NATURE

"To the solid ground
Of nature trusts the Mind that builds for aye."—Wordsworth

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NATURE

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THE INTERNATIONAL LABOUR ORGANIZATION AS A SOCIAL FORCE

A SIGNIFICANT passage in the recent report of the Conservative Central Committee on Post-War Problems, "Work: The Future of British Industry", recognizes the importance of strengthening existing institutions such as the International Labour Organization. The recent conference in London of the governing body of the International Labour Office has done something to bring more to the forefront a body the potentialities of which for reconstruction and the re-establishment of world order appeared to be in danger of being overlooked. Mr. Eden and other Government spokesmen have from time to time referred to those possibilities, notably in the debates in Parliament on economic reconstruction last year, but despite an admirable series of reports from the International Labour Office and the League of Nations, there have been few signs that practical steps are being taken to utilize the services of the International Labour Organization and to expand them where required to deal with the problems of relief or resettlement. The reference to the International Health Organization in the report of the sub-committee of the United Nations Relief and Rehabilitation Administration on policies with respect to health and medical care which has been included in the recently published report of that body* is not satisfying. While it welcomes co-operation with existing international health agencies and recognizes that the Health Organization of the League of Nations and the Industrial Health Section of the International Labour Office have much to offer on the basis of their experience and accomplishments, it does not encourage much confidence that such co-operation will in fact be fostered, or that new organizations will not be established where existing organizations might serve.

The decision that the governing body of the International Labour Organization is to meet and arrange for a full International Labour Conference next summer should dispose of the fear, entertained not without some reason, that the major Governments of the United Nations would allow the International Labour Organization to dwindle away in favour of new *ad hoc* organizations. The decision also represents, besides the preservation of continuity in international life, the formal association of employers and workers, as distinct from their governments, in post-war reconstruction. The bringing together of governments and occupational or technical groups, on which Mr. Bevin laid much stress in welcoming the delegates to the governing body at its opening meeting, may well be of decisive importance to the functional approach to international problems which now finds general favour, as well as in building up a moral force behind international law itself.

* United Nations Relief and Rehabilitation Administration. Resolution and Reports adopted by the Council at its First Session, held at Atlantic City, New Jersey, U.S.A., November 10 to December 1, 1943. (Miscellaneous No. 6, 1943. Cmd. 6497. London: H.M. Stationery Office, 1943. 1*s.* 3*d.*)

Much more indeed may flow from this termination of the neglect of the International Labour Office, for its brilliant studies and reports such as "The I.L.O. and Reconstruction", "Wartime Developments in Government-Employer-Worker Collaboration", "Wartime Transference of Labour in Great Britain" and "Approaches to Social Security", have fairly established its reputation as a leading world centre, even during the War, for research into labour and social problems and for the dissemination of accurate and unbiased information. There must obviously be some adjustment of the relative spheres of, and the co-ordination between, the International Labour Office and the Relief and Rehabilitation Administration, the Permanent Organization on Food and Agriculture, and the other economic agencies to be set up. But beyond this, there must be hard thinking on the forms of international organization which the United Nations propose for the general welfare after the War.

If the International Labour Organization is to make the contribution to world co-operation and the elimination or minimizing of those strains in the economic and social structure of the world that tend to international friction and misunderstanding which the reports already referred to have suggested, important work must be done both at the International Labour Conference and before it meets. The growing social consciousness has strengthened the tendency to regard the International Labour Organization as a vital international agency and the desire for closer international co-operation in labour matters. Mr. Bevin asserted that the Organization must become the body charged with the duty of assisting governments by advice to give effect to that article of the Atlantic Charter under which the United Nations seek to "bring about the fullest collaboration between all nations in the economic field with the object of securing for all, improved labour standards, economic advancement, and social security".

It is true also that functional organizations such as the International Labour Organization are important means by which the smaller Powers can take their place and exert their influence in an international community; further, the method fits the circumstances of the United States, with its readiness to co-operate in practical work of the moment and its reluctance to make formal commitments. Nevertheless, there are important obstacles still to be overcome. The absence of Soviet Russia from the International Labour Organization, due to an old technical quarrel, is one; the attitude of American Labour is another.

To overcome these and other obstacles it is essential that the future status and policy of the International Labour Office should be clearly visualized, and this should be an early item in the agenda of the forthcoming conference. There must be unequivocable decision as to whether the International Labour Office is to be just an instrument for the co-ordination of information, or whether it may become a positive international instrument of co-operation for the improvement of existing laws and conditions, the regulation of labour supply, the protection of workers against sickness, old age, and accidents, industrial welfare and safety, and labour relations. There have been sharp reminders of the way in which a backward labour policy in even one of the United Nations may hinder the great war effort now demanded of us and delay victory, while in turning to face the problems involved in post-war reconstruction and a full employment policy, we cannot but be aware that the success of measures projected in Britain will depend on social, economic and labour conditions elsewhere.

For all that, a narrow view of the functions of the International Labour Organization is still taken in some quarters, and scientific workers are far from being alive to the extent to which this affects their own direct interests. Few of them have shown much appreciation of the work which the International Labour Office has done in such technical matters as industrial safety and health, accident prevention or the like, and its careful studies of the position of professional workers, of service agreements and like matters, have largely been ignored by their professional organizations. Moreover, the suggestion advanced by Sir Frederick Leggett on behalf of the British Government at the session of the governing body of the International Labour Office on December 18, on joint industrial committees on international lines, can scarcely have its full effect without their participation.

Sir Frederick suggested that the International Labour Organization could bring together employers and workers in the coal, iron and steel, engineering, building and civil engineering, textile and transport industries. He thought that great benefit would result from employers and workers themselves dealing with each other internationally, as they now do in national industry; and Sir J. Forbes Watson, welcoming a resolution for a revision of the constitution of the International Labour Organization submitted by the workers' group, urged that the Organization should not be too conservative. Its machinery clearly requires strengthening to fulfil the mandate implicit in the Atlantic Charter, and if there is to be a wide view of its functions, its machinery must be examined in a constructive and courageous as well as critical spirit.

Such a wide view of the functions of the International Labour Organization and revision or extension of its organization does not mean an extension into the high politics of economic affairs. The line may be hard to define at times, and in the economic and social sphere technical matters often tend to pass into the political sphere. None the less, in the future as in the past, the International Labour Organization will make its best contribution to the promotion of social justice and the adoption of humane conditions of labour as envisaged when it was first established, if it keeps so far as possible within the technical field, and contents itself with purely advisory functions when political action by governments appears to be necessary.

If, however, those technical functions are to be exercised most effectively, the full support of all scientific and technical workers will be essential. That contribution must be made, in the main, through their professional associations, and it is to

be hoped that in approaching the problems of post-war reconstruction, as some of them are now doing, they will take a much wider view of professional activities and responsibilities than in the past. It is not merely that past neglect of the work of the International Labour Organization in the professional field must be remedied; there must also be a much clearer and more realistic view of the functions of professional associations than has characterized them in the past. They have a distinctive technical contribution to offer, which has sometimes been as readily thwarted by political proclivities as it has been by the innate conservatism of all professional associations. The meeting of the governing body of the International Labour Organization and the forthcoming conference give a direct challenge to professional workers for the creative thinking which must precede both the re-shaping of the Organization itself and the effective functioning of technical and scientific workers in a democratic system which will adequately serve the changing needs of the post-war world.

CONTROL OF CIVIL AVIATION

International Air Transport

By Brig.-Gen. Sir Osborne Mance, assisted by J. E. Wheeler. (International Transport and Communications.) (Issued under the auspices of the Royal Institute of International Affairs.) Pp. x+118. (London, New York and Toronto: Oxford University Press, 1943.) 7*s*. 6*d*. net.

UPON agreements among the nations of the world on the future development and organization of civil and military aviation may depend the very existence of civilized progress and freedom as we know them. Upon agreements among the nations of the world, by which they yield up some part of their national sovereignty to an international controlling body, may well depend a world organizing for peace. The failure to arrive at such agreements, the demand by each nation that its national sovereignty must be kept intact in the air, on the sea, and on the land, will ultimately lead to another world war, far more disastrous in its effects than the present one—one from which, indeed, the world may not recover for many generations.

These are strong statements to make, but a little reflection will lead to the conclusion that there is some justification for them; and very little knowledge of the past and possible future developments of air transport will convince those who acquire that knowledge that there is a very serious justification for the statements.

"International Air Transport" is an important book, for it supplies in a condensed, authoritative, logical and readable form just that information which all those who have not studied deeply the implications of air transport should have in their possession before they attempt to form public opinion, or worse still, take part in the laying down of air legislation. In its twelve chapters, the book contains the most concise, and documented, summary of the development of civil aviation, its failures and successes and its political repercussions, which has yet appeared.

The difficulty of arriving at a solution of international air traffic and control is nothing like so great technically as it is politically. In the past, civil aviation has been used as an instrument of policy, often closely linked with military aviation, and civil air lines have been used to give military pilots intimate experience of routes over which they have to fly in war. To quote from the book:

"Perhaps the most striking and extensive use of aviation for economic, political and military penetration was made by Germany in Latin America. Partly through the direct action of the Lufthansa, partly through numerous highly subsidized companies under Lufthansa control thinly veiled by national façades, partly through the grant of extensive long-term equipment loans to these virtual subsidiaries, and to other local companies when in need of financial assistance, German control of aviation extended to nearly every South American country. A large proportion of the technical and flying personnel were either Germans or Germans who had been nationalized in a South American country for expediency's sake. . . . An attempt was made to secure a contract from the Ecuadorean Government to operate a service to the Galapagos Islands which could have no possible commercial justification, but the Islands happen to lie in a highly strategic position just off the Pacific entrance to the Panama Canal . . . since the outbreak of war, German air activities in America have been largely eliminated by expropriation and other measures".

Now it could quite easily have been argued that this South American development on the part of Germany was purely the altruistic one of commercial expansion, and it may be a difficult argument to combat.

In the past, two methods have been suggested to control civil aviation with the view of abolishing also the chances of air warfare. One has been by international regulation and supervision of the manufacture and export of aircraft, and the other international organization of air transport. Attempts to carry out both these methods have failed; largely because it was believed that there was not enough difference between military and civil aircraft, and that any nation allowed to construct the latter could easily adopt them for the former. This reason is far less strong to-day than it was. Any present-day civil aircraft would make a poor military aeroplane for fighting and bombing purposes. But the danger still remains that civil transport machines, of the many varieties which will be developed, could be used for the transport of troops, munitions and guns.

It is becoming increasingly clear that only by some world-wide authority, overriding that of any particular nation, and provided with the necessary power to enforce its decisions, can the menace from the air be prevented; that is, the formation of an international air police force which would supervise the observance of civil air regulations and decisions regarding aircraft construction. As the authors point out, this police force would be quite different from whatever international military force may be created for protection against aggression.

The world stands at the cross-roads of aviation, and upon which road the nations decide to take may well depend the future of the world. It is to be hoped that the United Nations have already prepared the basis for an international co-operation and control which will prevent any nation becoming aggressively active at the terrible speed which aviation will enable it to be.

This is a book which should be widely read.

J. L. PRITCHARD.

FOOD-POISONING

Food-Poisoning

Its Nature, History and Causation, Measures for its Prevention and Control. By Elliot B. Dewberry. Pp. viii+187+17 plates. (London: Leonard Hill, Ltd., 1943.) 15*s*.

TO the Ancients, food-poisoning meant, as the name implies, the intentional adulteration of food with some deadly poison, and official food-tasters were still in vogue up to the Middle Ages. In the nineteenth century it was noticed that acute attacks of diarrhœa and vomiting followed the ingestion of certain foods, and the illness was blamed on ptomaines, the toxic alkaloids which are formed when foods are in an advanced stage of putrefaction. Later it became apparent that outbreaks of gastro-enteritis frequently followed the eating of apparently normal food, and just over half a century ago, when bacteriology was still in its infancy, Salmon, in the United States, and Gaertner, in Austria, showed that these alimentary upsets were due to certain bacteria (since called the Salmonella) and their toxins. About the same time van Ermengen, in Belgium, proved that the neuro-paralysis which frequently followed the eating of German sausage was due to the powerful toxin of an anaerobic sporing bacillus which he called *B. botulinus*, and the disease botulism. In the past fifty years much has been added to our knowledge of this type of food-poisoning, perhaps better called food infection or intoxication, and this knowledge has been collected and admirably arranged by Mr. Dewberry, together with sections on food-poisoning with metals, poisonous plants including the fungi, poisonous fish and shellfish, food allergy, and the contamination of food by war gases.

In dealing with the most common form of bacterial food-poisoning, that characterized by an attack of diarrhœa and vomiting within twenty-four hours of eating the peccant food, the author describes first the responsible bacteria—the Salmonella family, now more than 120 strong, certain Staphylococci, and certain strains of Proteus—some of which produce the syndrome early because the toxins are already formed in the infected food, while others, ingested with the food, produce their toxin in the gut, so that the onset of symptoms is delayed for 6–24 hours. The most common vehicles of infection nowadays are milk and milk products, or *prepared* meats (pies, sausage, brawn, boiled ham, etc.) which have been contaminated by human or animal carriers, and which act as culture media for these food-poisoning bacteria. Less often the infection is present before the animal is slaughtered for food and, because calves are particularly liable to Salmonella infection, veal is most likely to be infected in this way. The difficulty in sterilizing infected meat, particularly in a pie, is pointed out.

On the other side of the picture, the great improvement in the canning industry has meant that infection of tinned food before the tin is opened is now uncommon. No cases occurred among British or Allied troops during the War of 1914–18 despite the enormous amount of tinned food that was consumed.

In regard to sources and reservoirs of infection, Mr. Dewberry quite rightly stresses the importance of human convalescent carriers and mild 'missed' cases; but chronic Salmonella carriers must be extremely rare. Rats, mice and ducks are other sources of infection, and the house-fly, as carrier, must not be forgotten. The machinery for investigating and controlling food infections is fully discussed, with bacteriological technique given in an appendix. Food-poisoning due to the contamination of food with metals is, with the possible exception of lead and arsenic, quite rare, because metals are rendered inert by combination with the protein in the food. Botulism gets forty-eight pages, although it is a very rare infection in Britain—only one small outbreak has been reported since the Loch Maree tragedy in 1922. The organism is found in the soil of most countries, and, in recent years, many cases of botulism in America have been traced to infection from home-canned fruits and vegetables due to the fact that the spores of the organism require several hours' heating at 100° C. to destroy them. They are, however, much less resistant in an acid medium.

This is a book which in its lucidity and simplicity of language should appeal to the interested layman as well as to the medical expert. Its pages are enlivened by photographs of many pioneers in this branch of medicine, including a goodly sprinkling of Englishmen, but not, unfortunately, of Salmon.

ROBERT CRUICKSHANK.

PLASTICS

Plastics in the Radio Industry

By E. G. Couzens and Dr. W. G. Wearmouth. ("Electronic Engineering" Technical Monographs.) Pp. ii+58. (London: Hulton Press, Ltd., 1944.) 2*s*. 6*d*. net.

THIS, the second of the technical monographs issued by the publishers of *Electronic Engineering*, does not quite justify its title, for although it contains a full description of the types of plastics, their methods of manufacture and processing, and their general physical properties, their uses in the radio industry are barely mentioned. The authors, Mr. E. G. Couzens and Dr. W. G. Wearmouth, present the subject mainly from the point of view of the industrial chemist; that is, they describe plastics *for* the radio industry, rather than plastics *in* the radio industry. An amazingly gaudy frontispiece shows how dazzling to the eye is a collection of typical plastic products, but there is no discussion of their uses, and a natural desire to suppress some of the cruder decorative effects may blind one to the fact that brightly coloured insulating sleeving may serve useful technical purpose in identifying the elements of a complicated radio network.

There is, of course, much in the booklet to interest workers in the radio field, and perhaps it is legitimate to assume that they are already familiar with the kind of equipment for which such materials can be and are in fact used, and that what they most require is classified information on all the types they are likely to meet. This information is plentifully provided; the means of identifying the various plastics by heating tests, trade names and sources of supply are given, as well as the electrical and general physical properties. Experimentalists will be interested in the cements and solvents listed for the various materials, as well as some of the details of moulding, polishing and machining. A chapter on electrical properties is sufficient to outline the essential practical data, and to show the complexity of the relation between electrical properties and the factors such as temperature, frequency and molecular structure, which control them. Little attempt is made, however, to give a scientific discussion of this side of the subject.

MEDICAL AND SURGICAL ACHIEVEMENT IN THE U.S.S.R. DURING WAR*

By E. ROCK CARLING

WHEN the fighting was at its height in Crete, 2,164 years ago, the people of Knossos applied to those of Cos, then the leading medical school in the world, for a military surgeon. Hermias, who was sent, did his duty so well that he not only saved many lives, but also by his example sustained the morale of the troops and thus contributed to victory. An inscription acknowledging his merits with gratitude is extant in Cos to this day, unless the Germans have recently removed it to grace one of their museums.

The duties of military doctors differ from those of their civilian colleagues. To relieve suffering, to save life, and to restore function, are indeed a part of their task; but there is an overriding duty—to keep every possible man in the firing line, and to return every possible man to that line at the earliest moment after injury or sickness. This may mean, for example, that a lightly wounded man has priority for attention over one so gravely injured that, though he recover, he will never return to the front.

More men leave the front as the result of sickness than of wounds. Sickness has determined many campaigns since that of Hannibal against Rome, and doubtless many before it. Thus a supremely important but undramatic part of the military medical officer's duty is concerned with sanitation in all its aspects, with such things as water supplies, and particularly with 'prevention'; from the control of flies, mosquitoes and other pests, to inoculation against specific diseases like tetanus, typhoid, yellow fever, and so on.

Modern implements of war, in their design, require the aid of physiologists and medical specialists if their full efficiency is to be achieved. It is idle to fabricate very powerful machines unless their control is within the physiological capacity of those who are to use them. In many cases elaborate measures must be devised to extend the limits of normal human functions. To endure extremes of temperature or to protect against them; to ensure co-ordination of the sensations and reactions in the atmospheric conditions of high altitudes and at great depths; to perfect the adaptation of vision to dim light; to control, or sometimes for offensive purposes to enhance, the means of illumination and dazzle; to protect against, and incidentally to find means to evade the possibility of protection against, flame as a weapon of offence; to perfect the means of audible communication amidst external din; to concentrate nourishment in palatable form within restricted limits of weight; to find means of minimizing the effects of rapid acceleration and deceleration of the body, and of the motions which produce sea and air sickness. These and many similar tasks called urgently for further consideration by several committees of the Medical Research Council in Britain at the outbreak of war, and concurrently with the rapid development of the machines have demanded continuing intensive research. The Russians have, so far, not emulated our other Allies in pooling the results of their researches; but it is certain from the success that has attended their corresponding weapons in the field, and indeed their whole military effort, that they have solved the problems which have beset us. Like ourselves, they have mobilized the resources of their physiological, pathological and other research departments to promote the efficiency of their military forces.

