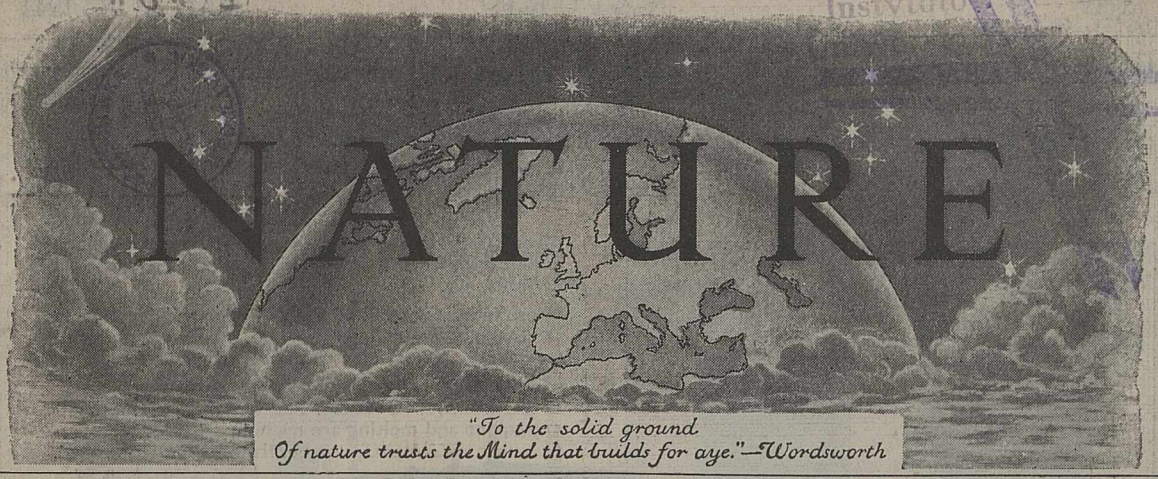

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NATURE

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SEX TEACHING IN SCHOOLS

ONE result of war-time conditions has been the focusing of attention on the problems of sex guidance. This is not essentially a war-time question, and it should be viewed in perspective as part of the normal education of normal people in normal times, but the unsettled social conditions of recent years have brought the matter into prominence.

Among those who have been giving it attention are the rank-and-file teachers of Great Britain, who have expressed their willingness to play their part. This ferment has worked its way up to the top, and is beginning to produce results in the governing bodies of the various teachers' professional organizations. At their January meetings the Associations both of Assistant Masters and of Assistant Mistresses passed resolutions pledging their support, and now the National Union of Teachers has issued an important statement*.

The advance represented by this statement may be gauged by the fact that whereas in 1933 it was the considered opinion of the Executive of the National Union of Teachers "That the giving of class sex instruction is undesirable and against the best interests of the children in the schools", it is now concluded that "The position in relation to sex instruction has been considerably modified. Given the right conditions the information of the 'facts of life' can be taught in schools."

While recognizing that both teachers and parents have in the past tended to evade their responsibilities in this connexion, the pamphlet correctly reasons that "In the absence of a proper method of instruction, however, there is the real danger, too often experienced, that scraps of information or misinformation are liable to be whispered in a lewd or vulgar manner from one to another among pupils in a school"; and that "It would appear, therefore, that danger may lie less in the dissemination of knowledge than in its perversion and vulgar distortion."

Proceeding to a consideration of the content of sex education, the statement quotes with apparent approval an interesting paragraph from the *Health Education Journal* : "Sex education is more than the mere imparting of knowledge. Factual information is indispensable, but it is also necessary to interpret for the pupils the relationship between the facts of human physiology and the conventions of human society. Moreover, even an understanding of the origin and value of certain conventions will not ensure the living of a fine sex life. The children must be inspired with a feeling of the excellence of sex and of its immense potentialities. As in the pioneer days of widespread elementary education there was the slogan of the 'three R's', so sex education might well be characterised as the 'three I's'—sex information, sex interpretation and sex inspiration".

After pointing out that the nature study which is included in most school curricula provides a firm foundation for further instruction, the pamphlet then

* Sex Teaching in Schools. Statement by the Executive of the National Union of Teachers. Obtainable from the N.U.T., Hamilton House, Mabledon Place, London, W.C.1.

discusses the question of the extent to which school biology courses should deal with our own species. In this connexion it quotes the recent contention of Mr. Cyril Bibby (education officer of the Central Council for Health Education) that *Homo sapiens*, instead of being obscurely tucked in at the end of a course in which Amoeba, Hydra and Rana hold the places of honour, will be introduced in the first year of the post-primary school. Information about the biology of reproduction in plants and lower animals is an excellent adjunct to information about sex in humans, but is no substitute for it. It must be remembered that in many children there is an actual resistance against knowledge, due to fears and guilt-feelings, and if we leave a gap in our description they will fill it with the most fantastic imaginings. Children are interested in the functioning of their own bodies, and in a series of lessons on human physiology, sex and reproduction may be introduced in their proper place without undue emphasis. It is a sound principle that "reproduction should be regarded as a normal function of organisms, and no attempt should be made to isolate it or single it out for special attention".

The next problem is that of deciding who should be responsible for imparting the necessary information. It is recognized that parents should play an important part, but sight is not lost of the fact that "many parents do not give it and that many have neither the knowledge adequate for the purpose nor the skill to impart what knowledge they have". In these circumstances, the statement goes on to ask, "Should doctors or nurses be asked to visit the schools for this purpose ?" and gives a clearly negative reply. Many weighty arguments are marshalled against this proposal, all leading to the conclusion that "if this direct teaching is given, the teacher is the one on whom the duty is likely to devolve". It is very important that this point be borne in mind, for there are many who, while agreeing that sex education is desirable, tacitly assume that medical men should be responsible for it. By far the majority of medical men are not trained educationists, and there is also a real danger in bringing in a doctor, who still to the lay mind is associated chiefly with disease, to talk on something which is natural and healthy.

But the teachers themselves will need much preparation; and it is with pleasure that one reads recommendations 6, 7 and 14 of the pamphlet. These are of sufficient importance to warrant full quotation :

"6. Steps should be taken to ensure a greater supply of teachers fully qualified to teach biology and to afford facilities and provide adequate equipment for biological teaching to be given."

"7. Greater attention to the human aspect of biology should be given during teachers' training courses."

"14. Those teachers who wish to engage in the teaching of this subject should be afforded facilities for attendance at lectures or refresher courses to prepare themselves as fully as possible for the task."

Teachers will be faced with the decision whether to give instruction to individuals, to small groups, or to ordinary classes. The advantages and disadvantages of each type of approach are discussed, and although the pamphlet avoids any clear-cut decision, the weight of the argument appears to be in favour of dealing with sex in full class—even, it would appear, where the classes happen to be mixed.

Emphasis is quite rightly laid upon the importance of co-operation between teachers and parents; but it is doubtful if the Executive of the National Union of Teachers has quite caught up with the times when it states that "it is at the present stage of public opinion imperative" to "obtain the consent of the parent before it [that is, sex instruction] is given, and to make the position quite clear to all parents that if they do not wish for their children to receive the instruction they are fully entitled to say so, and the teacher will arrange accordingly". The fact is, that many schools do not ask prior consent, and that very rarely is there any complaint. Parents generally are overwhelmingly grateful to schools for dealing with this matter. Nevertheless, in some areas it may be wise to obtain consent.

It is perhaps pertinent to inquire whether the Executive has given sufficient weight to the arguments against granting this right of withdrawal. In the first place, the very act of asking consent can scarcely fail to imply that there is something a little doubtful about this instruction, something which makes it necessary to isolate it from the rest of the child's education—despite the emphasis to the contrary elsewhere in the pamphlet. The matter is considered in a recent article* from which we may quote : "Thirdly, a fine crop of problems arise if any replies to the question are in the negative.

(*a*) What do you do with the child who is not to attend the course ?

(*b*) What does the rest of the class think about this withdrawal ? Are all your careful plans to be frustrated as this subject is shown to be a queer, secret thing after all ?

(*c*) The child who is to be isolated will get the information from the other members of her class, second-hand, probably somewhat distorted and certainly in the wrong setting; her feelings of guilt will be intensified; her relationship with her parents will be marred.

(*d*) Further, the prohibition suggests that the psychological atmosphere in which the child lives is already difficult : if this is so, then the school seems to be her only hope. Where the parents say they wish to tell the child themselves, they seem to have left things rather late. Beginnings must be made in the home in early childhood; left until adolescence is reached, a barrier has been set up between parent and child that may be insurmountable : again, the school seems to be the child's best chance."

On the whole, however, the statement by the National Union of Teachers represents a marked step in the right direction, and, coming as it does from one of the most powerful professional organizations in the country, should bear very fine fruit.

* *Health Educ. J.*, 2, No. 1 (Jan. 1944).

THE NEW CYTOLOGY

Frontiers in Cytochemistry

The Physical and Chemical Organization of the Cytoplasm. Edited by Prof. Normand L. Hoerr. (Biological Symposia, Vol. 10.) Pp. vii+334. (Lancaster, Pa.: The Jaques Cattell Press, 1943.) 3.50 dollars.

THE well-known jibe that the specialist is one who knows more and more about less and less may be taken in its complimentary sense by workers in many branches of science. Those who are endeavouring to determine the biochemical nature and enzymic composition of the microscopic and submicroscopic components of living cells belong to this category, and now they are at least beginning to show signs of penetrating some of the mysteries which beset the isolation and identification of anything so small and so sensitive as the protoplasmic particles and granules.

Ten years ago, Dr. R. R. Bensley retired from active occupation of the chair of anatomy in the University of Chicago. During the preceding forty years he had contributed largely to the study of cytological problems, to glandular secretion, and to advances in histological technique. Among his distinguished pupils was E. V. Cowdry; and his successor is N. L. Hoerr. On his retirement from academic duties, Dr. Bensley began work on cytoplasmic components, which Dr. Hoerr considers to be perhaps the most significant contribution of a long and very active career. He celebrated his seventy-fifth birthday last year, and in honour of this event a symposium was held at Chicago in November. The theme was the chemical and physical organization of the cytoplasm, the contributors were all active and distinguished investigators in this field, and the present volume is the record of the papers given, which incidentally have been brought fully up to date and constitute a most useful and comprehensive collection, especially valuable in a field such as this where publications are liable to be scattered over very many journals.

Dr. Bensley's guiding principle has been the separation of separable things before proceeding to their analysis. In 1934 he succeeded in separating granules considered to be mitochondria in a state of purity from liver cells, a feat in which Warburg in 1912 had been partially successful and which enabled Warburg to state that these particles contributed to the oxygen uptake of saline extracts of liver. Later, A. Claude, and independently A. Lazarow in Bensley's laboratory, discovered and isolated yet smaller, submicroscopic particles contained in liver and other cells. All these workers make excellent contributions to the book; but their accounts would be much clearer to follow if they could agree to a common system of nomenclature. Thus the "mitochondria" of Bensley and his colleagues are the "secretion granules" of Claude, while the latter's "small particles" or "microsomes" are called "submicroscopic lipoprotein particles" by the Chicago school. Lazarow states that these smaller bodies are red; but Claude, who has got them from other sources besides liver, finds that they are light to dark amber in colour. They are about 50–300 mμ in diameter, whereas the larger granules are 0·5–1 μ. Although, as Claude has shown, both contain ribosenucleoprotein and phospholipins, there are quantitative differences in their composition. The larger granules ("mitochondria") disintegrate rapidly in distilled water, yielding submicroscopic particles closely resembling the "small particles" already mentioned. Possibly the latter are concerned in the formation of the larger granules, which contain, however, much less lipin. Both contain inositol to the extent of 2 per cent of the lipin content. The zymogen granules isolated by Claude from the pancreas closely resemble in composition and in their properties the larger granules described above.

So far, organic structures which exhibit the property of self-duplication seem to contain nucleic acid, as, for example, the viruses of plants, Shope papilloma virus, and, it is claimed, Rous chicken sarcoma agent and probably the mouse-milk cancer factor (Kahler *et al.*, *J. Nat. Cancer Inst.*, 4, 37; Aug. 1943). This prompts Claude to suggest that perhaps these particles isolated from cytoplasm, particularly the submicroscopic ones, may be endowed with this property also, and may participate actively in cell division.

These cytoplasmic components have, according to recent studies, distinct metabolic activities of their own. Hotchkiss and Hogeboom have shown that *d*-aminoacid oxidase activity is localized in the "secretory granules" but absent from the "small particles" of guinea pig and rat liver. Barron, who contributes a valuable 40-page synopsis of present knowledge of biological oxidation mechanisms, finds in experiments with Lazarow that partially separated mitochondria (secretion granules of Claude) oxidize succinic and glutamic acids, the latter more vigorously, but the nuclear concentrate is notable for its high succinoxidase activity, while the alcohol oxidase diffuses into the aqueous phase during centrifugation. Dounce has found that liver nuclei contain cytochrome oxidase, esterase, phosphatase, arginase, and lactic dehydrogenase, and more recently Lan (*J. biol. Chem.*, 151, 171; Nov. 1943) has added *d*-aminoacid oxidase and uricase to the list. Bartlett has shown that, while the tomato seed contains carboxylase, its coenzyme appears only on germination, and it is evident that if the type of technique now being developed could be applied to locating the origin of coenzymes and enzymes within the living cell, it would immediately acquire enormous potentialities.

K. G. Stern has an interesting chapter on various "macromolecular particles" which he has separated and analysed. Like much of the work described in this book, this is naturally an application of modern developments in high-speed centrifugation and other technical advances. The British reader is a little dazzled by the resources of this kind at the disposal of his American colleagues, so that it is something of a relief to find that Mirsky and Pollister, at the Rockefeller Institute, have a chapter in which they do quite a lot with a saline extract of tissue and "a glass rod with a crook at the base". With these homely accessories they seem to have separated nuclear nucleoprotein in a high degree of purity. Contrary to Stedman and Stedman (NATURE, Sept. 4, 1943), they believe that "threads of chromatin (chromosomes ?) assay practically 100 per cent nucleoprotein; that the nucleoprotein is, in fact, the substance of the chromosomes".

There is so much in this book that one can only catalogue other contributors here. These include N. L. Hoerr (isolation methods), H. W. Beams (ultracentrifugal studies), R. Chambers (intracellular 'Ringer' solution), E. V. Cowdry (cytology of carcinogenesis), I. Gersh and D. Bodian (histochemical changes in motoneurons), O. H. Lowry (cytoplasmic electrolytes), F. O. Schmitt, C. E. Hall and M. A.

Jakus (electron microscope studies on fibrils), and G. H. Scott (mineral distribution and localization in the cytoplasm). This excellently produced book contains a valuable collection of current individual adventures into the domain of the cell interior.

F. DICKENS.

REGIONAL EDUCATION

The Book of Buchan

(Jubilee Volume.) A conjoint Publication in five Sections on the North-East in Ancient, Medieval and Modern Times, by sixteen Contributors and eight Chapters by the Editor. Edited and arranged by Dr. J. F. Tocher. Pp. xii+330+44 plates. (Aberdeen: Dr. J. F. Tocher, 41½ Union Street, 1943.) 21*s*.

EDUCATION begins at home and, by stages which become more formal and circumscribed with each advance, proceeds to the primary and to the secondary schools, and for a fortunate few leads to the university. But outside the formal education, and for many more potent than it in building character and creating loyalties, almost as powerful as the home, is the influence of the geographical region in which impressionable years are spent. The Scottish clans were regional units, and it is this fealty to place which has been guided to the service of a wider patriotism in the territorial regiments, and which, so long as recruitment was more or less confined to the regiment's area and dilution by 'foreigners' was avoided, ensured for each regiment its own distinctive and cherished *esprit de corps*.

Although in the press of the ordinary school's curriculum the regional interest as a basis for the development of a wider instruction has scarcely found a place, it has nevertheless played a notable part in that education which begins when school-days end. It is represented in parish histories, such as Sir John Sinclair's "Statistical Account of Scotland" (1791) and its successor of the following century, "The New Statistical Account", in county histories, such as the ambitious "Victoria History" of English counties, and in innumerable local histories, of varied merit. The aim in every case is similar, to put on record regional developments and achievements and so, in deepening knowledge, to confirm and strengthen pride of place; and if this is to be done effectively the history must cover many aspects, and in such a manner as to appeal to the interest of the plain man.

In 1910 the Buchan Club issued such a history, "The Book of Buchan", to celebrate its majority. It was a local history fit to arouse the enthusiasm of the people of north-eastern Scotland. Now a second "Book of Buchan" commemorates the jubilee of the Club. Like its predecessor, it is edited by Dr. J. F. Tocher, who has skilfully contrived into a consecutive series the work of many contributors, using his own editorial articles as the constructional cement. Twenty-six articles elaborate or supplement the subjects of the earlier book, dealing in groups with the natural history, prehistory, literary, medical and martial celebrities, selected miscellanies of history and events.

The majority of the contributions are what they were intended to be, primarily of local interest, though the development of any region has its own significance to its neighbours and to the nation of which it forms a part. Of wider interest may be mentioned Prof. Gordon Childe's resetting of the prehistoric archæology of the district in the light of modern knowledge, the editor's records of the plague which, in 1647, caused professors and undergraduates of King's and Marischal Colleges to migrate respectively to Fraserburgh and Peterhead, Dr. Milne's account of the rise and decline of the whale-fishery of Peterhead, founded upon the publications of the late Dr. R. W. Gray, and Prof. R. A. Fisher's suggestion that with the gradual impoverishment in human quality of local areas, the character and destiny of each locality will come to depend less upon the regional spirit, and more upon the evolution of the nation as a whole.

The "Book of Buchan" is an excellent example of what may be done to consolidate a local heritage, in a region still markedly individual and distinctive.

JAMES RITCHIE.

PLANT TISSUE CULTURE

A Handbook of Plant Tissue Culture

By Dr. Philip R. White. Pp. xiv+277. (Lancaster, Pa.: The Jaques Cattell Press, 1943.) 3.75 dollars.

IT is rare, even in these days of specialized studies, that circumstances permit an investigator to present a 'first book' on pioneer work in any subject. This opportunity has come to Dr. White, and he has taken full advantage in the presentation of an admirable book. In the past, text-books of tissue culture have given the quite erroneous impression that only animal biologists have any interest in the subject or could derive anything of value from its study. Dr. White presents the case of the plant biologist, based on 457 references, with commendable force. He compresses into this relatively small volume the 'high spots' of plant tissue culture up to the present, in which he has himself played an outstanding part, and points out wide fields of interest for future research.

The most valuable part of the book, from a strictly utilitarian point of view, is undoubtedly the chapters dealing with matters of technique. Here we have, for the first and possibly last time, as befits a pioneering work, a most detailed description of the facilities necessary for starting and maintaining cultures, of the nutrient solutions needed, which Dr. White has himself set up as the accepted standard, and of a host of those small details of technique so vitally important and so often overlooked. Emphasis is rightly laid on scrupulous cleanliness, and here, as in the rest of the book, the fruits of years of experience are packed in a remarkably small space. For this section of the book alone, it is to be recommended to those who anticipate using this new tool, as a clear and stimulating exposition. Dr. White proves himself, however, more than a mere guide—he is also philosopher and friend—and the opening chapters in particular, dealing with the philosophical and historical approaches to the subject, are well conceived as placing this new technique in its true perspective against the general background of plant biology.

