarly treated with 720 mgm./kgm. a day. Both histological and radiological examinations of the fœtuses at term were made to study the effect of this treatment on the skeletal development.

The outstanding histological difference between the fœtuses from the sulphonamide-treated rats and normal fœtuses from comparable litters was the almost complete absence of calcification, as judged by the hæmatoxylin staining of the decalcified knee joints (Figs. 1–3). These results must, however, be interpreted in the light of Cameron's observation[4] that "hæmatoxylin does not stain calcium salts, though it often identifies areas in which changes favourable to the deposition of calcium salts are taking place". The differences in the mice were equivocal, probably owing to the slight development of the skeleton at this stage, as well as to the lower dosage administered.

X-ray examinations of the sulphonamide-treated rat fœtuses revealed striking defects in various parts of the skeleton. These were most pronounced in the skull, the parietal bones of which appeared quite translucent.

It is obvious that the observed impairment of calcification cannot be interpreted as an inhibition of carbonic anhydrase alone, since both sulphanilamide and sulphapyridine had the same qualitative effect. Despite the demonstration by Ercoli and Ravazzoni[5] that the activity of phosphatase from rice bran and from *Aspergillus oryzæ* is not noticeably influenced by sulphanilamide, Blum's observation[6] that certain sulphonamides inhibit bone phosphatase suggested that the effect may have been due to phosphatase inhibition. The confirmatory demonstration by Golding and Silver that both sulphanilamide and sulphapyridine inhibit bone phosphatase *in vitro* makes this interpretation more likely. It is, however,

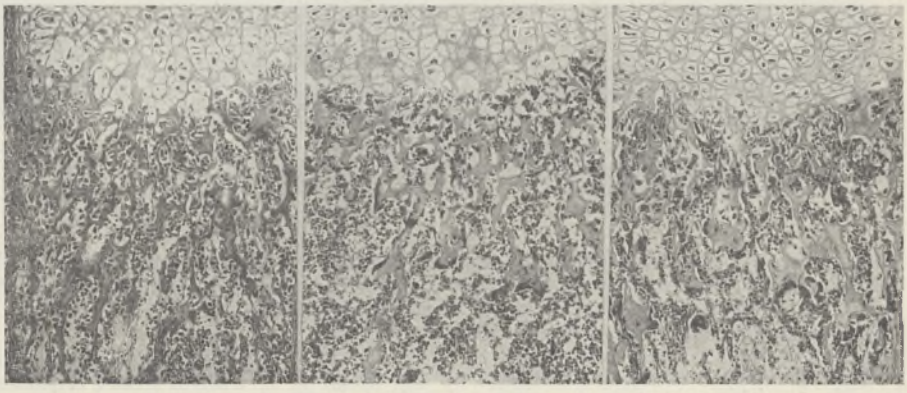

Fig. 1. Fig. 2. Fig. 3.

LONGITUDINAL SECTIONS OF LOWER END OF FEMUR OF FŒTUS FROM (1) CONTROL RAT SHOWING BASOPHIL STAINING OF THE BONE TRABECULÆ; (2) SULPHANILAMIDE-TREATED MOTHER, SHOWING ABSENCE OF BASOPHIL STAINING OF THE BONE TRABECULÆ; (3) SULPHAPYRIDINE-TREATED MOTHER, SHOWING ABSENCE OF BASOPHIL STAINING OF BONE TRABECULÆ. HÆMATOXYLIN AND EOSIN. × 75.

still possible that in the case of sulphonamides with a free $-SO_2NH_2$ group, carbonic anhydrase inhibition may have been masked by the concurrent phosphatase inhibition.

In conclusion, it is pertinent to point out that whereas the dosage used in our experiments was about seven times the therapeutic one, the resulting blood-levels would, however, be still very much lower than the concentration used by Golding and Silver to demonstrate gross phosphatase inhibition *in vitro*.

Further work is in progress on the lines discussed in this communication.

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Insecticidal Sprays and Flying Insects

IT has already been reported that insects are comparatively little affected if they remain motionless in an insecticidal spray of droplet size less than 10 microns in diameter[1]. However, when they fly through such a mist, the insects collect a very large number of droplets on their wings. This observation has been shown to be true in the case of *Aëdes ægypti*, *Musca domestica* and *Drosophila* spp. which have been exposed to both oil and water sprays.

The oil droplets which are collected by the wings do not spread since they are held by the microtrichia (Fig. 1), but on the rest of the body small droplets, applied directly, spread quickly. When the spray consists of a dyed dilute aqueous gum solution the situation is rather different, since the droplets do not spread either on the wings or on the body surface (Fig. 2). Now a few droplets can be seen on the antennæ, mouth parts, eyes, halteres and spiracular guard hairs, and the house-fly also collects very many on the ventral side of the abdomen. It remains true to say, however, that by far the largest number of droplets is collected on the wings.

It is not difficult to demonstrate the insecticidal importance of the spray collected on the wings. When the wings of both *Aëdes* and *Musca* are removed just after exposure to an oil spray mist, the kill recorded twenty-four hours later is reduced by about 50 per cent in comparison with an unoperated control group.

As is well known, insects use their legs to clean their heads, antennæ and wings; and it is, therefore, not surprising to find that droplets which have impacted on these parts are later removed and collect in the first place on the legs (Fig. 3). From the legs the spray may be transferred to the substratum or, as in the case of the fore legs of the house-fly, it may be cleaned off by the proboscis.

Insects which are being exposed to a spray mist commence the cleaning process as soon as an appreciable number of droplets has been collected. As a result, streaks of dyed spray are deposited from the legs and can be seen on the walls of the cage in which the insects are being exposed. In this way much of the spray collected by an insect during flight will be removed and lost to the surroundings. During the process of removal, however, it will be passed over the legs, which in certain cases are known to be favourable sites for the entry of insecticide. The material removed by the proboscis passes through the gut and is apparent there and in the excreta. There is, therefore, the possibility that material collected on the head and its appendages may ultimately act as a stomach poison.

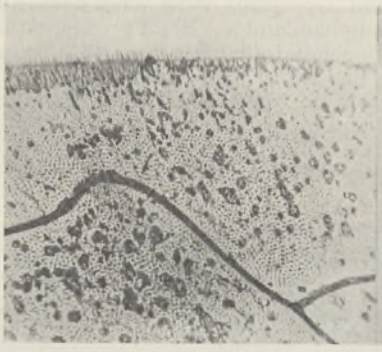

Fig. 1. OIL DROPLETS HELD BETWEEN THE MICROTRICHIA ON THE WINGS OF *Musca domestica*. THEY WERE ACCUMULATED DURING FLIGHT THROUGH AN INSECTICIDAL MIST.

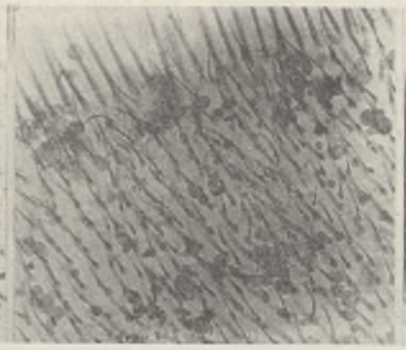

Fig. 2. DROPLETS OF AN AQUEOUS SPRAY ON THE WING OF *Musca* COLLECTED DURING FLIGHT. NOTE THE SPHERICAL FORM IN CONTRAST WITH THE OIL DROPLETS OF FIG. 1.

Fig. 3. DROPLETS SHOWN IN FIG. 2 NOW ENTANGLED IN THE BRISTLES ON THE FIRST TARSAL JOINT OF THE HIND LEG OF *Musca*. THESE DROPLETS HAVE BEEN COMBED FROM THE WING.

These observations are being extended, and it is hoped to publish a more detailed account at a later date.

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A Third Factor for Resistance to *Puccinia graminis Tritici*

WE have recently found a third factor for resistance to *Puccinia graminis Tritici* race 34 present in the Kenya varieties of *Triticum vulgare*, and it is considered that a short statement concerning this would be of interest.