The Russian is a man with a realistic sense of the main chance, and the Soviet military surgeon, like others, believes in prevention at all costs. Thus it is that the Russian soldier of the Red Army finds himself better prepared to face the rigours of winter than his counterpart in the vaunted German military machine. If one sees, as one may, ill-shod folk in the streets of Moscow, it is because the soldier must have the best footwear if he is to sustain, in wet, cold and rough going, the sternest tests. No civilian in Russia grudges sacrifice or discomfort or hardship that is the outcome of the soldier's necessity. The Red Army is the darling of the nation. The people have unshakable confidence in it. It is perhaps the knowledge of the implicit trust reposed in them by their own people that inspires the Soviet soldier to such heroic deeds, to such wonderful feats of endurance. To have created such morale in people and army alike is one of the major achievements of Marshal Stalin and those who serve him.

Of the actual achievements of the Red Army doctors we shall not know in full until years after the War, when medical history is written. All I can do is describe what we of the Surgical Mission saw and did not see (though we looked for it), in our carefully conducted visit to the Red Army. In the South African Campaign I was plunged into a devastating epidemic of typhoid fever at its height. I know what it does to an army and the strain it puts upon the medical corps. In the War of 1914–18 I learned what a very different picture is presented at an advanced C.C.S. when wounded men are streaming in from victory or dragging wearily back from unsuccessful fighting. In this War it has been my rather tragic duty to witness in most of the heavily attacked cities the effect of bombing on civilians of all classes. I have been privileged to see and hear a good deal of the most modern accomplishments of our own and our Allies in war surgery and medicine. My companions on the Mission were men of similar experience and knew what to look for. With that background, then, what did the Russian picture reveal?

A first estimate of the achievements of military medicine in the U.S.S.R. may be deduced from the fact that the Red Armies are still in the field and victorious after retreats of depressing magnitude. There are authenticated examples in history of the collapse of good troops in the face of epidemic sickness and mass casualties, simply and solely because of the absence of a competent medical personnel. It is certain that the Russian soldier must have been well cared for; it is certain that the organization and the standard of service we witnessed must have extended, if not quite at the level chosen for demonstration to foreigners, yet at approximately that level along all the fronts, and throughout the territory to which troops found their way.

The People's Commissar of Health claimed that the U.S.S.R. have practically abolished two of the greatest scourges of armies in the field: one universal on modern battlefields—gas-gangrene—and the other, formerly endemic in a great part of the territory over which their fighting spreads—typhus fever. He told us that since the fighting began there has been no

* Substance of a Friday evening discourse at the Royal Institution delivered on February 25.

cholera. He also claimed that they get 70 per cent of their wounded back into the firing line—a figure not reached elsewhere. Probably we get between 60 and 70 per cent back into service, but not all of them into the front line. How have these feats been accomplished ?

I am not prepared to admit as yet that either typhus or gas-gangrene has been entirely prevented, or treated with such uniform success as might appear from the claims put forward ; but undoubtedly the Russians have controlled typhus epidemics where they might have devastated an army ; and they acknowledge the same methods we ourselves employ in the mitigation of gas-gangrene. It may be that they have other and better methods than those disclosed ; but so far, the allied medical corps are unaware of them, or of documented reports that justify confidence in their existence. On the other hand, the traditions of Russian research are so great, and the devotion of the Soviet authorities to-day to research in every field so intense, that there is nothing inherently improbable in a claim which perhaps can only be publicly substantiated after the War.

In connexion with those research traditions, one may consider three names, those of Mendeléeff, Metchnikoff and Pavlov. First, that of Mendeléeff, upon whose fundamental work much of modern chemistry rests ; remotely, but veritably, he laid foundations upon which modern biochemistry has been built, with all that the sulphonamide drugs have accomplished by way of lessening the horrors and the tragedies of the battlefields. It is not such a far cry from the recognition of atomic numbers and the Periodic Law to the production to-day by the ultrasonic generator of microcrystals no more than eight times the size of a red blood corpuscle by Prof. Paramanov. Nor to the fabrication of emulsions by Prof. Lossovsky, which, by the aid of chemical stabilizers, gradually dispense with more and more oil until they are almost wholly aqueous. Both these methods permit safer use of sulphonamides intravenously ; indeed, in one respect they have gone farther than we—injection into the arterial as well as the venous stream. This is the appropriate place to mention penicillin. The Russians having hitherto scarcely any supply, though our Mission took a small quantity, Prof. H. W. Florey has been sent to Moscow with a considerable quantity of the drug and all his knowledge. That is one of the gestures made by the British and American Governments to convince the Russians we are ready to put all our resources, all our discoveries in any science, at their disposal. Of course, we should welcome reciprocal trust.

Metchnikoff, who worked largely in Paris, made great contributions both to bacteriology and to the understanding of the natural defences of the body against infection, which we now exploit by every means that can be devised. It is in the tradition of his work that the attention of Russian research should be directed not only to the control of infecting organisms by bacteriophages and bacteriostatic agents, but also to new methods of stimulating the defensive mechanism. For that purpose they are exploiting 'activators' of various kinds. Prof. Bogomouletz produces sera by injection into horses of splenic and lymphatic tissue, and finds that their action upon mesoblastic structures, particularly the vascular network, materially stimulates repair. They use the sera to promote healing of gastric ulcers and also to diminish the period of repair of wounds. They claim something like a 20 per cent reduction of invalidity-time in cases of fractures and gross soft-part wounds.

They have other methods of producing the same effect, by burying under the skin partially ischæmic cutaneous flaps or placental tissue prepared by a chemical treatment. Extracts of placental tissue are also employed to hasten the 'taking' and the growth of skin-grafts. We saw these methods in use in the wards of Profs. Louria and Friedland.

Pavlov, whose contributions to physiological psychology introduced the element of measurement and exact observation necessary for all scientific advances, clarified a wide field of mental processes ; he trained a school of Russian psychologists whose labours in their turn have been fully employed by the Red Army medical authorities in the training, conservation and care of their man-power. One example from their system of rehabilitation of the lightly wounded soldier struck me forcibly. These men go to special hospitals where curative measures, both operative and physiotherapeutic, are employed. There, 'education' accompanies their progress and serves a twofold purpose. A man may return to his regiment fully restored to his former vigour ; but he rejoins men who have had further experience that he has not shared. To that extent he is at a disadvantage and his sense of this particular inferiority may be deflected to the past disability, which he had far better forget. The Russians, therefore, see to it that his rehabilitation education shall make him more expert than ever in the use of his weapons ; better acquainted with the enemy methods and weapons he has to meet, and familiar particularly with the latest type of offensive machines of all kinds, and with the drill necessary for their most effective use. He then goes to his regiment with something his comrades do not possess, the last word in means for defeating and destroying the enemy ; he has at least one source of superiority and his morale is that much heightened.

Even to so elementary a medical requisite as cleanliness, the Russians add a psychological twist. Wounded men come in extremely dirty and often with several days' growth of beard. So, upon entry to the reception ward they find a 'barber'—not an orderly turned hair-cutter but a professional *coiffeur* who shaves them skilfully, cuts and shampoos the hair and starts the sequence which restores a man's self-respect. Thence they pass, after a drink of vodka, to the care of nurses, who bathe those who cannot manage for themselves—they have a real nursery 'tub'—and provide them with a clean set of underclothes or pyjamas. Only then, when they feel respectable again, does examination, sorting, dressing, begin. The cleanliness and warmth go some way towards 'resuscitation' of cases suffering largely from the fatigue, exposure and thirst which account for a good deal of the minor degree of shock. Of course, some cases are far too seriously ill to undergo this whole process ; but wounds as such are no bar, for they are covered with waterproof bags or 'jackets', and in the case of broken legs the patient is put upon a slatted wooden stretcher before immersion and the limb can be completely steadied by ties to the slats. A good wash restores morale. These examples, trivial as they are, illustrate the realistic attitude of the Russians and the intelligence with which their problems are attacked. Their psychology, theoretical and applied, is far from being at fault. Perhaps the success of their propaganda has prepared us for appreciation of their psychological methods with the soldier.

In my youth there was a famous book (Hilton on "Rest and Pain"), the theme of which was advocacy of immobilization; it held sway and governed practice for a generation. "Rest must be secured if pain is to be abolished." The pendulum of opinion swung and the supreme importance of early movement after injury was taught by the foremost surgeons of the day. We all know rather more precisely now when to employ rest and when movement.

In the recent Spanish War, a very well-known surgeon of Barcelona, Trueta—happily and fruitfully working among us now—advocated the treatment of gross injuries of the limbs, and especially fractures, by so close an application of plaster-of-Paris cases that all movement of the muscles of the limb was inhibited. Called the 'skin-tight plaster', it fitted like a glove. He advocated and secured 'rest', and the immobility of the muscles was so perfect that the pumping action which they normally exert upon the veins and lymphatics was abolished, and thus poisonous substances fabricated in the wounds failed to reach the general circulation, where their toxic effects would endanger the life of the patient. The principle is one which makes imperative meticulous observation of certain essential preliminaries in the way of operation and treatment; but in appropriate circumstances, the method is now very widely used in the Allied Armies and probably in those of the Axis, too. There was an earlier protagonist of a form of this expedient, an American, Winnett-Orr, to whom surgery owes very much, but the actual initiator of the close-plaster was a Russian. Pirogoff, whose name is known to every British medical student as the originator of a particular type of amputation which bears his name in our text-books, has been described as the "greatest Russian surgeon, and one of the greatest of all military surgeons". He used plaster-of-Paris for fractures in the Crimean War. He had noticed the use of plaster by a sculptor and realized at once how it could be adapted to war injuries. He wrote repeatedly on the subject, but years later lamented that neither French nor Italian military surgeons knew of his method.

Pirogoff's contributions to surgery were many. One more may be mentioned. Perhaps only after hearing of Florence Nightingale, but at any rate, in the Crimean campaign, with the help of one of the Grand Duchesses, he introduced nurses into military hospitals of the Russian Army.

Nursing means rather more in Russia at war than it does with us. Not more than our nurses would certainly volunteer to do did the necessity arise; scarcely more than they were ready to do in North Africa: but the position of women is a little different in the Soviet State in peace as well as in war. It is, I think, fair to say that the concession to women in the U.S.S.R. of exactly the same 'rights' as men has led to the full acceptance by them of their implied duties. Nurses go not only to the front-line hospitals, but also up to main dressing stations and into the line itself. They reach wounded men under fire, and drag or carry them to safety, and even if need be, defend their patients from enemy attack.

On our way to the front we found all the main road-crossings guarded by women soldiers carrying tommy-guns, and it was obvious that they would not have stood upon ceremony if our cars had not promptly obeyed the 'halt'! We did not, at the clearing hospital, see any armed nurses, but many women have been decorated for feats of bravery.

Of the versatility of the Russian nurses we had evidence enough. The story of their prowess with the axe, saw, plane and spade is now well known, and we witnessed it. The 2,000-bedded hospital in the pine-forest had at the time of our visit only about 700 patients, but the Orel advance was about to begin and expansion to 4,000-bed capacity was under way. The nurses not needed for their professional work were taking a full share in all the labours of construction, foundation digging, timber squaring, carpentry, camouflage and decoration. Very deft with their tools they seemed to be. It must not be forgotten that for our entertainment that evening those same women staged a very good cabaret show.

To judge of their proficiency in their proper sphere we had opportunity in operating theatres. It was manifest that the standard of the theatre sisters and their staffs was very high. As surgeons we felt that we should confidently work in theatres run by those women. In no hospital that we visited did we observe evidence of poor ward-work. Their bedsteads and mattresses are not so good as ours, and that makes nursing more exacting; demands more conscientious attention to detailed care; and I think we are entitled to infer that nursing is well done.

Organization is a strong point in the Russian of to-day. The basic plan of military hospitals is flexible; they are planned in units which may be grouped or detached at will; the staffing is so systematized that a unit sent forward from a base hospital can take over the whole or a section of a forward post. They have aimed at 'leap-frogging' as a means of maintaining continuous service in advance or in retreat, so that the supreme requirement of getting the wounded early to operation can be fulfilled in all circumstances. In our own North African war, with characteristic capacity for putting a telescope to a blind eye, the British overlooked the rules laid down in the manuals and improvised just such a leap-frogging plan—section by section—to the great betterment of a threatening situation. Necessity, with us, mothered invention; the Russians planned it in advance. Moreover, they have so arranged the segregation of all regional wounds in their forward clearing hospitals, into the care of front detachments of the staff of their head, chest, abdominal, plastic and orthopædic hospitals, that the patients fall at the earliest moment into the hands of those who will initiate specialist treatment. The same 'teams' will have members away in the far rear, to whom long-stay cases are sent, and thus the whole course of a soldier's invalidity can be controlled and studied by the same specialist staff. There is no doubt that such a system, if the nature of the warfare permits its adoption, is the best devised for saving not so much the life as the full function of the wounded. This, perhaps, is one of the means by which they secure so high a percentage of return to full duty. By contrast with the Soviet success in this respect, one may compare the results on the same ground a century and more ago.

In Napoleon's campaign of 1813, out of 22,000 French soldiers admitted to certain hospitals during May 1–June 1, 6,700 officers and men were known to have returned to active service in their units: just over 30 per cent. Another 20 per cent were capable of some duty; the total figures may have been higher in both categories, but certainly did not approach the modern Russian claim. Moreover, there were 972 amputations in that one month—tragic testimony to the prevalence of gangrene. 2,400 died, that is, more than 10 per cent of those reaching base hospitals.

These French figures were given by the great military surgeon Larrey, of whom Napoleon said, on leaving him 100,000 francs, that he was the most virtuous man he had known. Of cases reaching our own base hospitals in some recent actions, the deaths were little more than 1 or at most 2 per cent.

I have sat at a table in a clearing hospital behind the front with a woman surgeon wearing five wound stripes, and in the same hospital saw a woman operating on chest cases, of which she had done more than a thousand. Many women doctors have been decorated for bravery. It is perhaps of interest to mention that whereas in peace 50 per cent of medical students are women, now in war they number 85–90 per cent of the 24,000 a year being trained. 16,000 young military doctors, of both sexes, were given special courses in military medicine in 1942.

Another test of efficiency that may be applied is the recognition of problems of major importance in modern military experience. One of the most valuable of all modern methods for saving the life of the wounded soldier is blood transfusion, and here the Russians have been no whit behind us. Their methods for the collection, preservation and distribution of whole blood, their preparation of dried blood constituents for reconstruction in the field, and their many plasma substitutes, indicate very clearly how early and how thoroughly they were seized of the immense life-saving value of this means for controlling 'shock'. A minor measure reveals their appreciation of a psychological factor. The blood is mainly given by women —95 per cent of it, we were told. To the ampoule of blood the name of the girl donor is attached. She knows the wounded Red Army man will hear of her. He knows to whom he is indebted. Romances result and are broadcast for their full propaganda worth. The man who has once benefited, if he be wounded again, asks for the same life-giving blood once more. Blood donors in Great Britain may be interested to know that after tests, and on arrival at the taking station, all women are clothed in sterile garments, caps and masks, before admission to one of the four theatres kept for the four blood groups. They are given a light meal, without fats, just before the blood is drawn. In another station the donor does not enter the theatre at all, but lies upon a couch and thrusts her cleansed arm through a sterilely curtained window into the room where the blood is taken. The arrangements are on a vast scale and thought out to the last detail. As many as eight hundred donors are bled daily in one institute. The headquarters of the Blood Transfusion Service has seventy-nine subsidiary institutes under its control, with 1,500 minor stations. Preservation of the blood calls for methods adapted both to the duration required and to the means of transport. When taken by air at high altitudes or in the very low temperatures of winter, special insulating boxes must be used. Distribution is generally by air.

As to other pressing problems, we were fortunate enough to obtain first-hand evidence from distinguished research workers. The Academicians Orbeli and Lena Stern, whose studies have for long been devoted to the elucidation of the functions of the autonomic nervous system, are probably responsible for the orientation of Soviet thought towards neural rather than biochemical predominance in normal and disturbed metabolic functions.

The former, Orbeli, has among other applications of his research, turned to advantage his long studies of the phylogenesis of parts of the nervous system in relation to dark-adaptation of the eye, especially for night-pilots, using his differential study of the rods and cones, and of the Purkinje effect, to that end.

Lena Stern, the only woman Academician, has tackled a problem that still eludes complete solution. It is recognized that in some cases of what we loosely term 'shock', a phase is reached when no amount or kind of transfusion is effective. The dynamics of the circulation have been disturbed to a degree which is 'irreversible'. It is a stage desperate as regards the patient's recovery, and justifies desperate remedy. Stern believes that the 'irreversibility' is dependent upon a complete loss of tone of the musculature of the whole vascular system. She believes that tone is ultimately controlled by centres bordering upon the cerebral ventricles; probably the fourth ventricle particularly. Potassium stimulates the sympathetic and calcium the parasympathetic. She therefore forcibly injects into the cisterna magna, and believes that she thus directs into the ventricle a sterile solution of potassium phosphate; the potassium for its direct effect, the phosphate radical to form, with calcium already present, a non-ionizable and inert compound. An injection into the cisterna magna, except in very expert hands, and in conditions giving guarantees against infection, is not a method to be lightly employed. The syndrome it is sought to remedy is met with within a matter of hours after wounding and exposure; met with, therefore, most frequently before the victim arrives at a well-stabilized hospital, and the remedy must be chiefly useful, at any rate until its value is very thoroughly established, in the hands of experts who reach the forward positions. Prof. Stern stated that a considerable number of reports of success with her method had reached her, but among Russian surgeons generally its use, we gathered, is regarded as experimental. Incidentally, Prof. Stern told us that she had had success with the treatment of tetanus by the cisternal route. In man many severe cases had been cured, and in horses there was a 100 per cent recovery.

As with the Russians, so among the other Allies, the factor of fluid loss in shock has been in the foreground of the picture, but in recent years there have been periods when the neurogenic factor has been enthusiastically pursued here; its importance, however, has never gained unquestioned credence. The 'toxic' factor, to the importance of which Sir Henry Dale directed attention twenty-five years ago, and to the investigation of which his researches lent such impetus, has again come right into the foreground and is engaging a great deal of attention. The Russians have not entirely overlooked this possibility.

We were interested in one method of treatment which runs contrary to all past experience, ours and their own, for frost-bite. It has been the universal practice, of mountaineers as well as soldiers, to avoid rapid warming of parts involved. To rub gently with snow; to warm the rest of the body, perhaps, but to keep the frozen or menaced areas cool. The Russians now put the patients into a well-warmed ward and deliberately heat the frost-bitten limb. They believe in early excision of dead tissue, and, we gathered, in early amputation, and that may possibly be part of the explanation: they cut their losses. But they maintain that their method has a sound physiological basis.