The last two short chapters are devoted to problems which have been attacked successfully by tissue culture methods; mineral nutrition and a study of nutrients generally both as regards their necessity for the maintenance of growth and as regards the quantitative reaction of tissues to specific doses of specific nutrients; water secretion in excised roots, giving a new stimulus particularly to the meaning and importance of 'root pressure'; tropisms in roots; growth of individual cells; and the effect of viruses

and other pathogens on the host tissue. Studies are described in the realm of morphogenesis, and this isolation of tissues from the morphogenetic influences of neighbouring tissues will undoubtedly form the soundest approach to questions of the effects of growth substances, chemical gradients, and so on.

It cannot be doubted that the isolation and successful growth of tissues is of great promise in many fields of plant science, or that the study has now reached the stage at which rapid advances are to be expected. It seems, in fact, probable that only the difficulties, real and imagined, of the culture of plant tissues has prevented the use of this method in many problems which can scarcely be solved by any other means. This book does much to remove these difficulties by emphasizing the precautions to be taken and the pitfalls to avoid, and its service to science in this way alone can scarcely be estimated at this time.

The book is to be heartily recommended to all plant biologists interested in new developments as a volume which can be read with pleasure as well as profit. It is illustrated by numerous photographs of excellent quality (including portraits of the principal workers in the field of tissue culture), and the presentation is of high standard. R. D. PRESTON.

ASPECTS OF REHABILITATION

Rehabilitation of the War Injured

A Symposium. Edited by Dr. William Brown Doherty and Dr. Dagobert D. Runes. Pp. 684. (New York: Philosophical Library, Inc., 1943.) 10 dollars.

DURING the past few years, the word 'rehabilitation' has come into common usage, but there does not appear to be a clear definition of its exact significance. This doubt is evidently shared by the contributors to this symposium, and we are presented, therefore, with articles based on almost every shade of its meaning. This variation in interpretation carries us from excellent chapters on the creation and maintenance of physical and mental fitness in those who have suffered from extensive war injuries, down to much less excellent sections upon highly specialized surgery.

There may be justification for considering that surgical repair is necessarily part of rehabilitation; it may, indeed, be all that is necessary. On the other hand, rehabilitation may more urgently follow conditions which do not require preliminary operation. That great part of the book, therefore, which deals with the technique of reconstructive and plastic surgery would seem to refer chiefly to those patients in whom no serious after-treatment is of importance. Parts of this section fulfil no particular purpose. They are couched in vague terms and end by being neither a technical description which might be of surgical value, nor yet sufficiently free from detail to make them valuable for anyone whose interest is not primarily surgical. Worse still, the contributors of some of these chapters have not considered it desirable to keep within the elastic limits of such a title as the editors have chosen, and have diverged to describe the treatment of defects which have no relation to war or its sequelæ. It may be that the writers themselves are not to blame for this, as it appears from the extensive list of acknowledgments that a great deal of the material has been collected from already published sources. This may also account for the very marked lack of clarity in the illustrations.

It should not be supposed, however, that this adverse criticism is applicable to the whole symposium. Many of the sections are concerned with specialized after-treatment which is rendered necessary by reason of some particular injury—the loss of sight, of hearing, or of a limb. Others deal fully with the specialized aspects of such treatment, and naturally enough the amount of stress laid on any particular method is in direct relation to the enthusiasm of its exponent.

The multiplicity and diversity of the views expressed are but an index of the magnitude of the problem, and one cannot help feeling that even if this volume does not answer the questions it raises, it should do much to stimulate coherent thought upon a subject which is, at the moment, only vaguely appreciated. In other words, when rehabilitation ceases to be a political catchphrase and is returned to the specialists who practise its component sections, we may well look forward to a great improvement in both the degree and duration of disability from which an injured man may suffer.

If this book is intended for the general public, it will, in the reviewer's opinion, leave them interested but somewhat confused. If, on the other hand, it is directed towards the medical profession, it should go far towards convincing them that the solution of the problem lies almost entirely in the integration of their various efforts into one harmonious whole.

SYMPOSIUM ON CANCER

Selected Papers from the Royal Cancer Hospital (Free) and the Chester Beatty Research Institute

Published by order of the Governors of the Royal Cancer Hospital (Free), London. Vol. 2. Pp. viii+414. (London: Royal Cancer Hospital (Free), 1943.) 16s.

TWENTY-SEVEN authors contribute to this symposium, which will be welcomed by all who have to deal with any aspect of cancer. The papers, some of which are highly technical, are reprinted from many journals and form four main groups: three of general clinical interest; four on radiation therapy; eight on calculations and physical measurements of radiation; eighteen on experimental research, and a review of the world literature 1938–1939 on chemical compounds as carcinogenic agents. The latter paper, by Profs. Cook and Kennaway, follows an earlier review on the same subject and is a masterly piece of work, including a bibliography of some five hundred new references. About half the volume is concerned with the synthesis and testing of chemical carcinogens and growth inhibitors. It is not yet certain that any of these substances are directly related to human cancer other than industrial cancer. A careful perusal of the results shows that many new facts could not have been established by studying only the earliest and best-known carcinogenic hydrocarbons. To the reviewer, the most interesting new experiments are those dealing with growth-inhibiting hydrocarbons that are not necessarily carcinogenic; with carcinogens that act on remote organs as well as locally; with those that show the need for more than one kind of biological test before a substance can be regarded as non-carcinogenic; and, particularly, with the extraction from human livers (not necessarily from cancer subjects) of unidentified carcinogens.

The scientific world owes much to this team and to the guiding influence of Prof. Kennaway, who was the first to prove that cancer could be induced by a hydrocarbon. P. R. PEACOCK.

ROAD ACCIDENTS AND ROAD STRUCTURE

By W. W. DAVIES

ACCORDING to recently published information, 40,000 people were killed on the roads in the United States in 1941 and the cost of all road accidents during the same period amounted to little short of £500,000,000[1]. Comparable figures for Great Britain are not available, but the records of past years speak for themselves. In the ten years preceding 1940, 69,781 people lost their lives in road accidents and about 2¼ million people were injured. The most conservative estimate shows that the average cost of these accidents to the community, together with that of the much larger number of accidents involving damage, but not death or injury, could not have been less than £50,000,000 a year.

The figures for the two decades prior to the War show that the number of accidents was roughly proportional to the total number of vehicles using the highways (Fig. 1). In the case of the United States, up to 1938 the accident curve reflects quite remarkably the curve of the number of vehicles. The graph for Great Britain shows less faithful correlation, due to the increase in accidents in the 'bad' years 1931–34; but there is no significant break in the general relationship. The accident/vehicle ratio was 0·082 in 1925, and after reaching a maximum value of 0·098 in 1934, was again 0·082 in 1938.

There seems little doubt that the number of vehicles in Great Britain will increase two- or three-fold in the twenty-five years following the War, and that *unless novel methods of prevention are introduced*, the country will be faced with an annual casualty roll mounting steadily to some 500,000, representing an economic loss of the order of £100,000,000 a year. Road accidents, in fact, are a liability that the nation can ill afford at the best of times, much less with a man-power depleted by the ravages of war. Humanitarian motives apart, it is clear that on grounds of economy alone, the spending of very large sums of money on prevention will be fully justified.

The causes of road accidents are so numerous and complex as to defy all but the most detailed analysis[2]. As motor-vehicles are involved in some 85 per cent of the accidents, however, it is a reasonable simplification to say that the essence of the road accident problem is to find a way of neutralizing the 'accident-potential' of the motor-vehicle. Broadly speaking, this may be achieved in three ways:

(*a*) By reducing the lethal effect of the vehicle (for example, by automatic speed-control or by guard devices).

(*b*) By inducing greater caution and skill in the road-user by means of legal restrictions and penalties, and through education and propaganda.

(*c*) By improving the road structure (for example, by segregation, better surfaces, etc.).

Opportunities to reduce the lethal power of the vehicle are very limited; they probably do not go beyond minor improvements in steering and braking, and in providing a wider and less interrupted angle of view for the driver. A large proportion of accidents are stated to occur at speeds between 10 and 20 m.p.h., and although these figures may underestimate the facts, it would scarcely be practicable to reduce the speed-capacity of vehicles to the safety level (wherever this may be) without enormously reducing the utility of road transport.

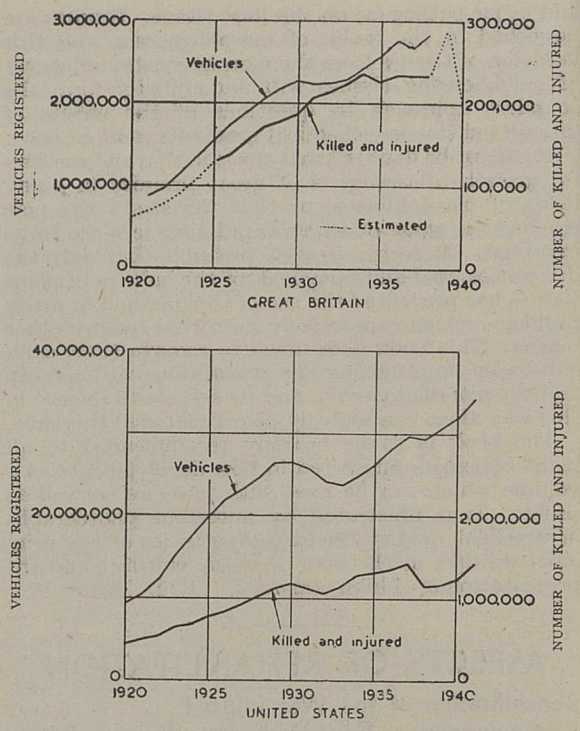

Fig. 1. VEHICLES AND ROAD ACCIDENTS IN GREAT BRITAIN AND THE UNITED STATES.

To 'improve' the road-user is at first sight an attractive proposition, and there is no doubt that a great deal can be, and will be, done to educate and restrain all classes of user. As the road structure is the theme of this article, the temptation to enlarge on this aspect of road safety must be resisted. We may note in passing, however, that all the campaigns and efforts on behalf of road safety of the past twenty years, although they have undoubtedly had beneficial effects, have notably failed, as the curves in Fig. 1 show, to reduce the overall accident/vehicle ratio below its value in 1925. Moreover, the reformer is handicapped by the nature of the weapons at his command; restrictive measures are unpopular because in most cases they have to be applied to the just as well as to the unjust; punishments cannot easily be devised which do not harm innocent people; and propaganda has to fulfil the almost impossible condition that it must be persistent without losing its novelty. While, therefore, improvement of the road-user must be regarded as one of the major objectives of the immediate post-war attack on road accidents, it would be unwise to anticipate sensational successes or to rely upon it to maintain a lasting effect.

Effect of the Road Structure

To consider now the restricted accident field imposed by the title of this article: What can be expected from improvement of the road structure?

The answer to this question in official statistics is, to say the least of it, discouraging; for "road conditions" (including the weather) are said to be the "sole or main cause" in no more than 5 or 6 per cent of the accidents. These statistics, however, are based on reports prepared by the police, whose primary job

is not to dissect the road accident problem but to assign responsibility; and it is fully realized that these do not represent the real part played by the road structure. For more illuminating evidence we must turn to authorities who are responsible for road conditions, and who have therefore made a special study of the effect of these conditions on road accidents.

The best-known example in Great Britain of the effect of the road structure is afforded by the experiments conducted by the County Surveyor of Oxford before the War in co-operation with the Ministry of Transport[3]. To test certain conclusions that had been reached by the County Surveyor, fifty-eight junctions on rural roads within the county were improved to the standard recommended in the Ministry's Memorandum 483 on the layout and construction of roads; and the effect on accidents was observed. In the twenty-one months following the completion of the improvements, there were no fatal accidents; non-fatal accidents involving serious injury were reduced by 79 per cent, and accidents involving minor injury were reduced by 37 per cent.

Another published example of the effect of road conditions in Great Britain is given in a paper read before the National Safety Congress by Lyddon in 1939[4]. The accompanying table, which is quoted from this paper, shows the effect on the frequency of road accidents of certain traffic control measures carried out at road junctions.

EFFECT ON ACCIDENT STATISTICS OF SOME PREVENTATIVE MEASURES AT ROAD JUNCTIONS

Type of improvement	Percentage of cases in which number of accidents		
	decreased	did not change	increased
Roundabouts: provincial	78	3	19
London	62	10	28
Island refuges: provincial	75	18	7
Light signals: provincial	53	9	38
Light signals (including a previous analysis)	47	10	43
'Halt' signs: provincial	76	13	11

While the figures show a reduction in accidents at most of the junctions, it is interesting to note that there was a marked increase in quite a large number of cases. This fact is significant in the light of comments to be made later.

In general, the evidence from the United States suffers from incompleteness of data, but two investigations may be mentioned as showing a fairly reliable trend. The first was concerned with the effect of 'safe-speed' signs (not used in Great Britain) in alleviating accidents on curves. The signs were erected in 1939 on a 95-mile stretch of highway in Indiana. Records of the accidents during a year before and after the installation showed that despite a 15 per cent increase of traffic, "there were 10 fewer fatalities and 12 fewer persons injured, 36 fewer accidents on curves and approximately $9,000,000 less property damage as a result of the erection of the signs"[5].

The second investigation was concerned with the effect of the colour of the road surface on night-driving hazards of a street in Philadelphia[6]. Here, for reasons not connected with safety, the tone of the road surface was changed from light to dark without any corresponding alterations in the character of the street-lighting. Examination of accident statistics showed that, whereas in six winter months preceding the change 232 accidents had occurred during daylight and 182 at night, in the corresponding period after the change the ratio was reversed, 172 accidents occurring in daylight and 211 at night.

The Case of a London Street

A very striking example of the effect of the road structure on the incidence of road accidents occurred in the course of an investigation, undertaken by the Road Research Laboratory as part of the programme of the Road Research Board, on the use of surface-dressings to reduce the slipperiness of certain types of paving in London. The Board being concerned with research on road materials and methods of construction, the tests were devised in the first place to examine the efficacy of a certain type of surface-dressing in terms of its durability and resistance to skidding. As the ultimate object of such treatments is to increase road safety, it was decided later to attempt to link-up the improvement made in the road surface with its effect on road accidents, and police records of all fatal, non-fatal and damage accidents involving vehicles before and after the improvement were examined. About a year earlier, island refuges had been installed on the same stretch of road, so the period of the statistics was extended to cover this feature also. Traffic records over the period of the review were not available; but there were no indications of any appreciable variation either of traffic density or of any other factor that might have affected the accident ratio.

The results of the inquiry are indicated diagrammatically[7] in Fig. 2, which shows the incidence of accidents between November 8 and February 7 in the three successive years during which the changes in the road conditions were made. Referring to the two areas under observation (hatched on the bottom diagram), the main conclusions were as follows:

(1) In the three months following the installation of the island refuges, a measure specifically intended to reduce accidents, 63 accidents occurred, compared with 24 in the corresponding period of the previous year.

(2) After the sections had been surface-dressed, the number of accidents on them fell from 63 to 4. In the same period there was a considerable increase in the number of accidents on other stretches of the road.

(3) Although the surface-dressing treatment had served only to reduce the slipperiness of the road surface, the proportional reduction of accidents (94 per cent) was far greater than the proportion of accidents previously attributed in police reports to skidding.

(4) Although measurements showed that the treatment had reduced the slipperiness of the surface only at low speeds (up to 10 m.p.h.), the treatment practically eliminated accidents on the lengths treated.

(5) Assuming the average cost of the accidents to be £10 per accident (a conservative figure) the initial outlay on the treatment was recovered in less than two months by savings on accidents. Assuming the surface-dressing would require renewal after two years, the savings on accidents would represent a 'dividend' in this period of 1,500 per cent.

A notable feature of these results is their unexpectedness. The installing of island refuges actually caused a serious increase in the number of accidents; while the surface-dressings, although having such a

limited effect on the slipperiness of the surface, reduced the accidents to negligible proportions. It is equally noteworthy that the police reports, because of the particular viewpoint from which such reports are prepared, failed to give proper emphasis to the influence of road conditions on the accident ratio.

How Science Can Help

From what has been said, it will be seen that far too little is known of the principles governing road safety and the relationship between traffic and road structure—for the simple reason that no organized and persistent attempt on a sufficient scale has been made to track these principles down. It is true that the police in many areas maintain accident maps; and by concentrating road improvements on the methods simple and its instruments ready-to-hand. There is a growing realization that this is not enough, and that it must be backed up without delay by a strategic attack having fundamental and far-reaching objectives, using the precise methods and instruments of science, and envisaging remedies that may not be immediately applicable. Such a step, in fact, was envisaged by the Alness Committee in its recommendation that a Road Safety Research Board should be set up, so far as possible as an independent body but closely in touch with the various authorities concerned with road safety. The functions of the Board would be to conduct researches and to make recommendations. A Road Safety Research Committee has already been set up in the Union of South Africa.

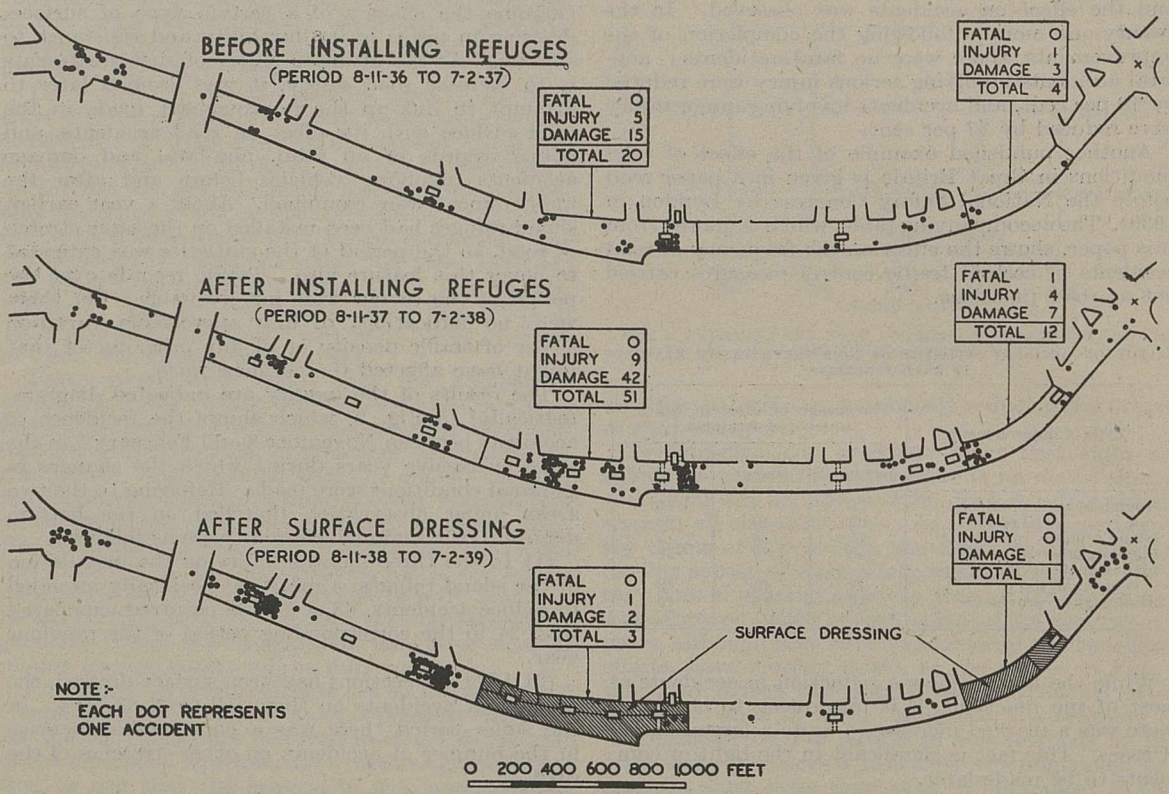

Fig. 2. RELATION OF ACCIDENTS TO ROAD CONDITIONS ON A LONDON STREET.

