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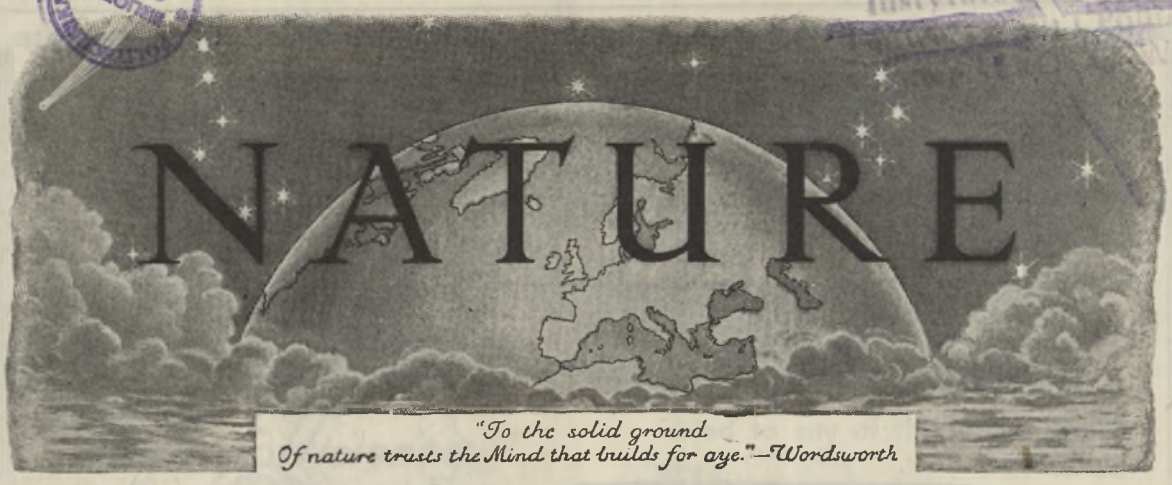

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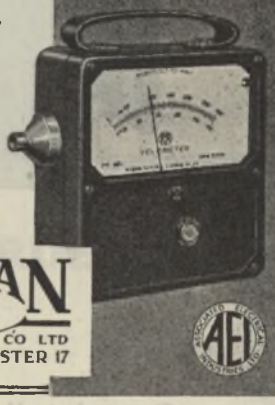

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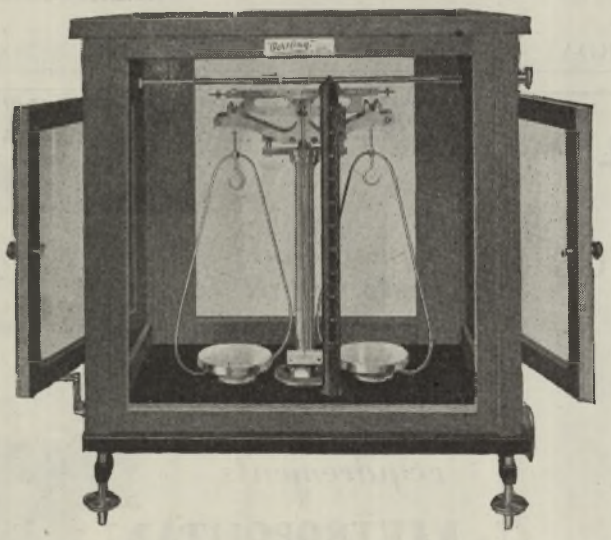

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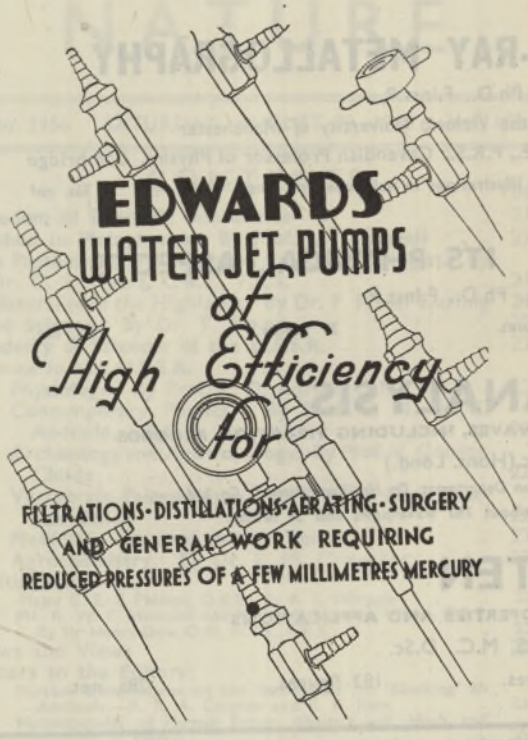

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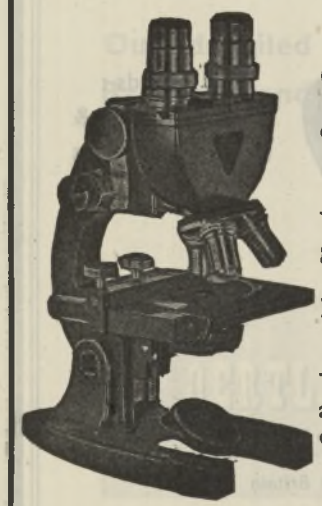

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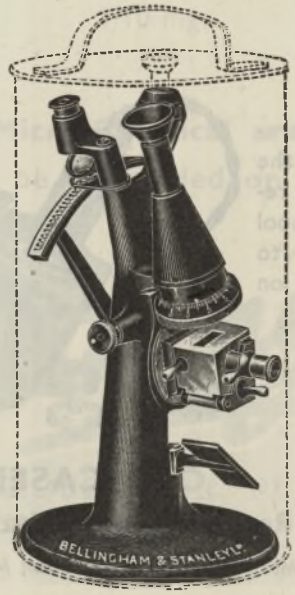

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NATURE

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FREEDOM OF SCIENTIFIC INTERCOURSE

SPECULATIONS as to the implications for material progress no less than for destructive purposes of the immense co-operative scientific effort that went to the evolution of the atomic bomb may tend to distract attention from some important issues relating to the progress of science itself. The profound secrecy in which this effort has been enveloped should emphasize the fact that for some six years the normal channels of communication between scientific men have been interrupted, and to restore such intercourse across national frontiers is the first step to stimulate the creative thought and exchange of knowledge and ideas upon which the progress of science finally depends. Sir Henry Dale has been prompt to point out, in a letter in *The Times*, that the preservation of civilization itself may now well depend on the fullest freedom of scientific intercourse. The abandonment of any national claim to secrecy about scientific discoveries, he suggests, must be a pre-requisite for any kind of international control such as will be indispensable if we are to use atomic energy to its full value and avoid the final disaster which its misuse might bring.

There may be no immediate opportunity for a national, still less for an international, exchange of scientific opinion, but the magnificent loyalty with which scientific workers have kept this greatest of war secrets cannot disguise the fact that those concerned, and their colleagues in science everywhere, are increasingly impatient for the revival of the world community of science to which Sir Henry referred. The importance of removing the restrictions on the scientists' liberty "to know, to utter, and to argue freely according to conscience" has already been stressed in the discussions on the development of scientific and industrial research in Britain, and has been emphatically endorsed in the report which Dr. Vannebar Bush recently presented to President Truman under the title "Science: the Endless Frontier". That report showed unmistakably that authoritative scientific opinion in the United States has come to recognize the need for more official methods of carrying on international scientific activity. Not merely the removal of war-time restrictions and hindrances, but also the positive encouragement of the exchange of knowledge and ideas by means of international scientific congresses, international fellowships and the like is strongly advocated.