In Australia, varieties of *Triticum vulgare* from Kenya Colony, East Africa, have been used widely as a source of resistance to *P. graminis Tritici*. Three strains, Kenya 743, 744 and 745, have been utilized for this purpose. Kenya 743 (*C* 6040) is a parent of the commercial variety Eureka developed by the New South Wales Department of Agriculture. Several new rust-resistant lines developed at this University owe their resistance to Kenya 745 (*C* 6042). Kenya 744 (*C* 6041) was used by wheat breeders in Western Australia since it is also resistant to race 95 of *P. triticina*, which occurs commonly in that State. Although we have used this latter variety, no promising lines have resulted from it.

Varieties of wheat from Kenya Colony have been investigated on the North American continent, and in Canada they have been found to be practically immune to many physiological races of stem rust under some conditions[1]. Since their resistance is much reduced by increasing temperatures they have not proved popular in the spring wheat areas. The effect of high temperatures, 75–80° F., on the rust reaction of seedlings has also been observed here in the glasshouse but it has never been important on adult plants in the field.

In New South Wales the standard race 34 of *P. graminis Tritici* formed the bulk of the stem rust inoculum until 1941, and all the above varieties were highly resistant to it. Genetical studies have shown that the resistance of each variety is apparently governed by a single major factor. Studies on F_3 lines have shown that in 744 the factor is the same as that previously recorded for resistance to races 17, 36 and 56 and the one in 745 is K_1, these factors being inherited independently[2]. These two factors are not allelic with the one present in Kenya 743, because when this variety was crossed with 744 and 745 in turn and F_2 seedlings were tested with the standard race 34, it was found that approximately fifteen were resistant and one was susceptible. Although a new rust capable of attacking Kenya 743 has recently turned up in Australia, 744 and 745 remain quite resistant to it. In these latter two varieties it seems that the same gene gives resistance to both the new and the old rusts.

Other varieties which were known to possess a single major gene for resistance to the standard race 34 have been crossed in turn with each of the above three varieties, and on the basis of the segregations of F_2 and F_3 seedlings their relationship to them was determined. So far, Kenya 744 is alone in one group but the other two groups are well represented. All varieties which fall into the group with 743 are susceptible to the new rust which attacks this variety, and at the University of Sydney they are all later in maturity than Kenya 745. Included in the 745 group are varieties of *Triticum vulgare* which have a single factor for resistance and which have derived it from Gaza (*T. durum*).

While there is clear evidence for the existence of these three independent genes no attempt has been made to allocate symbols to them, since this is at present being undertaken by the committee considering nomenclature of wheat genes.

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Nutrients in Wheat Endosperm

RECENT work[1–4] has added considerably to our knowledge of the distribution of nutrients, particularly the B vitamins, in the wheat grain. The scutellum portion of the germ is the main deposit of vitamin B_1, while the bran is rich in nicotinic acid and iron. Riboflavin is more uniformly distributed throughout the grain, although the highest concentrations are found in the germ. Further work has now shown that the endosperm, far from being uniform in composition, has a complex and graded structure.

The endosperm of wheat is bounded by the aleurone layer which is reputedly rich in protein and minerals. In normal milling, however, this aleurone layer, together with an appreciable amount of 'starchy' endosperm, remains firmly attached to the bran. It has long been known that the concentrations of protein and ash increase from the centre to the outer part of the endosperm adjoining the bran or seed coat; Cobb[5], for example, found with one sample of wheat that the protein in the central endosperm averaged 7·4 per cent against 16·5 per cent near the periphery. Binnington and Andrews[6] have also obtained evidence showing that the endosperm adjacent to the bran is much richer in vitamin E than the endosperm contained in patent flour. It has now been found that there are similar gradients for other nutrients. In one experiment a mixture of English wheats was milled on the laboratory plant to produce a short patent flour. The coarse bran was then freed so far as possible from adhering endosperm by four successive passages through a pair of fluted rolls. These four fractions (sieved finally through a 14 silk :

Factor	Endosperm fractions (corrected for bran contamination)				Cleaned bran	Whole wheat	Patent flour
	1st	2nd	3rd	4th			
Fibre (per cent)	—	—	—	—	11·5	2·0	—
Ash (per cent)	2·1	3·9	5·9	7·7	6·54	1·49	0·39
Protein (per cent)	13·6	14·3	15·6	16·2	11·4	8·9	8·1
Iron (mgm./100 gm.)	6·4	11·3	16·0	21·4	12·4	2·95	0·54
Total P (mgm./100 gm.)	490	937	1440	1850	1494	311	59
Phytate P (mgm./100 gm.)	371	805	1245	1593	1280	213	< 10
Phytate P/total P	0·78	0·86	0·86	0·88	0·86	0·68	< 0·17
B_1 (I.U./gm.)	1·4	1·8	2·1	2·3	1·6	1·03	0·13
Riboflavin (μgm./gm.)	1·9	1·5	1·7	2·0	5·0	1·55	0·4
Nicotinic acid (μgm./gm.)	77	148	240	393	250	42	5
Theoretical per cent by weight of wheat	0·89	0·39	0·34	0·43	12·5	100	11

aperture 0·095 mm.) together with the residual coarse-cleaned bran were carefully analysed. From the fibre contents of the fractions it was possible to calculate the amount of powdered bran in each fraction and in turn to arrive at the approximate composition of the pure endosperm in each fraction. Certain of the results, together with those for the cleaned bran, the whole wheat and the patent flour (roughly typical of the central endosperm), are given in the accompanying table.

From the method of preparation it would be expected that the fractions contained increasing amounts of aleurone cell contents, but in general the analyses are typical of the starchy endosperm adjoining the aleurone layer. Other experiments, however, indicate that the slopes of the gradients in the endosperm, certainly that for protein, vary in different samples of wheat.

Four points stand out from these results: (1) the outer endosperm is particularly rich in protein, iron, nicotinic acid and phosphorus; (2) the B_1 content, although much higher than in patent flour, is low compared with that in the scutellum where it averages 60 I.U./gm.; (3) the bulk of the phosphorus is in the form of phytate P (this incidentally is also true of germ[1] and aleurone layer[7]); (4) the total weight of endosperm included in the four fractions was approximately 2 per cent of the weight of the wheat, corresponding to a thickness of about 12 μ. Analyses showed that the coarse bran after cleaning still had its aleurone layer practically intact and contained in addition about 5 per cent starchy endosperm (thickness approximately 3·5 μ).

This work is part of a general investigation on the detailed chemistry of the wheat grain and the biophysics of flour milling.

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Sources of London Honey

IT is well known that the main nectar flow in the London area comes from the limes (*Tilia* spp.) and to a lesser extent from the privet (*Ligustrum*). In some seasons privet predominates and the resulting honey is dark in colour with a slight greenish cast and has an unpleasant flavour with a bitter after-taste. The honeys that were the subject of my note[1] could not be mistaken for privet honey. The colour of the *Ailanthus* honey is a pale amber with a more definite green tinge than any other honey I have seen. Mr. Farmiloe[2] has evidently misunderstood my description of the flavour. It is quite distinct from that of privet honey, which does not develop the muscatel flavour. The cat-like odour referred to is that of tom-cat urine and differs from both *Ribes nigra* leaves and the musky smell of mice. The odour of *Ailanthus* flowers is strong and similar to that of fresh elder flowers (*Sambucus nigra*), which changes when they wilt to the tom-cat odour. The odour of *Ailanthus* leaves is different from that of either fresh or wilted elder flowers, but it is irrelevant to this discussion. Another point confirming *Ailanthus* as the source of the cat-like and muscatel flavours is that there was no marked difference of flavour between the two honeys, although in 1944 there was nearly five times as much privet pollen present as in 1943.

That the proportions of pollen species found in a honey do not represent exactly the relative amounts of nectar obtained from the source plants is appreciated full well by palynologists—to use the term recently proposed by Hyde[3]. Many factors contribute to this lack of correlation in addition to the peculiarities of the bee's honey sack quoted by Mr. Farmiloe. To take an extreme case, no pollen can be gathered from the garden catmint, *Nepeta Mussinii*, so beloved of the bees, as the plant has sterile anthers. Generally, however, the pollen content of a honey is a good indication of the botanical sources of the nectars from which it was derived. Thus in a honey pronounced by a well-known honey judge to be one of the best samples of raspberry honey he had seen, 79 per cent of the pollen came from raspberry. Pollen from another honey reputed to be from fruit trees consisted of 68 per cent of fruit tree pollens, more than 50 per cent being apple. Other constituents in this were horse-chestnut 10 and *Tilia* 1 per cent. These particular analyses probably indicate fairly closely the composition of the honeys. On the other hand, dicœcious trees like *Ailanthus* will tend to be under-represented as the female flowers have no pollen. Sweet-chestnut, *Castanea sativa*, on account of its abundant and fully exposed pollen, will tend to be over represented in a mixed honey containing lime, privet and other plants flowering at the same time. Floral morphology and relative abundance of pollen must both be important factors affecting the amount of pollen finding its way into the honey.