'black-spots', local authorities are often able to secure a substantial reduction of accidents: but little attempt is made to collect the supporting data by means of which a local success might be translated into a general relationship. 'Belisha beacons' marking pedestrian crossings have been installed in the towns and cities of Great Britain: but who can say with certainty whether they have failed or succeeded in their object? There is much talk of the benefits to be derived from motor roads: but there is not a single piece of reliable evidence to show that motor roads would effect an overall reduction in the number of accidents.

Those are but a few of many examples of our failure to study the fundamental causes of road safety. To borrow a popular metaphor, our method of attacking the problem has been tactical in scope: its objectives have been limited and immediate, its

The field of investigation is obviously a wide one, and it embraces problems associated with the vehicle and the road user as well as with the road structure. Space permits only a brief reference to two or three aspects that concern road structure.

As there are 200,000 accidents yearly (omitting the large number of 'damage' accidents), and at least twenty-five major variables affecting the road structure alone, it is clear that the conditions for investigation are difficult and that a great deal will depend upon a proper use of statistical analysis. But contrary to general practice in the past, the statistics will have to be collected by trained observers, they must include not a few but many factors relating to the road, and they must aim at elucidating facts rather than apportioning blame. Since the accident/traffic ratio, rather than the actual number of accidents, is clearly of basic importance in a scientific

inquiry, parallel statistics relating to the type and density of traffic will also be required. The task is a formidable one; but it can no doubt be reduced to manageable proportions by sampling and by the use of standardized methods.

The scientific worker in partnership with the road engineer will also require a 'practical laboratory' in which the conclusions reached by theory and experiment can be tried out under normal working conditions and checked statistically. The area, or areas, might well be selected from those set apart for the statistical inquiry; and it would be necessary not only to avoid publicity but even to go to considerable trouble to conceal the experimental character of the site from the road user. As the behaviour of drivers is often conditioned by events in the recent past (for example, a 'narrow squeak' or a passing glimpse of the results of an accident) a careful watch would also have to be kept for possible 'edge effects'. Under properly controlled conditions, however, the true, as distinct from the local or temporary effects of modifications in the road structure, would in course of time be ascertained.

Finally, there is a large field for purely experimental research, in the laboratory as well as on the road. Perhaps the most important part of this work would be concerned with the relationship between the road structure and the movement or 'flow' of vehicular traffic. It is a curious thing that in spite of a quarter of a century of experience of modern road construction, very little is known of this relationship, and methods of design are still empirical. Making full allowance for the complications introduced by the presence of the human factor, it seems certain that definable laws govern the movement of vehicular traffic along the channel of the highway, and that they are dependent on the alignment and width of the carriage-way and the incidence of such intermittent elements as road junctions and traffic signs. It is the business of research to study these factors experimentally. By doing so, not only will valuable contributions be made to the solution of the problems of road safety, but also the information will help materially to reduce the overall cost of road transport to the community.

As O'Gorman, who has done much to direct public attention to the problem of road accidents, has said[8]: "What we want, what we lack and what we must have are measurements scientifically correlated, and analysed by competent persons".

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[2] A tabulated statement of the main headings of the road accidents problem, given by Glanville in the discussion of a paper at the Institution of Civil Engineers, contained thirty items, each of which could have been further subdivided. See, Rayfield, F. A., "The Engineer's Part in the Promotion of Road Safety", *J. Inst. Civ. Eng.*, **14** (7), 280 (1939–40).

[3] "Report by the Select Committee of the House of Lords on the Prevention of Road Accidents together with the Proceedings of the Committee, Minutes of Evidence and Index". Questions 941–951, p. 83. (London: H.M. Stationery Office, 1938.)

[4] Lyddon, A. J., "Road Junction Design in relation to Road Safety". National Safety Congress (1939).

[5] Highway Research Board. Proceedings of the 20th Annual Meeting, p. 425.

[6] National Safety Council. "Visibility versus Traffic Accidents: 1939 Report of the Committee on Night Traffic Hazards." (Chicago, Illinois: National Safety Council, Inc., 1940.)

[7] Adapted from the report in the *Journal of the Institution of Civil Engineers* of the discussion referred to in footnote 2.

[8] O'Gorman, M., "Bringing Science into the Road Traffic Problem" (London: The British Science Guild, 1934).

CONTRACTION, TURGOR AND THE CYTOSKELETON OF NERVE FIBRES

By J. Z. YOUNG

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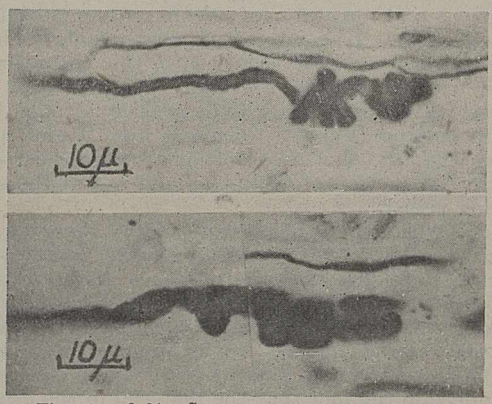
A STRETCH of nerve fibre which has been cut off from its cell body degenerates and disappears. There must, therefore, be some influence emanating from the cell body and nucleus which normally maintains the integrity of the axon. Two facts which throw light on the nature of this influence are that (1) during degeneration the isolated portion contracts and forms folds and spirals; (2) the central portion swells as if under the influence of a turgor pressure.



Figs. 1 and 2*. SPIRALS IMMEDIATELY BELOW A CUT MADE 48 HOURS PREVIOUSLY.

The contraction is shown most markedly in the region immediately distal to the cut, where the fibres contract back, often into quite tight folds and coils (Figs. 1 and 2). The more distant regions of the fibres remain intact for about two days (in a mammal) and then break up into granules, falling into loose spirals as they do so (Fig. 3). This contraction is presumably a manifestation of the process of disorientation of longitudinally arranged protein particles, the presence of which is shown by many other indications. The axoplasm shows a visible longitudinal fibrosity (the 'neurofibrils'), and birefringence studies indicate that part at least of the protein exists as micelles showing form and intrinsic anisotropy[1]. Electron microscopy of extruded squid axoplasm shows the presence of fibrils of all sizes from 15 mμ upwards[2]; distilled water or formalin coagulate the smaller particles into larger fibres[3]. The small amount of evidence available about the proteins of the axoplasm shows them to contain a complex resembling a nucleo-protein, from which a basic constituent like a histone or protamine can be split off[1].

Fig. 3. MORE DISTANT PORTION OF AXON 3½ DAYS AFTER CUTTING.

It is therefore evident that the axoplasm contains orientated molecules. In the intact fibre these are

* All figures are of sections of rabbit's nerve stained by Bodian's method. They are arranged as if the cell bodies lay to the right.

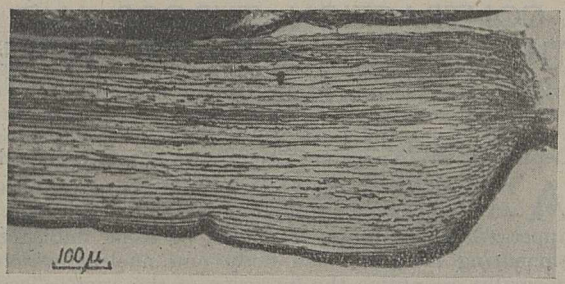


Fig. 4. PERIPHERAL END OF NERVE CUT FIVE MINUTES AFTER ALCOHOL HAD BEEN POURED AROUND IT.

somehow held in the extended condition, which is not the most probable one, so that when the constraining force is removed the disorientation is shown by the contraction, folding, disappearance of birefringence and break-up of the fibrous organization into granules. It is interesting that agents such as dehydration or heat accentuate the contraction. Very marked spirals are seen at the ends of nerves which have been immersed in alcohol just before cutting (Fig. 4). Schmitt and Wade[4] have shown that the shortening of nerves when heated is due to contraction of the axons and not of the supporting tissue.

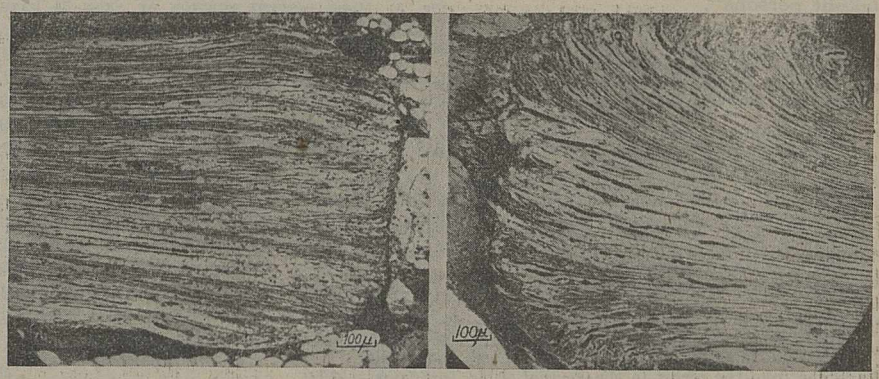
Since, when a piece of nerve is isolated, there is a disorientation of previously well-arranged particles, it may be suggested that the influence of the nucleus and cell body is to maintain this organization. Parker[5] has already suggested a connexion between the 'neurofibrils' and the 'trophic impulse' in an axon. A clue as to how the transmission may be effected is provided by the fact that the material in the central stump is under pressure. On the second day after cutting, the central ends of the nerve fibres are swollen and reach to the open ends of the endoneurial tubes in which they lie (Fig. 5). The peripheral ends, on the other hand, lie some tenth of a millimetre back from the cut surface and are little swollen. During the succeeding days the material of the central end flows out from the tube, forming one or several regenerating strands. These phenomena seem to show that there is a turgor pressure within the nerve fibre which must be transmitted from the cell body, since it is absent from the peripheral stump, although this is symmetrical with the central one except at the ends. The whole central stump is visibly more swollen than the peripheral[6,7], probably largely as a result of this intra-axonic pressure, although, as Weiss suggests, the swelling may be partly due to the accumulation of fluid between the nerve fibres, as a result of a centrifugal flow in the endoneurial lymphatic spaces.

Further evidence that there is a pressure and movement within the nerve fibres is the observation of Gutmann and Sanders[8] that during regeneration the diameter of fibres in the central stump decreases, while that of the fibres developing from them is increasing.

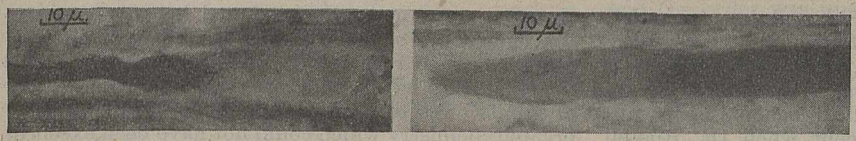
That the material of the axons is a fluid, or at least is thixotropic, is shown by the fact that it can flow freely and quickly from the ends of the large axons of Cephalopods[3], and by the movements which Speidel[9] has seen within it. We can therefore imagine the transmission of a turgor pressure along it, and this may well be important for several aspects of its functioning, including the maintenance of the orientation of its proteins. Studies on virus proteins and other materials[10,11] have shown that there are long-range forces capable of maintaining needle-like particles parallel to each other. Orientation in such solutions is produced by flowing and "the action of neighbouring surfaces, for example, in narrow tubes". Waugh[12] finds that the globular molecules of insulin may also form fibrous aggregates under mechanical stress.

The pressure could scarcely produce the orientation of the proteins originally, unless there is a definite continuous movement within the axoplasm. But the original orientation is produced during development, probably by the relatively rapid flowing which certainly occurs at that time. The influence of the cell body is to *maintain* the orientation, and it seems not impossible that it does this by the pressure which it produces within the axon. Comparison of the central and peripheral tips of the severed fibres certainly shows signs of disorientation in the latter (Figs. 7 and 8). Both may terminate in a lightly staining cap, but in the peripheral stump this contains a tangle of irregularly twisted or spiral threads, whereas the material in the central stump, besides being turgid, is also more orientated.

Of course, the fact that there is a disorientation during degeneration does not prove that the influence of the cell body is exerted directly by the maintenance of molecular orientation. The effect might be produced by a substance diffusing from the cell body which was necessary to maintain the metabolic activities of the fibre, and these in turn for the maintenance of the organization. Such diffusion has often been suggested, though no convincing evidence for such a substance has ever been produced. Hardy[13] considered that diffusion would be too slow, but Howe and Bodian[14] have shown that the virus of poliomyelitis spreads within the axoplasm at a rate of 2·4 mm. per hour; of course, the process need not be simple diffusion. A suggestion of correlation between the organization and the metabolism of a nerve fibre is the fact that isolated nerves which are stimulated become inexcitable sooner, and perhaps degenerate sooner, than those left at rest[15]. Gerard



Figs. 6 and 5. ENDS OF NERVE CUT 33 HR. PREVIOUSLY. IN THE DISTAL STUMP THE FIBRES END SOME WAY BACK AND ARE LITTLE SWOLLEN, WHEREAS THE TURGID ENDS OF THE CENTRAL FIBRES REACH TO THE CUT SURFACE. NOTE THAT THE CENTRAL STUMP AS A WHOLE IS OF MUCH GREATER DIAMETER.



Figs. 8 and 7. CENTRAL AND DISTAL ENDS OF FIBRES FROM A NERVE CUT 48 HR. PREVIOUSLY.

interprets this effect as due to the exhaustion of a supply of material normally diffusing from the cell body.

Hardy[13,16] suggested that organization within a cell might depend on an ordered arrangement of molecules originating at an interface and transmitted through quite large distances. Danielli[17] has a similar thought, that in muscle fibres the resting potential may orientate the outer molecules of the fibres, which in turn orientate those within. A similar relation might well obtain in nerve fibres, and would be consistent with the contraction and spiralling which are here discussed. However, since we know that the resting potential is maintained, at least for a time, in an isolated stretch of nerve, it cannot be regarded as an influence emanating directly from the cell body. The turgor pressure seems to be the only such influence for which there is some evidence, and it therefore merits serious consideration as the agent responsible for maintaining the organization.

It is even possible to suggest how the nucleus plays a part in maintaining this pressure. Gersh and Bodian[18] have confirmed the view of Caspersson[19] that the basophil Nissl granules contain nucleotides. After the application of ribonuclease, nerve cells lose the characteristic nucleic acid ultra-violet absorption band at 2600 A. Moreover, this band also becomes much less marked in cells undergoing the 'chromatolysis' which follows section of their axon. Gersh and Bodian suggest that after severance of the axon the intra-cellular ribonuclease breaks up the nucleotides, allowing the nucleoproteins of the Nissl substance to depolymerize and hence to produce the increased intra-cellular osmotic pressure which gives the turgid appearance to these cells and leads to the lateral displacement of the nucleus. It may be suggested

Fig. 9. DIAGRAM TO SHOW APPEARANCES IN CENTRAL AND DISTAL PORTIONS OF A NERVE FIBRE DURING THE DAYS FOLLOWING SECTION.

that normally some such process goes on continually, and that it is the 'function' of the Nissl substance to provide the material the break-up of which increases the intra-cellular pressure necessary to maintain the organization of such long cells. This would explain the occurrence of such large amounts of extra-nuclear nucleo-proteins in these very large cells. It has often been suggested that after chromatolysis the Nissl substance is re-formed from the nucleus, and this has been confirmed by Hyden[20]. Possibly in this way the nucleus maintains a pressure within all cell, and hence perhaps the orientation of a 'cytoskeleton' of proteins. There have been many indications in recent years of the importance of such a 'cytoskeleton'[21,22,23], but we lack definite information about its connexion with either metabolism or the control exercised by the nucleus over the cell.

No doubt these relations will prove to be much more complex than are here suggested. But at least we have two significant and probably connected facts (summarized in Fig. 9): (1) there is a turgor pressure transmitted from the nerve cell body, and (2) degeneration of severed parts is accompanied by the disorientation of a protein framework.

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OBITUARIES

Dr. F. D. Chattaway, F.R.S.

THE death of Dr. F. D. Chattaway, which took place at Torquay on January 26, severs another of the few remaining links between organic chemistry in Great Britain and the great school of the subject built up by von Baeyer at Munich.

Frederick Daniel Chattaway was born on November 9, 1860, at Foleshill, Warwickshire, and was the eldest of the five children of Daniel Clarke Chattaway and Eliza Ann Adcock. His father was a ribbon and trimming manufacturer in Coventry, and the collapse of this trade which followed the treaty with France in 1870 caused the family a very severe loss of income. As a consequence, Chattaway's scientific education was achieved almost entirely by means of scholarships; while as a further consequence he thereby gained an experience of universities and colleges wider than falls to the lot of most men. He received his early education at a school kept by a Nonconformist Minister, the Rev. J. L. Withers, who fostered his taste for natural science—a taste which had already been stimulated by his grandfather. His scientific education proper began at Mason College, Birmingham, where he was a pupil of Sir William Tilden. From there he went to University College, Aberystwyth, for two years, and then won a scholarship to Christ Church, Oxford, where his tutor was A. G. Vernon Harcourt. He took his degree with first-

class honours in chemistry in 1891, and then proceeded to Munich to work under von Baeyer and Bamberger.

On his return to England, Chattaway became a demonstrator in the Chemical Department of St. Bartholomew's Hospital Medical School, being appointed head of the Department when Dr. Russell retired. He left St. Bartholomew's in 1905 and again went abroad, this time to Heidelberg, where he studied under Bredig, and to Utrecht to work with Ernst Cohen. During this period, while he was in Holland, he was elected into the Royal Society.

Back in England he settled in Oxford, where in 1909 he took over from Cronshaw the chemistry teaching at Queen's, of which College he became in due course fellow, tutor and praelector in chemistry. He retired from teaching in 1935, remaining, however, a supernumerary fellow of Queen's until his death.