Similar ideas have previously found expression in the report of the British Commonwealth Science Committee (see *Nature*, **152**, 29; 1943) and Dr. Joseph Needham's proposals for an International Science Co-operation Service (*Nature*, **154**, 657; 1944). They have been strongly emphasized in Britain, in the U.S.S.R. and in the United States in connexion with the recent visit of scientific workers to the Soviet Union to celebrate the two hundred and twentieth anniversary of the Academy of Sciences of the U.S.S.R. Co-operation with Russian men of science, said Sir Robert Robinson, in addressing the

Parliamentary and Scientific Committee, is absolutely necessary. Prof. E. N. da C. Andrade commented on the complete absence of suspicion, and on the value of personal contacts, particularly in view of the existing postal delays. With the opening of the Baltic and increased air service, an improvement in the postal services and in means of communication in general may be expected, but even so, as Sir Lawrence Bragg has emphasized elsewhere, it is often impossible to judge the value of a new theory or technique without personal visits or discussions. An interchange of advanced students would do much to increase understanding and to promote collaboration, and Prof. D. M. S. Watson on this same occasion referred to the evident desire of Russian scientific workers to keep in touch with scientific work and progress in the world also and for such interchange of young men of science and research students.

Several of the British visitors have surveyed very briefly their general impressions of Russian progress in the various branches of science, and elsewhere in this issue of *Nature* we are publishing some of these articles. From these it seems clear that Russian men of science and their Government desire such a two-way traffic. Prof. Andrade writes of the abiding impression made by the spirit of cordiality and co-operation in which the delegates were everywhere received. Prof. Watson refers to the real need for closer contact with workers in other countries, and especially of travel, and of the dependence of satisfactory work on such free association of workers in all lands. Prof. E. D. Adrian makes the same point even more emphatically in respect of physiology. Until the war-time restrictions on travel are removed, we shall not properly appreciate all that Russian physiologists are doing, and they will have no first-hand experience of our methods and ideas. We and they both need an exchange of students in addition to the exchange of journals.

Everyone is so aware of this, and the delegates were so cordially received, that it is hard to believe that the restrictions will remain, particularly in view of the speech of Kapitza on June 23, which showed that the U.S.S.R. recognizes the importance of international co-operation and that the Academy intends to promote international co-operation by these measures, all of which have been urged on the Government of the United States in Dr. Vannebar Bush's report. When Prof. Adrian concludes that the British delegates will only complain if they are not allowed to repay some of the kindness shown to them by their hosts, he is clearly expressing a common sentiment. It may be a further hopeful sign that there should since have been published the draft proposals for an educational and cultural organization of the United Nations, to be established, according to the preamble, in recognition that "co-operation in education and the furtherance of cultural interchange in the arts, the humanities and the sciences will promote the freedom, the dignity and the well being of all and thereby assist the attainment of understanding, confidence, security and peace among the peoples of the world"; and in dedication to the proposition "that the free and unrestricted education of the people of the world and the free and unrestricted exchange among them of ideas and knowledge are essential to the advancement of human welfare and to the preservation of security and peace."

But for the effective promotion of scientific intercourse across national frontiers, something more than organization is required; and the point has been uncomfortably emphasized in connexion with this very visit to the Academy of Sciences of the U.S.S.R. The appointment of scientific attachés might indeed do something to increase the flexibility of organization, to promote more informal and intimate contacts, as well as to remove causes of misunderstanding. Such a system may become imperative to the building up of the confidence essential for framing a system of co-operation in handling and harnessing to constructive purposes the new powers disclosed in the release of atomic energy; but so far, apart from Great Britain's agricultural attaché in Washington and Prof. E. Ashby's appointment to the Australian Legation in Moscow earlier this year, no practical steps have been taken to give effect to an idea which has already been widely discussed among scientific workers.

If the recommendations of Dr. Vannebar Bush's report are accepted, we may expect to see the United States also experiment with scientific attachés in certain embassies, and Dr. Bowman's Committee had the U.S.S.R. specially in mind in making the suggestion. No system of scientific attachés, however, can obviate the need for the handling of scientific co-operation and communications with more understanding, not to say courtesy, by Government departments and officials generally.

The readiness with which scientific workers have accepted the restrictions on their freedom of communication does not mean that such restrictions should be imposed unreasonably or without regard to the common courtesies of civilized life.

It is on this ground that men of science in Britain have a right to protest firmly against the circumstances in which the exit permits of eight of their colleagues invited to attend the anniversary celebrations of the Academy of Sciences of the Soviet Union were cancelled at the last moment by the Government. We may leave the Foreign Office to deal with the discourtesy to the Soviet Government implied in such a cancellation; but however substantial may have been the reasons which decided the Government to withhold permission for these eight men to proceed to the U.S.S.R., we cannot reasonably be expected to believe that such a decision could not have been reached at a much earlier stage. The complete disregard of all personal considerations has undoubtedly roused strong resentment, and scientific workers owe it to themselves to protest emphatically against what appears to be a piece of bureaucratic incompetency or tyranny.

The right of the Government to impose restrictions on international scientific intercourse, at any rate in war-time, or to lay down conditions to which such intercourse must conform, is not challenged; though scientific men have a perfect right to consider for themselves whether it is worth proceeding with a

particular foreign visit under particular conditions. Even with the improvement of communications through air transport, however, a visit to such a country as the U.S.S.R. is not to be undertaken without a certain amount of personal inconvenience. Responsible scientific men may have to obtain leave of absence and to arrange for deputies during their absence; private arrangements have to be made regarding homes or families; and in these days, in addition to passports and visas, there is usually inoculation against typhus or other diseases likely to be encountered, with all the physical discomfort or even incapacitation that is involved. No one complains if for some urgent and unexpected reason it is necessary to cancel at the last minute arrangements made in good faith, but common decency should forbid any one being put to the inconvenience involved in the preparations unless there is every reason to believe that he or she will make the journey.

Nor is it merely in regard to scientific workers leaving Britain that there are strong grounds for complaint of official slackness and discourtesy. The treatment of distinguished scientific visitors to Great Britain leaves a great deal to be desired. Both in entering and in leaving the country, such distinguished visitors, possibly invited by a scientific society of standing, may be obliged to spend the better part of a day awaiting their turn at government offices completing various formalities. There should be some mechanism whereby distinguished men of science entering or leaving Britain could be given the privileges accorded to those of ambassadorial status, for truly they are ambassadors of science. An intermediary is evidently required, able to keep in touch with learned societies on one hand and Government departments on the other. Such a body would be a centre to which those desiring to entertain foreign visitors would hand over all formalities; it might equally act for British men of science visiting foreign countries. Something on these lines is being done by the British Council, but more comprehensive action is required; the Council, however, if suitably strengthened, might be an appropriate body to undertake such activities.

Sir Henry Dale has pointed to some of the implications of the atomic bomb and the control of atomic energy for the full freedom of scientific intercourse; and the importance of full scientific intercourse across national frontiers, as already indicated, has never been more widely recognized. While the improvement of scientific communications is urgently required, and the relaxation so far as possible of the war-time controls over publication, it may still be necessary to retain some measure of Government control. Such restraint should be reasonable, however, and the minimum consistent with the national interests regarded from the broadest point of view. Scientific workers have a right to expect and to insist that Government departments to which the framing of the necessary regulations is entrusted are staffed with those competent to do their work with imagination and understanding of the real issues—constructively and not obstructively—and to administer and interpret them with common sense and courtesy.