It has been my experience that the preconceived ideas of beekeepers as to the floral sources of their honeys are frequently at fault. All the evidence I have gathered suggests that the pollen content is a very useful, though not yet quantitative, indication of origin, and reflects more or less faithfully the history of the bees' labours. For example, the presence of the lime and horse-chestnut pollens in the fruit tree honey mentioned above was explained on inquiring into the history of the hive. The beekeeper had been too busy to extract the honey and had left the supers on the hive until she noticed the first open flowers on the limes. Evidently the bees had already found the lime and had previously worked the horse-chestnut. This honey also shows the working of two separate nectar flows, a feature in evidence in the analysis quoted by Mr. Farmiloe. The most unusual feature of his honey is the high proportion, 27 per cent, of monocotyledonous pollen, for there can be few places in London where such a result is possible.

Exception must be taken to some of the statements quoted from Mr. Yate Allen. The limes produce pollen in fair abundance and moderate amounts are carried back to the hive. The amount of pollen produced bears little or no relationship to the orientation of the flowers. Although anemophilous and nectarless flowers are worked, when the demands of the brood require it, not much pollen of this kind finds its way into the honey. In normal circumstances the bulk goes directly into the brood nest.

While it may be agreed that chemical methods of identification and quantitative estimation of the

botanical sources of honeys are desirable, the chemist has yet a long way to go before he can analyse a 5 gm. sample of honey and state with an error of ± 5 per cent the percentage composition in, say, a mixture of horse-chestnut, sweet-chestnut, lime and privet. The mere identification of a readily recognizable substance such as methylanthranilate is but a beginning. Such a goal is probably more nearly within reach of the palynologist.

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[2] Farmiloe, C., *Nature*, **155**, 80 (1945).
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Duration of the Larval Stage of *Echinometra*

BY adding every day a small quantity of food to cultures of *Echinometra* larvæ, Onoda[1] was able to grow them to full larval shape in forty days from fertilization. Mortensen[2] succeeded in growing larvæ of the same species to metamorphosis in eighteen days. He transferred the larvæ every day, by means of a pipette, to fresh sea-water, thus giving them access of their natural food. Using Mortensen's method, but transferring the larvæ to fresh sea-water twice a day, I have been able to grow them to metamorphosis in twelve days only. Attempts are being made to rear these and other larvæ in order to find the minimum duration of the larval stage; the results will be published elsewhere.

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[2] Mortensen, Th., *Mem. Acad. Sci. Copenhagen*, ix, **4** (1937).

Preparation of Stable Colloidal Solutions of Carcinogenic and other Water-Insoluble Compounds

E. BOYLAND[1] prepared colloidal solutions of 1 : 2 : 5 : 6 dibenzanthracene by using acetone as a solvent with the addition of a gelatine solution. Following Berenblum's technique[2] by using pyridine as a solvent with the addition of a solution of gum arabic, P. H. O'Hara and J. A. Pollia[3] succeeded in preparing colloidal solutions of low concentration of carcinogenic hydrocarbons. N. Waterman[4] prepared colloidal solution using acetone-water dispersions of carcinogenic hydrocarbons. The acetone was evaporated in vacuum. M. Wolman[5] obtained a colloidal solution by the dispersion of acetone solutions of carcinogenic hydrocarbons in water; the acetone was evaporated in large Petri dishes exposed at room temperature.

As neither of these methods, nor the evaporation of the organic solvent on a water-bath, was practical or convenient for our purpose[6], the following procedure was adopted.

The water-insoluble compounds are dissolved in a small volume of acetone, in a test-tube, and added drop by drop with continued stirring in a given volume of distilled water, depending on the required concentration. The test-tube is washed out with another small volume of acetone and this also added to the water. The colloidal solution is then freed from acetone by dialysing against distilled water for 2–3 hours as follows. The colloidal acetone-water mixture is poured into a 'Cellophane' bag, the mouth of which is securely fastened about a glass tube. The bag with its protruding glass tube is suspended in a beaker into which distilled water was introduced, allowing the diffusion of the acetone from the mixture into the water. Within 2–3 hours the mixture is freed from acetone. If the water is changed two or three times the period of diffusion may be reduced. The acetone-free colloidal solution is then brought to the desired volume according to the concentration required.

In this simple way we have succeeded in preparing stable and perfect colloidal solutions of any desired concentration (in our experiments we could prepare solution of more than 1 per cent concentration) of almost all carcinogenic and other related and unrelated compounds such as 1 : 2 : 5 : 6 dibenzanthracene, 3 : 4 benzpyrene, methylcholanthrene, anthracene, pyrene, phenanthrene, cholic acid, desoxycholic acid, cholesterol, œstrone, ergosterol, etc.

We have still to test this method for other water-soluble solvents.

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Commutation of Annual Subscriptions

MR. J. H. UNNA, in *Nature* of December 9, makes the point that it almost always pays members of scientific and professional institutions who are 'good lives' to commute their annual subscriptions. The great practical objection to this is that a member who commutes is no longer able to make his disapproval felt by resigning. On the contrary, his resignation puts money into the institution's pocket.

It is not difficult to imagine circumstances in which the control of an institution might pass into the hands of a minority, or in which the country and foreign members might object to a policy decided by those who happen to live near London. Foreign members in particular are often disenfranchized entirely, even when questionnaires or voting papers are circulated to all members, since the closing date is usually such that foreign replies arrive too late.

In any such circumstances a dissatisfied member, so long as he pays an annual subscription, can in the last resort exert pressure of a practical kind by withdrawing. This real power should not lightly be forfeited. The professional 'man in the street' may finally have to apply economic sanctions to the scientific and professional institutions in order to force those measures of rationalization which, as the editorial in *Nature* of December 9 points out, have been so long delayed.

R. EDGEWORTH-JOHNSTONE.

Pointe-a-Pierre,
Trinidad, B.W.I. Jan. 6.

RESEARCH ITEMS

Mould Inhibition of the Tubercle Bacillus

IT is well known that Sir Alexander Fleming discovered penicillin because a mould accidentally contaminated one of his plate cultures. Reference is made in the *Lancet* (632, Nov. 11, 1944) to the work of D. K. Miller and A. C. Rekate (*Science*, **100**, 172; 1944), who found that the growth of a strain of the tubercle bacillus, *Mycobacterium tuberculosis*, was inhibited by a green mould of the *Penicillium* group, which accidentally grew on a culture of the tubercle bacillus stored in an icebox. The mould grew rapidly and well in other cultures of tubercle bacilli at room temperature, but it did not grow at all at 37° C. It grew faster and sporulated earlier on cultures of tubercle bacilli than on sterile media. It also grew in suspensions of human tubercle bacilli in saline at room temperature, and the authors failed to recover the tubercle bacilli from these suspensions later on. Experiments done by inoculation of guinea pigs suggested that some inhibition of growth had occurred, but were less definite. The mould grew well on tuberculin diluted as much as 1 in 10,000, and these dilutions of tuberculin thereafter failed to give positive skin tests in tuberculous guinea pigs. Suspensions of the mould inactivated 1 in 100 tuberculin in 2 hours, and the supernatant fluid obtained by centrifuging such suspensions also did this. When, however, the suspensions were passed through a Seitz filter, they did not inactivate the tuberculin. On the other hand, fluid media on which the mould had grown for 8–15 days had no effect on tuberculin or tubercle bacilli. *Staphylococcus aureus* grew on media on which the mould had grown and from which it had been removed, so that it was concluded that the substance produced by the mould which inhibits tubercle bacilli is not similar to penicillin.