In 1812 Larrey said that the hospitals of Moscow, both military and civil, were the finest he had ever seen. That could not be said to-day of those we saw. The

buildings are not recent. It is an item to which the Soviet has not yet fully turned its planning attention. When it does so, it is certain that the structures will be determined by function and leave nothing unfit for comparison with the best of other countries. The scale upon which the Russians think is illustrated by their projected great Research Institute, V.I.E.M. It was intended at first to erect it in Leningrad, but afterwards Moscow was decided upon. The plans are, as they themselves say, grandiose. With only five hundred beds for the intensive study of normal health and somatic disease, they provide approximately a hundred sets of laboratories or departments and 1,300 workers as a beginning. Since every medical student proceeding to an M.D. must present the results of research, which with clinical work normally spreads over six years, the laboratory space, technicians and directors of research must be provided on a great scale. A Red Army convalescent home provides another example of the scope of Russian planning.

When it comes to military hospitals in the forward zone, we were witnesses of their skill in construction, their admirable camouflage, their adaptability and the excellence of their improvisation. It was in a pine forest just beyond Vyasma that we found the clearing hospital already mentioned. We came upon it without realizing that any building, let alone a great hospital, was anywhere near. They also have tented hospitals in the forests—of two hundred bed capacity for each of their specialist departments. Camouflage is essential, since on the Russian fronts the German does not observe the Geneva Convention. It entails two hardships upon the wounded even if the hospitals are not attacked. Smoke must not rise to give away a position and that makes contention with winter cold very difficult. There must be no metalled road running to the site, or the first reconnaissance plane will detect something to be attacked. This means a very uncomfortable and sometimes agonizing ambulance ride over the last mile of track.

We came in contact here with the partisans and guerrillas, who when wounded were regularly fetched in from their concealed collecting points by air. So complete is the organization that dentistry for those behind the German lines seemed quite a natural provision; they make the denture in Moscow, to the mould brought in by air, and fly it back forthwith. The dental department of the Red Army has made enormous numbers of dentures for the troops on every front. In that attached to one facio-maxillary unit we visited, more than a million dentures had been made for soldiers. Artificial limbs, too, are made on a scale commensurate with the size of the armies. Those we saw were entirely constructed of wood, and to our thinking a little on the heavy side, but mechanically good.

No account of medical service in war would be complete without reference to the preparations for dealing with casualties in bombed cities. It is true that we have no towns comparable for utter destruction with Stalingrad and Vyasma, to mention only two that we saw for ourselves, though there are so many others in like plight. But in Moscow there is, judging by experience in Great Britain, little sign of bombardment, and the civil defence arrangements are not so much in evidence. We saw one control room, which had been used for bomb casualties, but it existed in peace, and enables every accident or acute emergency in Moscow to be brought to the great emergency hospital or to one of its six satellites. We watched three calls. From the receipt of the message to the dispatch of an ambulance with nurse and doctor aboard, the average time was one minute forty seconds. It would be difficult to better such a system, but I must add that with our own bitter experience in mind, I was disappointed to be told they had no organized messenger service to replace the telephones when an unlucky or well-directed bomb fell upon the exchange. I have no doubt that had the need arisen in Moscow a service would immediately have been improvised, and I expect Leningrad would tell a different tale.

Among the men responsible for Soviet achievement in the section of their life under review there are three whom we met whose characters suggest the basic reason for success.

The director-general of the medical corps of all the Russian armies, Lieut.-General Smirnov, is a man of thirty-seven. He is a big, fair man whose face can be expressive of determination, of irony, of humour. It is stated that as a child and youth he had no education and was employed in labouring work. Between twenty and twenty-four he fitted himself to enter a medical school. He qualified at twenty-nine. In eight years his ability has raised him to the highest administrative post in the medical services, and we were informed by an Academician that, in addition, his purely professional attainments were held in high esteem by men of science and practitioners alike.

The chief consultant surgeon, Lieut.-General Burdenko, is a man whose energy has enabled him to triumph over a personal disaster to his health that would have ended the career of a lesser man. He has inspired in his pupils and his assistants an unassailable devotion. It is evident that his opinion has moulded current military medical thought and practice. His own particular interest has been neurosurgery, and it is to him that is owing the very active research in that department now so fruitful in Russia. He told us with pride that from front line to far base he had seven thousand beds for neuro-surgery, and we had evidence from Profs. Rappaport, Propper-Grashenko and Schlikov of the intensive study devoted to the occupants of his wards. Operative surgery on the central and peripheral nervous systems as we saw it practised is perhaps lacking in the refinements now the rule in American and British units, but the neuro-surgeons with us recognized that some of the records made at the front were as good as any they had ever seen, and they felt that the skill and ability were not lacking in the young men to permit their quickly reaching the highest proficiency.

In Prof. Yudin, head of the famous Sklissosovsky Hospital for accidents and acute emergencies in Moscow, Russia has an abdominal surgeon who would lend distinction to any clinic in the world. His experience is immense; in some respects unique. His courage is matched by his gentleness; his skill by his untiring devotion. It is characteristic that in war he should go often to the front and there devote his abilities to perfecting and teaching others the technique by which that most disabling of curable wounds, compound fracture of the femur, can best be treated. Watching this man at work, studying the conditions of work he has created about him to ensure success, seeing the subjects of his most daring and extensive operations a week after operation, we could not but feel that the service which has such a man, nay, such men, has a source of inspiration

which has carried it far, and will lead it to great heights.

Russian military medical officers have maintained their armies in the field without the occurrence of any epidemic disaster; they have enabled their soldiers successfully to use the most powerful and elaborate of war machines; they have cared for the wounded so skilfully as to obtain a record recovery-rate; and they have sustained the morale of their troops through a period of devastating tribulation to the dawn of a triumphant advance.

What more could be asked of the army medical corps of any nation?

INTER-RELATIONS OF PLANTS AND INSECTS

IN opening a joint discussion on "The Inter-relations of Plants and Insects: the Place of Both in the Eco-system" between the British Ecological Society and the Royal Entomological Society of London held on November 12, Prof. E. J. Salisbury claimed that though the insect – flower relations have been extensively studied, the quantitative aspects of insect-pollination have been little explored though economically important, while the competition aspect has been largely ignored. The elaborate and familiar relation between the yucca moth Pronuba and *Yucca filamentosa*, in which the reproduction of each is dependent on the other, but the larvæ take a high percentage of potential ovule production, serves to illustrate how narrow may be the margin between benefit and disadvantage in the relations between insects and plants.

The relations of insects to plants as pests or predators set many questions that require answers. Why, for example, are some insects almost omnivorous, whereas others are confined to particular species? Familiarity with human preferences obscures the fundamental problems waiting to be investigated. Something of the complexity of the problem is indicated by insect larvæ which in the wild state are found on one food-plant only but in captivity can be reared on a variety of species. An analysis of the physiological basis for such preferences might well yield data of great practical importance in the field of horticulture and agriculture. Whether a plant species in the British Isles supports the same insect population as the same kind of plant in continental Europe is also a matter of great biological interest. For the nature and variety of the insect predators and pests to which a plant species in Britain is subject may be an important indication as to the length of time that the plant has been present in these islands or, on the other hand, as to the efficiency of insect dispersal.

The influence of man has created in the past, and is constantly creating in the present, habitat conditions where the pressure of competition is reduced or even negligible, and the species associated with the arrested successions thus artificially maintained have been frequently regarded as under suspicion of being introductions. But the species which to-day we find most frequently occurring in, or even confined to, artificial conditions, may be those which in former times were to be met with in similar though much less frequent conditions created by natural agencies. On the other hand, they may represent what may be termed domestic species which have arisen since the widespread occurrence of such habitats, and in some instances may have extended into natural habitats of a similar character. This might appear to have little concern with the relations between plants and insects were it not that both groups of organisms present the same general problem, and an intensive study from this point of view of such very interesting series as that presented by the group of house spiders and their allies might well shed light on the fundamental problem. The domesticated flora and fauna not only deserve more attention than they have hitherto received, but also attention to the relations of both might reveal what the study of either alone could not achieve.

Dr. E. A. Cockayne discussed a number of Macrolepidoptera which are limited by special plant species. Many species of moth are attached to a genus rather than to a species, and others eat two or three plants belonging to allied genera, such as Fraxinus and Ligustrum, Calluna and Erica, Urtica and Humulus, *Silene maritima* and Spergularia. Oak has more species of Macrolepidoptera restricted to it than any other plant; they are eighteen in number and belong to several families. In the case of many larvæ limited to a single plant species, the latter is the only representative of the genus found in Great Britain, but on the Continent, where other members of the genus occur, these also are eaten; for example, *Bupalus piniaria* is confined to *Pinus sylvestris* in Britain, but eats other species of Pinus on the Continent. Other examples of genera with only one native species are Fagus with one species of moth restricted to it; Alnus with two; Clematis with five; Euphrasia with two; Eupatorium with one; Serratula with one; Solidago with two; Phragmites with nine; Elymus with one; Ammophila with one. On the other hand, *Ulmus campestris* has two species peculiar to it and *Ulmus montana* has two others; *Carex glauca* has one; *Calamagrostis epigeios* has two; *Festuca arundinacea* has one; *Deschampsia cæspitosa* has one; *Artemisia absynthium* has one, and *A. maritima* has two; *Lysimachia vulgaris* has one, and *Convolvulus arvensis* has three. In such cases the selection of one species of a genus is usually due to a difference in ecological conditions.

It is interesting that most British moths with a very restricted range are not restricted because of the absence of a special food-plant. *Anepia irregularis*, however, has the same narrow range on the Breck sand as its food-plant, *Silene otites*, and it is probable that the limited south-western range of *Drepana harpagula* is coterminous with that of *Tilia parvifolia*.

Some British Lepidoptera have reached the northern or western extremity of their distribution and have become limited to special ecological conditions or to a special food-plant. *Papilio machaon* is found only in the Fens, and feeds chiefly on *Peucedanum palustre*; while abroad it is found in all kinds of country and feeds on many umbellifers; *Malacosoma castrensis*, an inland and woodland species on the Continent, is only found in the salt-marshes of south-eastern England, though it feeds on most of the plants which grow there. *Brachionycha nubeculosa*, which feeds on many kinds of tree abroad, only eats *Betula alba* in its local haunts in the Highlands of Scotland.

There are instances of biological races with different food-plants. *Eupithecia denotata* eats the seeds of *Campanula trachelium*, and its race *E. jasioneata* eats those of *Jasione montana*, while *Hydrelia flammeolaria* eats maple in the south and alder and mountain ash

in Scotland. The distribution of the two plants might explain the former case, though it is not clear why other species of Campanula are avoided; but there is no obvious reason for the different food-plants of the Hydrelia in the south and in the north. *Plemyria bicolorata* eats rose, blackthorn, crab apple, birch and alder in England, but in Dr. Cockayne's experience, only alder in the north of Scotland.

Captain C. Diver spoke of insects limited by the general conditions imposed by plant communities. The good field naturalist undoubtedly knows where and when to look for the species in which he is interested. This apparently intuitive recognition is the subconscious crystallization of innumerable small impressions and experiences revealed by his acute powers of observation and slowly built up by his memory into a complete picture. Knowledge of this kind is fundamental to a clear understanding of some of the major problems of biology, whether pure or applied. No progress can be made in the study of animal and plant populations, distribution, colonization, plagues, the control of pests, and so on, until we can give a proper answer to the question why this place is 'right' and that place is 'wrong'.

After giving examples of the simpler aspects of this problem from among Lepidoptera, Odonata and other groups, Capt. Diver went on to consider two genera of hover flies investigated at Studland Heath in Dorset. There occur at Studland seven out of the nine British Helophilus and ten out of the eleven Eristalis. The larvæ of both these genera can be stated broadly to live in stagnant wet conditions; but the adults require additional amenities which are not all present in the places where the larvæ can live; and if these are not represented in neighbouring habitats, places where the larvæ could live are not likely to be occupied by permanent populations.

The adult Helophilus generally stays closer to the larval habitat than does the adult Eristalis; but it requires the structure of the vegetation to be such that this provides sheltered flying places, and preferably a fair supply of flowers to visit. Helophilus will not normally be found hovering or laying in the type of marsh where the vegetation over a large area is uniformly short, which means that there is no shelter from wind at heights above a few inches from ground level. What these flies seem to like is an uneven structure giving a good mosaic of patches of short and tall vegetation, the air above the former being protected by the wind-breaks made by the latter. It does not appear to be so important which plant species are present as that some should be tall and some short; although a good flowering population of *Potentilla palustris* Scop. is an added attraction for the less adventurous species, provided it is growing in a sunny and reasonably sheltered spot.

The species of Eristalis vary more widely in their needs; though most species are inveterate flower visitors, and the commoner ones are on the wing from the flowering of the sallow to the flowering of the ivy. But they need also the right conditions for hovering. *E. aeneus* Scop. and *E. sepulchralis* Linn. can tolerate the low vegetation and exposed conditions of salt-marshes, where they hover close to the ground. *E. intricarius* Linn. tends to hover high, but does not apparently demand good wind-breaks. While *E. pertinax* Scop. and *E. tenax* Linn., which usually hover at heights between 4 ft. and 8 ft., seem to find their optimum for this exercise in sheltered woodland glades. The primary characteristic of a woodland glade for this purpose is precisely the same as that required by Helophilus in the marsh; that is, an area of relatively low vegetation surrounded and sheltered by taller species. But unless these glades are of sufficient size relative to the height of the trees so as to get full sunlight, they will not provide good conditions for these species. Eristalis seldom hovers in the dapple light under trees. These sites are occupied by other Syrphids, particularly the common *Syrphus ribesii* Linn. and *S. vitripennis* Meig.

The width, the complexity and the difficulties of the general problems raised by these few illustrations need no stressing; there is here an immense and fascinating field for careful observation and research. As a final plea, Capt. Diver urged that, though it is highly important to call a species by its right name according to the rules, it is even more important to know where and how that species lives, and why it chooses to live where it does.

Dr. C. F. C. Beeson dealt with the influence of insects on the regeneration, composition and destruction of forests. Virgin forests are characterized by freedom from insect epidemics, but catastrophes due to external factors may release destructive forces latent in endemic phytophagous insects. Seed insects are less important influences on the regeneration of forests than are insects feeding on the seedling and young sapling. The composition of a tree community is determined largely in early youth but may be modified later by insects. "Pure forests are more liable to outbreaks of insect pests than are mixed forests" is an axiom of forestry. Virgin tree-associations, which are immune, are protected by components of the field stratum. Mixed forests derive immunity from complex interactions based on structural and floristic characters. The composition of a mixture from the aspect of crop protection can be defined in terms of its primary and subsidiary insect communities.

In the subsequent discussion, Dr. H. Godwin, president of the British Ecological Society, mentioned that the British Ecological Society has just begun publication of a "Biological Flora of the British Isles", which should prove of especial interest to entomologists.

Prof. P. A. Buxton directed attention to the interesting differential reaction of insects to associations of native and closely related exotic plants growing near together. He instanced the fact that the sawfly so familiar on *Iris pseudacorus* spreads to some cultivated Iris spp., but not by any means to all. Mr. B. D. W. Morley recounted similar observations made on *Aphis fabæ*, the usual winter hosts of which are *Euonymus europæus* and *Viburnum opulus*. The species has also been observed on some, but not all, foreign species of Euonymus growing in various nurseries and botanic gardens, and Mr. Morley suggested that physiological changes brought about by approaching leaf-fall may prove to be one of the factors affecting the choice of host-plant by the aphis. In this connexion Mr. A. J. Wilmott emphasized that very varied reasons may decide why a particular insect feeds on one or more species; even if Mr. Morley's explanation that leaf-fall is the decisive factor concerning *Aphis fabæ* be accepted, many other factors must also be operative.

Prof. Hale Carpenter asked how it is that bark beetles, normally attacking only unhealthy or dying trees, are able to become a pest to healthy trees. Do trees normally produce some deterrent preventing the spread of bark beetles, which the beetles by insistent attack in great numbers are able to overcome? Do

trees cease to produce a deterrent, or do the beetles become by degrees less affected by constant exposure to it? Dr. C. F. C. Beeson replied that trees certainly do react to these attacks, but not to such an extent as to be able to control large-scale attacks.

Dr. W. H. Thorpe referred to the probable influence of parasites in reducing or eliminating a polyphagous host species on certain of its food-plants. In this connexion he directed attention to the desirability of placing on record, with as much detail as possible, particulars of differences in percentage parasitism associated with different food-plants. Dr. B. Barnes remarked that just as related species of insects attack members of Rosaceæ and Salicaceæ, so do related species of fungi; he stressed the need for biochemical investigation.

Prof. H. G. Champion emphasized the point made by Dr. Beeson, that the influence of insect attack on the specific composition of vegetation is relatively greater in the earlier stages of plant colonization or succession, when the competition between species is most severe, and it may take very little to tilt the balance one way or the other.

On the more general aspects of the subject, Dr. G. C. Varley suggested that problems of numbers, or of animal or plant distribution, are insoluble until the fundamental problem of what factors control the population density of the species of plant or animal in the community have been solved. He believes that when ecology can go beyond the descriptive stage, and studies and analyses the problems numerically, a rapid advance will follow. Dr. B. P. Uvarov said that to him it was very significant that practically all speakers had concentrated their attention on problems of the individual ecology of species, or of groups of species, rather than on community ecology. The way of individual ecological studies may be a long and arduous one, but it is a very healthy symptom that British ecologists are deliberately choosing it instead of the easier, but barren, method of mass collecting, counting and statistical analysis of populations assumed to form communities.

OBITUARIES

Sir David Prain, C.M.G., C.I.E., F.R.S.

THE death of Lieut.-Colonel Sir David Prain on March 16 has removed from the botanical world a distinguished man of science and an endearing personality.

Born at Fettercairn, Kincardineshire, nearly eighty-seven years ago, Prain was a product of the period when recruits to the botanical ranks were mostly obtained from the medical profession. From Aberdeen Grammar School he passed to the University, where he graduated with honours in science, and after an interlude of two years teaching turned to medicine, for which he qualified with distinction in 1882. The two following years were occupied in the positions of demonstrator in anatomy at the Edinburgh College of Surgeons and then at the University of Aberdeen. In 1884 he entered the Indian Medical Service, where his botanical aptitude at once attracted attention, so that at the age of thirty he began an official botanical career as curator of the Herbarium at Calcutta and eight years later became professor of medical botany. Thus the earlier years of Prain's life were largely spent in the art of imparting knowledge to others, but with his appointment as director of the Botanical Survey of India and superintendent of the Calcutta Botanic Garden in 1898, Prain entered on the career of administration in which he achieved such conspicuous success. During this period he not only acquired a considerable knowledge of the Indian flora but also was instrumental in furthering the cultivation of species of medicinal value. In particular the cinchona production of India is almost wholly an outcome of his foresight and initiative.

When in 1903 Sir Francis Younghusband led the Sikkim-Tibet Boundary Commission, Prain accompanied it as botanist and, as a result, our then scanty knowledge of the flora of that area was greatly augmented.