METHOD IN METAPHYSICS

The Nature of Metaphysical Thinking

By Dorothy M. Emmet. Pp. xi+238. (London: Macmillan and Co., Ltd., 1945.) 10*s.* 6*d.* net.

MISS EMMET describes metaphysical statements as statements about the real which transcends experience. Her view in brief is as follows: There is a real world of which we are part and to which in our living we are responsive, but of the nature of which we have no direct experience. Nor have we any means of characterizing it as it is in itself, since in all our awareness, whether through sensing or through reasoning, what is displayed is rather our responses to it than its own nature. In this sense the real transcends experience.

But since we feel ourselves responsive to it, we can describe it indirectly in terms of our responses. We need not, however, confine ourselves to simple statements such as that 'the real is that to which we respond in such and such ways'. We want to tell a connected story about it, to make it out as having a structure which seems intelligible to us. Miss Emmet is concerned with the question of the ways by which we do this, what justification there is for doing it, and in what sense, if at all, the accounts we give in this way can be true.

The fundamental method on which she lays stress is that of analogy. This is used in science, in the building up of any theory. Some experienced arrangement which seems intelligible is taken as a model for the description of a situation the details of which cannot be experienced. Such a model is valuable not merely for predictions, but also as giving an intelligible co-ordination of various observed facts, and as a means toward the forming of more complex models in relation to wider situations; and while it cannot be taken as a literal representation of the situation as it is in itself, it can be taken as corresponding in some way to the situation, even though we cannot say directly how.

In religion, theology and metaphysics, analogies are used in the same way as in science. But there are certain fundamental differences. The former are concerned with what, following Prof. Stocks, Miss Emmet calls total assertions: assertions about the nature of the real considered as a whole, and therefore qualitative, whereas assertions in science are concerned with features from which quantitative relations can be derived. The basis of this difference is her view that some of our responses to the world are responses of our whole being to some feature of the world considered as an individual whole, while others are responses of part of ourselves to some partial feature of the world: somewhat as, for example, I may stand on tiptoe to help my tall friend to put on his overcoat (partial response to a partial feature), whereas my whole being goes out to him in admiration when he shows some special excellence of character (total response to a total feature).

I have no space to deal with Miss Emmet's interesting and careful account of analogies in religion and theology. A metaphysical system takes its rise in total responses. As a starting point, we can say that the world has such a nature as to rouse these responses in us. The next step is to seek for some further account of it which will enable us to link our various total assertions into an intelligible system. Analogy is fundamental here, as in science. Some type of situation is felt by a particular thinker to be

of special importance within human experience, and also to provide a clue to that in the nature of the whole which calls out our total responses to it. Further than this, in principle, he cannot go, in his account of the whole. He can never say directly what it is in itself. His account remains analogical and symbolical.

Such an account of the real is valuable partly because of the way in which it enables us to co-ordinate our experiences in various fields. But it may be valuable in this way only for particular persons at a particular epoch; and this partly accounts for the variety of metaphysical systems. When a system has lost this value, it can still have a value of a different, though perhaps less exalted, kind. It brings out more clearly the significance of the system of relationships within experience which provided the original clue.

Miss Emmet admits that the present age is not favourable for system building. "The real problem is that our diverse worlds of thought do not make sense as a coherent unity." Even when the physical and the social sciences make a new synthesis possible "it may well be that . . . we shall have learnt that the old style synthesis in the grand manner is impossible". At the same time she feels that failure to reach some such co-ordination results for many people in a failure to achieve any sort of significant communication with their fellows. She suggests in her closing pages that our most pressing need is to get clear about the difficulties of communication. How can we get across the barriers which divide people whose types of experience are diverse? To answer this question we need more investigation into the nature and the potentialities of what she grandiloquently calls "the word". At the same time we should be alert to new "possibilities of responsive awareness", to be ready for a new master analogy.

Miss Emmet thus has quite modest expectations in regard to metaphysics, at least in our time, and for her modesty there should be nothing but approval. The doctrine in her book which needs most critical scrutiny is the view that some of our responses can be taken as responses to some qualitative feature of the world as a whole. She says that we can take them as such only by an act of faith, by which she means a decision which is different in kind from any decision based on reasoning or on considerations about probability.

But if so, assertions about the world based on these responses are pre-judgments which stand in need of justification. The kind of justification she offers is that of coherence—success in giving a systematically connected account of the world, which appeals to us as intelligible, and which serves to clarify and to intensify those responses we took, on faith, to be responses to the world as a whole. I am sceptical about the value for knowledge of all this. I cannot work up any interest in the idea that we are responsive to features of the world as a whole; and the fact that there are many different accounts which claim to be coherent seems rather to indicate that the responses on which they are based are only partial. Very often "giving a coherent account" simply reduces to "telling a good story". A good story is itself capable of playing on people, and rousing in them responses which are quite easily interpreted as responses to the world, and which in this way increase the convincingness of the story: for this reason, I think, coherence is not a satisfactory test of truth in any field where responses of this indeterminate character form part of the material to be woven into the system. In scientific investigation, the important responses are those made by instruments; and while the interpretation of the response made by a scientific instrument depends on the general body of theory which is being developed by its aid, yet the response itself is independent of any theory. If the responses of the instruments were affected by the theories they supported, scientific workers would all be medicine men, with inadequately controlled theories. Stories about the universe as a whole do not seem to be in any better case.

The book is an attractive one. Miss Emmet has a wide knowledge of theological and philosophical literature, often shows great delicacy of perception, and has a fund of self-criticism which keeps her from thinking it a merit to get conclusions, whatever the evidence. I have only one complaint about her style. She has a habit (which seems widespread nowadays) of preferring abstract or generic nouns to concrete nouns. The subjects of her active verbs are rarely concrete nouns. Phrases such as "Conceptual activity orders and interprets . . .", "Faith confesses . . .", "The religious mind seeks . . .", "The religious symbol conveys . . .", "The word discloses . . ." are frequent in her pages. Abstract words have a place even in philosophical language; but in discussions of the kind dealt with in this book we cannot afford to flirt with plausible rotundities, which play on our emotions and put our critical faculties to sleep. The more concrete we can make our language, the better will be our chance of finding out how untrue are the things we say. In this lies our only hope, when we are trying to speak truly.

L. J. Russell.

THE POSTHUMOUS TESTIMONY OF AN ANTHROPOLOGIST

A Scientific Theory of Culture

And other Essays. By Bronislaw Malinowski. Pp. ix+228. (Chapel Hill, N.C.: University of North Carolina Press; London: Oxford University Press, 1944.) 18*s*. 6*d*. net.

Bronislaw Malinowski, born in Poland, died three years ago at the early age of fifty-eight. Besides carrying out detailed and exceptionally brilliant field-work in Melanesia and New Guinea and for shorter periods in Australia, East Africa and Mexico, as professor of anthropology in the University of London, and attracting to himself a large number of able students, he displayed throughout his life the keenest interest in developing the theoretical background of his subject. His well-known theory of culture, presented by him in this volume in its finally elaborated form, has been for many years before his anthropological colleagues and has met alike with acceptance and with severe criticism. It is couched in terms of 'functionalism'; and by 'function' he means "the satisfaction of human needs". Even 'basic' human needs (for example, those of hunger and sex) demand cultural satisfaction; and they become linked up with new, 'derived', cultural needs. Any analysis of culture, he says, "in which we attempt to define the relation between a cultural performance and a human need, basic or derived, may be termed functional" (pp. 38, 39).