Chattaway was once described by an Oxford colleague as a "true-blue organic chemist", and the description fitted. Although his sojourn on the Continent from 1905 onwards was the result of his desire to acquaint himself with the then new subject of physical chemistry, he never really took to, or sympathized with, physical methods as applied to organic chemistry, preferring always the "beautiful crystalline body" which could be handled and investigated directly, and so with a greater feeling of reality. It was, in fact, in the production of such materials that a large part of his practical skill lay: few men excelled him in the ability to produce pure crystals from the most unpromising tars.

Within the realm of organic chemistry as he understood it, all was grist to his mill. Always his interest was in the way substances reacted together, and in the elucidation of the constitution of any hitherto undescribed products of a reaction. Here again lay one of his gifts; for he had a knack of choosing the correct alternative for synthesis, where doubt was still possible after degradation experiments, in a way reminiscent of Medicus's famous pronouncements on the purines. But he was no mere 'paper chemist': in the laboratory his industry was prodigious and his enthusiasm unbounded and infectious.

Chattaway's earliest work was done with Bamberger at Munich, and resulted in the determination of the constitution of a number of polynuclear hydrocarbons which occur in minute quantity in the highest boiling fractions of coal tar. His patience and tenacity were early shown in this work, which was both laborious and difficult, by reason of the intractable nature of the materials concerned and the very small quantities available. Later, his interest was caught by nitrogen iodide, and a series of thorough investigations enabled him to settle several hitherto doubtful points in its chemistry. He later prepared and examined exhaustively the properties of a very large number of N-substituted halogen derivatives of acylanilides, and championed with great vigour the view that the change which occurs when they are treated with acids is an intra- and not an inter-molecular change. He then became interested in organic perhalides, particularly those of the diazonium compounds, and in all aspects of the chemistry of hydrazines and hydrazones. He also investigated the nitration of benzil, condensation reactions of azides, many cases of polymorphism, and the stereoisomerism of thioparachloral derivatives, while his most recent work on condensation products of chloral and related compounds revealed a ready means of making derivatives of the benzdioxin ring system.

Chattaway's delight in the *practice* of organic chemistry was never dimmed and he only gave up the long hours of work in the laboratory (and then grudgingly and regretfully) when advancing age and circumstances left him no alternative. A small army of pupils owes to him a training in the methods of organic chemistry which could not have been excelled.

Dr. Chattaway married in 1894 Elizabeth Bettney, second daughter of Thomas Bettney, of Handsworth, Birmingham, who, with a daughter, now survives him. Their only son, a scholar both of Eton and of Christ Church, was killed at Thiepval in 1916.

G. D. PARKES.

Prof. Alfred Stansfield

THE announcement of the death on February 5 at the age of seventy-two of Prof. Alfred Stansfield, for thirty-five years Birks professor of metallurgy at McGill University, Montreal, has recalled to many of his friends and associates the outstanding contributions made by him to the progress of physical metallurgy in Great Britain while collaborating with Sir William Chandler Roberts-Austen at the Royal Mint and also at the Royal School of Mines.

To Stansfield was due in no small measure the actual experimental work and the improved means of pyrometric measurement (including the 'null' and 'differential' methods) which constituted such remarkable features of the Third, Fourth and Fifth Reports made by Robert-Austen to the Alloys Research Committee of the Institution of Mechanical Engineers, in 1895, 1897 and 1899 respectively. An important appendix to the Third Report, on "The Pyrometric Examination of Alloys of Copper and Tin", appeared under Stansfield's name. Its importance at that time can scarcely be over-estimated. Not only did it represent the first recorded attempt to give as 'freezing-point curves' an explanation of the copper-tin series as a whole, but it also marks the beginning of all investigations which have since been made in correlating the physical and mechanical properties of alloys with their equilibrium curves. Stansfield, in fact, a few years later, himself suggested the adoption of the term 'equilibrium curve' for metallic alloys, a term which had hitherto been restricted to the consideration of fused salts and saline solutions.

Stansfield's most striking and convincing contributions to physical metallurgy, however, were those by which he participated in the discussions in the late 90's on the "Solution Theory of Carburised Iron". Of the two papers by him which appear in the *Journal of the Iron and Steel Institute*, 1899 and 1900, it can well be said that these constituted a remarkably clear enunciation of the problems involved in a proper understanding of the relations between carbon and iron within the ranges covered by steel and cast iron. The latter of these two papers was presented and discussed jointly with the well-known contribution by Bakhuis-Roozeboom on "Iron and Steel from the point of view of the Phase Doctrine". Stansfield expressly set out to dispel the tendency to regard the solution theory as being, in a sense, opposed to, or as supplanting, the older allotropic theory. His paper, he hoped, would effectually dissipate such an error by showing how entirely the solution theory of the relations of carbon and iron involves the allotropic changes with which the distinguished name of Osmond is inseparably connected. Roberts-Austen, who was at that time president of the Iron

and Steel Institute, commended Stansfield's work in terms which now appear as being prophetic. He said: "He considered Dr. Stansfield's communication to be about as important as any that could well be made to the Institute. Its full significance might not be understood for months or even for years but it did afford a scientific basis on which the theories and practice relating to the metallurgy of iron might be built up".

Prof. Stansfield's subsequent work in Canada included, among other important matters, notable contributions to the technology of electric furnaces and of their application to electric smelting. This work has received wide recognition and is probably more familiar to those of later generations than his earlier work in Great Britain to which this note is intended more particularly to direct attention.

S. W. SMITH.

Prof. James Young, O.B.E.

JAMES YOUNG, who retired from the professorship of science at the Royal Military Academy, Woolwich, in 1925, died on December 2, 1943; he was born in Ulster in 1862.

Young joined the Royal Military Academy in 1889 as instructor in chemistry. When war started in 1914, the authorities had ordered that all non-military subjects should be shut down; but Young had no difficulty in persuading a sympathetic commandant that science was a necessity, not a luxury, and the order was quietly ignored. With the small time available in a much shortened course, Young did great work, which was rewarded by the O.B.E.

When Young came to the Royal Military Academy, science there was little but chemistry applied to explosives. The Academy had been early in the field with chemistry. It was first taught there in 1789, and one of its teachers for thirty years had been the great Faraday himself. Electricity came in 1893, and Young wrote an Army handbook on that subject later on.

Young did little research, but great teaching work for the Army, and it was as unobtrusive as it was useful. He was far-sighted in his ideas of science in warfare. When wireless telegraphy was in its infancy, he put it in the curriculum, predicting its great future in the field. Also, within a few days of the first German gas attack, he was giving lectures on poison gas which became famous in the Army, and predicting that mustard gas would be the most effective.

Young was rather a recluse, and perhaps rather too gentle with his high-spirited students, though he earned their respect from his clear and original lectures, and is remembered with affection by many who are now officers of high rank. Particularly well remembered are his lectures on explosives, with their terrifying bangs, by which he made everyone realize how safe explosives are when handled with understanding; he was highly successful in giving his students the confidence due to knowledge. No one ever had an accident under his care.

NEWS and VIEWS

Science and Industry in Great Britain

A SERIES of meetings on science and industry has been arranged by the Manchester Chamber of Commerce. The first of these meetings, on March 3, was addressed by Lord Riverdale on "Research and Industry: the Need, the Ways and the Means"; the second, on March 16, by Dr. A. P. M. Fleming on "Research Workers: their Education, and their Place in Industry". At subsequent meetings on March 31 and April 20, the speakers will be, respectively, Dr. Andrew McCance on "The Application of Research" and Sir Edward Appleton on "Fundamental Research: its Practical Importance". The meetings, admission to which is by ticket, are being held in the Houldsworth Hall, Deansgate, at 11.30 a.m.

At the first of these meetings, which was attended by several hundred business men, Lord Riverdale gave an outline of the work of the Department of Scientific and Industrial Research, and more particularly of the activities of the research associations in Great Britain, which at least hinted that when publication of the annual reports of the Department is resumed, it will be found that the research association movement has gained new vitality. Lord Riverdale gave a list of twenty-two existing associations and stated that several others are in process of formation. The provision of means and the formation of research associations, however, are not enough. Until individual firms use these means and become imbued with a full appreciation of scientific research and translate it into highest quality products, full benefit to firms and the community has not been achieved. Much remains to be done, especially in those industries containing many small units. Lord Riverdale is not satisfied that the Department can 'put over' the results of its research sufficiently dramatically, or that members of the associations really take an interest in it; the Department is now creating a public relations officer to meet this need. He also thinks that the question of invention requires further attention. Unless we have an authority with sufficient funds and able staff to watch inventions, see how they react on research in progress here, and make some attempt to introduce them to a concern which will test them effectively as to whether they are not of national importance, there is serious danger that we shall not be able to hold our own. Lord Riverdale also referred to the importance of obsolescence and of allowance being granted by the inland revenue authorities and the Treasury for expenditure on buildings and equipment for research—a matter in which he was strongly supported by Sir Raymond Streat, who also emphasized the implications for industry itself.

Lord Riverdale's address showed that the present outlook of the Advisory Council for Scientific and Industrial Research is in full harmony with that inspired by Lord Balfour and Lord Rutherford. While he did not disguise the dangers ahead and the necessity for Great Britain to increase its visible exports at least another two hundred millions if it is to continue to enjoy imports of the same value as before, he pointed out that, to an ever-increasing extent, the value of British exports must lie in the superior ability of our scientific men and technologists, the

keener enterprise of our industrialists and the higher skill of our workmen. Experience of the War has shown that Great Britain is second to none in the fields of scientific discovery and invention, and industrialists have shown that they are capable of translating the results of research rapidly and efficiently into products required for the successful prosecution of the War. This high quality of research is one of the surest grounds for confidence in our ability to meet successfully the difficult times that lie ahead.

Taxation and Research

REFERENCE has been made in various recent reports on scientific research and industry to the financial aspect in its relation to taxation. Thus the London Chamber of Commerce report (see NATURE, March 11, p. 294) advocates that expenditure on research should be chargeable on revenue. The matter has also been taken up by the Parliamentary and Scientific Committee, which has prepared a memorandum on the subject. This memorandum urges that the Government, in considering its taxation policy, should look to the prospect of benefiting from higher income tax returns when industry, as a result of the development, through research, of new processes and products, is made more profitable. The recommendations, however, are intended to afford a basis for discussion rather than to represent rigid and final views, and in particular the Committee wishes to learn the opinion of the revenue authorities on the practical reactions of its proposals. In general, it is recommended that the law relating to the taxation of profits should be amended so as to recognize the principle that all expenses incurred on research and development are allowable as deductions from taxable profits, with the corollary that receipts from a lease or sale of discoveries should be brought into taxable profits. It is also suggested that an allowance should be made for taxation purposes of a fixed percentage of any capital assets which have been provided solely for research purposes. The Committee also supports suggestions made by representative trade bodies to the Inland Revenue Committee regarding the amortization of business premises and machinery generally. Depreciation rates should be increased so as to include obsolescence, which has become a more important factor than wear and tear.

British Radio Research Institute

THE British Institution of Radio Engineers recommends the formation of a British Radio Research Institute, the functions of which would be the pursuit of basic research of the type that has hitherto suffered restriction owing to its high cost, absence of obvious or immediate practical applications, or the poor prospect of early financial returns. The institute should be financed by industry supplemented by a Government grant of at least equal amount. The work of the institute should be directed by a board representing Governmental authorities, the B.B.C. and the Services, the industry, the British Institution of Radio Engineers, the associated professional institutions and the universities of the Empire. In addition to a permanent scientific staff, the assistance and engagement of extra-mural workers should be arranged in co-operation with industry and the universities.

The advantages to be derived from the proposals are that the advancement of radio and electronic sciences would be freed from the limitations of restricted finance, duplication of original research work, spasmodic trade fluctuations, etc. Competitive private enterprise would be stimulated and the intake of high-grade technical personnel increased. It would remain with private enterprise to develop the practical and industrial applications of the scientific results flowing from the research institute. The pre-war hiatus between industry, the Government and scientific workers would be effectively bridged by the proposed governing board. New knowledge, carrying with it the possibility of new industries, would be continuously sought and be available for the free use of manufacturers to develop practical applications of the scientific principles. The necessity for private research departments would not be reduced; but the availability of undeveloped basic knowledge would give such departments a far greater opportunity for returning a dividend. The application of radio technique to fields other than broadcasting is capable of considerable development, and therefore the potential absorption of labour is considerable.

On the financial side, the contribution of industry to research associations was increasing before the War, and support is now being given to the principle of larger contributions being made in the future. Assuming the turnover to be only £20 million for the radio industry, an allocation of 0·25 per cent would give, with Government assistance, an income comparable with that of other research associations. If subscribing membership is open to all British industrial undertakings in the British Commonwealth which produce, manufacture or use electronic equipment, the income of the research institute would be comparable with the support given to any other association, while at the same time making the field of research inexhaustible. During the War, radio has graduated into a highly important industry. In the post-war era it should be supplying capital goods on a scale equal to many of the older industries; not only should the range and quality of its consumer goods be very different from anything known before, but also essential instruments and devices for other industries must be provided if British scientific and industrial progress is to be maintained. For all this development co-operative research is essential. It is strongly advocated by the Institution that opportunity for participation in the work of the research institute shall be provided for all countries in the British Commonwealth. Such collaboration in research will materially aid development of communications and the prosperity of the entire Empire.

Fuel for Household Use

ON February 18 Mr. J. G. Bennett, addressing the Fuel Luncheon Club in London on "The Future of Coal for Small-Scale Uses", compared raw coal, town's gas and electricity for household space heating. The comparison was based on heat costs incurred in production and distribution and the efficiency in use of gas and electricity when these are produced from coal. The results for all three, with appliances of current type, turned out to be identical —16 per cent of the heating value of the coal. Developments anticipated in appliances were estimated to increase these figures to 45 per cent for coal burnt in open fires, 24 per cent for gas and 33 per cent for electricity. Some may read into these figures the implication that no fuel-saving can be expected from the processing of coal before use. It should, however, be recalled that coal-less countries import

The vacancies advertised in these columns are available only to applicants to whom the Employment of Women (Control of Engagement) Orders, 1942-8, do not apply.

THE ROYAL INSTITUTE of CHEMISTRY of GT. BRITAIN & IRELAND

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

APPOINTMENTS REGISTER

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

Particulars of the Regulations and Examinations of the Institute can be obtained (free), on application to the Registrar.

All communications to be addressed to The Registrar, the Royal Institute of Chemistry, 30 Russell Square, London, W.C.1.

UNIVERSITY OF ST. ANDREWS

UNITED COLLEGE, ST. ANDREWS
CHAIR OF NATURAL PHILOSOPHY

The University Court of the University of St. Andrews invites applications for the Chair of Natural Philosophy, United College, St. Andrews, which will become vacant owing to the retiral, on September 30, 1944, of Professor Stanley Allen, F.R.S.

Physicists at present engaged on National Service and who, in consequence, are not in a position to take up duty immediately, are not thereby precluded from being considered for the appointment. The date on which the appointment becomes operative will depend on when the professor is available to take up duties.

Candidates are requested to submit notice of their intention to apply for the vacancy as soon as possible to the undersigned, and not later than June 15, 1944. Candidates are requested to submit at least three testimonials, or, alternatively, to give the names of three referees. The initial salary attached to the Chair is £900 per annum increasing, in accordance with the conditions of appointment, to £1,000. It is hoped that the associated appointment of Director of the Physics Research Laboratory, St. Andrews, to which a stipend of £100 per annum was attached, will be operative in peace conditions. Further conditions of appointment may be obtained on request.

The University, St. Andrews.
March 1, 1944.

DAVID J. B. RITCHIE, Secretary

APPOINTMENT OF A BOTANIST

Applications are invited for the post of Botanist (male) in the Branch of Plant Pathology and Botany of the Department of Agriculture, Southern Rhodesia. Candidates should possess an Honours degree of a University in the British Empire or equivalent, and should have a working knowledge of the flora of Southern Africa. Herbarium experience will be regarded as an added qualification. The appointment will at first be on contract for two years at a salary of £400, at the termination of which the officer will be eligible for appointment to the Fixed Establishment in Grade A.7, rising by £25 per annum to £850 per annum. A higher commencing salary may be paid to the successful candidate, according to qualifications and experience, and he will be required to assume duty on April 1, 1944.

The successful applicant will be required to submit a satisfactory Medical Certificate from a Government Medical Officer.

Applications stating nationality and marital conditions, accompanied by copies of testimonials (including degree certificate) should be addressed to the Official Secretary, Rhodesia House, 429 Strand, London, W.C.2. Canvassing will disqualify applicants.

ROYAL (DICK) VETERINARY COLLEGE

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

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Applications are invited for the post of SUPERINTENDENT of the METALLURGY DEPARTMENT of the NATIONAL PHYSICAL LABORATORY. Candidates should have considerable research experience in metallurgy and should also have a broad outlook on the possibilities of research applied to industry. The salary contemplated is up to £1,250, but the starting salary would depend on qualifications and experience. Superannuation provision will be made under the Federated Superannuation System for Universities. Applications giving full particulars of qualifications and experience and not less than two personal references should be sent to the Director, National Physical Laboratory, Teddington, Middlesex, not later than March 25, 1944.

GUY'S HOSPITAL MEDICAL SCHOOL

(UNIVERSITY OF LONDON)

Demonstrator in Chemistry required to take up his duties in London on May 1, 1944. Present salary £300 plus £50. Applications, stating age, academic training and experience, together with the names of three references should be sent not later than March 31, to: The Dean, Guy's Hospital Medical School, St. Thomas's Street, London, S.E.1.

BEDFORD COLLEGE FOR WOMEN

(UNIVERSITY OF LONDON)

The Council of Bedford College invites applications for the following post open to men and women equally, vacant as from April 1, 1944:

MUSEUM ASSISTANT in the Department of ZOOLOGY to prepare and mount specimens and make microscopical preparations, etc. Knowledge of Zoology essential. Salary £300.

For further particulars apply The Secretary, Springfield, Sidgwick Avenue, Cambridge. Last date for receiving applications, March 22, 1944.

Boots Pure Drug Co., Ltd., invite applications for a number of vacancies in the Research Department. Candidates should have an Honours Degree in Chemistry, or its equivalent, and preference will be given to those with one or more years' research experience in organic chemistry. The undertaking is scheduled under the Essential Work Order.—Apply by letter to the Director of Chemical Research, Boots Pure Drug Co., Ltd., Nottingham, giving age, qualifications, experience, and publications.

A large industrial undertaking has a vacancy for an entomologist who would be required to carry out field and laboratory research on pest control, primarily in agriculture and horticulture. Applicants should possess good academic qualifications and a sound knowledge of applied entomology. The position is a progressive one, offering an unusual opportunity.—Apply in the first instance to Box 165, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Scientific apparatus manufacturers and laboratory furnishers require an assistant for the manager of Laboratory Fittings Department. The work is mainly clerical and involves estimating, supervision of stock, progress work, etc. Applicants should preferably have had laboratory or scientific training. Permanent post with prospects. Commencing salary £3 to £5 according to age and experience. Applications in writing to Staff Manager, Box 166, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Wanted: books on the microscope and microscopy.—Chards, Forest Hill, S.E.23.