Among the earliest of his more important scientific works was an account of the plants of Bengal which dealt with nearly three thousand species and provided descriptions of all the genera and keys to the individual species. A substantial monograph of the Indian species of Pedicularis, of which sixty-nine were then known, contained an analysis of their distribution, and this was also a feature of the comprehensive account of the genus Dioscorea in four folio volumes which he wrote with I. H. Burkill. His interest in regional botany was again seen in his "Vegetation of the Coco Group" (1891), "The Botany of the Laccadives" (1893), and the "Flora of the Sundribuns" (1893). To Prain also we owe the first authoritative monograph of the genus Meconopsis, which has gained in both botanical and horticultural interest with the passage of time. His contributions to botanical knowledge were recognized by his election in 1905 to the Royal Society, which he served as treasurer for ten years from 1919.

Prain's appointment as director of the Royal Botanic Gardens, Kew, in 1905 was the beginning of seventeen years of efficient control of an institution that had already become by its size, functions and importance the chief taxonomic centre of the British Empire, and where advice was sought on the widest range of botanical interests. Here the new director's many gifts found scope to the benefit of the Gardens themselves and to science in general. His winning and kindly personality coupled with a humour, no less real because it had a subtle Scots quality, endeared him to his colleagues, while even those who might not agree with him could not fail to respect an integrity that was always courteous and just. Many of his minutes, written as director, are models of lucidity and well-chosen phraseology which lost nothing of their trenchant forcefulness by reason of their meticulous correctitude.

No one was in greater demand as a president of societies or conferences, and as a chairman of difficult committees his qualities of sound judgment and firm tolerance were seen at their best. It would be tedious to enumerate the list of important offices he filled, but by reason of his long tenure mention may be made of his service for thirty-four years as chairman of the governors of the John Innes Horticultural Institution, for twenty-seven years as a Carnegie Trustee, and for twenty years as a trustee of the British Museum. He also served for many years as chairman of the Advisory Council for Plant and Animal Products of the Imperial Institute and was director of the Forest Products Research Board, not the least of the services he rendered to the progress of economic botany.

The later years of Prain's life were marred by increasing deafness and, although his mental alertness

was unimpaired, he felt keenly the sense of isolation which this engendered. The extent to which he prized personal contacts can be gauged from a passage in one of his letters, written in 1937: "the tragedy of age, and the only one that hurts is the loss of friends whom one has survived". We too have suffered the loss of a much-valued friend, and science one who served her well. E. J. SALISBURY.

Flight-Lieut. J. A. Moy-Thomas

BY the death, in a motor accident while on duty, on February 29, of Flight-Lieut. J. A. Moy-Thomas at the age of thirty-five, we have lost one of the most distinguished of the younger generation of zoologists. The study of fossil fishes attracted him most, and he made many valuable contributions to our knowledge of their structure and classification. Particularly did he devote himself to unravelling the difficult problem of the true affinities of certain well-known forms of very obscure relationship.

A pupil of Archer Vassal at Harrow School, he obtained a scholarship at Christ Church, and read honours in both zoology and geology at Oxford. His first published research was on the development and attachment of teeth in fishes (*Quart. J. Roy. Micro. Soc.*, **76**; 1934). There followed a series of memoirs on Chondrenchelys, Pristychius, Petrodus and other early shark-like forms, many of which he had collected himself during his expeditions to Scotland and elsewhere. These researches threw much light on the evolution of the Selachii and Bradyodonti including Holocephali. Already, in 1934 (*Proc. Zool. Soc.*), he had pointed out the affinity that very aberrant Palæoniscid, called Tarrasius by Traquair, may have with the living Polypterus (of which he had published a description of the chondrocranium), and thence passed to the detailed study of Palæoniscids in another series of memoirs not yet completely published. In the course of this work he brought out several papers in collaboration with E. I. White, of the British Museum, and Miss Bradley Dyne. With the same admirable powers of observation and happy interpretation he next dealt with the Cœlacanths, and described those of Madagascar. In 1939 he joined an expedition to Greenland to collect material with his intimate friend Prof. E. A. Stensiö of Stockholm.

Particularly important and characteristic of his careful method of dealing with difficult material is Moy-Thomas's work on Palæospondylus, recently published (*Phil. Trans. Roy. Soc.*; 1940). This little fish from the Mid-Devonian of Scotland has been a puzzle to all observers since Traquair first described it in 1890 and assigned it to the Cyclostomes. This interpretation was generally accepted, though some believed it to be a larval form of some higher fish or even amphibian. Moy-Thomas, after examining a vast number of specimens, rejected the larval theory as inconsistent with the presence of well-formed vertebral centra and the condition of the elements of the skull, and also was unable to confirm the presence of many alleged Cyclostome characters. More important still, he discovered that the tail had hitherto been misinterpreted, had been described upside down, and was really heterocercal with a larger ventral lobe supported by jointed radials; he also provided good evidence of the presence of paired fins, and of jaws. Thus he seems to have established that Palæospondylus belongs to the Gnathostomes. Fortunately, the most important results of these various researches were embodied in his excellent little book on "Palæozoic Fishes" (1939), published just before the War.

Deeply interested in the comparison of the dermal bones of the skull in the various groups of Osteichthyes and Tetrapoda and the tracing of their homologies, Moy-Thomas was not content with mere observation and description, but tried by experimental methods practised on living forms to discover the causes which may influence their shape, size and number. Already in 1941 he had reached important results on the rainbow trout, and concluded that, contrary to earlier theories, the origin of such bones is not due to the presence of the sense organs of the lateral line system or of the central nervous system (NATURE, May 31, 1941, p. 681).

Moy-Thomas began his teaching career under Prof. W. Garstang at Leeds, where he went soon after taking his degree. Returning to Oxford, he was made University demonstrator and lecturer in the Department of Zoology and Comparative Anatomy in 1933, and also became the first holder of the fellowship founded by the late E. T. Browne at the Queen's College.

Moy-Thomas's love of accuracy and his excellent memory made him a most successful teacher and tutor. But his influence on his pupils was not only academic. Possessed of great gaiety, sense of humour and zest of life, he was a continual source of stimulation and pleasure to everyone who knew him. With these attractive gifts he could make criticism, not only of their work but also of their life and manners, acceptable to his pupils.

Thus by this tragic accident has been cut short the life of one who will be much regretted by colleagues and many friends in Oxford and elsewhere. He leaves behind his wife and two children.

E. S. GOODRICH.

Prof. H. Buisson

HENRI BUISSON, professeur de physique générale à l'Université de Marseille, est mort le 6 Janvier 1944 à l'âge de 70 ans, après une courte maladie. Il s'était fait connaître par de nombreux travaux sur l'optique, souvent avec Charles Fabry (métrologie interférentielle, repères spectroscopiques formant le 'système international des longueurs d'onde', photométrie, 'équivalent mécanique de la lumière', etc.). Depuis 1912, il s'était consacré, avec Fabry, à l'étude de l'ozone atmosphérique, travail qui avait été l'origine de nombreuses recherches, principalement en France (Cabannes, Dufay, Gauzit, Chalonge, Vassy, etc.) et en Angleterre (Dobson et ses collaborateurs).

CH. FABRY.

THE work of MM. Fabry and Buisson on atmospheric ozone was the foundation of all later work on the subject. It had been suggested that the remarkably sudden 'cut off' of the solar spectrum at about 3000 A. was due to absorption in the earth's atmosphere. To test this hypothesis, they made careful measurements of the absorption by ozone of light of different wave-lengths in the laboratory and compared this with the extinction of sunlight passing through the atmosphere. From these measurements they were able to confirm the hypothesis, and also showed that the total amount of ozone in the atmosphere was equivalent to a layer of pure gas about 3 mm. thick.

In addition, Prof. Buisson made regular daily measurements of the amount of ozone in the atmosphere at Marseilles and also showed that the amount of ozone in surface air was relatively very small.

The importance of ozone in the upper atmosphere lies in the fact that, together with carbon dioxide and water vapour, it probably governs the radiative equilibrium temperature at great heights, and is largely responsible for the existence of the upper warm region at a height of 50–70 km., where the temperature is probably above that at ground-level. For these reasons the names of Fabry and Buisson are familiar to meteorologists the world over.

G. M. B. DOBSON.

Dr. E. Granichstadten

DR. E. GRANICHSTADTEN died at Edinburgh on January 5, 1944. He was one of Austria's most successful industrial chemists, possessing the rare ability both to make discoveries and to apply them; he was also a great benefactor to science. His most outstanding contribution to chemistry was the development of the catalytic hydrogenation of oils and fats which made margarine manufacture possible. Shortly after Sabatier and Senderens had demonstrated that unsaturated hydrocarbons in the gaseous phase could be hydrogenated in the presence of a nickel catalyst, Dr. Granichstadten began his experiments on the transformation of vegetable oils into edible fats. After many difficulties he finally succeeded by passing electrolytic hydrogen through the highly purified oils into which the catalyst had been introduced as a readily reducible nickel salt, a process which found wide industrial application in most European countries.

In later years Dr. Granichstadten founded and endowed a research institute at the Alpine spa Gastein with the view of putting the renowned effects of its radioactive springs on a scientific basis. Spectacular progress had been made by the time Austria was invaded. Within three days of the invasion, Dr. Granichstadten was forbidden to enter his own institute, and shortly afterwards he was driven from his native country. He found refuge at Edinburgh, where he was engaged in experiments on nutrition until his premature death. M. F. PERUTZ.

WE regret to announce the following deaths:

Sir Charles Boys, F.R.S., on March 30, aged eighty-nine.

Sir Cecil Harcourt-Smith, K.C.V.O., formerly keeper of Greek and Roman Antiquities, British Museum, director of the British School at Athens during 1895–97, and director of the Victoria and Albert Museum during 1909–24, on March 27, aged eighty-four.

Sir Thomas Lyle, F.R.S., formerly professor of natural philosophy in the University of Melbourne, aged eighty-three.

Prof. L. R. Wilberforce, professor of physics in the University of Liverpool during 1900–35, on April 1, aged eighty-two.

NEWS and VIEWS

Parliamentary and Scientific Committee

THE annual report for 1943 of the Parliamentary and Scientific Committee refers to a substantial increase in membership. Subjects with which the Committee was concerned during the year included income tax and subscriptions to learned societies, coal utilization research, the training of Civil servants, scientific research and the universities in post-war Britain, on the last three of which reports have been issued, research and Colonial development and income tax and research expenditure, on which a memorandum has since been issued. Further action is projected in regard to the universities and research. A motion has been tabled by members of the Committee in the House of Commons which, it is hoped, may provide the opportunity for a debate during the current session, while a sub-committee has been set up to report on the general question of how research in Great Britain might be developed and organized in the most efficient manner. At the annual general meeting held on February 3, 1944, the chairman reported that it was hoped that the first report would cover a general introduction as to the principles which should be applied to the organization and development of all fields of research work and the development of industrial research. Further reports might concentrate on research and agriculture, research and housing, etc.

At the annual luncheon on the same day, Lord Samuel, after referring to the presence in the Government of four men who had undergone scientific training at the universities, suggested that the Lord President of the Privy Council should have his functions enlarged so that he might become the representative of science as such in the Cabinet and among the other Departments. Lord Woolton paid a warm tribute to the work of the Committee, emphasizing that it is by the application of scientific discovery to the ordinary everyday life of the people that we raise the standard of life of the whole community, and referring particularly to what had been done in recent years with regard to food. Sir Raymond Streat suggested that the immense enlargement of the areas of fundamental knowledge and the increasing tendency for society to demand from science the attainment of specific objectives are leading us into an age of applied research. To meet that challenge, we have not so much to extend the quality and volume of our scientific work as our organization to develop and apply it, and to evolve modifications of our social, political, economic and legislative framework so that we may absorb the impact of an era of research and increase the health and vigour of our society. In connexion with the last, British natural conservatism is our danger. To what extent are our ideas of social security, our instinctive reluctance to acknowledge obsolescence, our regard for property, our trade union practices, inimical to rapid absorption of the consequences of scientific progress? Every effort should be made to prepare the public for the pace at which society must absorb the fruits of scientific work.

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.

BIRKBECK COLLEGE
(UNIVERSITY OF LONDON)
AUTUMN TERM BEGINS ON FRIDAY, SEPTEMBER 15

Applications for admission from men and women who desire to read as Internal Students of the University at the week-ends for degrees in the Faculties of Arts, Science and Economics or for the Diploma in Geography should be addressed to The Clerk, Birkbeck College, E.C.4.

CITY OF CARDIFF EDUCATION COMMITTEE
THE TECHNICAL COLLEGE

Principal: Dr. J. Stephenson, M.A., M.Com.

Required on September 1, 1944, a full-time lecturer in CHEMISTRY. Candidates should have a good honours degree, and experience both in research and in teaching. The person appointed will be required to teach Physical and Inorganic Chemistry up to Honours B.Sc. standard, and to direct the research work of postgraduate students. Salary in accordance with the Burnham Technical Scale (with due allowance for research, teaching or industrial experience); a man of suitable qualifications will receive in addition a special responsibility allowance of £25.

Forms of application, together with further particulars, are obtainable from the undersigned, to whom they must be returned not later than May 1, 1944.

W. J. WILLIAMS,
Director of Education.

Experienced Metallurgist-chemist required for research on corrosion, protection, and allied problems on magnesium-base light alloys in scheduled Industrial Laboratories in the Manchester district. Will have small staff of assistants and must be able to initiate and carry through research programmes without detailed direction. Sound knowledge of modern theory essential, together with ability to utilize this knowledge in practical applications.—Apply stating age, experience and salary required to Box 175, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Metallurgist required for light alloy research in Industrial Laboratories in Manchester area scheduled under E.W.O. Must be able to carry out research programmes with minimum supervision; sound basic knowledge of Physical Metallurgy necessary. Knowledge of German advantageous.—Apply stating age, experience and salary required to Box 176, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Metallurgist-chemist required for research on melting and fluxing problems on magnesium base light alloys in scheduled Industrial Laboratories in the Manchester district. Must have sound basic knowledge of Inorganic Chemistry; some experience in metallurgical work preferred. Apply stating age, experience and salary required to Box 177, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Agriculturist to organize and be respon- sible for research station and to direct team of graduate research workers in South American country with temperate climate. Applicants should have had experience with the applications of chemical products in pest control. Fortnight's local leave granted per annum and after 4 years service, 4 months leave this country with full pay and free passage. Good salary commensurate with qualifications and experience. Medical examination required.—Write Box 179, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Assistant Biochemist required by Midland firm of manufacturing chemists to work mainly on Pharmacological problems. Applicants should preferably be graduates with some experience in industrial laboratories, but this is not essential. Thorough experience of Biochemical technique will be a definite advantage. Salary £450–550 plus war bonus according to experience. Superannuation scheme in operation.—Replies to Box 168, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Export: Managing Director established New Zealand distributors, visiting England shortly, desires contact Manufacturers binoculars and Cameras and Associated lines. Buying Agencies required now. Substantial orders can be placed immediately manufacturing facilities available.—Write Sawell, 4 Ludgate Circus, London, E.C.4. Central 4353.

Wanted for India: Experts, any nationality, having knowledge of Biscuit Manufacture, Glass Bottle Making, Tar Distillation, Wine Manufacture, Perfumery, Flavouring Essences and Allied lines. Salary and commission.—Apply Box 178, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Translations of Scientific and Technical Papers from Danish, Dutch, French, German, Italian, Norwegian, Russian, Spanish and Swedish originals. Thirty-five years experience.—George Borrow, 6 St. Stephen's Grove, London, S.E.13.

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

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.

MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM
THE LABORATORY, PLYMOUTH

Limited supplies of marine biological material are still available, but orders should be placed well in advance.

For prices and detailed information apply to: The Director, The Marine Biological Laboratory, Plymouth.

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The Airborne Surgical Unit

THE limited but valuable experience which has been obtained of the feat of taking a surgical team into action with airborne troops is described by two R.A.M.C. surgeons who have organized it, Mr. C. J. Longland and Mr. L. Kessel (*The Lancet*, March 18, 1944, p. 381). Their article has been written "to correct the hyperbole and inaccuracy of accounts which have appeared in the lay press". Such surgical teams have been in action twice. On the first occasion it was proved that the feat could be done; the second job was a difficult one, but the team successfully established itself at night in a farm building behind the enemy's lines while a battle was going on near by. Some of the thirty-five operations performed were done 1½ hours after the wounds were received, and four fifths of them were done within five hours of the wounding. The team consisted of a surgeon, an anæsthetist and five other ranks, one of whom was responsible for resuscitation and two were chosen for their nursing abilities. All were, however, trained in all phases of the work. The team also had field and parachute training.

The details given of the equipment taken will interest all who have to provide transportable surgical equipment for field purposes. It was found that a light operating table or stretchers and trestles can be carried. Anæsthetics, plaster, dressings and other expendable material were put up in packs suitable for ten cases. Other items were instruments, plasma for resuscitation, feeders, bowls, trays and other ward equipment, and a sterilizer and boiled water container into which some materials could be packed. Linen thread was the basic suture material, and acriflavine tablets were found to be the most economical and useful antiseptic. Primus stoves were found satisfactory for heating, provided that several were available; but it was "distressingly and effectively proved" that ether may be a dangerous cause of fire in a theatre heated by primus stoves. Out of 150 cases, only 11 needed any anæsthetic other than pentothal; the other anæsthetic used was chloroform. For lighting, the choice fell on paraffin pressure lamps and electric headlamps.

Apprentice Scholarship Scheme at Birmingham

IN his annual report to the court of Governors of the University of Birmingham, the Vice-Chancellor (Dr. Raymond Priestley) comments on education for engineers. The University Joint Recruiting Board has been favourably impressed by engineering apprentices who have appeared before it for deferment or allocation in connexion with the Higher National Certificate in various branches of engineering. These men have entered industry either at or before the School Certificate stage, and have qualified, chiefly through evening work at technical colleges, to pass severe theoretical and practical tests. The successful candidates have impressed those whose duty it has been to interview them by their quality, grit and obvious sense of social responsibility. It has been quite clear that many of them are deserving of, and would be the better for, full-time university education, and that any university would benefit from their presence as students. Through conferences between the University of Birmingham, the Midland technical colleges and local firms, a scheme has been devised whereby the pick of the National Certificate holders in the Midlands might be admitted to the degree courses in mechanical and electrical engineering of the University. Candidates who have been three years in industry and who are nineteen years old or older will be able to matriculate through an examination towards which National Certificate subjects will count. A paper designed mainly to test ability for expression in English is the only additional obstacle to be surmounted. National Certificate scholarships with full maintenance, including residence at a hostel for the three years of the degree course, have been founded already by several firms.

Dr. Priestley points out that if the full value of the apprentice scholarship scheme is to be realized, it is essential that there should be the earliest possible modernization of the engineering equipment at the University of Birmingham. An appeal is therefore being made to the engineering industry of the nation, and particularly that part of it located in the Midlands, for a quarter of a million pounds for new buildings and equipment—a modest request for the Departments of Mechanical and Electrical Engineering. Close co-operation between the university and industry is necessary, and industry must accept the view that the university cannot by itself make practical engineers, production planners, and industrial managers. The university's primary aim must remain, on the research side, original contributions to the science of engineering; on the teaching side, the utmost possible development of the personality of students and a sound grounding in the sciences that underlie engineering and the basic principles of engineering science. What is needed is more and larger faculties of technology in the universities, possibly more universities, not hybrids in which applied science is developed to hypertrophy in dangerous isolation. The Manchester College of Technology is a good example of a well-developed faculty of technology in a university. We need also a more equitable division of Great Britain's intellectual *élite* among the universities.