South American Water Mites

AN extensive memoir on the water mites (*Hydrachina*) of South Brazil and Paraguay by O. Lundblad is brought to a conclusion by the appearance of the fifth part (*Kungl. Svenska Vetensk. Akad.*, **20**; 1944). This consists of 182 pages with 58 text-figures and 10 plates and is of approximately the same size as the other parts which, however, contain more text-figures. The richness of this fauna can be judged from the fact that the present memoir treats of 340 species, sub-species and varieties, and its contribution to our knowledge from the fact that, included in this total, are 282 new species. In spite of this, however, the author considers that the list is by no means complete, for the country has not been so exhaustively covered as some parts of Europe. The summary and conclusions occupy nearly half the present part, with twelve comparative and distributional tables. These include one on all the members of the group that have so far been recorded from South America. The seasonal distribution of the various forms is given, as is also their distribution among three different habitats, standing water, streams and brooks and springs. For the purposes of comparison with other southern hemisphere forms the author takes into consideration the previous work of K. Viets on the *Hydracharina* from the Sunda expedition. There is no doubt that this will form the classical work on South American *Hydracarina* for many years to come.

Lizard Heart

A VERY full account of the lizard heart, as illustrated by that of *Varanus monitor*, the Indian monitor, is given by P. N. Mathur (*Proc. Indian Acad. Sci.*, **20**; 1944). A number of new points have been noticed. A suspensory ligament and a sinu-atrial channel are described: both atria project for some distance into their respective ventricles and the author terms these the intraventricular portions: the apical region of the ventricle is divided internally into two cavities by a horizontal septum, and these are termed the cavum apicis dorsale et ventrale: the author suggests that the septum is not in its entirety the equivalent of the septum ventriculorum of higher forms as assumed by previous writers: it is further suggested that the names cavum arteriosum and cavum venosum, since they have a functional significance, should be replaced by cavum dextrum and cavum sinistrum. The bibliography, which is very full, is marred by certain slips that have not been corrected in the proof reading.

Strains of the European Corn Borer in the United States

UNDER the above title, K. D. Arbuthnot, of the U.S. Bureau of Entomology and Plant Quarantine, describes experiments conducted during 1937–40 on the possible occurrence of strains of this insect and their physiological relationships (*Tech. Bull. U.S. Dept. of Agric.*, No. 869; March 1944). It appears that material collected from New Haven, Conn., was found to be of a homozygous multiple-generation strain, and no evidence was obtained to indicate the occurrence of a single-generation strain in that locality. Material from Toledo, Ohio, was heterozygous, a complex of single- and multiple-generation strains occurring together. A homozygous single-generation strain was isolated from Toledo material but it was not found possible to obtain a homozygous multiple-generation strain. Larvæ of the single-generation Toledo strain grew more slowly than those of the multiple-generation strain from New Haven. Moths from the Toledo and New Haven field-stocks each showed a preference for mating among individuals from their own locality rather than crossing between the stocks. Mating of New Haven females with Toledo males was obtained in only a few cases, because of a racial inhibition to such mating. From these and other grounds, which are stated in detail, the author concludes that distinct biological strains of the insect in question have been demonstrated by his experiments.

External Factors and Growth of Wheat

AN attempt to assess the precise effects of differences in date and depth of sowing, conditions of spacing and kind of soil has been made by S. S. Labh Singh and Nek Alam (*Proc. Ind. Acad. Sci.*, B, 19, 29; 1944) in a study of one or two varieties of wheat grown in a series of randomized replicated blocks at two different localities. Irrespective of date, time or depth of planting, rate of germination was most rapid from midnight to 8 a.m. and slowest from noon to midnight. The optimum range for depth of sowing was large ($\frac{1}{2}$–$3\frac{1}{2}$ in.), deeper sowing being best for earlier planting and light soils needing deeper sowing than heavy ones. Shallow sowing at early dates gave a high seedling mortality. Spacing had no effect on the mortality and was the only factor which did not affect the rate of production of the first four foliage leaves. The main stems grew fastest but reached the shortest final height in late (January)

sown material, and such plants had a lower number (7·8) of fertile spikelets than the October sown plants (20·8). Wider spacing always gave more fertile spikelets. Head development in December material appears to have been at a critical threshold since the ears were long and lax in the more widely spaced material while under closer spacing they were very dense. It is concluded that in order to avoid discarding types which would be valuable introductions when grown under their optimum conditions, new varieties should always be given a very thorough trial under a wide range of conditions.

Root Stock and Scion Relationship

THE problem of root stock and scion relationship in grafted trees is one of interest and economic importance. Optimum growth and development of the grafted tree result only when scion and stock are compatible. Incompatibility generally results either in a failure of the graft to take, or else in reduced growth followed by an early death. E. L. Proebsting and C. J. Hauser (*Proc. Amer. Soc. Hort. Sci.*, **42**, 270; 1943) describe what may be a case of partial incompatibility between apricot scions and Myrobolan plum root stock. Apricots grafted on to this stock show a leaf scorch consisting of a cupping of the leaves, which are reduced in size and develop a marginal scorch. Excision of the dead tissue follows. The condition is neither cured nor prevented by injection of copper sulphate, boric acid, manganese sulphate, ammonium molybdate, zinc sulphate, thorium nitrate, potassium dichromate, barium chloride, sodium tungstate, cadmium sulphate or cobaltous acetate either alone or in various mixtures and is unlikely therefore to be a deficiency disease. On the other hand, scion rooting reduces the severity of the symptoms and diseased trees inarched with apricot seedlings show a recovery.

Kalsilite-bearing Lavas of South-west Uganda

AT a meeting of the Royal Society of Edinburgh on December 4, A. D. Combe and Arthur Holmes presented a paper on "The Kalsilite-bearing Lavas of Kabiringe and Lyakauli, South-west Uganda". It has been known for half a century that Ruwenzori is flanked by a series of recently extinct volcanic areas, each of which consists of tuffs, explosion craters and rare lava flows. The first systematic survey of these volcanic fields was carried out by Mr. Combe during 1933–39, and representative collections, amounting to nearly 1,000 specimens, were sent to Prof. Holmes for petrological study. The rocks of this unique petrographic province are highly potassic ultrabasic types of which the chief members are the following:

Ugandite	=augite+leucite	with abundant olivine, perovskite and iron ore ± biotite ± glass
Mafurite	=augite+kalsilite ($KAlSiO_4$)	
Katungite	=melilite+leucitic glass	
Kalsilite-katungite	=melilite+kalsilite	

The lavas described in the present contribution lie near the eastern edge of the Western Rift Valley, south-east of Kazinga Channel. They are kalsilite-bearing throughout and consist of mafurite and various transitional varieties containing leucite and/or melilite. The tuffs that preceded and followed the lavas are typical of those of the province as a whole and contain (*a*) fragments of quartzite, phyllite and granite derived from the underlying bedrocks; (*b*) fragments of cognate sub-volcanic biotite-pyroxenite and -peridotite; and (*c*) lapilli of katungite. The lavas contain xenoliths of (*a*) and (*b*) in all stages of transfusion by magmatic emanations, the most significant change being the transformation of the minerals of granite into leucite and eventually into an assemblage of minerals equivalent to leucitite. This discovery throws much new light on the genetic relationships between the various volcanic rocks, all of which can be traced back to the magmas responsible for kalsilite-katungite and mafurite. Twelve new chemical analyses have been contributed by Dr. H. F. Harwood and others.

Dielectric Constant and Energy Loss in Solids and Liquids

IN a published paper (*J. Inst. Elec. Eng.*, **91**, Part 1, No. 48; Dec. 1944), H. Fröhlich discusses the theory of the dielectric properties of a large group of solid and liquid organic substances built up of long-chain molecules, from the point of view of modern atomic and molecular structure. It is shown that in such substances dipoles have two equilibrium positions with opposite dipole direction. The static dielectric constant should increase with temperature below a critical temperature and decrease above it. The dielectric power loss for crystalline solids should be approximately described by the Debye equations, but for amorphous substances a flattening-out of the Debye loss curve is expected. For long-chain molecules the dependence of the time of relaxation on chain-length has been calculated, and the relevant equations are given in the paper.