Two-thirds of this book is occupied by the author's presentation of his "Scientific Theory of Culture". It is followed by two shorter essays, one entitled "The Functional Theory of Culture"—which he regards as "a mere sketch" (p. 175)—and the other, "Sir James George Frazer: a Biographical Appreciation" (tempered by some *de*preciation !), both of which help to clarify his position. All three essays travel far beyond their respective titles. But he regards the scientific study of culture as "the real meeting-ground of all branches of anthropology" (p. 4). Indeed the whole volume presents an invaluable critical examination of the past, present and future trends of the science of anthropology in each of its many aspects. It describes what appear to the author to be the uses and abuses of the various methods hitherto applied, and is thus a work which no student of modern anthropology or sociology can afford to ignore.

Malinowski's theory of culture is psychologically based on 'behaviourism', of a not extreme type. No doubt this attitude became strengthened when, towards the close of his life, he served as visiting professor at Yale University and came under the influence of the distinguished behaviourist, Dr. Clark L. Hull, who holds a chair there in psychology. Malinowski proclaims his sympathy with what he terms the latter's 'stimulus-and-response' school of psychology, and he stresses "the great importance which behaviourism promises to acquire as the basic psychology for the study of social and cultural processes" (p. 23), because it "allows us to describe facts which can be observed" (p. 71). He wisely warns us of the dangers of what he terms the "psychological method" of considering "what the primitive might have or ought to have thought or felt under certain conditions, and, how out of such a thought or feeling, a custom, belief or practice crystallized" (p. 19). Yet two facts are inescapable: that not every human action can be regarded as a sensori-motor function, and that in behaviourism the introspections of the conscious subject are only too apt to be replaced by the interpretations of the conscious observer.

Malinowski gives the name 'institution' to each unit of organization into which culture can be analysed; in his view the institutional structure of every culture must be recognized. "No element, 'trait', custom or idea is defined or can be defined except by placing it within its relevant and real institutional setting" (p. 54). He recognizes seven "general principles"—a rather heterogeneous medley listed by him as reproduction, territorial, physiological (due to age, sex, etc.), voluntary associations, occupational and professional, rank and status, comprehensive ("the intégration by community of culture or by political power")—which bind human beings together into permanent groups. Under each of these so-called "general principles" he lists a large number of universal institutional types which he allocates to the "general principles" from which, he believes, they have been derived; for example, the family, kinship, marriage, co-operation within and outside the household, the sexual differentiation of labour, secret societies, occupational institutions, distinctions of class and caste, and institutions arising from the exercise of authority. Such a scheme, even if theoretically inadequate, will at all events, as he urges, prove helpful to the student and to the field-worker investigating an unknown area, and as a measure in comparative research.

The author's next task is to list under three vertical columns, respectively headed (in functional terms) "impulse", "act" and "satisfaction", eleven "permanent vital sequences" (for example, hunger, thirst, sex-appetite, somnolence, bladder-pressure, fatigue and fright) which he regards as "incorporated in all cultures", in accordance with his view that all cultures have essentially a physiological basis. He proceeds to show how the "act" and the "satisfaction" of these "vital sequences" are regulated, defined and thus modified by culture. Next, he sets forth the "basic needs" of human communities (for example, bodily comforts, health and safety), and he considers in respect of each of these needs the "cultural responses" which are derived from them and the "derived needs" to which under social conditions they have given rise. Finally, he analyses these "derived needs" or "cultural imperatives" under the four main lines of cultural response to them, which he defines as economics, social control, education and political organization.

Malinowski lays stress on the distinction that must be drawn between the tribe-State and the tribe-Nation, that is, between the tribe as a political organization and the tribe as a cultural unit. Whereas the "charter" of a tribe-State—its purpose as entertained by its members—"is that unwritten but never absent constitution of authority, power, rank and chieftainship" (pp. 165, 166), the charter of a tribe-Nation is to be "found in those traditions that deal with the origins of a given people" and describe "their cultural achievements in terms of heroic ancestral performance" (p. 165).

"Culture", Malinowski wisely concludes, with special reference to present-day conditions, "as a way of life, as a national type of pursuit, taste and interest, cannot be dictated, controlled or legislated. It ought to be given the best conditions for development, and cross-fertilization with outside influences, but left to maintain its own balance and its own development under conditions of full autonomy" (pp. 220, 221). Anthropological analysis "would reveal that nationhood is a much older and more fundamental principle in evolution than the political organization of a police system, a tribe-state, or an empire" (p. 217).

C. S. MYERS.

A NATURALIST OF THE HIGHLANDS

A Highland Year

By Seton Gordon. Pp. 152+23 plates. (London: Eyre and Spottiswoode (Publishers), Ltd., 1944.) 12*s.* 6*d.* net.

MR. SETON GORDON is one of the few men of education who have been content to live their life in the Highlands rather than earn what many would consider to be an easier and better living elsewhere. The result is that, being a life-long observer, he knows more about the natural history of a remote region than almost anyone else. He has preferred to diffuse his wide knowledge in the form of popular books rather than as systematic papers, a fact for which many general readers are undoubtedly thankful. We of a younger generation of workers may be sorry that he does not give us a compendium or source-book which he alone could write and which

would preserve for us the great variety of knowledge which his sensitive, inquiring mind has gathered. Nevertheless, here is a book written graciously, one which in the opinion of the reviewer stands out as Seton Gordon's best.

The only plan the book can be said to follow is based on the title of "A Highland Year", the chapters being the months, beginning at October, which is a good choice. Within his months, Seton Gordon allows himself complete freedom of anecdote and description, jotting down in leisurely fashion an immense range of facts of natural history. Observers studying bird behaviour will find several points of interest: for example, a case of a black-throated diver moving her eggs from one islet to another in a hill loch during a heavy spate. This bird continued to sit on the eggs in their new place. A wagtail's nest in a quarry on the new Glencoe road was moved several yards by the navvies to a new site on the quarry floor, where they built a cairn round the nest to give it shade and protection. The birds continued to sit in the new place and reared their young, blasting, lorry-loading and hubbub notwithstanding. These occurrences are in such sharp distinction to that narrowly limited pattern which Howard with corn buntings and Kirkman with black-headed gulls have shown to be common in the perception of the nest site.

The influence of man on wild animal life in Scotland is described in many notes. Ptarmigan, for example, are extinct in the Forest of Harris, their last haunt in the Outer Isles. Rabbits increased to such an extent on the Slopes of Clisham, the highest hill (2,665 ft.), that someone put down ferrets. It would not have needed much actuarial knowledge to have contrasted the reproductive potentials and expectations of survival of these two species. Ptarmigan have gone; the rabbits remain. Less than a century ago, the pine marten was common in these treeless hills, but its influence on the ptarmigan was apparently much less harmful than that of the ferret.

Seton Gordon often speaks of the lobster fishery of the West Highland and Hebridean coasts: it has been prosecuted with intensity during the War, but as yet we know little or nothing of the cropping potential of this valuable wild-life resource. It is unfortunate that public opinion has not yet enforced what provident common sense dictates in the handling of these shellfish. Lobsters are still sent to Billingsgate alive with an estimated consequent loss of 25 per cent. Many lobster fishers still 'cut' their catch, that is, prevent these shellfish fighting in the crowded conditions of the box by severing the tendon of the main claws at the joint. This suffering could be eliminated by installation of 'quick-freeze' plants in the catching areas and transport costs would be reduced.

Seton Gordon the naturalist tends to overshadow the judge and talented player of the Highland bagpipe. He is an authority on *ceol mor*, the 'great music' of Gaeldom. The *piobaireachd* is a severely disciplined classical form comparable with the fugue, but a bigger thing altogether; yet the author of this book considers, with other pipers, that *piobaireachd* is dying. Is this because the bagpipe remains a solo instrument for its classical music, and times and places are few in modern life when this form can be appreciated? Perhaps we may yet see the *piobaireachd* orchestrated and brought to a wider field of music lovers.