Scientific Research and Development in India

IN his opening address to the symposium on "Post-War Organisation of Scientific Research in India" held at Calcutta during September 27 and 28, 1943 (*Science and Culture*, 9, 135; October 1943), Sir J. C. Ghosh urged that the time is ripe for a critical examination of the facilities for scientific research and training that are available in India, and for drawing up plans for improving and co-ordinating such facilities. At present the agencies responsible for this work are the universities, the central institutes under the Government of India, the Imperial Council of Agricultural Research, the Indian Research Fund Association, the Board of Scientific and Industrial Research, the endowed research institutes like the Indian Institute of Science, the Indian Association for the Cultivation of Science, the Bose Research Institute, etc., and the research laboratories of industrial concerns like the Tata's. Sir J. C. Ghosh suggests an annual grant of Rs. 2.6 crores for research, and an equal grant for training research workers, as reasonable in the first three years after the War. With regard to organization, he suggests that the National Research Council of Canada rather than Russian methods may form the best model for India. Laboratories concerned mainly with short-range programmes of research should be administered by an all-India national research council through properly constituted research committees functioning on their governing bodies. With regard to develop-

ment work, he advocates the formation of a corporation of the type of Research Enterprises Ltd. managed by the National Research Council of Canada. Such a development corporation should be encouraged to take risks by an annual State grant, and introduce into industry and agriculture the inventions and processes worked out under the national research council.

New Light on the Inductive Method

EVERYONE who is interested in the foundations of scientific method will find it worth while to read the article entitled "Hr. Von Wright on the Logic of Induction" which appears in the issue of *Mind* of January 1944, from the pen of Prof. C. D. Broad. It is Prof. Broad's account of the attack on the problem of induction which Hr. Von Wright has made in his published works consisting of a thesis (in English) and an article (in Swedish) on logical subjects. Prof. Broad deserves our thanks for bringing the content of these two works to the attention of English logicians. This article not only presents a remarkable original contribution of the Swedish logician but also reveals Dr. Broad's own illuminating comments upon it. It is impossible to summarize the argument adequately in a few sentences. The article begins by pointing out that *where an unlimited sequence of instances is concerned*, the proposition "100% of the Q's are R's" does not entail the proposition "All the Q's are R's". The nucleus of the problem of induction is, "How can we pass from propositions of the former type based on a finite number of Q's to propositions of the latter type ?" The attempt to justify such a passage by *a priori* argument is neatly refuted by a proof both ingenious and conclusive. The attempt to justify it by arguments *a posteriori* leads to a discussion of how in practice the necessary and/or sufficient conditions of a phenomenon are established. The question then arises : "Can we infer with certainty by such means general propositions about the necessary or sufficient conditions of a given characteristic Q ?" The answer, very briefly, is : "Not without the help of postulates". These postulates are either *a priori* propositions, which is proved impossible, or inductive generalizations, which would lead to a vicious circle. Hence no justification of inductive generalization along these lines is possible.

Radio-Frequency Heating

AT an informal meeting of the Institution of Electrical Engineers held in London on January 24, the industrial applications of radio-frequency methods of heating were discussed, and the opening speaker was Mr. N. R. Bligh. The two main fields of application were eddy current heating and capacitance current heating. A third heating field was where the use of radio-frequency currents was only involved because such currents could be led into the charge through small capacitances ; the actual heating process, however, was of the resistance heating class. The valve generator appears to be capable of generating all the power yet required for any application, even up to the highest frequencies of some hundreds of megacycles, and Mr. Bligh suggested that the only power rating which should be stated for a radio-frequency generator is its power output into its optimum resistance load, though for convenience the volt-ampere rating might also be given. The self-oscillator was regarded as the simplest form of generator, and up to a few hundred watts, glass envelope valves could be used, but beyond this, external anode valves were preferable.

Regarding the load circuits proper, the charge is placed between condenser plates for capacitance current heating with one side of the load preferably at earth potential. In the case of eddy current heating the heating coil should be as tightly coupled to the charge as mechanical and electrical conditions allow. Applications of capacitance current heating are the completion of the dehydration of food, and the bonding of thin layers of thermoplastic materials such as vinyl resins and the cellulose esters. Eddy current heating has been used for some time in the production of thermionic valves, while the heat treating of surfaces and heating of very small items are becoming increasingly common.

Electricity Supply System Load Analysis

IN a paper read in London on March 16 before the Institution of Electrical Engineers by Mr. P. Schiller, an analysis is presented of the load on the system of the Northmet Power Co. during the year ended June 30, 1939. The block of annual load is split up into a basic or all-the-year-round portion, and a seasonal portion, the latter representing all the consumption due to space heating and about half that due to lighting. The basic portion is sub-divided into its principal components, and for the seasonal portion, an attempt is made to separate lighting load and space-heating load, in respect of both demand and annual consumption. Seasonal demand curves are developed, in which the load at a certain time of day is plotted for a series of days, and compared with the simultaneous conditions of outdoor temperature and illumination. The annual load factors of modern lighting and space-heating loads are found to be normally of equal order of magnitude ; in a year with a cold snap the load factor of the latter may even be considerably lower than that of the former. Characteristic collective and component load curves are given, and graphs are presented dealing particularly with the space-heating load. The paper concludes with recommendations for further research.

Electrical Installation Equipment

A PAPER entitled "The Influence of Maintenance Requirements on the Design of Electrical Installation Equipment", read in London on March 9 by Mr. H. Drake before the Institution of Electrical Engineers, points out the weaknesses of electrical installation equipment from the maintenance point of view with particular reference to domestic and commercial installations ; in addition, a few comments are given on industrial equipment, the design of which seems far more satisfactory. Wherever possible, improvements and remedies which are commercially practicable are suggested. The equipment has been considered under the headings of switch and control gear, cables and cable accessories, wiring systems and accessories, utilization, including domestic, commercial and agricultural applications, and industrial plant. In general, complaints fall into the four main categories of insufficient space for wiring, inadequate terminal arrangements, lack of standardization and lack of appreciation of the innate clumsiness of the general public. If manufacturers' future designs overcome these four fundamental difficulties, much perplexity will be saved in the maintenance and installation industry.

Agricultural Scholarships

THE Ministry of Agriculture and Fisheries invites applications for ten senior scholarships, tenable at agricultural colleges or university departments of agriculture, for diploma or degree courses in an agricultural subject or at veterinary colleges for courses in veterinary science; and for six extended junior scholarships (for those who have already held junior awards), and thirty junior scholarships, tenable at farm institutes or similar institutions, for courses not exceeding a year in duration, in agriculture, horticulture, dairying or poultry husbandry. The scholarships are open to the sons and daughters of agricultural workmen or of working bailiffs, smallholders and other rural workers whose means and method of livelihood are comparable with those of agricultural workmen, and to persons who are themselves *bona fide* workers in agriculture. The value of the awards is such that neither the recipients nor their parents are normally required to make any contribution towards the cost of training provided. The usual method of selection is by interview, no written examination being held. Further information can be obtained from the Secretary of the Ministry, Block 4, Bickenhall Mansions, Baker Street, London, W.1, or from the offices of County Councils. The latest date for submitting applications is April 30.

Recent Earthquakes

DURING December 1943, twenty-eight earthquakes were registered by the seismographs at the geophysical observatory at Toledo in Spain. The greatest of these occurred on December 1, and registered at 10h. 47m. 14s. from an epicentre some 87·2° distant from Toledo. The depth of focus has been estimated to have been 150 km. and the earthquakes gave rise to amplitudes of 130 μ at Toledo. The nearest earthquake to Toledo during the month occurred on December 31, registering at 19h. 29m. 24s. from an epicentre 240 km. distant. The next nearest occurred on December 26 from an epicentre approximately 470 km. distant. This last epicentre may have been in the Pirineos Centrales.

During December 1943, thirteen strong earthquakes were registered on the seismographs in New Zealand. The following had their epicentres tentatively determined at the Dominion Observatory, Wellington: (1) December 1, New Guinea region; (2) December 2, south of Kermedecs; (3) December 23, New Guinea–Solomons region; (4) December 24, New Guinea–Solomons region (two shocks); (6) December 27, near latitude 36° S., longitude 175° W.; (7) December 30, Kermedecs region. Additionally, twelve earthquakes were reported as felt during the month in New Zealand. The greatest of these was scale V (modified Mercalli) and happened in the neighbourhood of Whangamomona on December 3. This shock was also felt near Taumaranui.

Training for the Chemical Industries

IN an address to the London Section of the British Association of Chemists on March 4, Dr. T. J. Drakeley, principal of the Northern Polytechnic, made a strong plea for a recognized system of technical education in Britain on an equal footing with more academic subjects. He attributed the industrial decline of Great Britain—instanced by the dyestuffs and coke industries—to the lack of such a system of technical training, in contrast to the highly developed system of technical high schools on the Continent, such as those at Delft, Zurich, Stockholm and Charlottenburg. He criticized the report of the Chemistry Education Advisory Board for stipulating that the study of a branch of applied chemistry should always be preceded by a three-year degree course in pure science. He maintained it is impossible to justify the view that the metal chemist and the rubber chemist should have the same basic training. It is only on the basis of a trained personnel that the chemical industries can regain world markets, revive British prestige and pass into a prosperous period of progress.

Royal Society of Edinburgh Awards

THE following awards have been made by the Council of the Royal Society of Edinburgh: Keith Prize for the period 1941–43, to Prof. James Ritchie, professor of natural history, University of Edinburgh, for his papers in the *Proceedings* of the Society within the period of the award and in recognition of his distinguished contributions to natural history; Neill Prize for the period 1941–43, to Dr. Douglas A. Allan, director of Liverpool Public Museums, for his papers on "The Geology of the Highland Border Region", published in the *Transactions* of the Society.

Announcements

THE Council of the Iron and Steel Institute has awarded the Bessemer Gold Medal for 1944 to Mr. Essington Lewis, director-general of munitions and director-general of aircraft production for Australia, formerly of the Broken Hill Proprietary Co., Ltd., in recognition of his outstanding services to the iron and steel industry of Australia.

MR. JOHN G. WINANT, American Ambassador in Great Britain, on March 31 presented the Charles P. Daly Medal and the Cullum Medal of the American Geographical Society to Sir Halford Mackinder, formerly professor of geography in the University of London, and Mr. Arthur R. Hinks, secretary of the Royal Geographical Society, respectively.

PROF. J. M. MACKINTOSH, since 1941 professor of preventive medicine in the University of Glasgow, has been appointed as from October 1 to the University chair of public health tenable at the London School of Hygiene and Tropical Medicine. He was formerly chief medical officer to the Department of Health for Scotland.

SIR AUREL STEIN, who died on October 26, bequeathed his collection of Oriental manuscripts, notebooks of travels, and written papers of a scientific character to the library of the Indian Institute at the University of Oxford, and residue, subject to life interests, to form the Stein-Arnold Fund for exploration of the ancient civilizations of India, China and Iran.

THE following degrees have been conferred by the University of Aberdeen: *D.Sc.*: G. H. Rawcliffe, for a thesis on "Some Current, Voltage and Power Relations for Complex Mercury Arc Rectifiers"; *M.D.*: S. A. B. Black, for a thesis on "The Environmental Health of British Merchant Seamen".

ERRATUM. In NATURE of March 18, p. 351, the price of the report on Polyzoa issued by the Discovery Committee should read 35*s.* net, not 9*d.* net as printed.

LETTERS TO THE EDITORS

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

Synaptic Transmission in the Spinal Cord

THE preparation used in this investigation has been either the spinal cord of the decerebrated or anæsthetized cat or the isolated oxygenated spinal cord of the frog, and it has been activated by electrical stimulation of a dorsal root (the 7th lumbar or 1st sacral in the cat, the 9th or 10th in the frog).

As Barron and Matthews[1] have shown, a single dorsal root volley normally sets up a large and prolonged negative potential of adjacent ipselateral motoneurones on which are superimposed spike potentials of discharged impulses (cf. ref. 2). The prolonged negative potential differs from the spike potentials in being decrementally transmitted by electrotonus along the axons of the motoneurones, and in the present experiments it has been recorded from the ventral root as it emerges from the spinal cord. This potential has been found to be diminished and shortened by nembutal anæsthesia, and ultimately with deep anæsthesia (about 100 mgm. per kgm. intravenously in the cat or prolonged soaking in 1 in 5,000 in the isolated frog's cord). A dorsal root volley sets up no spikes, but only a simple brief negative potential with a quick rise and a slower, approximately exponential, decay. It spreads electrotonically along the ventral root. The durations of latent period, time to summit, and time of half-decay are about 0·8, 3 and 7 msec. in the cat and 1·5, 5 and 25 msec. in the frog. When the potential is sufficiently large, owing either to a lower depth of anæsthesia or to summation of two or more successive responses, the motoneurones discharge impulses. The potential is thus analogous to the local catelectrotonic potentials set up by trans-synaptic stimulation of curarized ganglia[3] or neuro-muscular junctions[4,5], and may be termed a synaptic potential. Similarly, too, it appears to be set up by a brief active depolarizing agent, its decay being passive and governed by the electric time constant of the membrane.

The brief synaptic potential recorded in deep anæsthesia must be set up in the motoneurones by impulses in those dorsal root fibres which end in direct synaptic contact. By making the anæsthesia deep enough to block all synaptic transmission of impulses, the setting up of internuncial impulses has been prevented, and the spinal cord has been reduced to a single synaptic preparation (the two-neurone reflex arc). The complex and prolonged synaptic potential normally set up in motoneurones by a dorsal root volley results from summation of the synaptic potentials set up by bombardment of the motoneurones by the initial direct volley and later internuncial discharges.

With rapid repetitive stimulation (up to 200 per sec. in frog, 400 per sec. in cat) synaptic potentials in the anæsthetized cord sum to a plateau which decays abruptly on cessation of stimulation. There appears to be no building up of a persistent actively depolarizing agent such as gives the initial slowed decay with synaptic potentials of ganglia[3].

Eserine (intravenous doses up to 1 mgm. per kgm. in cats, prolonged soaking in 1 in 100,000 to 1 in 10,000 in isolated frog's cord) has no appreciable action on the time course of the synaptic potential of the anæsthetized motoneurones (single, double or repetitive stimulation). There is no trace of the prolonged junctional potential which was observed after repetitive trans-synaptic stimulation of the eserinized and curarized muscle or ganglion, and attributed to the accumulation and persistence of acetylcholine[6,7]. Dale and co-workers have provided convincing evidence that acetylcholine acts as a synaptic transmitter at such junctions. With synapses in the central nervous system, however, there is no unequivocal evidence of synaptic transmission by acetylcholine, so the present negative results with eserine make it unlikely that acetylcholine plays any part in the synaptic transmission of simple spinal reflexes. On the other hand, the time course of the active depolarizing agent is so brief that it could be due to direct electrical stimulation of the motoneurones by the action currents of impulses in the terminals of the dorsal root fibres. Similarly, it was suggested[7] that the analogous brief transmitter action observed in sympathetic ganglia was possibly due to a direct electrical action, but with ganglia it is superimposed on the more prolonged depolarization due to acetylcholine transmission.

Synaptic transmission in the spinal cord is also different from that in muscle and ganglia in that it is not paralysed by curarine. In fact, curarine has the reverse effect, having a mild strychnine-like action in concentrations so low as 12 μmol. per litre.

JOHN C. ECCLES.

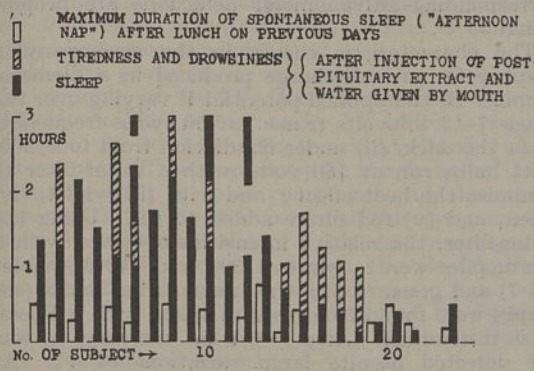
Physiology Department,
Medical School, King Street,
Dunedin, N.Z. Feb. 1.

[1] Barron, D. H., and Matthews, B. H. C., *J. Physiol.*, **92**, 276 (1938).
[2] Eccles, J. C., and Pritchard, J. J., *J. Physiol.*, **89**, 43*P* (1937).
[3] Eccles, J. C., *J. Physiol.*, **101**, 465 (1943).
[4] Eccles, J. C., Katz, B., and Kuffler, S. W., *J. Neurophysiol.*, **4**, 362 (1941).
[5] Kuffler, S. W., *J. Neurophysiol.*, **5**, 18 (1942).
[6] Eccles, J. C., Katz, B., and Kuffler, S. W., *J. Neurophysiol.*, **5**, 211 (1942).
[7] Eccles, J. C., *J. Physiol.* (in the Press).

Induction of Sleep by Simultaneous Administration of Posterior Pituitary Extracts and Water

THE following investigation arose from considerations based upon well-known observations on the state of normal sleep. These are: (*a*) that during sleep the urine volume output is decreased and the blood diluted; (*b*) that many drugs (caffeine, etc.) which cause wakefulness are diuretics; and (*c*) that severe muscular work which, it is recognized, often facilitates the onset of sleep, has an antidiuretic action. It was thought, therefore, that the antidiuretic principle of the posterior pituitary, if given together with water, might possibly bring about an internal milieu so similar in many ways to that of normal sleep (for example, antidiuresis, dilution of the blood) that this state might eventually cause, deepen or prolong natural sleep.

Experiments were made on a number of subjects, many of whom were unaware of the object of the procedure, and were carried out after the average time had been recorded for which each subject would sleep spontaneously after lunch when good and repeatable conditions were given. Through the kind permission of Prof. P. C. Cloake and other clinicians, a number of these experiments were made on suitable hospital patients. Other experiments were made on students where, though the element of suggestion



could not be excluded entirely, some sham injections with saline gave negative results and thus offered a certain measure of control.

Nearly all experiments using 5–10 units of the pressor principle gave negative results, though the antidiuretic effect was, of course, marked. Some effects of these preparations (for example, peripheral vasoconstriction, eventual rise in blood pressure) were thought to be incompatible with normal sleep, where the blood pressure is relatively low. Oxytocic preparations were therefore tried and eventually it was found that 10–15 units of oxytocic preparations, still showing definite antidiuretic action, given together with 1–2·5 units of the pressor principle and 1½–2 pints of water (given orally), had obvious effects. These doses were split into two injections, usually given at 11 a.m. and 12 (noon), and were followed by the subject having a normal lunch. From 2 p.m. the subjects were kept in bed. From the accompanying figure it can be seen that of twenty-four cases treated in this way thirteen slept for long periods, five cases experienced drowsiness and tiredness, but without sleeping much longer than usual, and six cases gave quite negative results. An additional eleven subjects were treated in slightly different ways (1 per cent saline given instead of water, etc.). Of the total of thirty-five subjects (including those shown in the figure) eighteen slept longer than could be expected normally, eight exhibited symptoms of pronounced drowsiness, while nine felt no effects whatsoever. Symptoms like "the eyes feeling heavy and itching", prolonged yawning, etc., were often recorded. The symptoms never appeared until 2–3 hours after the last injection. The sleep was often very deep and dreamless, which was noted by those who usually dream. It seemed that women responded better than men ; thus of the nine negative cases seven were men. Some subjects mentioned spontaneously a pronounced well-being after the induced sleep. If the injections or the water were given alone, uncertain or negative results were obtained in eight cases.