Spectrophotometry of a Wolf-Rayet Binary Star

C. S. BEALS, Dominion Astrophysical Observatory, Victoria, B.C., has discussed the Wolf-Rayet Binary HD 193576, noticed first as a variable by Martin and Plummer in 1917 (*Mon. Not. Roy. Astro. Soc.*, **104**, 4; 1944). Its range of variation at that time was believed to be small, and in 1939 O. C. Wilson announced that it was a spectroscopic binary. Beals undertook a series of spectrographic observations in the summer of 1942. The data consisted of 61 spectra, 39 of which cover the region λ 3900–5000, while 22 are in the region λ 5300–6700. Comparison of line and band intensities with those of typical stars of the same spectral classes led to apparent visual magnitudes of 8·30 for the *O*-type star and 10·5 for the *W* companion. The distance of the binary is estimated from the strengths of the interstellar lines, and the value adopted is 1,180 parsecs. On the assumption of an effective temperature of 80,000° for the *W*-star and 40,000° for the *O*-star, the radii are 1·3 and 4·2 respectively, the radius of the sun being the unit. A discrepancy between the diameter of the *O*-star as determined from the light curve and as determined from the absolute magnitude and temperature is explicable on the assumption that the *W*-star may have a very small radiating core and also an extensive envelope capable of absorbing light from the *O*-star. Beals's results differ considerably from those of Wilson, who suggested that the origin of the Wolf-Rayet emission bands takes place close to the photosphere, a view which was based on the absence of a transit-time effect. This assumed complete spherical symmetry in the expanding envelope. Beals's interpretation of the spectrum of the binary suggests that tidal effects prevent this condition from being realized even approximately in the envelope of the system. He pictures a shell of ionized helium surrounding the *W*-star only, the pair being surrounded by a larger shell of neutral helium; the ionized helium shell is distorted by the tidal action of the *O*-star, the mass of which is $2\frac{1}{2}$ times that of the *W*-star.

BIPHASIC ACTION OF PENICILLIN AND OTHER SULPHONAMIDE SIMILARITY

By SURG. LIEUT.-COMDR. W. SLOAN MILLER, R.N., SURG. COMDR. C. A. GREEN, R.N.V.R., and DR. H. KITCHEN
Royal Naval Medical School

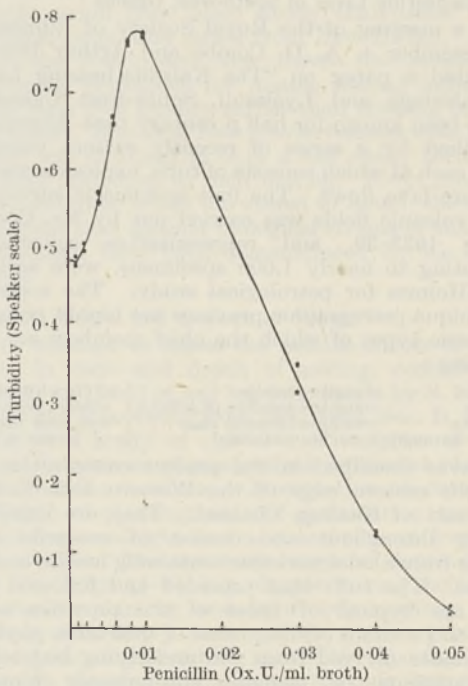
SUBSTANCES generally acknowledged as being toxic to cells may have an opposite effect in higher dilution. This biphasic action—inhibition in high concentrations and stimulation in low concentrations—has been observed with a wide variety of substances, including narcotics, cyanide, pyrithiamine[1] and sulphonamides[2]. There is ample evidence that low concentrations of the last group stimulate bacterial growth; and it would appear that the period of active proliferation, which frequently precedes bacteriostasis by sulphonamides in higher concentrations, is a manifestation of the same phenomenon. We here report what appears to be an expression of the same effect occurring with penicillin.

The growth of sensitive bacteria in broth is quantitatively inhibited by suitably graded dilutions of penicillin, and the degree of inhibition can be measured turbidimetrically[3]. With the Oxford H staphylococcus (No. 6571 N.C.T.C.) as test organism, and measuring turbidity on the logarithmic scale of a Spekker photoelectric absorptiometer, we have obtained turbidity-penicillin concentration curves generally sigmoid in shape, with broth penicillin concentrations from 0·05 Oxford units per ml. to nil. Frequently, however, we have observed that tubes containing 0·005 U./ml., and sometimes 0·01 U./ml., have shown significantly more turbidity than those containing no penicillin. This effect appeared inconsistently when the incubation temperature was 37° C. At that temperature it has been noted after 4–24 hours of incubation, with a staphylococcal inoculum of between one and ten million per ml. broth, and with different samples of commercial sodium penicillin assaying from 84–820 units per mgm. It occurred in nutrient broth containing 'Marmite' and 0·1 per cent glucose, and in 10 per cent horse serum broth without the addition of sugar. In a preliminary investigation of this phenomenon we have been unable to define the exact conditions necessary for its occurrence at 37° C., but the amount of bacterial inoculum and duration of subsequent incubation are certainly concerned; whereas the *p*H of the medium, age of inoculum, the order of mixing and initial temperatures of the various reagents in the test, within certain limits, are not critical.

We have been able to study this phenomenon more easily by incubation at temperatures below 37° C. It may be consistently reproduced by overnight (16 hr.) incubation at 24° C. of 20 ml. amounts of nutrient broth containing 'Marmite' and dextrose (0·1 per cent), with an inoculum of approximately 5,000,000 cocci per ml., from a 24-hour broth culture. Under these conditions a well-marked growth-stimulating effect has been repeatedly obtained with penicillin concentrations in the broth of about 0·01 Oxford units per ml., as shown in the accompanying graph from an actual test. The addition of *p*-aminobenzoic acid (5 mgm. per 100 ml.) to the medium makes no qualitative difference to the result, nor does the addition of 10 per cent horse serum.

The increased turbidity is not due to mere enlargement or distortion of the individual cocci[4]. The organisms from tubes at the peak of the curve (containing growth-stimulating dilutions of penicillin) are morphologically indistinguishable from those containing no penicillin. In fact, plate counts have provided unequivocal evidence that there may be twice as many viable bacteria in the penicillin growth-stimulated cultures as in controls containing no penicillin. That this observation is caused by impurities seems unlikely in view of consistent reproducibility of the effect with pure crystalline penicillin; significant increases in turbidity over penicillinless controls can be obtained with as little as 0·0006 micrograms per ml.

Apart from recording the participation of penicillin in a rather general biological phenomenon, the object of this communication is to direct attention to the accumulating empirical evidence of the similarity of penicillin and sulphonamide action. So far as we are aware, the only commonly held conception of the mode of action of penicillin is that it acts bacteriostatically by preventing division of growing cells. This is based on Gardner's observation that bacteria subjected to concentrations of penicillin too small to inhibit growth completely undergo distortion and enlargement[4]. Analogous morphological changes are frequently associated with sulphonamide action. It has been further proposed that penicillin acts only on dividing bacteria[5], and that this action is bactericidal[6]. One of the final conclusions reached by Henry, in a very comprehensive review of the mode of action of sulphonamides, is that they achieve their effect by stopping cell division[7]. In general, the antibacterial action of both penicillin and sulphonamides, *in vitro* and *in vivo*, appears to be primarily 'bacteriostatic'. Under certain experimental conditions, however, penicillin[6,8], like sulphonamides, may exert a 'bactericidal' effect. Confusion



TURBIDITY-PENICILLIN CONCENTRATION CURVE. Staphylococcal broth after 16 hr. incubation at 24° C. The concentrations lower than 0·01 U./ml. are 0·008, 0·006, 0·004, 0·002 and 0·001 U./ml. respectively. Test in duplicate.

is caused by drawing too fine a distinction between these terms.