Reflecting Telescopes: 10" Mirrors of excellent quality £18 10s. Flat 7s. 6d.—Roland Lee, "Infield," Babell, Holywell, Flintshire.

Urgently required: Diffraction grating ten divisions per 0.1 mm., Goniometric eyepiece for 23.3 mm. microscope tube. Research Department, Diamond Trading Co., Ltd., 32/34 Holborn Viaduct, London, E.C.2. CEN. 6435.

Wanted: Leitz binocular dissecting microscope. Details to Secretary, Royal College of Surgeons, Lincoln's Inn Fields, W.C.2.

Microscopes, of all descriptions, only a few available second-hand, perfect condition. Send details of your requirements enclosing 3d. stamp.—Chards, Microscope Specialists, Forest Hill, S.E. 23.

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WHY THE UNIVERSE?

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large quantities of coal for carbonization to produce gas and coke. It is unlikely that they are unanimously thriftless. Attention should be paid to the difference in the method of calculation. In the case of coal and electric fires, the resulting heat is usually a product of the raw coal. Gas, however, is derived from the volatile matter only, which is not more than one third of the whole of the coal. Then nearly the whole of the heat cost of processing is charged against this gas, and the end efficiency figure is reduced to one sixth. Even then, the efficiency figure is not less than the figure given for coal and electricity. Unlike, but over and above these, there remains some half-ton of coke available for domestic and industrial uses for which raw coal is unsuitable. At the moment, the Ministry of Fuel and Power is taking advantage of this reserve.

Mr. Bennett mentioned that the financial importance of the by-products of coal is apt to be exaggerated. This is true, but their usefulness should not be depreciated. Tar components amount to about 6 per cent by weight. They are, however, components of smoke and soot. As such, they are better recovered fit for uses which would otherwise necessitate importation of bituminous material. In this connexion it is interesting to take note of the views put forward by Harold Moore, only a fortnight earlier, in a paper read before the Institute of Fuel. This was a plea for a plan to meet the national needs for liquid fuels and organic chemicals. In addition to the development of home refining of petroleum, he considers that the most important feature of the plan should be the extension of coal carbonization. To promote this, he even advocates legislation against burning raw bituminous coal.

Basic English

MR. CHURCHILL announced in the House of Commons on March 9 that the Committee of Ministers on Basic English has submitted a report which has been approved in principle by the Government. So far as concerns the use of Basic English as an auxiliary international language, the Government is impressed with the great advantages which would ensue from its development, not in substitution for established literary languages, but as a supplement thereto, and is taking steps to develop its use as an auxiliary international and administrative language. The British Council will include the teaching of Basic English in addition to its more general activities in promoting the teaching of English for its own sake. Diplomatic and commercial representatives in foreign countries will be asked to do all they can to encourage the spread of Basic English as an auxiliary language. It is also intended to arrange for the translation into Basic English of a wider range than is at present available of literature, scientific, technical and general, both from ordinary English and from foreign languages, and also to increase the supply of manuals of instruction in Basic English. Some Colonial Governments will be invited to issue handbooks in Basic English for Colonial peoples on agriculture, hygiene, etc., and to use it in some administrative instructions. The British Broadcasting Corporation has been asked to consider the use and teaching of Basic English in appropriate oversea programmes. Primary responsibility for questions affecting Basic English and for giving effect to the recommendations of the Committee of Ministers will rest with the Foreign Office through the British Council.

Technology of Tea

DR. E. B. HUGHES, past-president of the Society of Public Analysts and Other Analytical Chemists, was unable to deliver his presidential address when he retired from office last year. Accordingly he delivered it after the annual general meeting of the Society held on March 1, speaking on "The Technology of Tea". Tea-growing areas are not now confined to Asia ; the necessary tropical or subtropical conditions exist elsewhere and tea is now grown extensively in Africa, even so far south as Natal, and also in Russia. In the production of black tea, as distinct from green tea, the main processes are withering, rolling, fermentation and final drying. Withering is a partial natural drying process at as cool a temperature as possible. It dries the leaves to a condition in which they can be rolled and twisted by mechanical action simulating rotatory rubbing between the hands ; this damages the cells, whereupon, possibly as a result of 'disorganized respiration', oxidase of the leaf brings about 'fermentation'. This so-called fermentation is mainly oxidation of polyphenols of the leaf to quinone compounds, which readily produce reddish, copper-coloured condensation products. The polyphenols of the leaf are the so-called tea tannins, but they are not tannins in the ordinary sense, as they are not able to convert hide into leather. The rate of 'fermentation' is highly important ; if too rapid, it gives inferior products, and the greater rate of fermentation, combined with lower quality of leaf grown in hot humid conditions, produces a commoner quality of tea. Indeed, the differences in quality and character between teas from different areas are due mainly to differences in geographical and climatic conditions, rather than to varietal differences in the plants grown. Changes in climatic conditions in the same area may produce much choicer tea at one time than a month earlier or later. It is the practice of blending, dependent on the remarkable skill of the tea taster, that enables the consumer to be supplied with brands of unchanging character. Most good teas, as supplied to the consumer, are blends of more than a dozen lots. Green tea is not subjected to 'fermentation', the enzyme activity being destroyed by heating the leaf (steaming) as soon as possible after plucking, after which the leaf is rolled and 'fired'.

Timber-drying Kilns

LEAFLET No. 30 (August 1943) issued by the Forest Products Research Laboratory, under the auspices of the Department of Scientific and Industrial Research, is on "Observations on the Design of Timber-drying Kilns". The leaflet, which does not pretend to deal in detail with design and construction, may be consulted for the information given on the size of kiln, double-stack pattern, single-stack patterns, heating systems, control instruments, and loading and unloading facilities. It is pointed out that in a well-designed timber-drying kiln provision must be made for (*a*) adequate and uniform air circulation between the rows of timber, (*b*) control of the humidity of the air, and (*c*) control of the air temperature. It is a generally accepted fact that except for a very limited type of drying operation, adequate air movement cannot be obtained except by means of fans, and that as a medium for heating and humidifying the air, steam can scarcely be rivalled. The practice of placing the heating elements and fans above the pile of timber is now fairly common in kiln design,

as this arrangement simplifies the construction and renders it unnecessary to excavate a basement. The propeller or axial-flow type of fan has also proved itself to be rather more adaptable generally to the requirements of timber kilns than has the blower or centrifugal type; the leaflet, therefore, is confined to the overhead-propeller fan types of kiln.

Micronesia and Melanesia

"Island Peoples of the Western Pacific, Micronesia and Melanesia" is the title of another volume in the series of War Background Studies published by the Smithsonian Institution. It is compiled by Herbert W. Krieger, ethnological curator, U.S. National Museum. The work is exactly what is required by anyone following the War in the Pacific at the present time. The Caroline Islands, the Gilbert Islands, the Marshall Islands, Bougainville and the Solomons, New Britain and New Ireland are all mentioned. To begin with, there is a general account of the region and its discovery and early history. This is followed by particular accounts of Micronesia and its islands, and similarly of Melanesia. The description of the native peoples and their customs will prove particularly interesting to many readers. There are throughout a large number of excellent illustrations.

Public Health in Colombia

THE April issue of the *Boletín de la Oficina Sanitaria Panamericana* contains an interesting paper on this subject by Dr. Eduardo Santos, a former president of the Republic of Colombia. He states that in spite of adverse conditions 140 aqueducts, thirty sewers and twenty new hospitals have been constructed in the Republic in the past fifteen or twenty years. More than eight hundred institutions are now devoted to maternity and child welfare, and the prenatal services number at present 126 as compared with 62 in 1937. During this period hospital beds have been increased from 11,422 to 16,322, and forty-five hospitals with a total of 1,500 beds are now under construction. There are at present twenty-five tuberculosis dispensaries as compared with only four in 1937. The yellow-fever campaign is being carried on by the Government in collaboration with the Rockefeller Institute, which has an excellent laboratory at Bogotá devoted to the production of yellow fever vaccine. The campaign against typhus and bartonellosis is continuing. There is practical co-operation between the State and private agencies, such as the Red Cross, the Colombia Anti-Tuberculosis League, the Association for the Care of Lepers and other groups.

The Health of France

THE underground newspaper *Avenir Médical*, as quoted by *The Lancet* of February 12, gives the following account of the effects of food shortage in France. Adolescents are losing weight. Want of strength reduces the competence of adults for their work and favours accidents. Hypotension and anæmia are common. Bone decalcification and rickets are seen as in the regions invaded in 1914–18. 'War amenorrhœa' is prevalent in girls and young women. Famine œdema is becoming increasingly prevalent in private and hospital practice. Tuberculosis has risen by at least 20–30 per cent and assumes malignant forms which are rapidly fatal, especially in young people. Pregnant women being inadequately nourished bear underweight infants with a growing proportion of still-births.

Red Blood Cells as Wound Dressings

AN annotation in the *Lancet* (252, Feb. 19, 1944) directs attention to experiments by J. J. Moorhead and L. J. Unger (*Amer. J. Surgery*, 59, 104; 1943) on the application of pooled human erythrocytes, collected and stored aseptically, to wounds. The red cells form a gelatinous mass which dries over the wound, and it is claimed that sepsis subsides under this, while healthy granulations develop. T. H. Seldon and H. H. Young (*Proc. Mayo Clin.*, 18, 385; 1943) have experimented with a dried and powdered concentrate of red cells applied once or twice daily. In some cases this application smelt noticeably; in others it produced severe burning pain and was discontinued. In three cases it gave good results. These authors think that the method deserves further investigation and suggest that bovine erythrocytes might be tried.

An Astronomical Paradox

SCIENCE SERVICE has directed attention to an investigation by Dr. Otto Struve, director of Yerkes Observatory, of 48 Libræ, which "presents a notable paradox". This star reveals the characteristics of a super-giant and also of a main-sequence star. At wave-lengths longer than 3,650 A., a main-sequence *B*-type star is suggested; but at shorter wave-lengths the spectrum resembles a super-giant *A*-type star. During the last ten to twenty years, strong metallic absorption lines have developed. Some spectral lines arising in the gaseous shell surrounding the star are sharp and strong, while others are diffuse and weaker. On the whole, the observations indicate stratification in the tenuous shell surrounding the star. The outside layers are rotating slowly while the inner layers have a much higher speed of rotation, and at times they seem to be contracting and expanding. It is pointed out that there is a certain amount of resemblance between the shell surrounding this star and that observed in 1940 surrounding Pleione, but the peculiarities in 48 Libræ are more difficult to explain than they were in Pleione.

Announcements

PROF. W. H. PEARSALL, F.R.S., professor of botany in the University of Sheffield, has been appointed Quain professor of botany in University College, London.

MR. WALTER FITZGERALD, senior lecturer in geography in the University of Manchester, has been appointed professor of geography in the University in succession to Prof. H. J. Fleure, who retires next September.

DR. OTTO STRUVE, director of the Yerkes and the McDonald Observatories, has been awarded the Gold Medal of the Royal Astronomical Society for his work on the observation and interpretation of the spectra of stars and nebulæ.

PROF. C. H. BEST, professor of physiology in the University of Toronto, and Mr. T. Whittemore, archæologist, have been elected members of the Athenæum under the rule for special elections.

AT the annual general meeting of the Society of Public Analysts and Other Analytical Chemists, held on March 1, the following officers were elected: *President:* Mr. S. Ernest Melling; *Hon. Treasurer:* Mr. George Taylor; *Hon. Secretary:* Mr. Lewis Eynon.

LETTERS TO THE EDITORS

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

Ground and Cloud Scatter of Electromagnetic Radiation

In former communications, the scattered echoes observed with high-power pulses have been described[1,2]. On a frequency above the vertical-incidence critical frequency there are normally short-lived echoes produced by direct scatter from ionic clouds in region *E*, and a patch of long-delayed diffuse echoes which has been assumed to be produced by energy which has been reflected obliquely from region *F* and scattered on its way down to the ground.

Although the rapid reduction in amplitude with increase of frequency suggests that the long-distance scatter is produced by the clouds in region *E*, it has been difficult to prove that the scatter is not, in fact, at the ground. Using the known theory of oblique transmission, it is possible to calculate the shortest possible delay-time from the *h'f* curve on either assumption as to the origin of scatter. The difference is not large, but recent experiments in which both have been simultaneously observed have definitely shown that cloud-scatter is responsible.

The first experiments were made using a fixed frequency of 8·8 Mc./s. A typical record of the observed variation of delay-time (in units of kilometres of equivalent height) is shown in Fig. 1, together with the calculated values.

It has since been made possible to vary the frequency of the transmitter, so that the equivalent of an *h'f* curve is possible. A typical example is shown in Fig. 2.

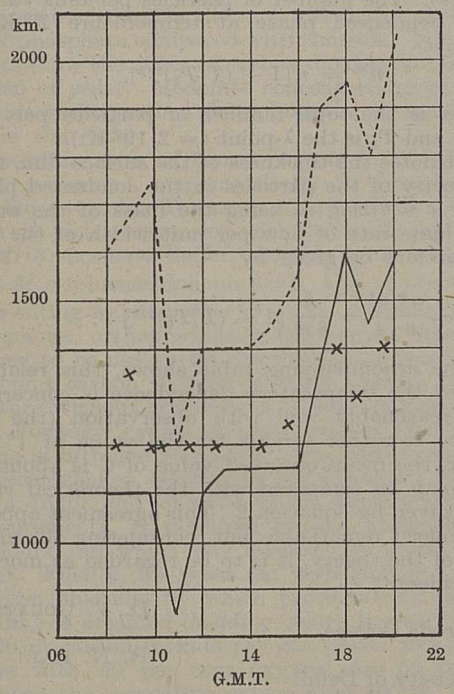

Fig. 1. Scatter delay on 8·8 Mc./s., Oct. 3, 1943. ×, Observed scatter delays; —, calculated delay for cloud scatter; - - -, calculated delay for ground scatter.

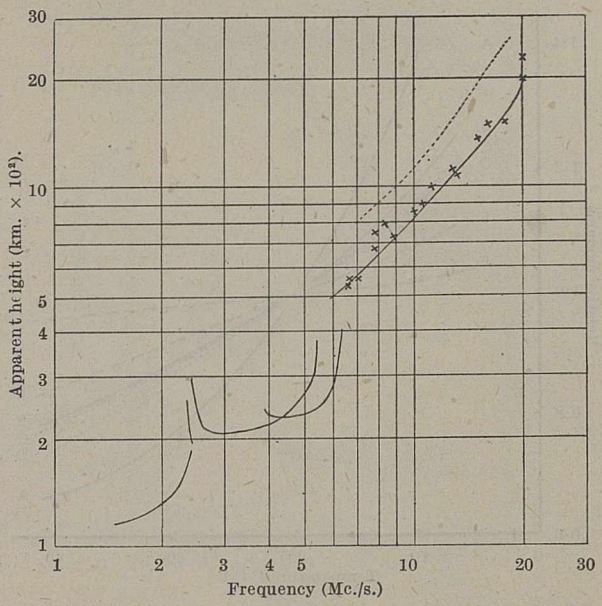

Fig. 2. Scatter *h'f* curve, 1110–1123 G.M.T., Jan. 4, 1944. ×, Observed scatter delays; —, calculated delay for cloud scatter; - - -, calculated delay for ground scatter.

It will be observed that in both cases the agreement with calculated values shows that the scatter is in fact from the ionic clouds, and the original theory is entirely vindicated. It is not proved that ground-scatter does not exist, because it would be mixed in with the cloud-scatter from lower-angle transmission; but the fact that there is no noticeable increase of amplitude at the delay corresponding to the ground-scatter shows that the cloud-scatter is predominant. The cloud-scatter will be less at higher frequencies, so that eventually the ground-scatter will predominate; but this is not likely to be the case until frequencies greater than about 30 Mc./s. are used, where ionic scatter becomes unimportant because of the lack of *F*-region transmission.

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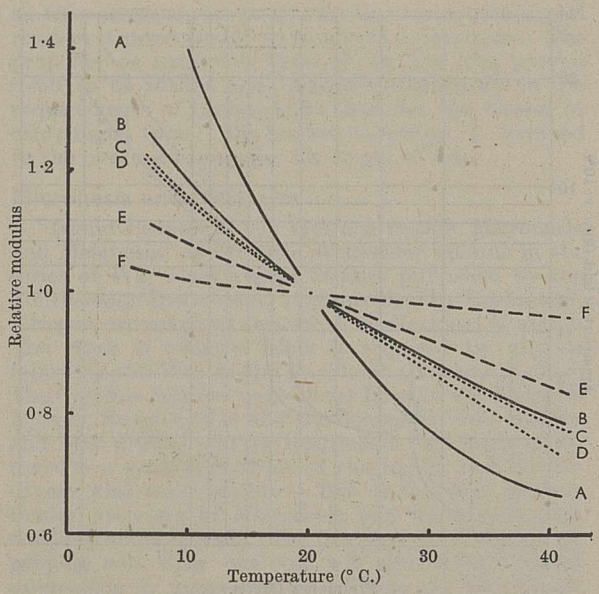
Effect of Temperature upon the Mechanical Properties of Rubber-like Materials

In the course of investigations into the mechanical properties of natural and synthetic rubber intended for use in anti-vibration devices, variations of a large order were encountered. As these variations seemed largely dependent upon temperature, a preliminary detailed examination in the region of 5–40° C. has been made. Using a mechanical vibrator somewhat similar to that employed by Gehman[1] and working at 20–60 c.p.s., measurements of dynamic elastic compression modulus and associated resilience were made by the well-known resonance method. A



detailed description of the apparatus, method and results is to be published later; for the present it may be said that the test pieces were in the form of cylindrical rubber blocks $\frac{7}{8}$ in. in diameter and $\frac{7}{8}$ in. high, bonded at each end to steel screws by the conventional brass-plate method.

The property of an elastic material which is of paramount importance in determining its use as a vibration insulator is the dynamic modulus (in compression and/or shear). In order to compare the temperature variation of a wide range of materials from very soft to very hard, a plot may be made against temperature of relative modulus, that is, modulus at the stated temperature divided by modulus at some standard temperature (20° C. in the present case). Some early results are illustrated by the accompanying curves. The area enclosed by the full lines *A* and *B* shows the variation of the modulus-temperature effect in a comprehensive series of 'Neoprene *E*' (chloroprene polymer) compounds, the dotted lines *C* and *D* show the effect for a range of *GR–S* (butadiene-styrene co-polymer) compounds, and finally the broken lines *E* and *F* show the effect for a series of natural rubber compounds analogous to those in *GR–S*.

The purpose of this note is to direct attention to the following facts in connexion with rubber-like materials intended for use in anti-vibration devices.

(1) The dynamic modulus has a considerable temperature coefficient.

(2) Quite apart from temperature variations likely to be encountered in service, this fact is of importance in the quoting of dynamic results. The temperature of test should always be stated.

(3) No sign of a temperature effect of this order is evident from static loading tests; in the present work these were carried out using a well-known torsion flexibility measurement.

(4) In view of these facts, the practice of specifying the low-temperature requirements of such products as instrument mountings (anti-vibration) in terms of a static test is likely to lead to wastage of valuable raw materials and labour in the production of articles quite unsuitable for their intended purpose.