Whether the described effect is due to the antidiuretic principle, or to the oxytocic one, or to both, cannot yet be stated. It may be that by creating much of the internal milieu of natural sleep, once that milieu is established, sleep may follow as a conditioned reflex, and that the actual chain of events at the normal onset of sleep may be different. The important fact, however, that most of the changes in composition and volume of the blood known to occur during sleep in man develop after merely lying down for 20–30 minutes[1,2] may suggest that the 'water shift' is among the earliest events concerned with the onset and maintenance of sleep, and that therefore the above described effect may not differ essentially from what happens at the onset of normal sleep.

F. SCHÜTZ.

Medical School,
University of Birmingham.
Feb. 23.

[1] Kleitman, N., "Sleep and Wakefulness" (Chicago : Chicago University Press, 1939).
[2] Thomson, W. O., Thomson, P. K., and Dailey, M. E., *Proc. U.S. Nat. Acad. Sci.*, **14**, 94 (1938).

X-Ray Divergent-Beam Photography as a Test of Crystal Perfection

IN a recent communication[1] I reported that good type I diamonds gave bad divergent-beam photographs, the deficiency (absorption) lines being scarcely, if at all, visible against a foggy background, whereas type II diamonds gave excellent divergent-beam photographs. I suggested that this could be explained if the type I diamonds were 'ideal' and type II diamonds 'mosaic' in structure. The poor photographs would be an indication of large primary extinction.

Confirmation of this interpretation has come in other ways. Prof. E. N. da C. Andrade tells me that when he and Sir E. (afterwards Lord) Rutherford took the first divergent-beam photographs some thirty years ago, using the γ-rays of radium, they found that a particular ordinary cleavage plate of rock-salt gave moderately good absorption lines[2]. Specimens apparently much more perfect, as judged by specular reflexions of ordinary light, which were selected from a large number specially fetched from a salt mine, gave much inferior effects.

I said also in my communication that crystals of organic compounds gave good photographs. This was true of the substances I had then examined. Further experiment has, however, revealed some notable exceptions. Three out of five crystals of oxalic acid dihydrate gave either no visible lines or lines so faint as to be seen only with the greatest difficulty ; the fourth gave a picture of moderate contrast and the fifth an excellent one. Very poor photographs were given also by erythritol, ammonium oxalate, stilbene, hexamethylene tetramine and a thin cleavage plate of calcite. Sucrose, mannitol, tolane, *trans*-azobenzene, 1-3-5 triphenylbenzene, penta-erythritol and penta-erythrital tetraphenyl-ether gave lines of only moderate visibility. Anthracene, benzil, dibenzyl, benzophenone, maleic acid, maleic anhydride, succinic acid, α-resorcinol, urea nitrate, hexamethylbenzene and hexaethylbenzene gave good clear pictures, although even among these some were distinctly better than others. Only one or two crystals of each of these substances were examined, and the results, therefore, must not necessarily be accepted as typical of the compounds in question. They are given to show what wide variations may exist.

In order to find out whether the absence, or comparative indistinctness, of absorption lines did, in fact, indicate the approach of the crystal to an 'ideal' state, with its resulting primary extinction effect, I dipped two of the oxalic acid dihydrate crystals into liquid air for a few seconds and rephotographed them when they had regained room temperature. The result was that a pattern appeared where none had been seen previously. A second immersion improved the sharpness and visibility of the absorption

lines, although they did not become quite so good as those of the naturally 'mosaic' specimen. The crystals became very brittle; presumably the small-scale breaking-up of the structure into slightly disorientated crystallites (which for complete absence of primary extinction would have to be about 1 μ or less in linear dimensions) was accompanied by cracks on a very much larger scale. Erythritol, stilbene and hexamethylene tetramine also gave good pictures after immersion in, or spraying with, liquid air, and some of the moderately good specimens (sucrose, mannitol and *trans*-azobenzene were tested) gave much improved pictures after similar treatment. Type I diamond and calcite, however, were apparently not affected even by repeated coolings. Those crystals the structure of which had been broken down into a mosaic by sudden cooling continued to give a good divergent-beam photograph even after an interval of more than 100 hours; there was no evidence of any recrystallization.

It is clear that, when X-ray structure analysis is being carried out, the possibility of large primary extinction effects existing even in small crystals of so-called 'soft' organic compounds must not be ruled out of consideration. That some primary extinction takes place in crystals of less than 0·1 mgm. weight was indicated by B. W. Robinson's comparison of the structure factors of anthracene deduced from single crystals[3] and from a fine powder[4], using copper and molybdenum monochromatized radiations in each case. Other workers[5,6] have reported marked primary extinction in single crystals of hexamethylene tetramine, which was reduced by liquid air treatment or eliminated by the use of a fine powder. In spite of these warnings, however, primary extinction has on the whole been neglected in recent years, partly because of the obvious difficulties of allowing for it. My experiments seem to show that some technique of detection and elimination will be essential in all X-ray analytical work where accuracy is desired. If such a technique is not adopted, there is no point in using very accurate methods of intensity measurement.

Large-scale distortion of crystals is readily detected by the divergent-beam method. Several diamonds gave photographs in which there was a general blurring of the lines in one particular direction, or in which lines were doubled which should have been single. It is a simple matter to calculate, from the photographs, the amount and direction of disorientation of individual crystallites necessary to give these effects.

KATHLEEN LONSDALE.

Royal Institution,
London, W.1. March 8.

[1] Lonsdale, NATURE, **153**, 22 (1944).
[2] Rutherford and Andrade, *Phil. Mag.*, **28**, 263 (1914).
[3] Robinson, *Proc. Roy. Soc.*, A, **142**, 422 (1933).
[4] Robinson, *Proc. Roy. Soc.*, A, **147**, 467 (1934).
[5] Wyckoff and Corey, *Z. Krist.*, **89**, 462 (1934).
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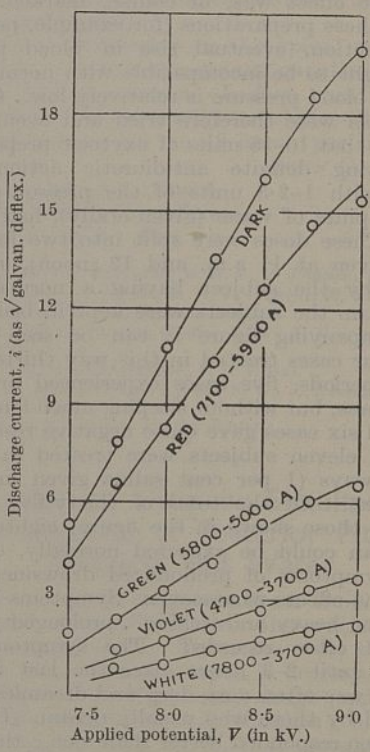
Light-Effect in Chlorine under Electrical Discharge: Influence of the Gas Pressure

AMONG numerous factors which determine the magnitude of the diminution Δi on irradiation of the discharge current i[1–6], the gas pressure p has been found to have a marked influence. The rectifier type A.C. indicator used previously[3] was replaced by a Cambridge vacuo-junction; this increased appreciably the sensitivity of the arrangement, since the corresponding galvanometer deflexions are proportional to i^2.

The characteristic curves in the accompanying graph refer to a discharge produced in a Siemens' ozonizer B, the applied potential V varying over the range 7–12 kilovolts (r.m.s.) at 50 cycles frequency, (i) in the dark, (ii) under irradiation from four 200-watt bulbs run at 180 volts, with a water-filter to minimize the heat effect; and with (iii) violet, (iv) green, and (v) red filters added to (ii). Using the water-filter, the relative intensities observed with a thermopile were: white (100), red (40·6), violet (16·7) and green (1·5); the transmission limits (see graph) were found from spectra taken with a Fuess' glass instrument. At $p = 0{\cdot}8$ cm. mercury, Δi was not detected despite large variations of V. At $p = 59{\cdot}6$ cm., Δi for (ii) white, rose from 13 to 35 per cent of i in the dark as V was increased from 9·3 to 11·2 kV.; at high applied potentials the discharge was unsteady; and also Δi was smaller and irregular. The light-effect was a maximum at 46·5 cm.



The intensity in the violet region (4700–3700 A.), especially towards its short-wave end in (ii) unfiltered white, was much greater than in (iii) the filtered violet. As Δi increases in the order, red < green < violet < white, which is different from their relative intensities, the frequency is the major determinant of this phenomenon. That, compared with the green and red, (ii) white and (iii) its violet component contain a much greater part of 2300–5000 A., the chief absorption band of chlorine[7], is possibly an additional factor[3,5,6]. The accompanying curve shows that Δi increases with V and that this influence increases in the order red < green < violet < white. This agrees with our results at various pressures. Further work has shown that $\Delta i/i$ is a more regular function of i than the corresponding V. The precise nature of any of these $\Delta i/i - i$ curves, however, depends

markedly on the pressure. This relation is simple at 46·5 cm.; approximately, $\Delta i/i$ is a constant, dependent upon the light-band.

At this pressure, it was interesting to observe, for example, at 9·0 kV. that, in the dark, i gave a deflexion of 400 units; under (ii) white, it was reduced to 2; corresponding to a light-effect of about 93 per cent. This, together with the fact that it has been observed in some compound and elementary gases, with the exception so far of the rare gases and metallic vapours, indicate a hitherto unrecognized and fairly widespread factor in the electrical discharge and photo-electric phenomena.

S. S. JOSHI.
P. G. DEO.

Chemical Laboratories,
Benares Hindu University.
Feb. 19.

[1] Joshi, *Curr. Sci.*, **8**, 548 (1939). Joshi and Narasimhan, *ibid.*, **9**, 536 (1940). Joshi and Deo, *ibid.*, **11**, 306 (1943).
[2] Joshi and Deshmukh, NATURE, **147**, 806 (1941).
[3] Joshi and Deo, NATURE, **151**, 561 (1943).
[4] Joshi and co-workers, *Proc. Indian Sci. Cong., Phys. Sec. Abst.*, 17 (1940); *Chem. Sec. Abst.*, 34, 35 (1941); *Phys. Sec. Abst.*, 36, 38 (1942); *Chem. Sec. Abst.*, 50, 51, 55–70 (1942).
[5] Joshi, *Proc. Indian Sci. Cong.*, Pres. Address, Chem. Sec. (1943).
[6] Joshi, *Benares Hindu Univ. J.*, **8**, 99 (1943).
[7] Halban and Siedentoff, *Z. phys. Chem.*, **103**, 71 (1922). Elliott, *Proc. Roy. Soc.*, A, **123**, 629 (1929).

An Interferometric Procedure for the Examination of Crystal Surfaces

IN a recent communication[1], Dr. S. Tolansky has described an interferometric method for the study of crystal surfaces. He includes two pictures showing the surface structures of mica and selenite.

This method has been used to great advantage in our laboratories for several years, especially for selecting suitable crystals for X-ray crystallography. In a paper[2] published in the proceedings of the Swedish Academy of Sciences for 1933, some fifty pictures from different crystals, calcite, topaz, quartz, gypsum, mica, rock-salt, sylvine and carborundum were reproduced. All these crystals, even the most perfect ones, gave contour patterns of the cleavage faces showing that the surfaces were split up into a great number of regions with different heights. In calcite, for example, the steps were of the order 0·1 μ and less. It was mentioned in the paper that the method made it possible to measure the steps with an accuracy of 5 A.

MANNE SIEGBAHN.

Research Institute for Physics,
Academy of Sciences,
Stockholm.
Jan. 3.

[1] Tolansky, S., NATURE, **152**, 722 (1943).
[2] Siegbahn, Manne, *Ark. f. Mat., Astr. o. Fysik.*, **23**, A, No. 12 (1933).

PROF. SIEGBAHN has very kindly sent me a reprint of his paper referred to in his letter; the journal in which it appeared is not available here and I was completely unaware of the existence of the paper.

I cannot agree, however, with Prof. Siegbahn's implication that his method and mine are the same. They are, in fact, very different optical procedures, since Prof. Siegbahn employs the classical *two* interfering beams, whereas I make use of the far more powerful *multiple-beam* interference. As a result of this the resolution in the two cases is of a different order. One can consider as an analogy that his resolution is to mine as the resolving power of a 2-line grating is to that of a 40-line grating. The intensity distributions within the two types of fringes are so fundamentally different that the multiple-beam procedure gives an accuracy of an entirely higher order.

While both methods reveal the coarser details of crystal surfaces equally well (and Prof. Siegbahn's paper contains many beautiful reproductions of fringes revealing coarser details), yet the more precise multiple-beam procedure reveals in addition subtle fine structure details far beyond the possibility of the simpler two-beam method. This difference is entirely a question of fringe width, and the employment of very high reflecting coefficients in my method is responsible for the improvement.

Prof. Siegbahn states in his paper that when his fringes are measured with a photometer, their *positions* can be determined to within 1/500 of an order (despite the very unfavourable $\sin^2$-intensity distribution). This is only 5 A. It is, of course, quite evident that the smallest *step* which he can resolve is much greater than this figure, which is the error in setting on a fringe. With my method, I can readily measure directly (without a microphotometer) actual steps so small as 30 A. in height with an accuracy of 1 A. It is more than probable that with a microphotometer this would be reduced by a factor of 2. Such *resolution* simply cannot be approached with fringes produced by two interfering beams, hence the two procedures cannot be considered equivalent.

While, therefore, the two-beam method is quite sufficiently sensitive for the purpose of selecting suitable crystals for X-ray crystallography, as a method of high precision for revealing the fine structure topographical details of crystal surfaces, it cannot compare with the multiple-beam procedure that I have independently developed. This is perhaps most clearly revealed in a more recent publication of mine[1].

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University,
Manchester.

[1] NATURE, **153**, 195 (1944).

Metabolism of Acetoacetic Acid

IN a recent publication Breusch[1] has reported experiments suggesting a condensation of the $-CH_2.COOH$ group of β-ketonic acids with oxaloacetic acid, resulting in the formation of citric acid.

Shortly after the theory of the citric acid cycle was first put forward by Krebs and Johnson[2], and following the observation of Korányi and Szent-Györgyi of the antiketogenic effect of succinic acid[3], I performed a number of experiments designed to test this very hypothesis. Acetoacetic acid was incubated with slices of rat brain and kidney with and without the addition of various members of the citric acid cycle. The observed effects on oxygen uptake, formation of citric acid and disappearance of total acetone bodies were, however, so small as to be inconclusive. The theory was abandoned on the strength of the following experiment in which the anaerobic disappearance of total acetone bodies was measured by a modified Messinger titration[4,5].

TISSUE INCUBATED FOR 2 HR. IN BICARBONATE-RINGER (N_2/5% CO_2).

Tissue	mgm. dry weight	Substrate	Q Aceto-acet.	$Q\beta$-Hydr-oxybutyr.
Rat brain	15·29	acetoacet. (0·002 M.)	—0·49	0·23
	19·92	" + oxaloacet. (0·0067 M.)	—0·55	0·37
Rat testis	33·62	acetoacet. (0·002 M.)	—0·98	0·38
	44·39	" + oxaloacet. (0·0067 M.)	—0·69	0·35
Rat kidney	14·39	acetoacet. (0·002 M.)	—1·57	0·81
	9·76	" + oxaloacet. (0·0067 M.)	—1·64	0·85

The reaction acetoacetic acid + oxaloacetic acid → citric acid + H_2O does not require oxygen. According to Breusch[1], the enzyme is insensitive to cyanide. One would have expected, therefore, that addition of oxaloacetic acid would raise the anaerobic rate of acetoacetic acid disappearance to the level of the aerobic rate (Q-value of about 6 for kidney and about 2 for brain). The addition of oxaloacetic acid was, however, without effect.

Moreover, it was found in these experiments that the ratio of acetoacetic acid disappearing to β-hydroxybutyric acid formed was roughly 2 : 1, a result typical for a dismutation, and it was concluded that the first step of acetoacetic acid metabolism is oxidative, or at least reversibly linked with an oxidative step. This, too, was not in agreement with a mechanism where the first step would have been a non-oxidative condensation. Subsequent investigations[5,6] gave no evidence for oxidation at the α- or the γ-position or for an oxidative cleavage into two C_2-compounds.

Though the limited value of negative evidence is fully realized, it remains to be explained why the expected results were not observed under the conditions employed.

H. WEIL-MALHERBE.

Cancer Research Laboratory,
North of England Council of the
British Empire Cancer Campaign,
Royal Victoria Infirmary,
Newcastle upon Tyne. March 6.

[1] Breusch, F. L., *Science*, **97**, 490 (1943).
[2] Krebs, H. A., and Johnson, W. A., *Enzymologia*, **4**, 148 (1937).
[3] Korányi, A., and Szent-Györgyi, A. v., *Deutsch. med. Wschr.*, **63**, 1029 (1937).
[4] Weil-Malherbe, H., *Biochem. J.*, **31**, 2202 (1937).
[5] Weil-Malherbe, H., *Biochem. J.*, **32**, 1033 (1938).
[6] Weil-Malherbe, H., M.Sc. Thesis, University of Durham (April 1940).

Effect of Temperature on the Reducing Activity of Leucocytes in Milk

SOME investigations were carried out as to the possibility of milk from cows infected with mastitis having an increased reducing activity due to the number of leucocytes contained in it, and in consequence failing the Standard Routine Resazurin Test adopted by the Ministry of Agriculture for the grading of milk under the National Milk Testing and Advisory Scheme. During the course of this work, milk samples with a high leucocyte content were submitted to ten-minute and one-hour resazurin tests at 37° C. immediately after production, and then again after holding the milk overnight at different temperatures, so as to attempt to reproduce the varying atmospheric temperatures at which milk is held before testing.

As will be seen from the accompanying results, milk held at 55° F. overnight did not reduce resazurin so rapidly as when tested immediately after production. This is no doubt due to the fact that leucocytic metabolism in milk is entirely catabolic and not anabolic ;

VARIATION IN THE RATE OF REDUCTION OF RESAZURIN DUE TO HOLDING THE MILK AT DIFFERENT TEMPERATURES.