F. Fraser Darling.

FOOD SCIENCE

The Chemistry and Technology of Food and Food Products

Prepared by a Group of Specialists under the Editorship of Dr. Morris B. Jacobs. Vol. 2. Pp. xx+890. (New York: Interscience Publishers, Inc., 1944.) 10.50 dollars.

HALF of this volume is concerned with unit operations and processes (describing generally the methods and equipment involved in the preparation of foods), food supervision by government agencies, sanitary and quality control, food machines, plant sanitation, control of insects and rodents, dehydration, food preservation by temperature control and by micro-organisms, canning, chemical preservatives and packaging. The other half deals with production and covers the milling of cereals, bread and bakery products, sugars, chocolate, fruit juices, milk and milk products, meats, oils and fats, beverages and industrial waters.

The book suffers from the weakness of being too comprehensive, and as a result many important aspects are dealt with inadequately. It is doubtful if the section on food supervision will interest the average food technologist, while the engineer interested in machines for food processing would probably gain more from a study of the elaborate catalogues produced by manufacturers. By contrast, the section on plant sanitation is so loaded with detail that the principles and remedies tend to be lost. The sections on insect and rodent control make interesting reading, but it is obvious that American work is behind our own on, say, the question of insecticidal dusts. Again, no mention is made of critical moisture contents in relation to insect spoilage.

The dehydration of foods is dealt with in masterly fashion but to anybody who has investigated or even eaten these products, it is no surprise to learn that the conditions of storage are vital to palatability. The authors also fight shy of the nutritional aspects of these foods, while no mention is made of compression as a method of saving space and packaging.

Food preservation by temperature control is written by Dr. Tressler, a noted authority on this subject. He has, however, too much ground to cover in twenty pages, and as a result he inevitably sounds dogmatic even on difficult and complicated points such as the meaning of and the desirable relative humidity for the storage of a particular foodstuff at a given temperature.

The sections on production are all first-class, as would be expected from the names at the head of them. When they are objective, however, they refer inevitably to American practice. Thus Dr. Urbain gives a lucid account of operations in the Chicago stockyards, Prof. Geddes makes no mention of wheat blending which is of such interest to many European countries, and also scarcely mentions rye, while discussing maize in some detail. On the other hand, there is a stimulating section on alcoholic beverages, which includes a short chapter on Scotch whisky.

This volume, like its predecessor, is largely an account of American laboratory and commercial experience on the properties and production of foods. It is, however, a welcome addition to the literature on food technology, and Dr. Jacobs is to be congratulated both on his courage and his achievement.

T. Moran.

ACADEMY OF SCIENCES OF THE U.S.S.R.

220th ANNIVERSARY

JUST over a month after the Red Army had captured Berlin, the Academy of Sciences celebrated its two hundred and twentieth anniversary by inviting scientific workers from all over the Soviet Union and from eighteen foreign countries to meet in Moscow and Leningrad. It was a very generous gesture from a nation which has suffered so severely from the War, and it is evidence of the importance which the U.S.S.R. attaches to international contacts in science. For two weeks some nine hundred scientific workers were guests of the Soviet Union. All the splendour of Russian hospitality was given to them. There were lectures and demonstrations and excursions. Soviet laboratories were freely opened for inspection. Most foreign delegates came away with very generous gifts of reprints and books and specimens: for example, the four foreign botanists each received a set of the ten volumes already published of the Flora of the U.S.S.R.

There were British delegates from the United Kingdom, Canada, Australia and India. Among the other foreign countries represented were the United States, France, Sweden, Poland, Hungary, Yugoslavia, China. The visitors included many very distinguished men: Adrian, Joliot-Curie, Langmuir, Szent-Györgyi, Svedberg, to name only a few.

The celebrations opened in the evening on June 15 with a reception by the president of the Academy, Prof. Komarov. On June 16 the first celebration meeting was held in the Bolshoi Theatre. There were speeches from Komarov, Bruevitch, Orbeli, Prianishnikov and Kapitza. After the meeting there was a banquet for more than fifteen hundred guests, which continued until the early hours of the morning, and gave the delegates an excellent opportunity to overcome any shyness they might have had. On June 17 the Academy organized visits to museums, etc., in Moscow, and in the evening there was a second formal meeting at which the veteran Zelinski spoke, and greetings to the Academy were read by Shapley (from the United States), Sir Robert Robinson (from the Royal Society), Maurice Caullery (Paris Academy of Sciences), and others.

June 18, 19 and 20 were occupied by sectional meetings, visits to laboratories, and special performances of the opera and ballet. Several informal meetings of specialists were held: one on biochemists attended by Parnas, Szent-Györgyi, Englehart, Adrian, Needham, and others; one on physical chemistry, addressed by Langmuir, Macbain, Hinshelwood and Svedberg; one on soil science, addressed by members of the Dokachaieff Institute (under Praslov), and by Ogg and Kellogg. Lysenko addressed a special meeting on his theory of variability in inheritance. The next two days were spent in excursions: a boat trip on the Volga canal and a trip to Tolstoi's home at Yasnaya Polyana.

On June 24 the delegates were privileged to see, in the Red Square, the impressive Victory Parade. The salute was taken by Marshal Stalin and Marshal Zhukov, and despite pouring rain the parade was followed by patriotic demonstrations from the citizens of Moscow. That night three special trains left Moscow to take the delegates to Leningrad.

Leningrad gave the delegates a delightful welcome. Many of them were presented with bunches of flowers at the station. The first engagement was a tour of the "Defence of Leningrad" museum, which gives a vivid idea of the terrible privations the people of Leningrad have recently suffered. In the evening there was a performance of "Swan Lake". The next two days were occupied by meetings, visits to laboratories, and excursions. There were visits to the ruined observatory at Pulkovo, to Joffe's physico-technical institute and his physico-agronomical institute (under the Lenin Academy of Agricultural Science), to the Botanical Institute and garden, to Orbeli's physiological institute, and to other places. At a formal session of the academy, Orbeli gave an account of the work of the Pavlov school of physiology, and Komarov was admitted to foreign membership of the Linnean Society of London by its representative at the celebrations, Prof. E. Ashby.

On June 27 the Leningrad Soviet entertained more than a thousand guests to a banquet in the magnificent Uritsky palace. On June 28 there was an excursion to Koltushi, the laboratory where Pavlov worked, and where work is being done on the genetics of behaviour in animals, birds and *Drosophila*, and on the evolution of function in animals.

The delegates returned to Moscow on June 29 and in the evening they attended a special concert. On June 30, the Soviet Government gave a banquet in the great St. George's Hall of the Kremlin. Marshal Stalin, President Kalinin, Mr. Molotov, Marshal Voroshilov, and other leaders of the U.S.S.R. were the hosts.

British men of science who attended the conference are surveying work in their own fields which they have seen. Its quantity and quality in some branches of science were very impressive. Even during the darkest days of the War, scientific research went on. Of course, much of the energy of the Academy was devoted to the solving of short-term problems connected with the War, and one of the keynotes of the celebrations was the gratitude of the Russian people for the contribution of Soviet scientific workers to victory.