Similar results have been reported by previous workers[2], but it is felt that a considerably wider appreciation of such facts would be of general benefit in the present emergency.

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Surface Flow of Liquid Helium II and Bose-Einstein Degeneracy

RECENTLY, London[1] has revived the theory of Bose-Einstein condensation and has discussed its application to explain some of the peculiar properties of liquid helium II. A most striking property of liquid helium II is the transport of the liquid over surfaces in the form of mobile films (thickness about 50 mμ) and, as is well known, it is because of the surface transport that the rate of flow of liquid helium II in very narrow channels (less than 10^{-3} cm.) is practically independent of the pressure head.

If v is the volume transferred per second per cm. width of surface, then the values of v for different temperatures, as observed by Daunt and Mendelssohn[2], are given below.

T_0 = λ-point = 2·19° K. $C = \dfrac{v}{1-(T/T_0)^{3/2}}$

T° K.	1	1·5	1·7	1·9	2·1	2·16
$v \times 10^5$ (c.c. per sec.)	7·4	7·5	6·3	4·0	1·2	0
$C \times 10^5$	10·7	17·3	19·9	20·9	19·7	0

It is interesting to observe that for a Bose-Einstein degenerate gas, a flow independent of pressure is realizable, this being due to the flow of the particles constituting the condensed phase (non-energetic particles). The number of particles per unit volume in the condensed phase at temperature T° K. is given by

$$n^* = n[1 - (T/T_0)^{3/2}], \quad . \quad . \quad . \quad (1)$$

where n is the total number of particles per unit volume and T_0 is the λ-point (= 2·19° K.).

If l denotes the thickness of the surface film, then the velocity of the particles in the condensed phase will be $u \sim h/2ml$, m being the mass of the atom. The volume rate of flow per unit width of the film will therefore be given by

$$v \sim \frac{n^*}{n}\frac{ul}{4} = \frac{h}{8m}[1 - (T/T_0)^{3/2}] \quad . \quad . \quad (2)$$

As the accompanying table shows, this relation, so far as the temperature dependence is concerned, agrees reasonably well with observation (the discrepancy is rather serious for the value at 1° K.). Further, the mean observed value of C is about 18, which may be compared with the theoretical value of 12·5 given by equation 2. This agreement appears to be indeed remarkable but, considering the crude nature of the theory, it is to be regarded as more or less accidental.

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Effect of Carbon Dioxide and Carbon Dioxide Fixation in Baker's Yeast

DETERMINATIONS of the amount of bound carbon dioxide in yeast cells under known carbon dioxide pressure in the gaseous phase were performed by me originally in order to investigate possible *p*H changes in the cells under different physiological conditions. This presupposes that carbon dioxide is bound in yeast chiefly as bicarbonate, which, however, according to the experiments described below, is probably not the case. In view of the importance of carbon dioxide in the metabolism of various cells, as pointed out by several workers, and in pursuance of earlier investigations on the physiology of baker's yeast, I have studied the influence of carbon dioxide on yeast metabolism.

The experimental material was fresh, compressed baker's yeast (dry weight *c.* 26 per cent) suspended in a *M*/15 sodium succinate buffer, *p*H 5·1 ; temperature 25° C.

The endogenous metabolism of yeast determined manometrically by means of the Warburg two-vessel method[1], as well as its uptake of glucose in the presence and in the absence of ammonium chloride, and, finally, the uptake of pyruvic acid, were found to be markedly higher under constant oxygen pressure and addition of up to 50 per cent carbon dioxide to the gaseous phase than in the controls in a mixture of oxygen and nitrogen. Anaerobically, however, the presence of 25 per cent carbon dioxide did not influence the uptake of glucose. The growth of yeast is markedly inhibited when the gaseous phase contains 50 per cent oxygen and 15–50 per cent carbon dioxide. During the endogenous aerobic metabolism, increased in the presence of carbon dioxide, the 'free' phosphate of the plasma, soluble in trichloroacetic acid, and the amount of orthophosphate passing to the outer solution (cf. ref. 2) were reduced. Anaerobically, carb n dioxide did not affect the amount of 'free' phosphate compared with controls. The experiments show the effect of carbon dioxide on the metabolism of yeast. Moderate concentrations of carbon dioxide in the gaseous phase, however, do not directly injure the cells.

Determinations of bound carbon dioxide in yeast were performed manometrically in trough-shaped Warburg vessels. The main compartment contained 1·50 ml. yeast suspension with 200 mgm. fresh yeast in *M*/15 succinate buffer, the side arms 0·30 ml. of 3·64 *M* *p*-toluenesulphonic acid. $\alpha_{CO_2}^{25°}$ of the mixture after tilting was found to be 0·728. Sulphuric, metaphosphoric, orthophosphoric and certain other acids proved to be useless for the fixation of yeast.

Bound carbon dioxide in yeast shaken in a gas mixture without addition of carbon dioxide is very low. For *baker's yeast*, the mean value of the measurements in nitrogen was 25 µl. ; for *starved yeast*, that is, yeast shaken aerobically for about 20 hours, it was *c.* 15 µl., and for yeast which, directly before the measurements, metabolized glucose aerobically for 2½ hours and which was washed (*fed yeast*), it was 40 µl. Finally, for yeast fed with glucose and ammonium chloride, by which procedure an incipient budding is attained (*budding yeast*), it was found to be 50 µl. carbon dioxide per gm. yeast. In a gaseous phase with 50 per cent oxygen plus 50 per cent nitrogen the respective values were 40, 20, 70 and *c.* 150 µl. carbon dioxide per gm. yeast. The bound carbon dioxide is markedly greater aerobically than

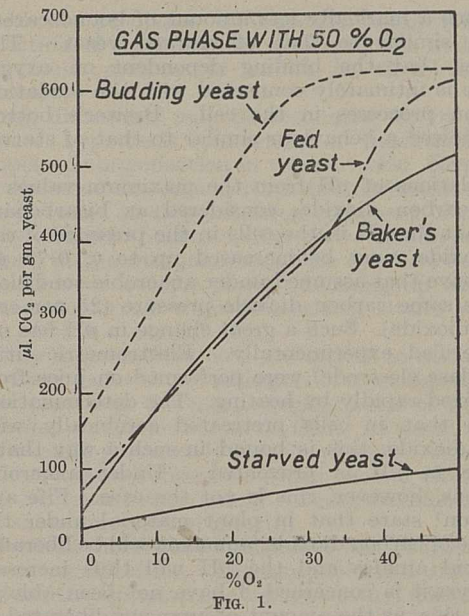

FIG. 1.

anaerobically, and it is dependent upon the endogenous metabolism and the thereby conditioned carbon dioxide pressure in the cell.

Fig. 1 shows the bound carbon dioxide of corresponding yeasts in a gaseous phase with an excess of oxygen (50 per cent oxygen) and varying amounts of carbon dioxide. Fig. 2 exhibits bound carbon dioxide at constant carbon dioxide pressure and increasing oxygen pressure. The curves are drawn from the mean values of a great number of determinations. As a consequence of changes in α_{CO_2} during mixing, carbon dioxide is developed in an atmosphere rich in carbon dioxide. Corrections for blank values at different carbon dioxide pressures were made.

The portion of the bound carbon dioxide dependent on the oxygen pressure is bound reversibly and mainly conditioned by the physiological state of the yeast. It is not influenced by illumination with visible light. In experiments on yeasts treated in advance with hydrogen sulphide, cysteine, cyanide, azide or iodoacetate, there was found under aerobic

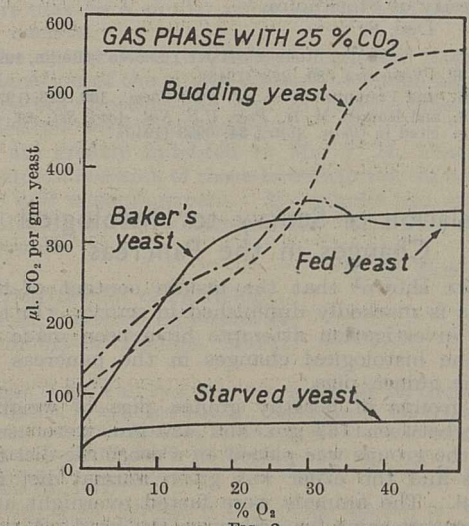

FIG. 2.

conditions a markedly less amount of bound carbon dioxide, similar to that of starved yeast. This indicates that the binding dependent on oxygen pressure is intimately connected with the oxidation-reduction processes in the cell. Brewer's bottom yeast showed a behaviour similar to that of starved yeast.

Calculations of *p*H from the maximum values of bound carbon dioxide, considered as bicarbonate, show that the *p*H in the cells in the presence of carbon dioxide must be increased up to *c.* 0·75 *p*H units above that assumed under anaerobic conditions and the same carbon dioxide pressure (25 per cent carbon dioxide). Such a great change in *p*H has not been verified experimentally. Electrometric titrations (glass electrode) were performed on juice from yeast, fixed rapidly by heating. The determinations indicate that in cells pretreated aerobically with carbon dioxide, this is bound in such a way that a decrease in *p*H is prevented. Under anaerobic conditions, however, this is not the case. Fife and Frampton[3] state that in plant material under the influence of carbon dioxide, ammonia will be liberated from acid amides and the *p*H will thus increase. Where yeast is concerned, I have not been able to confirm this, as the amount of ammonia liberated in the yeast was found to be extremely small, although the juice from yeast cells, pretreated aerobically with carbon dioxide, shows an increase in *p*H measured in absence of carbon dioxide in the atmosphere. Nor is it probable that carbon dioxide would be bound as carbamate (*R*.NH.COOH) at the *p*H in question.

The observations recorded here appear to have some connexion with the investigations performed on different material by Ruben and collaborators with radioactive carbon. Recently, Ruben and Kamen[4] have shown that baker's yeast can assimilate carbon dioxide (at present, the original paper is not accessible in Sweden). It appears probable that the carbon dioxide fixation described above might be interpreted as the first stage in the uptake of carbon dioxide and its further 'assimilation' in the yeast cells, corresponding to the dark reaction described by Ruben's school in connexion with experiments on photosynthesis.

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Relation of Scurvy to Histological Changes in the Pancreas

I HAVE shown[1] that the insulin content of the pancreas is markedly diminished in scurvy. In the present investigation attempts have been made to study the histological changes in the pancreas of scorbutic guinea pigs.

Two groups of healthy guinea pigs of weights varying between 163 gm. and 420 gm. were used. One of the groups was placed on a scorbutic diet for 24 days and the other was given normal diet for 15 days[1]. The animals were fasted overnight and killed next morning by a blow on the head. A portion from the tail end of the pancreas was fixed in Zenker-formol solution. Paraffin sections, 7 μ thick, were prepared, and these were stained with Heidenhain's iron hæmatoxylin and Heidenhain's 'azan' stains. In every fourth section from the tail end of each pancreas, stained with iron hæmatoxylin, the number of islets was counted and the size of the individual islets was measured. The results are summarized in Table 1 and the statistical analysis of the individual figures is given in Table 2.

PHOTOMICROGRAPH OF A SECTION OF GUINEA PIG PANCREAS; (*a*) NORMAL; (*b*) SCORBUTIC. × 80.

TABLE 1.

	No. of animals	Number (mean) of the islets in each section	Total (mean) size of the islets in each section (sq. mm.)
Normal guinea pigs	10	7·6	273·52
Scorbutic guinea pigs	10	11·2	1168·25

TABLE 2.

	Size of islets	No. of islets
Difference of the means	894·7	3·6
Standard error of difference	289·16	1·7
t	3·09	2·1
Remarks	Highly significant	Significant

The sections which were stained with 'azan' stain were examined for the different types of cells present in the islets of Langerhans. In the scorbutic guinea pigs, α-cells were found to be increased in number in proportion to the β-cells, and the β-cells were found to be mostly degranulated. There was no degenerative change in the sections studied. Photomicrographs show that the islets are very prominent in the scorbutic condition.

The increase in the size and also the number of islets may be due to Nature's attempt to react against the fall in insulin secretion observed in scurvy. The

absence of any degenerative change seems to be related to the fact that normal recovery takes place when the scorbutic guinea pigs are given supplements of vitamin C.

I wish to express my thanks to Dr. B. B. Sarkar and Mr. P. B. Sen of the Department of Physiology, University of Calcutta, for their kind help.

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Growth-Inhibiting Action of Some Pure Substances

THIS preliminary report describes the results obtained with a certain class of growth-inhibitors. Since evidence exists that *H*11 extract contains certain chemical compounds, it was decided to ascertain the inhibitory effects of some pure related substances upon the growth of the Twort carcinoma.

Tumour-bearing mice, averaging 25 gm. weight, were injected intraperitoneally, twice daily, with 0·5 c.c. of the solution to be tested. The surface areas of the tumours were calculated as the products of their diameters, and the group average determined. The inhibitory effect was calculated as the percentage difference between the average increases in size of the treated and the control mice.

Typical results obtained in comparable experiments are summarized in the accompanying table. Mice injected with certain chemicals, for example, anthraquinone, rapidly increased in weight during the course of the experiments, whereas the tumours were inhibited. Tests of substances toxic at higher concentrations, for example, the tannates, showed that, at lower concentrations, tumours were significantly inhibited, the host mice appearing completely unaffected.

Substance tested	Concentration (per cent)	Days of treatment	Percentage inhibition
Sodium tannate	0·25	28	83·3
Calcium tannate	Sat. soln.	8	51·3
1 : 2 : 4-trihydroxy anthraquinone	0·25	14	55·03
1 : 2 : 4 : 5 : 6 : 8-hexahydroxy anthraquinone	0·25	14	81·3
Anthraquinone	0·1	13	46·9
1 : 2-dihydroxy-5 : 8-naphthaquinone	0·25	14	90·6
henanthraquinone	0·1	8	52·1

Badger *et al.*[1] found that some quinone derivatives of carcinogenic hydrocarbons inhibited the growth of the Walker carcinoma 256, and Berenblum and Schoental[2] came to similar conclusions. Other phenolic, aldehyde and quinone derivatives of cyclic hydrocarbons have been tested; the results will be described later.

All these compounds have the property of combining with proteins. Derivatives of vegetable tannins react with proteins because of their polyphenolic constitution, and quinone compounds through their characteristic radicals. The inhibitory effects of these otherwise dissimilar substances are probably directly due to this reaction. A much greater inhibition of tumour-growth than of body-growth was produced. This greater susceptibility to the action of the inhibitors shown by the malignant cells must presumably reside in their intrinsic differences.

Such differences may be accounted for by a provisional hypothesis concerning a modification of cytoplasmic organization in tumour cells. Needham[3] has discussed the organization and differentiation of cells in terms of a cytoskeleton composed of protein fibrils. Wrinch[4] holds a similar view. The hypothesis is that, in the malignant cell, the cytoskeletal components have lost the power of linking up with one another to form a three-dimensional lattice such as may exist in a normal cell.

Fully differentiated cells are unable to divide, but the 'disarticulated' cytoskeleton of a malignant cell, while providing the morphological basis of dedifferentiation, would not hinder division. As the abnormal fibrils would presumably lose the power of responding to the evocator substances which control differentiation, malignant cells would remain undifferentiated and show unregulated growth.

Mottram[5] holds that malignancy results from cytoplasmic modification. The morphological differences between the cytoplasm of malignant and normal cells described by many workers are reviewed by Ludford[6]. The 'disarticulation' of cytoskeletal fibrils would result in such differences. The similarities between malignant cells and embryonic cells might also be explained in terms of the organization of the cytoskeleton.

On the cytoskeletal hypothesis, the various carcinogenic agents would induce malignancy by directly or indirectly modifying the cytoskeletal fibrils so that they no longer link up with one another. The pre-malignant period would be occupied by the accumulation of abnormal fibrils until their predominance prevents the formation of a normal 'articulated' cytoskeleton.

The mode of action of inhibitors with the property of tanning proteins would be to link up the discrete fibrils of a tumour cell to form a 'pseudo-cytoskeleton'; treated malignant cells would then become stabilized, 'non-malignant' cells, and would be much less able to reproduce themselves, with the result that the whole tumour would tend to regress. This effect of tanning agents on adult, healthy cells with normal cytoskeletons would be relatively insignificant. There may be a similar effect on the mitotic spindle and nucleus.

The cytoskeletal hypothesis furnishes a possible explanation of the site of action of tumour inhibitors which tan proteins and also of various phenomena associated with malignancy.

I am greatly indebted to Mr. J. H. Thompson, director of research of these Laboratories, for constant help and encouragement. My thanks are also due to Mr. C. R. B. Williamson for valuable technical assistance.

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Behavioural Changes in Spayed Female Guinea Pigs after Stilbœstrol Administration

IN a recent assay of the œstrogenic potency of stilbœstrol, the results of which will be published elsewhere, interesting behavioural changes were observed in our animals.

Altogether 25 spayed female guinea pigs were treated with subcutaneous injections of small priming doses (0·0005–0·0025 mgm.) of stilbœstrol for 6–10 days, and at the disappearance of the vaginal closing membrane this treatment was followed by massive doses (0·5–1·0 mgm.) of stilbœstrol for 2–5 days. Furthermore, five animals, 3–4 hours after the last massive dose of stilbœstrol, received a subcutaneous injection of 0·2 mgm. of proluton.

Within a few days of the commencement of treatment, and while still receiving only small priming doses of stilbœstrol, all our animals became extremely quarrelsome. Cage-mates previously living in peace and amity became pugnacious and bellicose, as shown in frequent fighting during which fairly severe injuries were inflicted, including lacerated wounds in the mid-dorsal region. Finally, it was necessary to house the animals separately during the whole period of the experiment.

There seems little doubt that this unusual and totally unexpected ferocity among the female of the species was a sequel to the administration of stilbœstrol, which induced in our animals a masculine aggression—a component of the male sex-drive.

It appears, however, that the male behaviour such as the mounting activity described by Young and Rundlett[1] is a regular feature of the heat response of the female of many species in which it is integrated into the pattern reaction of a normal *libido*. The androgynous complex has been described in the female guinea pig[2], female rabbit[3], female rat[4,5], the sow[6], the cow[7] and the ewe[8].

Young, Dempsey, Hagquist and Boling[2] relate mounting activity in the female guinea pig to the synergizing action of the œstrin and progesterone of the mature follicles, and this is supported by the findings of Young and Rundlett[1], who produced mounting activity in spayed female guinea pigs by injections of œstradiol benzoate followed by progesterone.

The extension of the male effector responses into the domain of overt sexual behaviour in females seems to indicate that there is some common denominator in the psychic urge motivating the male and the female response, and that the subjective and objective manifestations of the sex drive need not exist as clear-cut sexual differentials but, as in the guinea pig, there may be a certain overlap—the production of a specific hormonal complex.

It is therefore perhaps not altogether surprising that some slight deviation from the normal stimulus such as might be produced by the difference in chemical structure of stilbœstrol and the natural œstrogens should be reflected in the exhibition of masculine aggression. In other respects (copulatory response[9,10], mounting activity, and all the vaginal and uterine preparations) the œstrogenic response of stilbœstrol is normal and complete. This invites the hypothesis that the study of behaviour offers a delicate test of hormonal balance, and is a plea not to neglect altogether the reactions of the higher neurones in any biological assay of the internal secretions of sex.