	Resazurin disk reading at the end of		Complete reduction of resazurin
	10 min.	1 hour	
Tested immediately after production	4	0	1 hr.
Tested after holding at 55° F. overnight	4½	1½	1½ hr.
Tested after holding at 40° F. overnight	0	0	10 min.
Tested after holding at 32° F. overnight	2½	1	1½ hr.

for this reason the life of the leucocytes in milk is probably dependent upon the temperature at which the milk is held, and the nearer the temperature is to body temperature the shorter the life of the leucocyte, and the lower the temperature (providing that it is now low enough actually to damage the cells physically) the longer the life of the leucocytes.

If this is so, milk with a high leucocyte content should not reduce resazurin so rapidly after it has been held at temperatures approaching body temperature, and milk held at lower temperatures should reduce at approximately the same rate before and after holding. This has been found to be so, except in the case of milk held overnight at 40° F., when the reducing activity of the cells appear to be definitely increased for no apparent reason.

In all cases a bacterial plate count test was carried out to ensure that any increase in reducing activity was not due to the growth of cryophilic bacteria in the milk during the holding period.

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The Soil as a Source of Infection of Dry Rot of Potato

IT has long been suspected that the fungus causing dry rot (*Fusarium caeruleum*) is present in field soils[1,2] and in soil adhering to seed tubers[3], but, so far as I am aware, no direct proof, based on experimental evidence, has been published.

In 1942, inoculation of susceptible tubers with unsterilized field soil, previously sprayed with a spore suspension of *F. caeruleum*, caused dry rot to develop. The result suggested that this direct inoculation method with soil might be useful to prove the presence of the fungus in field soils and in soil adhering to seed potatoes.

In 1942 and 1943, soil samples were obtained from several farms in Cheshire ; each sample consisted of soil scraped from thirty tubers with a sterile knife and collected in a new envelope in the field at digging time, before the tubers came into contact with any possible source of infection such as hampers, seed boxes or sacks. All the samples proved to be infected. Suitable controls remained sound. Similar results were obtained with many samples collected at random from healthy seed tubers stored in seed boxes in lofts during the winter 1942–43.

During the present winter soil samples were collected at wholesale merchants' stores from seed potatoes imported from Scotland and from Northern Ireland. From each consignment ten of the top-

most tubers were taken from each of three sacks; sacks seen to contain diseased tubers (there were very few of these) were not sampled. Of forty-two samples tested (thirty-three from Northern Ireland and nine from Scotland) thirty-seven were infected.

In the above work, re-isolations and re-inoculations were made frequently; the Fusarium sp. isolated have not yet been identified, but all of them produced dry rot when inoculated into test tubers. The *p*H value of the infected soil samples ranged from 5·16 to 6·74.

The results establish that the fungus (or fungi) causing dry rot of the potato is frequently present in field soils in Cheshire and in soil adhering to imported seed tubers before these are distributed to farmers. To prove that field soils in Scotland and Northern Ireland are infected (as is suggested by these results), it would be necessary to collect the samples in the field at digging time.

The method is being used to test loft sweepings and soil adhering to tubers before and after seed treatment with organo-mercury preparations.

The implications of these findings will be discussed in a later publication.

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University of Manchester. Feb. 23.

[1] Pethybridge, G. H., and Lafferty, H. A., *Sci. Proc. Roy. Dub. Soc.*, **15** (N.S.), 21 (1917).
[2] Foister, C. E., and Wilson, A. R., *J. Min. Agric.*, **50**, 7 (1943).
[3] Foister, C. E., *Scot. J. Agric.*, **23**, 1 (1940).

Training for Citizenship

As one who has learned to look to science for a more dependable kind of guidance, I suffered a feeling of disappointment while reading the article entitled "Training for Citizenship"[1].

The deprecation of the omission of any reference to the value of science as a social discipline is mentioned; but the absence of a scientific approach to the problems of education is ignored.

The creed of 'world-citizenship' is applauded. "If we are all good citizens all the other good things will follow." Such an utterance sounds suspiciously like the very dogma of religious belief that science has struggled for centuries to supersede. Surely there is sufficient evidence of relationship between biological knowledge and educational problems for a scientific approach to be made.

Prof. Julian Huxley describes evolutionary progress as "increased control over and independence of the environment. As an alternative we might define it as a raising of the upper level of all-round functional efficiency and of harmony of internal adjustment"[2].

It does not appear illogical or impracticable to interpret this progress into terms of everyday productive and cultural behaviour of individuals. Neither does it appear unscientific to assert that there can be no fundamental difference between the impetus directing the behaviour of an individual and that of the species to which the individual belongs. If this be sound, then the purpose of education may be accepted to be the imparting of knowledge to aid individuals to solve the problems they may meet in their everyday life in a manner which conforms, so far as is practically possible, to the needs of society as an organic whole. The scientific approach is to gather data from the field of everyday behaviour and, in the light of biological and sociological knowledge, define the problems arising from conflict between inner impulses and environmental conditions. After an adequate definition is formed, the hypotheses of education and citizenship may be framed.

The too-academic man of science appears to overlook the fact that most human problems are social and economic in character. Science has already provided methods of dealing with mathematical problems. It is possible for an individual with an elementary school education to solve everyday problems of numbers with his knowledge of arithmetic. It is possible for him to develop his ability to deal with more complex problems of the same sort from the knowledge made available to him by science in a completely progressive manner. A similar facility exists, through the technical levels, in all branches of the physical sciences.

No such progressive ladders are provided by science in the fields of sociology and economics. If they are, the rungs begin too high. We must bear this condition in mind when scientific efforts are devoted to creating conditions of efficient education and 'world-citizenship'.

It must be remembered that types of education already exist and some have existed for many generations for nine-tenths of our population in the forms of newspapers, cinemas, magazines, music-halls, radio, advertising, foremen, salesmen, policemen, etc. (Some of them are applied far more scientifically than the types recommended in NATURE, and are, therefore, more successful in their results.)

Although these types of education lead to commercial and other solutions in accordance with the interests of small groups instead of cultural solutions in accordance with the interests of democratic society, the fact remains they are the sources of instruction received and the directing-forces of everyday behaviour.

Sufficient evidence can be found among sociological data to indicate that individuals do not integrate with groups, or small groups with wider groups, unless an anticipation exists that the consequences will lead to an all-round independence of environment.

The problem confronting the social scientific worker is to explain how individual independence of environment can only increase with an increasing interdependence on the social environment. The next problem—a technical one—is to make it happen.

Unfortunately, for a large number of people the benefits of socialization are not converted into individual advantage. Sometimes it results in a loss. To expect co-operation from individuals whose experience proves it to be detrimental to their conditions of living and to expect them to become conscious of the need for world-citizenship without evidence different from that derived through their common sense is as unscientific an assumption that can possibly be made. It is contradictory to all scientific knowledge.

While the conflict between inner urge and material environment continues, and while a scientifically directed form of government (which must include education up to the world-citizenship level) fails to materialize due to a false approach, then the practical consequences are likely to be of an explosive character that will force a more natural direction.

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[1] NATURE, **153**, 265 (1944).
[2] "Evolution", p. 564.

THE OAK TREE

By ALEXANDER L. HOWARD

"*Stabat in his ingens annoso robore quercus; una nemus.*" (In aged majesty a mighty oak towers o'er the subject trees, itself a grove.)—OVID.

FROM earliest times the oak tree has been held sacred by all people in all countries, and it is not surprising that it was worshipped by the rude and savage barbarians who inhabited Great Britain two thousand years ago, when Druids held their services under their sacred oaks. In comparison to their ignorant and primitive forms of worship it is good to think that these wild people were impressed by the solemn beauty of their great forests, where tall trunks of trees, roofed in with foliage, made natural cathedrals in the open air.

Apart from its beauty and grandeur the oak tree has played a vital part in the growth of our great Empire; in the reign of Queen Elizabeth our small battleships were built almost entirely of oak.

Boulger quotes it as having been the favourite timber of Greeks, Romans, and Norsemen—the latter having used it for the building of their long ships. He also tells us how the great iron industry of Sussex, which supplied the cannon for Elizabeth's Navy, relied for smelting upon an inexhaustible supply of British oak.

During the War of 1914–18, at a time of crisis, when foreign supplies of timber failed, the nation once again depended upon the faithful services of this mighty tree.

In a tree song which he dates A.D. 1200, Kipling says:

> England shall bide till judgment tide,
> By oak, and ash, and thorn.

Yet now that we have become in many respects a cultured and enlightened nation, there are ominous signs that the immense value and importance of the oak tree has been forgotten.

Those of us who have seen the great oaks that have been felled during the last twenty years cannot fail to have observed that there were definitely three outstanding plantings: the first, and most important, probably being self-sown, and dating back approximately twelve to fifteen hundred years; the second can be placed about 1450; and the third about 200–250 years ago. On the grassy bank beneath the church at Northiam, Sussex, can be seen two interesting examples—a venerable giant of the earlier date, and slightly lower down the bank a lesser giant, which probably belongs to the second era. Still lower there is a healthy youngster of about forty years, which, however, has been identified as a fine specimen of *Q. Merbeckii*, a semi-evergreen oak, native of northern Africa, which retains its leaves until the New Year. The Knightwood oak, near Lyndhurst, in the New Forest, still stands; until a year or two ago "The Twelve Apostles", in Lord Petre's Park, at Brentwood, Essex, and many other veterans were still flourishing. On Sir George Courthope's estate at Whiligh, near Tunbridge Wells, is an oak tree which can be best described in his own words:

> "the old manorial map which showed a little picture of 'ye olde oake' in more or less its present condition, was dated 1493. The bark is most vigorous. When I was a child there was an opening over two feet wide into the hollow trunk, in which several persons could sit. The opening is now only a few inches wide."

Near by is another fine example, the age of which is unknown, but which I thought might belong to the second category of about 450 years ago. Sir George Courthope describes it as follows:

> "The specimen oak today has a girth of exactly 15 feet five feet from the ground, and is practically cylindrical until the spring of the first two branches, just over thirty feet up. The stem continues from another 10 or 12 feet to the main spring of boughs. It still grows. In, I think, 1920, when the Royal Arboricultural Society first came here, Henry Elwes and Dr. Henry saw the tree for the first time. The girth was then just under 14 feet, and the volume of the log was calculated at 410 cubic feet. In 1914 a would-be buyer . . . offered me £317 f.o.v. . . . for the log up to the second spring of boughs, which they calculated at 634 cubic feet. The haulage of so great a log would have destroyed three-quarters of a mile of farm road and half a mile of carriage drive; so the tree still stands."

It would appear from Sir George Courthope's records that two other somewhat similar trees were taken from the west side of the house and used for the restoration of the Westminster Hall roof. The Clerk of Works to the House of Commons counted more than five hundred annual rings in a squared beam (heartwood only) which was used for this purpose. About thirty years ago another specimen belonging to this category was felled at Danbury Palace, in Essex. This is referred to in "A Manual of the Timbers of the World":

> "it had five secondary trunks growing out of the butt, all of which were of a very rich brown colour. After the tree was sold a man was idly pulling out the decayed wood from a hollow in the side of the trunk, when he felt something hard, which he discovered was a small coin, afterwards found to be of Roman origin."

The authority H. J. Elwes was sceptical about these accounts of the great age of the oak tree—a doubt shared by Sir Geoffrey Evans—but as a result of years of careful study, despite the opinion of these two authorities, I still believe in them. Under the best conditions I think the oak continues to flourish for about five hundred years: apparently a further span of two hundred years follows, during which time little change is noticeable, and afterwards five hundred years or more will be passed before it reaches its last stage. A good example of this later condition can now be seen by the church at Hawkhurst, in Kent, where there is an old oak, its life finished, but the dead remains bricked in. One other, which is still producing a few shoots, can be seen by the church at Catsfield, in Sussex. The historic oak tree at Hatfield Park, now a hollow shell filled with concrete and fenced around (said to have been dead for about sixty-five years) can still be seen. According to tradition, it was under this tree that Queen Elizabeth was resting when she received the news of the death of her sister—Queen Mary. Every care has been taken to preserve it, and there is a tablet painted stating that it is the identical tree. There is every reason to accept this story, and if such be the case we may well believe that four hundred years ago the tree was flourishing, and it is likely that at that time it would have been more than 500–600 years old. In the near neighbourhood, at Brocket Park, a tree still stands, which produces a good crop of leaves year by year. This tree is taken care of and valued for its antiquity. The butt, measuring 32 feet in circumference, is clothed with sound healthy bark to a height of 12 feet, where it breaks out with immense limbs, which still produce an abundance of

rich green leaves. It has sometimes been claimed that it was under this tree that Queen Elizabeth received the news, but the history of Hatfield Park negatives the claim of Brocket Park.

Fifteen hundred years ago Pliny tells us :

"In the same North climate is the mightie forrest Hercynia. A huge and large wood this is, stored with tall and big okes, that never to this day were topt or lopt. It is supposed they have beene ever since the creation of the world, and in regard of their eternall immortalite surmounting all miracles besides whatsoever. And to let passe all other reports which happily would be thought incredible, this is knowne for certaine, that the roots of the trees there, run and spread so farre within the ground, that they encounter and meet one another : in which resistance they swell and rise upward, yea, and raise up mounts of earth with them to a good height in many places : or, where as the earth followeth not, a man shall see the bare roots embowed arch-wise, and mounting aloft as high as the very boughes : which roots are so interlaced, or else rub one against the other, striving (as it were) not to give place, that they make a shew of great portailes or gates standing open so wide, that a whole troupe or squadron of horsemen may ride upright under them in ordinance of battell."

For near 250 years the planting and conservation of the oak tree has almost ceased, and during this critical time prodigious demands have nearly destroyed the last reserves in Britain. Nor is this the worst. Before the War, the numerous country sawmills found it a profitable business to handle small and immature trees, because the plant at their disposal was unsuited for the larger sizes. Meeting a vigorous demand caused by the ever-increasing building operations which have continued since the War of 1914–18, and finding owners hard put to it for death duties and increased taxation, great numbers of oak trees of 60–150 years growth have been reluctantly sacrificed. Indeed, since the present War began, whole tracts of beautiful woodlands have been ruthlessly cut down, quite regardless of size and age, and a host of parks throughout the country have been denuded of timber-like trees.

At three successive periods of our history, the Government or the reigning monarch has recognized the urgency of the situation, so that in the reign of Edward I, again in Elizabeth's time, and lastly in Charles II and James II reigns, laws were passed prohibiting the felling of trees. We read of how Samuel Pepys was greatly troubled on account of a strange situation concerning the Duke of Albemarle and the Earl of Clarendon with regard to the oak trees in Clarendon Park. Pepys notes in his Diary on July 23, 1664, that he would "rather fling away the gains of £2,000 or £3,000, than have it said that the timber *which should have been the King's* . . . was concealed by us in favour of my Lord Chancellor". It would be well if the same spirit which animated the people of those days could be revived again to-day. The fierce flame which burnt in those stormy times is illustrated by the action of the Duchess of Monmouth, who took revenge on King James after her husband had been beheaded, by cutting in half all her oak trees at Moor Park, in order that the timber should not be employed in the building of the King's ships.

The debate in Parliament (1943) possibly marked the second occasion only in more than a hundred years, when this subject of such vital importance to the State received the attention of the Government. One fact alone which emerged should open many eyes, and that is that the soil and climate of Britain can and will produce a growth of forest wealth as good and better than any other country of similar character.

It would, of course, be ridiculous to plant the oak tree in uncongenial areas ; but it should be planted, and planted again continuously, in those soils and counties where it flourishes. Natural regeneration of oaks occurs year after year, and trees so produced have a sturdier and better growth than anything that can be planted. Such areas should be preserved by law, as they have been for years past in southern Europe and elsewhere. No person or municipality should be allowed to cut down any tree, either mature or immature, unless he can prove to the recognized authority that he has planted at least five to take its place, or alternatively, that he has wired against vermin and preserved a naturally regenerated area of equal value.

Elwes mentions in "Timbers of Great Britain and Ireland" innumerable species of oak (*Quercus* sp.) as established in Great Britain, but in this article I shall confine myself to four which I consider the most important, namely, *Q. pedunculata* Ehrh. ; *Q. sessiliflora*, Salisbury ; *Q. Cerris*, Linn. ; *Q. Lucombeana* (Sweet).

Q. pedunculata is represented by many thousands of trees in all parts of England, Wales and Ireland, and in a smaller degree in Scotland. These trees are of all ages, sizes, and in all conditions, but alarmingly reduced in number throughout the last 50–70 years. To-day *Q. sessiliflora* is rare, and a careful search and inquiry carried out during the last forty years convinces me that it has never been abundant in Great Britain. Mr. D. W. Young, the deputy surveyor of the New Forest, tells me that there are considerable tracts in certain parts, but I and many others who have sought for them have never been successful in our search, and I think this species has been introduced from the Continent, an opinion which is shared by others. In beauty as well as in timber, despite the controversy which has persisted since the time of wooden ships and the writings of Laslett, we can safely say that these first two species have equal merit.

In strength and durability there is nothing grown in our country which can compare with British oak, and indeed, although the oaks of America, Canada, Northern and Southern Europe, Japan, etc., are very numerous and approach equality, it may be safely affirmed that the British oak is pre-eminent. In the days when our stout ships travelled the seas, there was nothing else that could have been found strong and sturdy enough to provide the main structure and the planks, and we have an intensely interesting and informative account of the manner in which the utmost care was taken to bring into use the huge branches with their gnarled and twisted growths, so that the limbs of the crown of one single tree were of more value than the huge trunk which supported them.

The Rev. C. A. Johns tells us about a tree which was felled in the New Forest :

"It stood singly in the wood, and extended its massive branches nearly 40 feet each way. Its head was all knees and crooks, aptly suited to naval purposes ; its bole or shaft was short, not exceeding 20 feet in length ; but it was full 6 feet in diameter at the top, and perfectly sound. It was felled in an unusual manner for the preservation of its crooks, which were cut off one by one whilst the tree was standing, and lowered by tackles, to prevent their breaking. The two largest arms were sawed off at such distances from the bole as to make first rate knees ; scaffolds were then erected, and 2 pit saws being braced together, the body was first cut across, half through at the

bottom, and then sawed down the middle, perpendicularly between the two stumps of arms that had been left, at the end of one of which stood a perpendicular bough, bigger than most timber trees. To prevent this being injured a bed was made of some hundreds of faggots to catch it when it fell. This half was so weighty that it crushed a new timber carriage all to pieces the instant it was lodged upon it; and none in the country being found strong enough, the King's carriage was sent purposely from Portsmouth to convey it to the Dockyard. This tree was sold in the 1st place for £40, was bought of that purchaser by a timber merchant for £100, who is supposed to have cleared £100 more; which he might very well do, for the contents amounted to 32 loads of hewed timber, which at 2/6 a foot—no unusual price for naval crooks—amounts to £200 precisely, besides faggots etc. sufficient to defray expenses. The breadth of the tree across near the ground, where it was cut was 12 feet."