The fundamental antibacterial action of penicillin and sulphonamides is inhibition of cell multiplication. Sulphonamides inhibit the growth of almost every variety of cell besides bacteria, although in widely varying concentration ; there is as yet little evidence that penicillin will have such a general effect, but Cornman has reported survival of normal cells in penicillin solutions lethal to malignant cells[9]. Sulphonamide action is usually biphasic ; our observations suggest that this may be true of penicillin. Primary bacterial proliferation preceding bacteriostasis, as occurs with sulphonamides, has recently been noted with penicillin and *Leptospira icterohæmorrhagiæ*[10]. (As mentioned previously, this may well be another aspect of the biphasic phenomenon.) Penicillin growth-inhibition, in conformity with that of sulphonamides, appears to obey the law of mass action, in that (*a*) the inhibition is reversible, by removing the bacteria from contact with penicillin or destroying the penicillin with penicillinase, and (*b*) the inhibition is directly related to the penicillin concentration[3]. Both penicillin[6,8] and sulphonamide activity are directly related to the temperature. In the presence of a constant amount of sulphonamide, antibacterial activity is inversely related to the number of organisms present ; this is a phenomenon which awaits satisfactory explanation ; and the explanation is also required in respect of penicillin[6]. A feature of sulphonamide activity is that it varies from one bacterial species to another, from strain to strain, and even perhaps from organism to organism. Penicillin exemplifies this selectivity *par excellence*. Antibacterial effect is greatly influenced by the sulphonamide chemical structure, and scientific progress with penicillin must be seriously impeded until its structure is made known. By analogy, however, there is every reason to expect that substances chemically related to penicillin will have different bacterial 'spectra'. Chemical information is also lacking for a comparison of the effect of *p*H changes on penicillin action ; at present this factor appears more important to sulphonamide action. Organisms can be trained to resist either penicillin or sulphonamides to a surprising degree, and with almost equal ease. Penicillin shares with sulphonamides synergism of antibacterial effect by antibodies and cellular defence mechanisms.

The commonly accepted theory of sulphonamide action, that of Woods and Fildes, casts *p*-aminobenzoic acid in an essential role[11]. Since this substance plays no similar part in penicillin action, some fundamental difference in mode of action might be presumed. But Henry's conclusions throw considerable doubt on the Woods-Fildes explanation, and reconcile this apparent anomaly in sulphonamide-penicillin similarity[7]. There appears to be general agreement that sulphonamide bacteriostasis is achieved by direct inhibition of one or more enzymes. The profound biological activity shown by penicillin in trace concentrations would appear to be eminently explicable in terms of enzymic phenomena. It is not our purpose, however, to speculate on the mode of action of penicillin ; but to suggest, on the basis of empirical observations available now, that it is not likely to be fundamentally unique. The differences that do exist between sulphonamides and penicillin, and which place the latter in its pre-eminent therapeutic position, appear to be differences of degree so far as mode of action is concerned.

Much of the technical work on which our observations are based was performed by laboratory assistants in the Royal Navy, to whom we are indebted. The crystalline penicillin was generously given by I.C.(P.), Ltd.

Addendum. Additional information has become available since this communication was written. It is now clear that at least three chemically different varieties of penicillin have already been identified and that their relative efficiencies for various bacteria are probably different[12]. The effect of *p*H on penicillin activity[13] is, in fact, in striking conformity with what has been reported for sulphonamides. The direct relationship of temperature to penicillin activity has been amplified[13,14]. Todd[15] has demonstrated the frequency with which primary multiplication occurs in cultures subjected to the influence of penicillin, and noted that Fleming originally reported this phenomenon in 1929.

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[12] See *Nature*, **154**, 725 (1944).
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CONFERENCE ON AUDIO-VISUAL EDUCATION

AUDIO-VISUAL education and the part it must play in the schools of Hertfordshire were discussed at a whole-day conference held at Welwyn St. Mary's C.E. School on February 2.

Opening the Conference, Mr. A. R. Chorlton, deputy education officer for the county, who has done much to foster an interest in this aspect of education, commented upon the suitable atmosphere for the subject under discussion created by a set of artist's originals for a series of coloured lithographic posters dealing with the Industrial Revolution, brought for the occasion by Lieut.-Commdr. Rawnsley, of Common Ground, Ltd., and the various optical instruments and demonstration material provided by Metalair, Dufay Chromex, and a Hertfordshire school which has been specializing in audio-visual education. The Conference, he said, was the outcome of work done during the past eighteen months by the Watford and District Audio-Visual Education Association and the North Herts Visual Aids Committee. Its object was to enable members of both Committees to meet and discuss a plan of action for the ensuing year.

In the absence of Mr. G. Patrick Meredith, lecturer in visual education, University College, Exeter, who

was to have addressed the meeting, Commander Rawnsley opened the discussion on visual material and media by outlining the objects of experiments he had conducted in this field in order to provide suitable material in the form of background posters, classroom exhibitions, film-strips and films. He stressed the need for integrating means and material in order to produce a living situation, and argued that only thus can a child be truly educated to become a useful member of the community. To do this, teachers will have to become attuned to the visual education approach. The value of Commander Rawnsley's contribution was emphasized by the excellent teaching quality of the film-strip and film on coal, edited under the guidance of J. Fairgrieve, which complemented the exhibition.

The afternoon session was opened by Mr. A. Arkinstall, headmaster of Callow Land Boys' School, Watford. His subject was "Essentials for a Successful Audio-Visual Aids Programme". Commencing with the child—for that, he felt, is where we should start if we are to have ultimate success with any project which concerns the child—he outlined the educational pattern which must be completed if his audio-visual needs are to be met. A better understanding of the dull and backward child's point of view and environment, coupled with an education which has a good audio-visual content, would do much to reduce juvenile delinquency. In the immediate future, we should collect as much information as possible to help to put audio-visual education on a sound psychological basis. The teacher has great opportunities in this connexion. Experiments should be conducted on research lines organized by committees of local associations, and the findings passed on to the university research departments. He envisaged the time when each county would have a central clearing-house in contact on one hand with the B.B.C., Federation of British Industries, museums, Ministry of Education, local education authorities, authors (for copyright permits), university research centres, and producers of audio-visual means and material; and on the other with audio-visual associations, head teachers, training colleges, adult education centres and youth movement leaders.

At the present time schools are ill-equipped for audio-visual education; apparatus such as wireless receivers, film-strip and film projectors, gramophones and records, together with plenty of good pictures in good sequences, all approved by teachers for quality in a teaching situation, are needed for use in rooms suitably equipped for such instructional means. Despite present shortcomings, the best use must be made of such material and means as are available in order to show by the results of one or two pieces of research work that this is a worthwhile project upon which money would be well spent.

This suggestion was followed by Mr. H. Goldsmith, one of the Ministry of Education inspectors, who gave an account of the conditions of loan to the county of a number of American strip-film projectors, each accompanied by fifty strips dealing with various aspects of life in America. He hoped that part of the research proposed would be in connexion with the evaluation of this material.

A particular feature of the Conference was the practical nature of the suggestions put forward by those contributing to the discussions in both sessions, but perhaps this was to be expected when their interest in the apparatus and material which surrounded them on all sides is considered.

MANGROVES IN THE NEW WORLD

MANGROVES have been of interest to botanists ever since the first details were given by morphologists in the eighteenth century, not only to specialists in ecology on account of their somewhat peculiar distribution as shore-line vegetation, but also to the general botanist in view of the unusual morphological and physiological features which they display. It is therefore satisfactory that it has been found possible to give a very full account of the main features of these plants as observed by the 1939 Cambridge Expedition to Jamaica[1]. Those of us who have attempted field experiments even a short distance from the laboratory will realize full well the difficulty in assessing requirements beforehand, and it can well be understood that the performance of the Expedition falls short of its members' expectations on this account and in view of the scanty data already in the literature on which they had to rely for guidance. Nevertheless, in spite of these unavoidable difficulties and notwithstanding the cessation of activity due to the outbreak of war, Dr. Chapman presents a most impressive series of three articles ranging over a wide field of endeavour. It is stimulating to find here a clear grasp of the problems involved in attempting to relate morphological character to physiological function, with repeated emphasis on the problems yet to be solved. Work of this kind can clearly not be final, and probably the most useful feature of the Expedition, as it is reflected in these papers, lies in the guidance it gives for more detailed investigation which may become possible in the future.

The first paper surveys the botanical processes involved in the maintenance and development of the shore-line in Jamaica, and discusses the distribution and ecological significance of the range of mangroves and associated plants found on the island. In the second and third, Dr. Chapman concentrates on one particular species (*Avicennia nitida* Jacq.) from the point of view of its relation to its environment, its morphology, and the physiological peculiarities associated with pneumatophores.