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Counterpart of the Davidson Current

DURING the period of upwelling in the California Current, it has been said that the California and the Humboldt (or Peru) Currents, on opposite sides of the equator, are "mirror images" of each other[1] (p. 204). Since upwelling is almost a constant process in the Humboldt Current, the similarity disappears when upwelling ceases in the more northern current during late summer, and is not noticeable until upwelling starts again the following March.

Each current has a subsurface counter-current of equatorial subsurface water flowing at approximately 200 metres below the surface. The factor preventing the rise of the subsurface current to the surface in the California Current appears to be upwelling, for, when upwelling ends, the subsurface current rises to the surface and also continues to flow in subsurface levels. Therefore, along the coast of California, from approximately November to January, there is equatorial subsurface water flowing northward from the surface to the shallow sea bottom within the narrow limits of the coastal counter-current.

This inshore, northward-moving, winter current along the California coast was discovered by George Davidson, in charge of the first U.S. Coast and Geodetic Survey of the West Coast, and was named after him. Parenthetically, it is worth remembering that Davidson, who was a scholar as well as a surveyor, wrote the first "U.S. Pacific Coast Pilot". At the outset, it was published by a San Francisco newspaper, because Davidson had difficulty in persuading the Government to print the material since it was undertaken outside his regular duties. He began gathering and writing the first "Pilot" in 1850; the Government publication was in 1858. The book was so helpful to shipping that the demand brought three editions within the next eleven years. In 1880, Davidson was commissioned to revise the "Pilot" again. Evidently he was at last afforded sufficient time to carry out his desires, for, in the nine years that followed, he prepared the monumental contribution, which has not been superseded since its publication in 1889.

Sverdrup[1] (p. 79) states that, during upwelling, the surface waters of the Davidson Current are too disturbed to allow the rise of the subsurface current to the surface. Certain it is, that only when upwelling

ceases or tends to cease does the Davidson Current exist as a surface current.

After reviewing the available data, I have come to the conclusion that a similar situation is maintained within the counter-current under the Humboldt Current.

In the southern winter of 1931, Gunther[2] (pp. 55, 129, 163) found the subsurface, return current at the surface twice—once at Antofagasta (23° 49′ S., 70° 36′ W.), and again at San Juan (15° 30′ S., 75° 12′ W.). Gunther attributed the rise in both instances to the unusually strong upwelling. His description of conditions at Antofagasta is too limited to admit of definite conclusions, for he states that the situation here is unusually changeable.

But at San Juan, the wind was blowing from the south-east—an inshore wind at this point on the coast. Inshore winds tend to terminate upwelling, according to both Schweigger and Gunther. At San Juan, the subsurface current was at the surface for a width of 60 miles, and was flowing against the wind with a strength sufficient to carry the survey ship backward when the wind had a Beaufort Scale force four. A little to the south, and also to the west and to the north, the subsurface current had dropped below the surface.

It seems likely that the inshore wind had caused the upwelling to cease sufficiently at San Juan to allow the subsurface current to rise to the surface, similar to the Davidson Current and for the same reason[3]. The only real difference is that the upwelling in 1931 had ceased only in the vicinity of San Juan; whereas, in winter, upwelling ends throughout the coastal flow of the California Current.

Schweigger[4] has shown that, when upwelling is strong, even large attempted invasions from the north and west of tropical waters into the Humboldt Current area are held back. The data of the International Petroleum Company, Ltd.[6], recorded at Ancon and La Libertad, Ecuador, and compiled during the strong upwelling of 1938 support the same conclusion.

In 1939, the period of weak upwelling, the warm waters succeeded in entering the Humboldt Current area. They did not appear in one compact, surface water mass, but in bands or strips largely separated from the coast and from each other, either by cooler bands, or by successively or alternately warmer strips out toward the open sea. At times, these warm water areas were entirely isolated by surrounding cooler water. At Pisco, the southward moving surface stream was a torrent; yet less than seven miles farther south, the normal cool waters of the Humboldt Current were at the surface[5].

In my opinion, such strips or bands indicate a rising to the surface of subsurface water due to temporary cessation or weakening of upwelling within the Humboldt Current, typical of the Davidson Current. If this apparent tendency proves to be correct, to Gunther's suggested explanation of strong upwelling, the cessation of upwelling may be added as a possible cause for the rise to the surface of the subsurface current. If oceanographic data concerning low oxygen content in the subsurface waters be demonstrated to be as low as that in the subsurface waters of the east Pacific equatorial regions[1,7], this would offer another probable explanation for the occasional catastrophic death of the rich surface-water life in the Humboldt Current, and also another possible explanation for the appearance in these coastal waters of the mysterious recurrence of hydrogen sulphide, which is locally known as the 'Callao Painter'.

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[1] Sverdrup, H. U., "Oceanography for Meteorologists" (New York: Prentice-Hall, Inc., 1942).
[2] Gunther, E. R., Discovery Reports, **12**, 107 (1936).
[3] Mears, E. G., *Trans. American Geophys. Union*, pt. 1, 242 (Oct. 1943).
[4] Schweigger, Erwin H., *Compañía Administradora del Guano, Boletín*, **18**, No. 1, 27 (1942).
[5] Schweigger, Erwin H., *Bol. Soc. geogr. de Lima*, **56**, 178 (1939).
[6] Anglo-Ecuadorian Oil Co., Ltd. Observaciones meteorologicas efectuadas en Ancon y La Libertad, Peninsula de Santa Elena Ecuador, 1933–1941, por el personal de la Anglo-Ecuatorian oil co. Manuscript notes obtained from the Consul of Ecuador, Los Angeles, California (1942).
[7] Thomsen, Helge, NATURE, **127**, 489 (1931).

White Plumage of Sea-Birds

THE interesting communication from Dr. K. J. W. Craik in NATURE of March 4 has inspired me to look up my correspondence with the Government on the subject of war camouflage during the War of 1914–18, and I find, according to the official copies obtained through the Royal Commission on Awards to Inventors, that the letter laying down the principles now popularly known by Thayer's terms 'Countershading' and 'Dazzle' was addressed to the then First Lord (Mr. Winston Churchill) on September 24, 1914, and that which laid down the principle that the underside of opaque aircraft should be coloured 'brilliant white' was addressed to the then Secretary of State for War (Mr. D. Lloyd-George) and dated September 28, 1916.

Since these early days, I have had various entertaining encounters with camouflage artists—not to mention high Government officials—who held white to be the most conspicuous, instead of the least conspicuous, colour against a background of sea or sky, except, of course, under special conditions such as at sea when viewed from a high angle, or in the air when viewed against a dark sky or when banking and illuminated on the underside by the sun at a low altitude.

The utility of the white undersurface of aquatic birds and fish in reducing their conspicuousness as viewed from below by their potential prey is, of course, recognized by all field naturalists.

JOHN GRAHAM KERR.

House of Commons.

An Early Swanscombe Skull

IN all accounts and discussions which I have seen of the important fossil cranial remains found at Swanscombe in June 1935 and March 1936, there is no mention of an earlier discovery of more complete human skeletal remains made in the same locality some time prior to 1913. A few hours before this present note was written, I stumbled across the reference to this earlier Swanscombe skull. This reference is contained in a footnote to an article written by Dr. W. L. H. Duckworth[1].

It would be of great interest to know where these human skeletal remains are now to be found. It is to be hoped that this communication will lead to the location of these remains and to a full report on their history and character.

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[1] "The Problem of the Galley Hill Skeleton", in "Essays and Studies Presented to William Ridgeway" (Cambridge: At the University Press, 1913), 460.

THE SYCAMORE TREE

By ALEXANDER L. HOWARD

IN company with many other prosperous exotics, the so-called 'sycamore' has lived for many generations in Great Britain under a false name. Sycamore is an attractive name, but as applied to this tree it is both incorrect and misleading: the term *Acer pseudoplatanus* is equally so. The word 'sycamore', spelt by the early botanists 'sycomore', is the name for a fig tree, very well described by Pliny, 69–115 A.D. The botanical term *Acer pseudoplatanus* is inaccurate, as in no respect can the sycamore be considered a spurious or, in modern phraseology, *ersatz* tree. The only excuse which can be put forward is that the leaf resembles the plane in its shade of green, and also in its shape. If this reason be sufficient, then most certainly the botanical name for the wych elm should be *Ulmus pseudo-corylus*, since the resemblance between the leaf of the wych elm and that of the hazel (*Corylus avellana*) is greater. Four authorities of very different dates all bear witness to this long-standing mistake.

Pliny says:

"In Aegypt likewise there be found many trees which grow not elsewhere: and principally the Sycomore, which thereupon is called the Aegyptian Figtree. The tree for leafe, bignesse, and barke, is like unto the Mulberie tree. It beareth fruit not upon the branches, but out of the very body of the stocke. And the same is a passing sweet fig, but without any graines at all within. It doth increase in exceeding great abundance."

John Evelyn (1664):

"The Sycamore or Wild Figtree falsely so-called, is our *Acer Magus* or Broad-leaved *Mas*, one of the Maples."

Students of the New Testament remain under the impression that the tree into which Zaccheus climbed to see Christ pass on his way to Jerusalem was the sycamore as we know it, whereas it was in fact the *Ficus Sycamorus*—the fig mulberry. Even Jacob S. Strutt in his "Sylva Britannica" falls into this error.

William Boutcher, nurseryman, in 1776, writes:

"The greater Maple, in England *falsely* called the Sycamore and in Scotland the Plane tree."

Whether the term 'broad-leaved maple' as in America, the botanical name *Acer macrophyllum*, or *A. Magus*, or any other scientific name should be applied, matters not, but the tree should certainly not be called sycamore or *Acer pseudoplatanus*. In bark, twig, leaf, fruit, and flower, and more particularly in wood, there is no kind of resemblance between the so-called sycamore (English) and the plane. Both trees produce valuable and useful wood, but they are not suitable for similar purposes. Whereas the sycamore is not indigenous to Great Britain, its close relative—the small-leaved or old-English maple—belongs here, as will be seen later. Although the introduction of the sycamore to southern Europe may have occurred at an early date, Pliny does not mention it. The earliest known record is about the fourteenth century, when, according to the Rev. C. A. Johns, Chaucer speaks of it as "a rare exotic".

Elwes quotes:

"Clement Reid hazards the suggestion that it was introduced by the Romans. Ray states, Synopsis 230, published in 1690, that the Sycamore was then planted in cemeteries and about the houses of the nobility, and that it was nowhere wild in England."

All records show that it did not receive a very warm welcome. To quote John Evelyn again:

"the Sycamore is much more in reputation for its shade than it deserves . . . for the honey-dew leaves, which fall early like those of the Ash turn to mucilage and noxious insects and putrify with the first moisture of the season, so as they contaminate and marr our walkes, and are therefore by my consent, to be banished from all curious gardens and avenues."

The Rev. C. A. Johns, and all other early writers, speak of it unkindly, but the sycamore, in spite of this unpopular reception, seems to have become well adapted to its new habitat, and full of life, vigour, and determined perseverance, and has now become established in Great Britain.

In youth it cannot be classed among the beautiful trees of our landscape, but in later age the case is different, and the fully matured sycamore is a noble tree holding its own among its neighbours. While it is certainly surpassed in beauty by its cousin, the small-leaved English maple (*Acer campestre*), it is now an outstanding feature of parks and public gardens, churchyards and stately mansions, where it attains a certain grandeur. The crown in the early spring is clothed with rich green leaves falling in graceful sprays, which later turn to a darker colour, reminiscent of the ebony in tropical regions. As autumn approaches, the small-leaved maple turns to a rich gold, while the sycamore still holds its sombre green, only broken by the appearance of black spot, against which precaution should be taken. While its life may be extended far beyond 150 years, it cannot be said to compare in this respect with our indigenous trees, and the forester should therefore realize that it should be harvested at an earlier age than others—perhaps not later than 80–100 years, after which time the quality of the tree deteriorates. "English Forests and Forest Trees", published in 1853, mentions as the largest known sycamore at that time the tree at Bishopston in Renfrewshire:

"which measured 60 feet in height and 20 feet in girth. This tree is known to have been planted before the Reformation, and is supposed to be not less than 300 years old, yet it has the appearance of being perfectly sound."

But Elwes in 1913 says:

"I think the palm must be awarded to a tree near the Marquess of Ripon's house at Studley Royal, Yorkshire. This tree is about 104 feet high, by 17½ feet in girth. It has a very large burr close to the ground, where it is 29½ feet round, and a clear bole of about 30 feet."

He also mentions another tree at Powerscourt, Co. Wicklow, which "is a fine wide-spreading tree 80 feet high by 14 feet in girth". When I saw this tree in 1936 it was an outstanding example of grace and beauty, and always attracted the attention of many who travelled far to see it.

When felled at its prime, the sycamore tree provides a wood of such exceptional value that for this purpose alone its continued prosperity should be assured. The colour of the wood is creamy white, and the grain close, compact, and capable of an ivory surface—whether straight-grained and plain or beautifully figured with mottle or broken roe and mottle, it is always attractive and comparable to the wood of the same tree which has been imported from Canada and America in considerable quantities. The timber from these sources can be mixed with our own home-grown products, so that they are indistinguishable. When the wood is stained with a

solution it is possible to produce a surface which is so universally admired that it has proved invaluable for decorative purposes such as panelling and interior decoration of houses, and furniture : this production is known as 'hare-wood'. Sycamore has been used for the making of a great number of domestic utensils and furniture in its unstained condition, and for many years has been greatly in demand for rollers for printing linen. In this connexion Elwes mistakenly assumes that the outstanding value of this wood is for these rollers. In actual fact, the great value of sycamore renders it far too costly for this purpose, as the strict selection for quality and waste in conversion, both essential for this work, can only result in a loss.

While its natural colour is not always improved by exposure to light and air, if it is used where continual scouring and cleaning is necessary, it is an admirable medium, and since the eighteenth century it has been much in demand for kitchen tables, counters and the like. The gangway for the admission of Royal personages to King Edward's steam yacht was, by his special command, constructed of sycamore, which by continual scrubbing kept its spotless white appearance.

The small-leaved English maple (*Acer campestre*), improperly called the 'common or field maple', deserves especial attention. Why the undignified term 'common' should have been applied to it is difficult to understand. The dictionary gives as the definition of 'common', "vulgar, mean, usual, and public", but the tree is none of these—there is nothing mean about it, and it is by no means common ; in fact, to-day, whatever it may have been in the past, it is uncommon. It is one of the most beautiful trees which ornament the country, principally in parks and surrounding stately mansions. Throughout its life, whether in spring, summer, autumn or winter, it is a graceful feature of the landscape. Unadorned, its branches make a lovely pattern against the winter sky. In spring its tender pale green leaves present a pretty sight. In summer the spread of the foliage is different from all other forest trees ; but its full glory is reached in the autumn when the leaves turn to ripe gold.

In the historical place at Cassiobury Park, Watford, the seat of the Earls of Essex, among a unique collection of oaks, chestnuts, beeches, elms and ash trees, there were two early English maples, equal in beauty to any of that noble company, and one of them, probably the best of its kind, was to be found thirty years ago. Its important uses do not seem to have been ever fully recognized. Its suitability for hedgerows has been almost entirely ignored : in such places quickthorn, privet, cypress, yew, ivy, beech, hornbeam and Japanese *Lonicera nitida* are commonly employed, whereas the maple has had to struggle on alone without encouragement. English arboriculturists do not seem to have appreciated either its beauty or its value for timber, which was not the case with those earlier enthusiasts whose writings have come down to posterity. The Rev. C. A. Johns quotes that "Virgil represents one of his kings as seated on a *Maple* throne", and Pliny says "the trunk for beauty and firmness of grain is inferior only to the Citron wood". It is curious to notice that from the time of Evelyn no one seems to have been interested in furthering the claims of this beautiful tree. The timber generally is little known to-day, although it possesses qualities which would have rendered it invaluable in place of wood which has been imported from other countries. In this category may be named American, Canadian, European, Swedish and Norwegian supplies—most of them unknown to the craftsmen of those earlier times, who depended upon their own home-grown timbers for the supply of domestic utensils made of wood. Indeed, the origin of the name 'mazer' for bowls and drinking cups signified the name of the wood from which they were made, the word 'mazer' being a corruption of the old Welsh word 'masarn'—the maple tree. Such bowls and drinking cups were in common and continual use, and were handed down from father to son as heirlooms.

Even ordinary observers will have noticed the habit which many trees exhibit of throwing out all round the trunk, sometimes at the base, sometimes at the crown, and sometimes in between, the growth of tiny branches massed together. This habit is most pronounced in the English or common maple, and is even more abundantly found in similar trees of other countries. Such examples are highly prized and eagerly sought for, and when cut on the rotary machine, round the tree in veneer, the wood yields a product named 'birds-eye' maple. This peculiar growth increases the value threefold and sometimes more.

The ivory-white colour and the quality of the grain of the small-leaved maple enable the craftsman to produce an article which will withstand continual washing and preserve an ornamental surface. While the grain is tough, it is not brittle, and the tool of the sculptor or engraver can work it with satisfactory results in every direction of its growth. As Pliny says, "it is in great request for many exquisite and sumptuous workes".

In the list of trees which the future forester should establish, planting them again and again, the so-called 'sycamore' and the 'common' English small-leaved maple should certainly receive a prominent place. The man who plants these trees will be repaid in full measure, and in a shorter period of time than in the case of most hardwood trees.

BUILDING RESEARCH IN THE UNITED STATES

THE report of the British Building Mission, appointed by the Minister of Works in July 1943, on building methods in the United States, which has now been published by the Ministry of Works (H.M. Stationery Office, 4*d*. net) contains, among much that is of general interest, a good deal of special interest to scientific workers. This is particularly true of the first part of the report, dealing with the design of buildings. The report points out that American designers, knowing that many buildings of no great age are threatened with obsolescence of equipment and general design, show a tendency to assume that, in view of the rapidity of scientific development and social change, future generations of Americans will demand to live and work in buildings evolved by themselves and appropriate to their own times ; they appear to believe that many of the buildings of the present should be designed strictly for their immediate purpose, and that a limited life for a building may be an advantage rather than the reverse. American manufacturers are accordingly seeking to produce new materials fulfilling the general requirements of serviceable building but costing less

than traditional materials and not necessarily having the same length of life.

Early specimens of new materials for building construction were inspected by the members of the British Mission, who were informed that when in full production their cost would be substantially less than that of traditional materials. The importance of such developments with reference to the short-term planning of building in Great Britain to deal with the immediate problems of reconstruction in bombed areas needs no emphasis, while the observations on amenities in buildings are fully as relevant to a long-term building plan. The report mentions that the most noteworthy improvements in general amenities, particularly in housing, involved a considerable increase in the consumption of electricity, gas and water; thus the average consumption of water per head of population is more than double the British rate, while a number of plug-in socket outlets for electrical appliances is provided in every room.