For the foreign visitor the celebrations were a generous token of the intention of the U.S.S.R to promote international co-operation in science. Through the initiative of the Soviet Government, contacts between Soviet scientific men and their foreign colleagues, so seriously dislocated by the War, have now been repaired. The hope of every foreign delegate is that the good promise of these two weeks shall be fulfilled. Perhaps the most important occasion of the celebrations was Kapitza's speech on June 23. He pointed out that the U.S.S.R. recognizes the importance of international co-operation in science, and that the Academy intends to promote international co-operation by three measures: (1) enlarging and extending its publications of scientific work in foreign languages, and publishing monographs in Russian, English, or French; (2) arranging and taking part in international congresses; (3) exchanging scientific workers between the U.S.S.R. and foreign countries. If, as a result of these celebrations, foreign men of science can keep in touch with their Soviet colleagues, can meet them at congresses, and even work with them occasionally, then the celebrations will be much more than a delightful experience: they will be the first step on the road to stable international co-operation.

SCIENCE IN THE U.S.S.R.

PHYSIOLOGY

By Prof. E. D. ADRIAN, O.M., F.R.S.
University of Cambridge

IN the summer of 1935, physiologists from all over the world gathered in the U.S.S.R. to attend the international Congress held in Leningrad and Moscow. Though we knew that scientific men there were held in high esteem and that our president, the renowned Pavlov, had every privilege the State could grant, we were not at all prepared for the magnificence awaiting us and for the intense interest which the doings of the Congress seemed to arouse in everyone we met. Whatever our political colour, we had to conclude that in the U.S.S.R. scientific workers were genuinely regarded as estimable people to be encouraged at all costs.

Ten years later, the jubilee meeting of the Academy of Sciences of the U.S.S.R. has reinforced this impression. We have been dazzled as before by stately entertainment, but although the spirit of victory was in the air, the meetings of the Academy were not merely an overture to the military parade before the Kremlin. We celebrated the achievements of Russian science, past as well as present, in all its branches, in archæology, linguistics and exploration as well as in aeronautics and chemistry. Clearly science and learning still hold an exalted position in the U.S.S.R. and the title of 'academician' carries more weight there than in any other country in the world.

What has science done to deserve such esteem ? In the U.S.S.R., as elsewhere, it has played an essential part in the War, and the great development of the country would have been impossible without it. For the man in the street, the achievements of science may be measured by the 'metro' and the higher yield of agriculture ; but the man in the street seems to read text-books on physics or astronomy (to judge by their sales), and it is evident that the respect for science owes something at least to the particular philosophy on which the State is based. Guided by this philosophy, the State is willing to spend very large sums on research institutes of all kinds and to keep large numbers of men of science working on problems of the more academic type in spite of the War and the shortages it has caused.

This is certainly its policy in physiology. The War has naturally focused attention on the nature of surgical shock, on blood transfusion and resuscitation, etc., but work on such problems as the chemistry of muscle and the development of functions in the embryo has continued, under difficulties of course, but with no lack of interest and official encouragement. Near Leningrad, where one in three of the inhabitants died of starvation in the siege, the large experimental station built for Pavlov at Koltushi is already a hive of activity. It has modern equipment and houses more than fifty scientific workers and many more technicians engaged on the problems of the nervous system. In the city itself, the large Pavlov Institute of Physiology is in full swing. In Moscow, work has gone on continuously in the research institutes directed by Academicians Orbeli, Lina Stern and Englehart. Many of the scientific workers in these institutes are women, but by no means all, and many papers have been published during the war period, some concerned with war-time problems but the majority dealing with pure rather than applied physiology.

How far has this large-scale encouragement of science been justified by results ? In physiology there have been few outstanding advances in recent years, in the U.S.S.R. or anywhere else. The result which justifies the policy has been the general raising of standards, in equipment, in training and in the quality of the work that is published. In 1935, as now, the senior physiologists were men of established reputation, pupils of Pavlov, Samojloff or Wedensky, but the juniors had little experience of physiology outside their own laboratories and could scarcely avoid some restriction of outlook. The training is now much more thorough, the libraries are better and there is far less reliance on traditional methods. The papers which are published reflect this improvement. The special features of Russian physiology remain. There is the same keen interest in the central nervous system and in the interaction of the different regulating processes of the body ; but in addition there is the tendency to explore new fields with new techniques which has been characteristic of physiology elsewhere. A good example of this has been the recent almost simultaneous appearance of work on the electric response of the human eye from Moscow, Stockholm and Cambridge.

In the years to come, the U.S.S.R. with its large numbers of trained physiologists will have an output of research in that subject exceeding anything in Europe. There is little to criticize in the organization for this research. Whether the policy of large institutes with a pre-arranged plan is as good for physiology as it is for agriculture does not matter very much, for if it does not work it will be altered, as recent educational policy has been altered. On paper, the director of an institute may seem to have an uncomfortably large number of scientific workers to look after, but in fact he can probably trust most of them to look after themselves. The director has considerable power over his staff. Yet in any country the junior who disproves his professor's conclusions may find his position difficult, and there is no reason to think that these difficulties would be increased by the particular organization of the research institutes in the U.S.S.R. But the physiologists there have had one disability which, if it persists, will certainly check the rapid development of the science. In the past, only a few of them have been able to visit laboratories in other countries for study and research. During war-time, restrictions on movement are inevitable and we have all suffered from them. Until they are removed we shall not properly appreciate all that Russian physiologists are doing, and they will have no first-hand experience of our methods and ideas. We and they both need an exchange of students and professors in addition to the exchange of journals. But everyone is aware of this, and we have been so cordially received on our visit that it is hard to believe that the restrictions will remain. It is significant that the first international meeting of scientific workers has been held in the U.S.S.R. Those of us who had the good fortune to attend it cannot complain of any lack of co-operation. We shall only complain if we are not allowed to repay some of the kindness shown us by our hosts.

CONTEMPORARY PHYSICS

By Prof. E. N. da C. ANDRADE, F.R.S.
University College, London

IT must, of course, be clearly understood that the following brief notes do not profess to mention, even by name, every important line of research in physics that is going on in the U.S.S.R.; they cannot even hope to mention everything of interest that I personally saw during our recent visit as guests of the Academy of Sciences. They must be taken, rather, as general impressions left by the varied activities of the laboratories in which we were so warmly welcomed by our Russian colleagues, who were anxious to let us see the progress that they were making in the world of research, but equally anxious that we should not miss any of the receptions or festivities so bountifully prepared.

The leader of Russian physics is Academician A. F. Joffe, vice-president of the Academy of Sciences, who first began in 1903, in conjunction with Röntgen, the work on crystals which, in one form or another, has always occupied his attention. His book on the physics of crystals is known to most English physicists. He is now sixty-seven, but in full vigour and actively controlling a great variety of research, as well as pursuing his own investigations—a comment on the British system of fixing sixty-five as the retiring age in most scientific posts. In the Physico-Technical Institute at Leningrad, which is under his immediate direction, work is mainly concentrated on three general subjects, namely, semi-conductors, intermolecular forces in polymers and nuclear problems. It must be understood that the Institute was transferred to Kazan during the siege of Leningrad and did not return until March this year: it says much for the vigour of the laboratory that work is already in full swing on the first two subjects named, and it is not surprising that the nuclear work is only just beginning. The spectral distribution of particles emitted by the nucleus is the general theme that is to be undertaken.