It comes somewhat as a surprise to the uninitiated to realize the comparatively wide tolerance of mangroves to soil conditions. Here we have soils ranging from sand to mud well populated, with salinity of soil water ranging over wide limits even up to fresh water in isolated cases. It is impossible in a short space to consider the vast amount of information presented in any detail; but it may be said in general that the drift in dune development resembles in broad outline that found in the British Isles and that the mangroves of the New World as found in Jamaica come under the "wide salt tolerance" class into which Schimper put some of the Old World species. Details of species and probable origin are given, and the brief discussion of the migration of seeds and seedlings along ocean currents, and the effects of fresh water at river estuaries, surely forms one of the most fascinating stories in all nature study.

In the second paper an attempt is made to elucidate the edaphic factors important in the growth of this mangrove, which shows optimum growth in soils with more than 0·5 per cent sodium chloride where the water content either does not fall below a certain minimum or is replenished periodically by flooding. Oxygen content is not thought to play any important part in zonation, partly because the root system has

a comparatively thick bark which may be impervious to gases, and the role of sodium chloride is doubtful. It is probable that a number of factors—winter temperature, ocean currents, tidal inundation, soil accretion, mechanical composition of soil, exchangeable base and the behaviour of the water table—are all important collectively. Soil conditions vary over relatively narrow limits. Soil *p*H varies from about 6 to about 8 over the soil types populated and the water-table fluctuates through only two to three inches. This latter is particularly important, for it means that the horizontal roots and the pneumatophores are above the water-table for considerable periods, and we must abandon the idea that mangrove roots must be bathed in water continually. In the soil water the oxygen content is well below the atmospheric percentage, but carbon dioxide is on the whole higher, and this therefore lends colour to the widely accepted belief in the function of the pneumatophores in aeration. The Na^+ and Cl^- contents of soil water and of plants are presented at some length, but unfortunately the statements made in this part of the paper lose much of their force as the basis upon which the percentages are given is not clearly defined.

The third paper gives a very welcome and admirably thorough description of the developmental morphology of *A. nitida* from the young seedling to the mature plant, profusely illustrated by line drawings in some of which, however, it is not always easy to pick out the details referred to in the text. Secondary thickening appears to varying extents in almost all the organs of the plant, and it is particularly interesting that, so far as one can judge from the data presented, thickening begins in the roots before it does in the stems (though this is not, in fact, specifically stated). The pneumatophores (which are said to be negatively geotropic, but may, as Dr. Chapman points out, be positively aerotropic) may be some 35 cm. high by about 8–10 mm. thick, with well-formed lenticels in the above-ground portion. The cortex has numerous large longitudinal air spaces, as has also the corresponding tissue in the horizontal roots from which the pneumatophoros arise, but the two systems are apparently separated by a more solid tissue at the base of the pneumatophores. Movement of gases from pneumatophore to horizontal roots must therefore occur by diffusion and not by mass flow. The gas in these air spaces is very much like that in the atmosphere and very different from that found in the soil water. Experimental work shows that of the carbon dioxide exhaled by a pneumatophore, about 50 per cent may come from the respiration of the pneumatophore itself (a figure which should apparently be in fact much higher, since in the experiments the air spaces in the horizontal roots were replaced by an atmosphere containing 10 per cent carbon dioxide applied to the lower end of the pneumatophore from cylinders prepared in advance in Britain; this carbon dioxide content is much larger than that actually found in the air spaces). The respiratory function of the pneumatophore itself must therefore not be overlooked. Further, as Chapman also emphasizes, the pneumatophores carry absorbing rootlets near the soil surface and as soil accretion occurs, these rootlets appear higher up the pneumatophore and therefore nearer the new soil surface. A further important function of the pneumatophores may therefore be the maintenance of a functional absorbing root system.

Dr. Chapman makes it abundantly clear that mangroves will repay intensive study by morphologists, physiologists, geneticists, biochemists and even students of cell-wall problems. In this latter regard, some of the cells in pneumatophores bear peculiar internal buttresses growing into the cell from the wall and recalling the trabeculæ found in the tracheids of some conifers and similar structures in marine algæ like *Caulerpa*. These iodioblasts, as they may be called, would repay study. All the papers include a very full bibliography and a careful comparison of the writer's work point by point with that of earlier workers in the field, and this makes them, indeed, a veritable compendium of mangrove-lore.

R. D. PRESTON.

[1] Chapman, V. J., *J. Linnean Soc.*, **52**, No. 346 (1944).

EFFECTS OF HEAT ON HUMAN BEINGS

AN interesting series of physiological and clinical observations on the effect of the desert climate of Shaiba, southern Iraq, in the summer of 1943, has been reported by W. S. S. Ladell, J. C. Waterlow and M. F. Hudson (*Lancet*, 491, Oct. 14 and 527, Oct. 21, 1944). Both fit soldiers and cases of the effects of heat were studied. All the fit men lost some weight in the hot weather, especially those who had the highest chloride concentration in their sweat. The measured rate of sweating and the estimated salt intake indicated that subjects with a high concentration of chloride in their sweat (more than 0·3 per cent of sodium chloride) may not always have been in salt balance. Low output of urine, in spite of high water intake, low urinary chloride and raised blood urea, suggested salt-deficiency dehydration.

Twelve cases of hyperpyrexia are recorded and two types of heat exhaustion. The first type occurs, it is suggested, in persons who secrete sweat containing much higher chloride concentrations than the average; their salt intake is insufficient and they become salt-deficient; extra salt might prevent the occurrence of heat exhaustion in these persons. The second type was seen only in the second half of the summer in men unaffected by the heat of the first half; prickly heat accompanied the heat exhaustion, but this type did not have the vomiting and cramps suffered by the first type. The condition of the second type suggested a breakdown of the body's defences against heat. There was salt-deficiency, but no dehydration. It would be worth while to inquire whether the concentration of salt, or of other constituents of the sweat, or the influence of other factors controlling its secretion, could be related in any way to the well-known variations in susceptibility to the bites of mosquitoes and other biting arthropoda.

Following this article, D. H. G. MacQuaide describes (*Lancet*, 531, Oct. 21, 1944) two cases of congenital absence of the sweat glands. Both had to be classified as totally unfit for service in the tropics. The author adds an interesting note on the literature relating to congenital ectodermal defects. These include an idrotic group, which is mostly a hair and nail dystrophy found in both sexes and transmitted by either, and an anidrotic group, found mostly in males and probably transmitted by a maternal carrier; in this latter group are absence of the sweat glands and occasionally of the sebaceous glands, dental dysplasia and other conditions of the nose, skin and hair. No cases belonging to this group are known in Negroes or Latin races. G. LAPAGE.

FORTHCOMING EVENTS

Saturday, February 17

INSTITUTE OF PHYSICS (LONDON AND HOME COUNTIES' BRANCH) (at the Royal Institution, Albemarle Street, London, W.1), at 2.30 p.m. —Dr. R. E. Slade: "The Organisation of Research in Industry".

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS (at Neville Hall, Newcastle-upon-Tyne), at 2.30 p.m.—Lieut.-Colonel H. E. B. Daniell and Mr. L. H. Forster: "Successful Operation of Two-Stage Air-Cooled Inbye-Compressor"; Mr. R. Williams, Mr. W. Jeffery and Mr. A. Taylor: "Outbursts of Gas from the Floor of Coal Seams, Part 2".

Saturday, February 17—Sunday, February 18

ASSOCIATION OF SCIENTIFIC WORKERS (at Caxton Hall, Westminster, London, S.W.1)—Conference on "Science in Peace".

Saturday, February 17

At 2.15 p.m.—"Science and Production" (Chairman: Prof. P. M. S. Blackett, F.R.S.).

Sunday, February 18

At 10 a.m.—"The Future Development of Science" (Chairman: Sir Robert Watson-Watt, F.R.S.).

At 2.30 p.m.—"Science in Everyday Life" (Chairman: Prof. H. Levy).

Monday, February 19

IRON AND STEEL INSTITUTE (joint meeting with the CLEVELAND INSTITUTION OF ENGINEERS) (at the Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough), at 6.30 p.m.—Mr. G. D. Elliot: "Ironmaking at the Appleby-Frodingham Works of the United Steel Companies, Limited".