A section in this first part of the report is devoted to research and information services. A considerable volume of scientific research is regularly undertaken by various interests including the Federal Government, universities, professional institutions, trade associations, materials manufacturers and organizations financed by private benefactors. The importance of research to American building is fully recognized by all concerned with the welfare of the industry. Large funds are expended, but while the Mission was impressed by the excellence and variety of the equipment in the research establishments visited, and the many channels of contact between research workers, there is no institution in the United States comparable with the Building Research Station in Britain, and greater co-ordination on a national scale is an admitted need. The keenest interest was expressed in many places in the work of this and other research stations of the Department of Scientific and Industrial Research; and British research concerned with the daylighting of schools and with the control of sound transmission in buildings is followed with special attention.

The large number of university-trained scientific workers employed in the American building and manufacturing industries, and the status of these workers, impressed the Mission, which considers that the efficiency of the industry in Britain would greatly benefit by the employment of more research workers and by the adoption of American methods of using scientific personnel. It is also suggested that existing provision for the exchange of scientific papers relating to building and constructional work generally between Government agencies in the United States and in Britain should be broadened, and that regular liaison should be established between the Ministry of Works and development and research organizations concerned with American building, including the National Bureau of Standards. The comparatively few personal contacts between research workers of the two countries appear to have been well worth while, and hopes are entertained of a regular exchange after the War.

In the United States, as in Great Britain, much of the research effort which would normally be directed to the improvement of building and building materials is now being expended in the war effort, and many advances are anticipated in the development of building materials, more particularly in plastics, non-ferrous metals, composite and temporary materials and materials used for thermal insulation. On the other hand, the Mission did not find many new materials in use, nor many new methods of using old materials. The more interesting materials are not yet in full commercial production. In particular, the application of plastics in building is at present inconsiderable. Some use has been made of extruded plastic pipes as an alternative to metal pipes, and the use of plastic sheets having a base of laminated paper or fabric for table tops, sinks, draining boards, etc., is expected to extend very rapidly after the War. The future of plastics in building, however, must depend on the cost of production.

Statistical research is of vital importance to the building industry, and this is well realized in the United States. Among the more outstanding work, the report mentions "The Study of Consumer Purchases", a social survey by the Bureau of Labour Statistics, which includes housing, furnishing and equipment; the Construction Section of the Census of Business, a national survey undertaken by the Department of Commerce in 1939; the regular bulletins on new building issued by the Bureau of Labour Statistics of the Department of Labour; the monthly bulletins of the same Bureau, giving details of labour conditions and trends; the analysis of new house building in selected areas published by the Federal Housing Administration; the annual report of that Administration, analysing building loans insured during the year; and the publications of the F. M. Dodge Corporation covering new building throughout the Eastern States and the Middle West.

Again, the Mission was impressed by the efficiency of American methods of disseminating the knowledge gained by research workers through trade publications and the daily Press, through wireless broadcasts, exhibitions and technical and scientific meetings and conferences. Materials manufacturers realize the importance of supplying architects and engineers with technical information about their products. The general excellence of the presentation of technical data is well exemplified in the information services of the Dodge Corporation of New York, while the small and medium-size instructional exhibition is regarded in the United States as one of the most useful and popular channels for spreading new information. The report suggests that this instrument should be fully used by the Ministry of Works and by the building and manufacturing industries in Great Britain.

One of the most impressive features of this exceptionally interesting report is, in fact, that it illustrates the soundness of many of the arguments advanced in Great Britain for extending the research effort and encouraging a wider utilization of science in industry.

Fuller use should be made of American experience with factory-produced houses, materials for soil stabilization, the moving of entire buildings, repair of damaged buildings by the cement-gun process, materials already in extensive use in the United States such as composite slabs and panels, asphalt floor tiles and pitch for flat roofing, and materials likely to be more widely used after the War, such as plastics and compositions making use of sawdust and other wood waste. In regard to investigations, those on installations and appliances for houses and flats, availability of public utility services, methods of thermal insulation, district heating and hot-water supply, abatement of noise in buildings, standardization of materials and components for quality and

performance and of dimensions of components and equipment and on artificial lighting of buildings, particularly of shops, museums and art galleries, should be pressed forward, while other investigations should be instituted into minimum standards of quality in house design and construction, and standardization generally.

Among the American practices adoption of which is recommended are simplification of design of buildings for greater standardization and for mechanization of constructional work, greater use of factory-produced units and assemblies, increased employment of scientific workers for industrial research in the factory and in the field, encouragement of operatives by spreading information concerning the job and by official recognition of good craftsmanship and greater use of plant machinery and hand-power tools. Finally, the report recommends that legislation be promoted with the object of securing registration of architects and of professional engineers, so that building plans shall be prepared by registered persons only.

SUB-ANTARCTIC AND ANTARCTIC POLYZOA

DR. HASTINGS' extensive monograph on part of the Polyzoa of the Discovery collections includes much careful and critical work*. The six families involved are the Scrupocellariidæ, Epistomiidæ, Farciminariidæ, Bicellariellidæ, Aeteidæ and Scruparidæ. The last family is, however, included with the Cellularina merely for convenience, and it is not intended to imply that it certainly belongs to that group.

The most important part of the work is undoubtedly the distributional data. Recent hydrological investigations made by the Discovery expedition have been available throughout, and correlation of the distribution of the antarctic and sub-antarctic species with the hydrology gives suggestive results. Thus change of hydrological conditions at the Antarctic Convergence appears to have a decisive influence on the non-abyssal Polyzoa. The presence of species with antarctic affinities in a zone off the Patagonian shelf is probably influenced by antarctic wa ers, and the distribution of abyssal species is possibly related to warm and cold deep currents.

An interesting fact is the similarity of the polyzoon fauna of Heard Island to that of the other islands in the South Indian Ocean although the hydrological conditions are different. Deacon (1933) has shown that these islands of the South Indian Ocean are hydrologically on the borderland between the Sub-antarctic and the Antarctic Convergence, Heard Island being well to the south and clearly antarctic hydrologically, but there appear to be grounds for regarding the Cellularine polyzoa of the islands, including Heard Island, as sub-antarctic rather than antarctic. It may be pointed out, however, that while Heard Island is connected with Kerguelen Island to the north by a submarine ridge, it is separated from the nearest point on the Antarctic mainland by some eight hundred miles of deep sea, for the so-called Kerguelen-Gaussberg ridge, although it represents a considerable rise in the floor of the great basin south of the Indian Ocean, still shows depths of more than a thousand fathoms over most of its length. The Patagonian region, on the other hand, has a series of stepping-stones with the Antarctic provided by the islands of the south antillean arc. In considering the distribution of a group such as Polyzoa, which are sessile during a large part of their life-history, these facts may help to explain why a correlation with hydrological conditions apparent in one region does not work in the other.

The collection is rich in ancestrulæ (the ancestrula being the first zooecium of the colony formed by the metamorphosis of the larva). These are different from the rest of the colony and important from a systematic point of view. They are only known in a small proportion of the species and much new material is described here. It was thought that these might give evidence of the breeding seasons. Although only tentative, the facts assembled seem to show that the ancestrulæ are more frequently found in the early months of the year, although colonies were collected over a period of from four to seven months.

The report is very well illustrated both by numerous clear text figures and photographic plates.

* Polyzoa (Bryozoa) I. Scrupocellariidae, Epistomiidae, Farciminariidae, Bicellariellidae, Aeteidae, Scruparidae. By Anna B. Hastings. Discovery Reports. Vol. 22. Pp. 301–510, plates v–xiii. Issued by the Discovery Committee, Colonial Office, London, on behalf of the Government of the Dependencies of the Falkland Islands. (Cambridge: At the University Press; 1943.) 9*d*. net.

THE GEOLOGY OF RHUM (INNER HEBRIDES)

AT the meeting of the Geological Society on January 19, Dr. E. B. Bailey presented some new facts and a revised interpretation of the igneous and tectonic geology of Rhum. A great dislocation described by Harker in 1903 as a Palæozoic thrust is now claimed as a Tertiary ring-fault with central uplift. Harker was influenced by the curvature of the outcrop of the fault, and by the slump-bedding of the Torridonian which he interpreted as a tectonic structure. He was also misled by a patch of Trias which he mistook for crushed Torridonian; by certain associated banded Lewisian gneisses which he regarded as banded Tertiary igneous rocks; and by a set of Tertiary explosion-breccias which he thought were crush-breccias developed by early Palæozoic thrusting. Bailey considers the outstanding tectonic feature of Rhum to be a block uplift, amounting locally to about 7,000 ft., which took place at the start of the Tertiary vulcanicity and was indirectly responsible for the inter-lava river gravels of the neighbouring island of Canna. The peridotites of Rhum were later than the block uplift; they rose along ring-fissures about a centre well to the west of that surrounded by the great initial ring-fault.

At the same meeting S. I. Tomkeieff described the petrology of the famous ultrabasic and basic plutonic rocks of the Island. The mineral compositions of the rocks and the order of crystallization have been accurately determined and it is shown that the ultrabasic rocks comprise a continuous peridotite-allivalite series which is assumed to have been formed by the crystallization of an already differentiated heterogeneous magma. How this differentiation took place remains the outstanding problem still to be solved. The basic rocks are mostly olivine-eucrites, locally strongly banded. A later boss of granophyre is found to be contaminated along its junction with the eucrite.

FORTHCOMING EVENTS

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

Saturday, March 18

INSTITUTE OF PHYSICS (INDUSTRIAL RADIOLOGY GROUP) (in Room 1, Chelsea Polytechnic, Manresa Road, Chelsea, London, S.W.3), at 2.30 p.m.—Open Discussion on Miscellaneous Questions on Industrial Radiology.

BRITISH INSTITUTE OF RADIOLOGY (in the Reid-Knox Hall, 32 Welbeck Street, London, W.1), at 2.30 p.m.—Mr. W. J. Meredith and Dr. G. J. Neary: "The Production of Isodose Curves and the Calculation of Energy Absorption from Standard Depth Dose Data"; Mr. P. H. Flanders: "A Demonstration of an Optical Contour Finder".

SHEFFIELD METALLURGICAL ASSOCIATION (at 198 West Street, Sheffield), at 2.30 p.m.—Dr. H. M. Finniston and Mr. T. D. Fearnehough: "The Physical and Mechanical Properties of Segregates".

Monday, March 20

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Dr. Franklin Kidd: "Dehydration of Foodstuffs" (Cantor Lectures, 1).

INSTITUTION OF ELECTRICAL ENGINEERS (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Discussion of "Industry's Opportunity in Education" (to be opened by Dr. P. Dunsheath).

SOCIETY OF CHEMICAL INDUSTRY (PLASTICS GROUP) (by invitation of the Nottingham Section), (at University College, Nottingham), at 6.45 p.m.—Mr. G. Loasby: "Nylon".

BRITISH ASSOCIATION OF CHEMISTS (TEESIDE SUB-SECTION) (in the Y.M.C.A. Rooms, Stockton), at 7 p.m.—Mr. A. Heron: "Micro-analysis".

Tuesday, March 21

BRITISH ECOLOGICAL SOCIETY (at the Linnean Society, Burlington House, Piccadilly, London, W.1), at 10.30 a.m.—Discussion on "The Ecology of Closely Related Species" (Speakers: Mr. D. Lack, Mr. C. Elton, Dr. G. E. Blackman, Capt. C. Diver, Mr. G. M. Spooner and Dr. G. C. Varley).

ROYAL ANTHROPOLOGICAL INSTITUTE (at 21 Bedford Square, London, W.C.1), at 1.30 p.m.—Mr. P. D. Mehta: "Tribes, and the Caste System of India".

ROYAL SOCIETY OF ARTS (DOMINIONS AND COLONIES SECTION) (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Dr. J. R. Furlong and Mr. E. L. Hill: "Paper-making Materials of the British Empire".

ROYAL COLLEGE OF SURGEONS OF ENGLAND (at Lincoln's Inn Fields, London, W.C.2), at 4 p.m.—Dr. Geoffrey Bourne: "The Problem of Bone Formation".

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY (at the University, Manchester), at 5 p.m.—Prof. H. W. Florey, F.R.S.: "Some Antibiotics with special reference to Penicillin".

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 5.15 p.m.—Sir Henry Dale, G.B.E., Pres.R.S.: "Chemical Factors in Nervous Effects", i. "Substances Imitating Nervous Effects—Adrenaline, Nicotine, Muscarine, Acetylcholine".*

INSTITUTION OF ELECTRICAL ENGINEERS (WIRELESS SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Discussion on "Treatment and Tests for Extreme Climatic Conditions" (to be opened by Mr. P. R. Coursey).

Wednesday, March 22

INSTITUTE OF FUEL (at the Engineers' Club, Albert Square, Manchester), at 2.30 p.m.—Mr. P. D. Kirkman: "The Use of Unfamiliar Fuel in Steam-Raising Plant".

INSTITUTE OF PHYSICS (LONDON AND HOME COUNTIES' BRANCH) (joint meeting with the LONDON AND SOUTH-EASTERN COUNTIES' SECTION OF THE ROYAL INSTITUTE OF CHEMISTRY) (at the Royal Institution, Albemarle Street, London, W.1), at 2.30 p.m.—Dr. L. R. G. Treloar: "Rubber and the Rubber-like State".

Thursday, March 23

TOWN AND COUNTRY PLANNING ASSOCIATION (at the Waldorf Hotel, Aldwych, London, W.C.2), at 12.45 p.m.—Luncheon preceding Annual Meeting; Rt. Hon. Sir Montague Barlow, Bart.: "National Planning and British Industry"; at 2.45 p.m.—Annual Meeting.

ROYAL COLLEGE OF SURGEONS OF ENGLAND (at Lincoln's Inn Fields, London, W.C.2), at 4 p.m.—Dr. Geoffrey Bourne: "Vitamin C and the Regeneration of Bone".

Friday, March 24

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 5 p.m.—Sir Lawrence Bragg, F.R.S.: "Lightning Calculations with Light".*

INSTITUTION OF MECHANICAL ENGINEERS (in conjunction with the MANUFACTURE GROUP) (at Storey's Gate, St. James's Park, London, S.W.1), at 5.30 p.m.—Mr. J. F. Kayser: "Surface Finish".

Saturday, March 25

ASSOCIATION FOR SCIENTIFIC PHOTOGRAPHY (at the Caxton Hall, Westminster, London, S.W.1), at 2.30 p.m.—"The Assessment of Lens Performance" (Mr. A. Cox: "General Theory of Lens Performance"; Mr. H. W. Martin: "Lens Types and their Characteristics").

BIOCHEMICAL SOCIETY (at the Courtauld Institute of Biochemistry, Middlesex Hospital, London, W.1), at 2.30 p.m.—Annual General Meeting.

APPOINTMENTS VACANT

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

PSYCHOLOGIST (full-time) for the Child Guidance Clinic—The Acting Director of Education, Becket Street, Derby (March 22).

SPEECH THERAPIST—The Director of Education, Education Offices, Woodlands Road, Middlesbrough (March 25).

SUPERINTENDENT OF THE METALLURGY DEPARTMENT—The Director, National Physical Laboratory, Teddington, Middx. (March 25).

DEPUTY BOROUGH ENGINEER AND SURVEYOR—The Town Clerk, Finsbury Town Hall, Rosebery Avenue, London, E.C.1 (endorsed 'Deputy Borough Engineer') (March 27).

TEACHER OF ENGINEERING SUBJECTS (in particular Engineering Science) at the Cambridgeshire Technical School—The Education Secretary, Shire Hall, Cambridge (March 27).

LECTURER IN THE MINING DEPARTMENT—The Principal, Technical College, Church Street, Barnsley (March 27).

LECTURER IN PSYCHOLOGY—The Principal, Froebel Institute, at Knebworth House, Knebworth, Herts (March 28).

LECTURER (full-time) IN THE DEPARTMENT OF BUILDING of the Leeds College of Technology—The Director of Education, Education Offices, Leeds 1 (March 28).

DEMONSTRATOR IN CHEMISTRY—The Dean, Guy's Hospital Medical School, St. Thomas's Street, London, S.E.1 (March 31).

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

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

TECHNICAL DEVELOPMENT OFFICER—The Executive Officer, Bucks. War Agricultural Executive Committee, County Offices, Aylesbury, Bucks. (March 31).

DIETITIAN-IN-CHIEF—The Secretary, University College Hospital, Gower Street, London, W.C.1 (March 31).

DIRECTOR OF THE ELECTRICAL DEPARTMENT (location, Bahamas)—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Advertising Section, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. D.773A) (March 31).

BOROUGH ELECTRICAL ENGINEER to the Great Yarmouth Corporation—The Engineer and General Manager, Electric House, Regent Road, Great Yarmouth (March 31).

ASSISTANT CHEMIST for the Shellac Research Bureau at Edinburgh—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Advertising Section, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. F.1994A) (March 31).

LECTURER IN THE MECHANICAL AND CIVIL ENGINEERING DEPARTMENT—The Registrar, Technical College, Sunderland (April 3).

SENIOR LECTURER IN MECHANICAL ENGINEERING, and a LECTURER IN BUILDING SUBJECTS—The Clerk to the Governors, South-East Essex Technical College and School of Art, Longbridge Road, Dagenham, Essex (April 3).

GRADUATE TEACHER OF GENERAL SUBJECTS, particularly MATHEMATICS—The Principal, Leicester College of Technology and Commerce, Leicester (April 5).

DIRECTOR OF THE ART GALLERY AND MUSEUMS—The Town Clerk, Council House, Birmingham 1 (endorsed 'Art Gallery Director—Room 1') (April 12).

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

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

W. H. COLLINS PROFESSORSHIP OF HUMAN AND COMPARATIVE PATHOLOGY—The Secretary, Royal College of Surgeons of England, Lincoln's Inn Fields, London, W.C.2 (July 31).

LECTURER IN THE ENGINEERING DEPARTMENT (chief subject ENGINEERING DRAWING and DESIGN up to Higher National Certificate standard) of the Bournemouth Municipal College—The Director of Education, Town Hall, Bournemouth.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

London School of Hygiene and Tropical Medicine, incorporating the Ross Institute. Report on the Work of the School for the Year 1942–43. Pp. 42. (London: London School of Hygiene and Tropical Medicine.) [162

Imperial Forestry Institute: University of Oxford. Nineteenth Annual Report, 1942–43. Pp. 12. (Oxford: Imperial Forestry Institute.) [172

The International Secretariat of the Future. Lessons from Experience by a Group of Former Officials of the League of Nations. (Post-War Problems.) Pp. 64. (London: Royal Institute of International Affairs.) 2*s.* 6*d.* net. [212

Ministry of Health and Department of Health for Scotland. A National Health Service. (Cmd. 6502.) Pp. 86. 1*s.* net. A National Health Service: the White Paper Proposals in Brief. Pp. 32. 3*d.* net. (London: H.M. Stationery Office.) [212

Catalogues

The Microtimer. Pp. 2. (London: R. K. Dundas, Ltd.)

Catalogue of Books on Various Subjects. (Catalogue No. 670.) Pp. 74. (London: Francis Edwards, Ltd.)

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