Work on semi-conductors has for many years been a favourite subject with Joffe, and arose naturally out of his interest in the real structure of crystals. The investigations have been much influenced by a theory of the rectifying effect put forward some years ago by Joffe and Frenkel; incidentally, Frenkel's theoretical work pervades many branches of present-day physics in the U.S.S.R., and I much regret that a change in our general plans interfered with an appointment for discussion which we had made. Semi-conductors can show what may be for brevity termed both electronic and ionic conductivity, or positive and negative conductivity. It has been demonstrated in Joffe's laboratory that the same substance, for example, lead sulphide or thallium sulphide, can be produced with either high or low conductivity and with either positive or negative conductivity, according to the amount and the nature of small admixtures of certain substances. Excess of sulphur gives positive conductivity, excess of metal, negative. Active work is proceeding on many lines, both on the fundamental physical properties of semi-conductors, which throw light on the mechanism of conduction in solids, and on their practical use for industrial rectifiers. This combination of pure and industrial research in the same institute is typical of the U.S.S.R. system. Closely connected with the work on semi-conductors is that on photocells. The thallium sulphide cell developed under Joffe gives up to 8 milliamp. per lumen. In many of his own researches Joffe enjoys the collaboration of the charming Madame Joffe, who acted as our hostess on more than one occasion.

Work on dielectrics is also proceeding. For example, the dielectric properties of hexafluoride of sulphur, which has an electrical strength two and a half times that of air, are under investigation.

As regards the work on polymers, much is being done in the way of cross-linking the molecules of cellulose by acting on the hydroxyl groups, a process somewhat analogous to the vulcanization of rubber. In this way the fibres can be made either elastic or brittle, and filter papers have been prepared which retain their strength in water.

All kinds of physical work in other laboratories is under Joffe's general direction. He has, for example, taken a leading part in organizing work on the measurement of soil temperature by an ingenious new method and on the measurement of the temperature of leaves, which has led to important practical results in agriculture.

Academician P. Kapitza (or Kapitsa, as his name is usually transliterated by the Russians) has a splendid modern Institute for Physical Problems, built in 1935–36. The most striking work proceeding here is, on the pure side, that on the superfluidity of helium II, discovered independently in 1937 by Kapitza in Moscow and by Allen and Misener in Cambridge, and, on the applied side, that on the liquefaction of air by Kapitza's turbine liquefier and on the preparation of liquid oxygen from the liquid air by a new type of apparatus for fractional distillation. Kapitza has recently been studying heat transfer in helium II in its relation to superfluidity and has found that the supposed abnormal heat conductivity is really a manifestation of its abnormally low viscosity. Connected with this is the existence of a counter current in the liquid. There are also two possible velocities of sound in helium II, the existence of a 'second sound' having been recently shown experimentally by Peshkov. These most curious properties of liquid helium have been explained in a remarkable theoretical paper by Landau. Work in this field is being actively continued. As regards the production of liquid oxygen on an industrial scale, the turbine liquefier, described just before the outbreak of the War, has the great advantage that it can be started up very rapidly and that it is much smaller and easier to maintain than the conventional machine. One machine is said to have run non-stop for four thousand hours. The methods of producing liquid oxygen developed in Kapitza's institute are being installed in factories all over the U.S.S.R.

There are various special institutes in which physics enters largely, although not exclusively, into the work. The Optical Institute is probably the largest, employing in all about five thousand workers; an account of one of the most interesting developments there, Maksutov's meniscus telescope, was given in *Nature* of June 30, p. 798. The Institute for Theoretical Geophysics deals with geoprospecting by electrical, seismic and magnetic methods and by a new thermal method; with atmospheric electricity and the transparency of the atmosphere; with ionospheric phenomena; and with the light of the night sky, on which Khvostikov has worked extensively. Some of the work in Academician Semenov's Institute of Chemical Physics, housed in a converted palace, is of

a very physical nature, as, for example, a special method of measuring the abnormal viscosity which certain liquids have in layers immediately adjacent to a solid boundary : this method consists in blowing off the liquid with a controlled current of air and measuring the dimensions of the resulting wedge-shaped film by interference methods.

Academician Sergei Vavilov, director of the Lebedev Physics Institute, who is in charge of research at the Optical Institute, is keenly interested in the history of physics : he published a Life of Newton in 1943, in connexion with the tercentenary celebrations of Newton's birth, and edited a collection of papers on various aspects of Newton's work, to which he contributed a chapter on aspects of Newton's optical work. He also contributed a study of Galileo's work on optics to a recently published Russian work on Galileo. He tells me that he is now engaged on a complete Russian translation of Newton's "Lectiones Opticæ" : the English translation which appeared in 1728 is of the first part only.

Reference must be made to the work of Rehbinder on the effect of surface-active substances for facilitating the working of metals, and particularly to some very interesting recent work on the effect of surface-active films in decreasing the resistance to mechanical flow of single crystals of metals. These films send up the electrical resistance appreciably, indicating that they penetrate deep into interstices in the metal.

If it does nothing else, this brief account may give some idea of the variety of the work in pure and applied physics that is proceeding with vigour in the U.S.S.R. It cannot, however, convey the spirit of cordiality and co-operation in which we were everywhere received, which has left a deep and abiding impression in our minds.

ARCHÆOLOGY AND ANTHROPOLOGY

By Prof. V. GORDON CHILDE
University of Edinburgh

ARCHÆOLOGY and anthropology are classed as sciences in the U.S.S.R. and with other social sciences stand under the ægis of Akademiya Nauk as much as the natural sciences. Hence during the War, archæologists and anthropologists have been 'reserved' like geologists or physicists. However, several very promising men of the younger generation, notably E. Krichevskiĭ, perished during the siege of Leningrad, and the gaps left by such casualties will take time to fill. At the same time, archæological research naturally suffered worse dislocation since 1941 than that in sciences more directly related to the war effort.

Museum collections had inevitably to be packed up. But in Moscow the State Historical Museum is already re-installed fully and open to the public ; in the University of Moscow, despite considerable damage sustained by the building, the collections of the Anthropological Institute are actively in course of reinstatement, and I was able to handle the skull of the Neanderthal boy from Teshik Tash in Uzbekistan. In Leningrad the treasures of the Hermitage were not due to come back from hiding places in the Urals until August ; in the Ethnographic Museum of the Academy an impressive exhibition illustrated by choice specimens, hastily unpacked and specially arranged by the staff, anthropometric, archæological and ethnographic work of the last ten years. Terrible damage, on the other hand, has been done to the famous collections in Kiev and in many local museums in the Ukraine and the Caucasus, where much unpublished material has been destroyed or dispersed by the invaders. A fine Hellenistic sarcophagus from the Taman Peninsula, abandoned by the Nazis, has just been restored in Moscow from the fragments to which the enemy had deliberately reduced it.

Field-work and the study of the collected material were never entirely suspended during the War. The exhibition in Leningrad and a special session of the Institute for the History of Material Culture (IIMK) held in Moscow introduced the Academy's guests to the results of operations so recent that no published accounts have reached western Europe. In Transcaucasia, Zamiatnin's surveys of Abkhasia, initiated in 1934, have brought to light the first undoubted Acheulean hand-axes from the territories of the Union as well as flake industries of Clactonian and Mousterian types, all illustrated at Leningrad. Tolstov described before the Institute the main results of the expedition under his direction in the ancient Khorasmia (the lower Oxus valley). The earliest settlements discovered belong to hunter-fishers whose ceramic remains show analogies with the chalcolithic cultures of western Siberia and the Russian steppes. To the later Bronze Age belong some very schematic rock-engravings, while during the first millennium B.C. an advanced urban civilization, based on irrigation, developed. From the fourth century A.D. cities began to give place to isolated castles and fortified manors. At the same session Passek described her first explorations at Vladimirovka in the Bug basin, a large village of the 'Painted Pottery Culture' often called Tripolyan—excavations abruptly terminated by the Nazi invasion in 1941. Her survey has revealed there the existence of half-subterranean dwellings (*zemlianki*) as well as no less than five rings of *ploshchadki*. The 'areas' of burnt clay designated by the latter term turn out to be the floors of rectangular houses, which have been baked by fires specially kindled upon them and on which are found clay ovens, ritual pedestals, querns and groups of vases. These observations confirm and supplement the conclusions drawn from the excavations at Kolomishchina on the middle Dnieper, published with full documentation (in Ukrainian with French and Russian summaries) in *Tripil's'ka Kul'tura* (Kiev, 1941).