Tuesday, February 20

ROYAL SOCIETY OF ARTS (DOMINIONS AND COLONIES SECTION) (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Sir Edmund O. Teale: "The Contribution of Geological Survey to the Development of the Mineral and other Resources of East and West Africa".

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 5.15 p.m.—Sir George Dyson: "The Origin and Development of Early Musical Forms", (2) "Purcell and Couperin".

ROYAL STATISTICAL SOCIETY (at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2), at 5.15 p.m.—Mr. H. Leak and Mr. A. Maizels: "The Structure of British Industry".

INSTITUTION OF CIVIL ENGINEERS (at Great George Street, Westminster, London, S.W.1), at 5.30 p.m.—Dr. H. Chatley: "Dredging Machinery".

INSTITUTION OF ELECTRICAL ENGINEERS (RADIO SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Discussion on "Aspects of Post-War Valve Standardization" (to be opened by Mr. A. H. Cooper).

Wednesday, February 21

BRITISH SOCIETY OF ANIMAL PRODUCTION (at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1), at 10.30 a.m.—Discussion on "Meat". At 11.15 a.m. —Major W. H. Warman and Mr. R. W. Pomeroy: "Supplies"; at 2 p.m.—Dr. E. H. Callow: "Food Value, Quality and Grading of Meat with special reference to Beef"; at 3.15 p.m.—Mr. T. Shaw: "Marketing and Distribution".

ROYAL SOCIETY OF MEDICINE (at 1 Wimpole Street, London, W.1), at 2 p.m.—Discussion on "The Veterinary and Medical Control of the Milk Supply" (to be opened by Mr. H. T. Matthews (Veterinary), Dr. W. A. Lethem (Medical) and Mr. Clyde Higgs (Agricultural).)

BRITISH SOCIETY FOR INTERNATIONAL BIBLIOGRAPHY (at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2), at 2.30 p.m.—Mr. E. M. Bennett: "The Classification of Inventions disclosed in United Kingdom Patents Specifications"; Mr. H. Rottenburg: "Towards a Revision of the Engineering Section of the Universal Decimal Classification".

Thursday, February 22

LINNEAN SOCIETY OF LONDON (joint meeting with the ZOOLOGICAL SOCIETY OF LONDON) (at Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—"The Land's End and Beyond" (a colour-film with commentary by Mr. John Chear); Mr. Paul de Laszlo: "Colour Photography as applied to Biology"; "Ethiopia" (a colour-film with commentary by Mr. H. G. Hope Gill).

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 5.15 p.m.—Prof. James Gray, F.R.S.: "Locomotory Mechanisms in Vertebrate Animals", (4) "Nervous Control of Movement".

Friday, February 23

INSTITUTE OF FUEL (joint meeting with the NATIONAL SMOKE ABATEMENT SOCIETY) (at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2), at 10 a.m. —Conference on "Post-War Smoke Abatement". Dr. G. M. B. Dobson, F.R.S.: "A Statement of the Problem"; Major S. F. Markham, M.P.: "The Effects on Civilisation of Atmospheric Pollution"; Mr. A. Blackie: "Domestic Smoke"; Mr. M. G. Bennett: "Railway Smoke".

ROYAL SOCIETY OF MEDICINE (at 1 Wimpole Street, London, W.1), at 4.30 p.m.—Prof. Robert Debré (Professor of Pediatrics in Paris): "Conditions of Children in France under the Occupation".

PHYSICAL SOCIETY (in the Lecture Theatre of the Science Museum, Exhibition Road, South Kensington, London, S.W.7), at 5 p.m.—Mr. F. W. Cuckow: "The Electron Microscope and its Applications".

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 5 p.m.—Prof. Benjamin Farrington: "The Character of Early Greek Science".

Saturday, February 24

ASSOCIATION FOR SCIENTIFIC PHOTOGRAPHY (at Caxton Hall, Westminster, London, S.W.1), at 2.30 p.m.—Mr. D. R. Barber and Mr. E. H. Amstein: "Factors Influencing the Choice of Photographic Materials for Use in Quantitative Spectrography".

INSTITUTION OF MECHANICAL ENGINEERS (GRADUATES' SECTION) (at Storey's Gate, St. James's Park, London, S.W.1), at 3.30 p.m.—Mr. N. Hanlon: "The Problems involved in the Establishment of a Large Works in a Country District".

APPOINTMENTS VACANT

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

ASSISTANT MUNICIPAL ENGINEER by the Accra Town Council, Gold Coast—The Ministry of Labour and National Service, Appointments Department, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. E.1174.A) (February 22).

ASSISTANT ELECTRICAL ENGINEER for Colliery Power-House Overseas (India)—The Ministry of Labour and National Service, Appointments Department, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. D.1023.XA) (February 22).

TEACHER (resident, certificated, graduate or non-graduate) of GENERAL SCIENCE (preferably including AGRICULTURAL SCIENCE) in the Junior Technical School in Agriculture, Pibwrlwyd—The Director of Education, County Education Offices, County Hall, The Castle, Carmarthen (February 24).

CHEMIST (Metallurgist) for large engineering factory on North-East Coast—The Ministry of Labour and National Service, Appointments Department, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. F.3385.A) (February 24).

HEAD OF THE ELECTRICAL ENGINEERING DEPARTMENT—The Principal, Mining and Technical College, Church Street, Barnsley (February 24).

SENIOR and highly qualified MECHANICAL ENGINEER with specialized up-to-date knowledge of the Design and Operation of Large Steam Turbines and/or Boilers for highly efficient steam cycles—The Ministry of Labour and National Service, Appointments Department, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. C.2467.XA) (February 26).

MECHANICAL ENGINEER (resident) to supervise the installation of Boiler, Turbine and other Plant in a 100,000 kW. Station now under construction (Reference No. C.2468.XA), and several ASSISTANT MECHANICAL ENGINEERS and ASSISTANT ELECTRICAL ENGINEERS with experience in the Design, Specification and Construction of Power Station Plant (Reference No. C.2469.XA)—The Ministry of Labour and National Service, Appointments Department, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting the appropriate Reference No.) (February 27).

CIVIL ENGINEERS (4) for the duties of ASSISTANT DIVISIONAL ENGINEER in the Irrigation Department of the Sudan Government—The Ministry of Labour and National Service, Appointments Department, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. E.1376.A) (February 27).

TEACHER OF MECHANICAL ENGINEERING SUBJECTS, and a TEACHER OF ELECTRICAL ENGINEERING SUBJECTS—The Principal, Southall Technical College, Beaconsfield, Southall, Mddx. (February 28).

CHEMISTS in the Directorate of Food Inspection in India—The Ministry of Labour and National Service, Appointments Department, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. F.3592.A) (March 1).

CHIEF SUPERINTENDENT in a Government establishment concerned with the development of Army Radar—The Ministry of Labour and National Service, Appointments Department, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. D.1082.A) (March 3).

ENGINEER to take charge of all ENGINEERING and ASSOCIATED SERVICES in large old-established Works in North Midlands area—The Ministry of Labour and National Service, Appointments Department, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. C.2453.XA) (March 6).

LECTURER IN ELECTRICAL ENGINEERING, to teach Day and Evening Students for London External B.Sc. (Eng.) and for Ordinary and Higher National Certificates in Electrical Engineering in the Norwich City College and Art School—The Director of Education, City Hall, Norwich (March 9).

ENGINEER for position of Personal Assistant to the Chief Engineer of a large iron and steelworks combine in the North of England—The Ministry of Labour and National Service, Appointments Department, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. C.2452.XA) (March 12).

RESEARCH ENGINEER immediately to organize and control Laboratory and Experimental Department of progressive manufacturing Company situated in N.W. London area—The Ministry of Labour and National Service, Appointments Department, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. C.2462.XA) (March 12).

PRINCIPAL OF THE SOUTH-EASTERN AGRICULTURAL COLLEGE, Wye —The Clerk to the Governors, 11 Bank Street, Ashford, Kent (March 19).

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

LECTURER (full-time) IN ELECTRICAL ENGINEERING—The Principal, Technical College, Brunswick Road, Gloucester.

CROP RECORDER at Sub-stations in Shropshire and Northumberland—The Secretary, National Institute of Agricultural Botany, Huntingdon Road, Cambridge.