It is impossible to catalogue the great number of uses for which oak is preferable to any other British home-grown woods, nor is it necessary, as its qualities are so widely known. Perhaps, however, its uses for panelling or general interior decorative woodwork are not sufficiently recognized. When it was first used in this capacity the superiority of English-grown oak over that of foreign origin was apparent. By degrees its merits appear to have been forgotten, so that importations of foreign competitors became fashionable. Proprietors, proud of their rich inheritance of real old English oak panelling, recognized its value, but new aspirants failed to understand that imported oak was not comparable with British. There is no oak obtainable from any part of the world which will assume the rich golden colour or the attractive figure of English-grown oak, which should not be polished, but left from the tool. Quoting from "A Manual of the Timbers of the World", p. 364:

"When certain individual British oak trees (*Quercus Robur*) are felled, their ordinary heart-wood is found to be partially or wholly changed into a richer toned reddish-brown wood which is known as 'brown-oak'. It was formerly, and indeed it is occasionally even now, among English timber merchants and others in this country, called 'red oak'. The colour is much like that of polished crocodile leather, very variable in character, depth, and richness. It may be uniformly of a comparatively light brown, or again a deep rich brown, having in some cases lighter streaks; while in some portions from one to two inches wide, the ordinary colour does not appear to have been affected at all; again, the warm brown may be spotted and streaked with almost black veins, presenting a rich appearance. This last form is called 'tortoise-shell' pattern."

The beauty and usefulness of this brown oak has never been properly appreciated in England, but curiously enough the demand from America has been persistent and considerable. To meet this demand during the last half-century many thousands of the oldest and best trees which we possessed have been shipped across the Atlantic.

It is commonly known that the sapwood of oak should never be included with any woodwork requiring a long life. The sapwood decays very rapidly, and moreover it is particularly liable to attack by the Lyctus and Zestobium beetles, and fungi. The attack from beetle will often begin within a year after the work has been finished, and will certainly appear in the course of years. Having started, it will invariably spread to the heartwood, and it is therefore essential that sapwood should be entirely excluded. Hitherto it has been rare to find any oak woodwork which has been installed, completely free from the inclusion of sapwood, and the failure to insist upon this practice has been the cause of most, if not all, of the trouble which has been experienced.

With reference to durability, Elwes tells us:

"Many cases have been recorded and published of the great durability of the timber of the oak under ground and under water; but I have come across no relic of the past so interesting in this respect as the prehistoric boat which was dug up at Brigg, in Lincs. in 1884. This wonderfully preserved dug-out was hollowed out of one huge oak log 48½ feet long and approx: 6 feet in diameter, which showed no signs of branches, a log which must have contained nearly 1000 ft. of timber, and which could not be matched now in England, or so far as we know, in Europe or N. America. The boat is 4 ft. 3 ins. wide by 2 ft. 8 ins. deep at the bows, and 4 ft. 6 ins. by 3 ft. 4 ins. at the stern, which was the root end of the tree. The sides are about 2 inches thick, the bottom 4 inches at the bows, and as much as 16 inches at the stern. One stern piece was ingeniously fitted in, though not found in situ, and a large rift on one side had been still more cleverly repaired with wooden patches caulked with moss. No metal had been used in any part of it. The boat was found imbedded in the blue & brown clay which underlies the peat, and is considered on geological evidence, which is given with great detail, to be from 2600 to 3000 years old."

The Lucombe oak (*Q. Lucombeana* (Sweet)) produced something of a sensation in arboricultural circles when in 1773 William Boutcher wrote as follows:

"About 7 years since, Mr. Lucombe of St. Thomas near Exeter, sowed a parcel of acorns, saved from a tree of his own growth, of the iron or wainscot species. When they came up he observed one amongst them that kept its leaves throughout the winter. Struck with the phenomenon, he cherished and paid particular attention to it; he propogated it, by grafting some thousands from it, which I had the pleasure of seeing, 8 days ago, in high flourishing beauty and verdure, notwithstanding the severity of the winter. Its growth is straight, and handsome as fir; its leaves evergreen: and the wood is thought by the best judges, in hardness and strength to exceed all other oaks. It makes but one shoot in the year, viz. in May, and continues growing without intermission: whereas other Oaks shoot twice, viz. in May and in August. But the peculiar and inestimable part of its character is, the amazing quickness of its growth, which I imagine may be attributed (in some degree at least) to its making but one shoot in the year: for, I believe, all trees that shoot twice are some time at rest before they make the second."

Although Boutcher reported the oak as evergreen, it is more correctly described by Elwes as "sub-evergreen", retaining its leaves until the following year.

It appears that Mr. Lucombe had in his nursery a specimen tree of the cork oak (*Q. suber*) near a specimen tree the Turkey oak, *Q. Cerris*, and that he concluded that the flowers were pollinated by the cork tree. This opinion was afterwards confirmed by Sir Hugh Beevor, who raised a similar tree under the same conditions. Messrs. Salter, Simpson & Sons, of Attleborough, have informed me under date of Feb. 1, 1944, that the tree Sir Hugh Beevor showed me forty-five years ago still flourishes, and that its present height is 45 feet, with a circumference of 3 feet 6 inches at 5 feet from the ground. The supposition that the tree is a hybrid of *Q. cerris* and *Q. suber*, which has produced such a remarkably fine timber, proves that we have been both idle and unenterprising, for in truth the wood of the Lucombe oak, if available, might have taken the place of foreign imports, and so released our shipping and increased our revenue. Little data exist upon which to base definite assertions; but the information we have goes to prove that this wood surpasses in

strength and durability more costly varieties that have been imported from abroad.

Elwes tells us that it is doubtful when *Q. Cerris*, or the Turkey oak, was introduced into Great Britain, but since neither Evelyn nor other authorities up to his time mention it, we may safely assume that its introduction dated from about two hundred years ago, when it became very popular throughout the south of England.

English landscape and parklands have a world-wide reputation, and one of the most noticeable and characteristic features is the Turkey oak, which has a grace and beauty all its own. As Elwes emphasizes, it grows not only faster but also straighter than other oaks, and although somewhat similar in appearance there is a subtle difference. The rugged dark-coloured bark first attracts attention, which is afterwards turned towards the noble crown, more widely spreading than the common oak and adorned with a richer green and jagged leaf. The tree produces a very pretty mossy-cupped acorn. The colour of the timber is similar to that of the common oak. It has a bad reputation among craftsmen, as it is harder and heavier to work and more inclined to split in seasoning. It contains a larger proportion of sapwood than the common oak, the outer line of which quickly perishes. The inner line, when carefully dried off, becomes as hard and durable as the heartwood. I am inclined to think that it has been used in the place of ordinary oak, and despite the difficulties already mentioned, I believe that with proper treatment it would be found as useful and durable as other kinds.

In Norway, Sweden and Finland, where the forest wealth plays a most important part in the economic life of the countries, I understand a day is set apart when men, women and children set forth to plant trees. For nearly two hundred years the people of England have enjoyed or been spoilt by a prosperity unequalled, if not unsurpassed, by any other country except America, which ominously reminds us of the state existing in the Roman Empire 1800 years ago. The contrast between the action of our forefathers, to whom we owe the inheritance of our woodlands, and later generations, is nowhere more clearly seen than in the direction of reafforestation.

I have been told that in the eighteenth century Admiral Collingwood used to walk out with his pockets full of acorns, which he distributed over his estate, and the owner of that country, which includes what is now called Chanctonbury Ring, used to ride or walk to the top of the hill every day during the season and sow beech mast or plant a tree.

No words of mine can better express the policy which should be adopted by the State to-day than those written by Evelyn 260 years ago :

"And if thus His Majesty's forests and chases were stored, viz. with this spreading tree at handsome intervals . . . benignly visited with the gleams of the sun . . . nothing could be more ravishing. . . . We should find such goodly plantations for the boast of our rangers, and forests infinitely preferable to anything we have yet beheld, rude and neglected as they are today, when his Majesty shall proceed, . . . to animate the laudable pride into fashion, forests & woods . . . will present us with another face, than now they do. And here I cannot but applaud the worthy industry of old Sir Harbotle Irmistone, who I am told from a very small nursery of acorns which he sowed in the neglected corners of his grounds did draw forth such numbers of Oaks of competent growth . . . and did wonderfully improve both the beauty and the value of his desmesnes."

TESTING WOOD PRESERVATIVES

AN article by J. Leutritz (*Bell Lab. Rec.*, 22, No. 4 ; December 1943) describes laboratory and outdoor tests made on wood preservatives used for impregnating poles for communication lines. Sticks ¾ in. square and about 3 ft. long are cut from boards of southern pine sapwood, the uniform size of these samples facilitating calculation of the wood density and the amount of preservative retained, as both are based on volume.

Laboratory tests on preservatives are now carried out in an experimental cylinder by either full- or empty-cell methods. For the former, the air is evacuated from the cylinder containing the specimens, and after a specified time the cylinder is filled with preservative, air pressure being applied to force the latter into the wood cells ; about 30 lb. of preservative can be injected per cu. ft. of wood. In the empty-cell treatment the cylinder air pressure is raised to from 25 to 50 lb./sq. in. Then the preservative is pumped in, and the pressure is raised still higher to force the preservative into the wood. Upon releasing the pressure, the expansion of the initial air trapped by the preservative forces out the excess from the wood, and theoretically only the cell wall is coated. Vacuum is applied after the pressure is released to empty the cells more completely. The initial air pressure largely determines the amount of preservative which will be forced out of the cells, while the difference between the initial and final pressures controls the distribution and penetration.

About twenty sticks are selected for each charge and the sample is weighed before and after treatment, the gain being taken as the basis for calculating the amount of preservative retained. Then the sticks are cut at the centre to give specimens treated under identical conditions for comparison by the laboratory rot test and by field exposures. For field-exposure tests the specimens are buried to a depth of 7 in. in a uniform distribution throughout the test plot. They are examined once a year and the amount of decay at and below the ground-line is rated. Since some specimens survive several years or do not fail under exposure tests, a time rating was devised which takes into consideration their past performance.

When a preservative shows promising results in laboratory and field tests, larger material of fence-post size and eventually 10 ft. posts are treated and exposed in 'test gardens'.

ELECTROSTATIC ELECTRON LENSES

AN article by K. Spangenberg and L. M. Field (*Elec. Comm.*, 21, No. 3 ; 1943) describes and discusses the measured characteristics of a number of electrostatic lenses, giving the characteristic curves of nine different lenses belonging to three basic types. The forms tested were cylinder lenses of various spacings and diameter-ratios, aperture lenses (parallel plates with circular apertures on the beam axis) of various spacings, and, for comparisons, a lens formed by a cylinder and an aperture in a plate. By interpolating between the sets of curves given, approximate predictions of the properties of lenses of slightly different spacings or diameter-ratio may be made. The test method employed makes use of a

conventional electron-gun with parallel wire grids which, for measurement purposes, are placed before and after the lens to be tested. All the lens characteristics are deducible from measurements made on shadows cast by these measuring grids upon a fluorescent screen placed in the electron beam at a suitable distance from the gun.

The measured characteristics of the electron lenses are presented in the form of object-image distance curves termed p–q curves. These show the relation between object distance and image distance for any ratio of the voltages applied to the electrodes; they also show the lateral magnification associated with any combination of object and image distances. These curves are a graphical presentation of the complete solution of the lens formulæ and they give immediately and directly the relation between all quantities necessary for lens design. The p–q curves further show the interrelation between all the operating characteristics, the quantities involved being object distance, image distance, lateral magnification, and voltage ratio. The object distance (p) is the distance from some reference plane in the lens structure to the point from which the rays emanate. The image distance (q) is the distance from the same reference plane in the lens structure to the point on which the rays are focused. The lateral magnification is the ratio between the height of any corresponding portions of image and object. The voltage ratio is the ratio of potentials on the two components of the electrode structure calculated on the basis of zero potential at the point at which the electron velocity is approximately zero, usually at the cathode. It is only the ratio of potentials and not the absolute magnitude that is of importance, since electron paths are independent of the scale of the potential for the same starting conditions. For completeness, the lens characteristics are also presented in the form of the conventional focal distance curves which show the variation with voltage ratio of the two focal lengths and of the two focal points. All the image-forming properties of the lens may be deduced from these parameters.

FORTHCOMING EVENTS

Wednesday, April 12

TOWN AND COUNTRY PLANNING ASSOCIATION (at St. Martin's School of Art, Charing Cross Road, London, W.C.2, in conjunction with the Exhibition "Reconditioning England"), at 3 p.m.—Mr. F. J. Osborn: "Preservation and Progress".

INSTITUTION OF ELECTRICAL ENGINEERS (TRANSMISSION SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Mr. G. W. Preston and Dr. H. G. Taylor: "Copper Conductors for Overhead Lines".

INSTITUTE OF WELDING (at the Institution of Civil Engineers, Great George Street, Westminster, London, S.W.1), at 6 p.m.—Dr. L. Reeve: "Factors Controlling the Weldability of Steel".

Thursday, April 13

GENETICAL SOCIETY (at the Linnean Society, Burlington House, Piccadilly, London, W.1), at 11.30 a.m.—Symposium on "The Application of Genetics to Plant and Animal Breeding".

INSTITUTION OF ELECTRICAL ENGINEERS (INSTALLATIONS SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Mr. C. A. Cameron Brown: "The Electrical Aspect of Farm Mechanization".

Friday, April 14

INSTITUTION OF CHEMICAL ENGINEERS (at the Connaught Rooms, Great Queen Street, London, W.C.2), at 11 a.m.—Twenty-second Annual Corporate Meeting; at 12 noon—Mr. F. A. Greene: "Our Title—a Reminder" (Presidential Address); at 3 p.m.—Mr. J. G. Bennett: "Coal and the Chemical Industry" (First J. Arthur Reavell Lecture).

SOCIETY OF CHEMICAL INDUSTRY (PLASTICS GROUP) (at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2), at 2.30 p.m.—Symposium on "Electrical Properties of Plastics" (Mr. H. A. Nancarrow: "A Survey of Thermal Plastics as Dielectrics"; Dr. L. Hartshorn: "The Principles of High Frequency Heating"; Mr. E. Rushton: "Tracking").

ROYAL ANTHROPOLOGICAL INSTITUTE (joint meeting with the INTERNATIONAL AFRICAN INSTITUTE) (at 21 Bedford Square, London, W.C.1), at 5 p.m.—Mrs. G. M. Culwick: "Nutrition in East Africa".

ROYAL ASTRONOMICAL SOCIETY (at Burlington House, Piccadilly, London, W.1), at 4.30 p.m.—Prof. E. A. Milne, F.R.S.: "On the Nature of Universal Gravitation".

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (at the Literary and Philosophical Society, Newcastle-upon-Tyne), at 6 p.m.—General Discussion on "Radiological Testing" (Speakers: Sir Lawrence Bragg, F.R.S., Dr. S. F. Dorey, Dr. V. E. Pullin, Dr. H. Harris).

APPOINTMENTS VACANT

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

MASTER FOR MATHEMATICS AND SCIENCE—The Clerk to the Governors, North-East Essex Technical College and School of Art, Colchester (April 11).

WAYNFLETE PROFESSORSHIP OF METAPHYSICAL PHILOSOPHY—The Registrar, University Registry, Oxford (April 13).

LECTURER for Degree and National Certificate subjects in MECHANICAL ENGINEERING—The Organizer of Further Education in Rugby, College of Technology and Arts, Eastlands, Rugby (April 14).

LABORATORY STEWARD in the Science Department of the Doncaster Grammar School—The Chief Education Officer, Education Offices, Doncaster (April 15).

RESEARCH WORKER (who should be a PHYSICIST with some research experience) in the Coal Treatment Laboratory of the Mining Department—The Secretary, The University, Edmund Street, Birmingham 3 (April 15).

LECTURER (preferably a woman) IN BIOLOGY—The Warden, Goldsmiths' College, at University College, Nottingham (April 15).

ASSISTANT HYDROGRAPHIC SURVEYORS by the Kenya Government Public Works Department—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Advertising Section, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. E.904A) (April 15).

PRINCIPAL of the Yeovil Art and Technical Institute—The Chief Education Officer, County Hall, Taunton (April 15).

HEADMASTER of the Junior Technical School—The Chief Education Officer, Education Offices, Doncaster (April 15).

GRADUATE ASSISTANTS (full-time) FOR MECHANICAL ENGINEERING, ELECTRICAL ENGINEERING, and a GRADUATE (or equivalent qualification) IN BUILDING OR STRUCTURAL ENGINEERING, at the Darlington Technical College and Technical School—The Chief Education Officer, Education Office, Darlington (April 15).

TEACHER (full-time) OF ENGINEERING SUBJECTS, including Electricity—The Principal, Technical and Art Institute, Queen's Road, Watford, Herts. (April 17).

ASSISTANT (full-time) to teach WORKSHOP PRACTICE, ENGINEERING DRAWING, MATHEMATICS and ENGINEERING SCIENCE, at the Jarrow Technical School and Evening Institute—The Director of Education, Shire Hall, Durham (April 19).

SENIOR AND JUNIOR ENGINEERS (MECHANICAL AND ELECTRICAL) to carry out work of national importance in a Government Department (location, London)—The Ministry of Labour and National Service, Room 432, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. C.2097A) (April 22).

RESEARCH METALLURGIST, preferably with knowledge of ENGINEERING, by well-known North Country firm specializing in the Use and Heat Treatment of High-Carbon and Alloy Steels—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Room 432, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. F.2019XA) (April 29).

PROFESSORSHIP OF ENGINEERING SCIENCE—The Registrar, University Registry, Oxford (April 30).

LECTURER (full-time) IN CHEMISTRY at the Cardiff Technical College—The Director of Education, Education Offices, Cardiff (May 1).

CHAIR OF PHILOSOPHY at the University of the Witwatersrand, Johannesburg—Dr. William Cullen, 4 Broad Street Place, London, E.C.2 (May 1).

DIRECTOR OF THE INSTITUTE OF MEDICAL AND VETERINARY SCIENCE, Adelaide—The Agent-General and Trade Commissioner for South Australia, South Australia House, Marble Arch, London, W.1 (May 31).

CHAIR OF NATURAL PHILOSOPHY, United College, St. Andrews—The Secretary, The University, St. Andrews (June 15).

LECTURER FOR BIOLOGY AND HYGIENE—The Principal, St. Katharine's College, Tottenham, at Cary Park, Babbacombe, Torquay.

LECTURER IN the Junior Technical School (subjects: MATHEMATICS, SCIENCE, DRAWING)—The Registrar, Technical College, Cheltenham.

SENIOR SCIENCE AND MATHEMATICS MASTER—The Headmaster, Alleyne's Grammar School, Stevenage, Herts.

DESIGNING ENGINEER for the Steel Tube Trade in Birmingham—The Ministry of Labour and National Service, Appointments Office, 2 Calthorpe Road, Birmingham 15 (quoting Reference No. 1368).

ASSISTANT MECHANICAL ENGINEER for the Sudan—The Secretary, Overseas Manpower Committee, Ministry of Labour and National Service, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. 1302).

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

British Standard Recommendations for the Storage of Micro-Film (British Standard 1153—1944.) Pp. 6. (London: British Standards Institution.) 1*s*. [143

Town and Country Planning Association. Forty-fifth Annual Report. Pp. 8. (London: Town and Country Planning Association.) [143

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