In physical anthropology the outstanding exhibits in Leningrad were the reconstructions from the skeletal material of faces and busts ranging from the Neanderthaler of Teshik-Tash to historical personages like Timur and Yaroslav Mudryĭ, executed by the sculptor anthropologist, Gerasimov, and exhibited with a convincing explanation of his methods. At the same time an anthropometric study is in progress on the abundant skeletal remains from the Fatyanovo cemetery of Balonovo near Kazan, while Debetz is in eastern Siberia continuing his anthropometric survey. Similarly Okladnikov, being again in Yakutia, could give no account of his interesting archæological and ethnographic discoveries along the Lena. For the same reason, we must await publication to hear of Grakova's latest finds in Fatyanovo cemeteries and her geographical and chronological classification of Fatyanovo relics, which is already prepared for publication.

Publication of archæological and anthropological periodicals in Moscow and Leningrad has been sus-

pended during the War, but not in the Transcaucasian republics—the Georgian branch of the Academy, for example, published Kuftin's "Earliest Roots of Georgian Culture in the Caucasus in the Light of Archæology" (using also philological evidence and that from early MSS. miniatures) in 1944. Moreover, the complete editions of two numbers of *Materialy i Issledovaniya* were annihilated by enemy action in Leningrad. Now No. 12 of *Kratkie Soobshchennie* has already been issued and new volumes of *Sovietskaya Arkheologiya* and similar publications are going to press. At the same time, even during war years, excellent works of popularization were published by the Academy, such as histories of the ancient world and of the Middle Ages, edited respectively by Struve and Kosminsky and both designed for middle schools. An exhibition of all its publications in the domain of social sciences was organized in the Academy's library and profoundly impressed Western visitors.

VERTEBRATE PALÆONTOLOGY

By Prof. D. M. S. WATSON, F.R.S.
University College, London

THE study of fossil vertebrates in the U.S.S.R. is concentrated in the Institute of Palæontology of the Academy of Sciences in Moscow, but two men who hold posts in Leningrad are doing important work in association with the Institute.

Fossil fish of many ages are found in the Union, often most beautifully preserved and of great interest. Asiatic Russia has produced a Lower Old Red Sandstone fauna, the Leningrad district a series of faunas from the top of the Middle Devonian upward, which are generally represented by perfectly preserved though fragmentary remains, and are of great interest because they are comparable with those of the Upper Old Red Sandstone of Scotland, the Rhineland, North America, and the Arctic regions. Carboniferous, Permian and Jurassic fish are known from Asia in perfect preservation; there are even late embryonic Palæoniscids!

The early Tetrapod faunas are represented by two horizons, known nowhere else in the world, which are more recent than the Artinskian Clear Fork of Texas, and older than the Tapinocephalus zone of South Africa. These faunas include Labyrinthodonts of structure intermediate between those of the Lower and Upper Permian, which are of much importance for our understanding of the evolution of the group, and they have yielded an extraordinary, extremely flattened animal which seems to be a Seymouriamorph. There are new Cotylosaurs of great interest, but the most striking specimens are those of mammal-like reptiles, belonging to the Deinocephalia, which bridge the structural gap between the Pelycosaurs, and specifically the Sphenacodontia, of Texas, and the South African Titanosuchids and Tapinocephaloids. These animals are perfectly preserved; indeed, the bones from one locality, where they occur in essentially quite unconsolidated sand, appear like fresh bones, the skulls being completely free of matrix inside and out, and complete skeletons are known. With them is found *Venjukovia*, a forerunner of the Dicynodons, perhaps an actual ancestor of *Endothiodon*, itself derived from a primitive Tapinocephaloid.

On the River Mesen there occurs a "M." Permian fauna of small animals which includes two Cotylosaurs essentially ancestral to *Procolophon*, and a remarkable reptile, *Mesenosaurus*, the rather Pelycosaur-like skull of which is in some ways most reminiscent of *Youngina*, and which may perhaps prove to be the ancestor of the whole group of Diapsids. The later Permian and Triassic Tetrapods include a varied assemblage of Labyrinthodonts and Seymouriamorphs of great interest, many Pareiasaurs and Dicynodonts, Gorgonopsians, Therocephalia and a most primitive Cynodont, all comparable with African animals.

The Tertiary rocks of the Union in Europe and Asia have already yielded mammalian faunas of many horizons from the Oligocene to to-day, and are being actively explored. Indeed, the Museum of the Institute has already mounted a splendid skeleton of a Lower Meiocene long-jawed Mastodon, perhaps the best in the world. They have half a dozen mounted skeletons of fossil rhinoceroses, including that of the giant *Indricotherium*, and much other material of equal quality.

It is evident that the collecting expeditions have been most ably carried out, the materials must have been properly bandaged, the preparation is perfect, and the Institute has an excellent artist and photographer.

Vertebrate palæontology, like palæontology in general, is essentially an international science; conclusions about phylogeny can only be drawn with any satisfaction after a study of the whole materials in the world—and the U.S.S.R. includes a very large part of the world. Lying as it does over a great continuous land mass between North America, India, Europe, and, though it does not directly meet that continent, also Africa, it may be expected to form the link between these regions of the earth and thus provide the solution of many problems of correlation of terrigenous deposits of all ages throughout the globe.

The palæontologists in the U.S.S.R. know more than a hundred entirely new localities which yield vertebrate fossils and are making arrangements for their exploration. There is, to my mind, no doubt that in the immediate future the U.S.S.R. will become the great centre of activity of vertebrate palæontology, giving us new facts in abundance and solving many outstanding problems of phylogeny and of migration.

It was therefore most pleasing to me to meet my colleagues in Moscow and Leningrad, to spend some happy days in discussion with them, and to establish a friendship which will, I hope, continue for many years. The group is composed of most active, enthusiastic and able men and women, in whose hands I feel that the future of vertebrate palæontology may safely rest.

But a real need is that of closer contact with workers in other countries, and especially of travel. It is essential that every palæontologist should be familiar with his materials, and they are preserved in museums all over the world. The Soviet workers should be able to visit the British Museum and those in America and Europe as easily as we can, and I, and my colleagues in England and America, should be able to visit the U.S.S.R. and give to the magnificent collections which are accumulating there the study which they deserve. It is on such free association of workers in all lands that satisfactory work on fossil vertebrates ultimately depends.

MEDICINE

By Prof. ARNOLD SORSBY
Royal College of Surgeons of England

THE normal correctives of sensational reports on medical activities at any particular centre or country are close personal contacts and a free flow of publications. Both these are conspicuously lacking in our relations with Soviet medicine, and it is therefore inevitable that our knowledge of Soviet medicine is at all times inadequate, and at times grossly misinformed. This is unfortunate, for Soviet medicine has a significant organization and substantial achievements.

The organization of Soviet medicine is conditioned no less by the immense territory of the Soviet Union than by the assured place research has in the organization of society. The territorial expanse imposes a considerable amount of decentralization. This is apparent in the structure of the medical services as a whole, and in research in particular. The medical services, though conceived on a central plan, have an endless variety of administrative organs. Each of the autonomous republics controls its own services, which supplement those of the Union. Moreover, the municipalities, different industrial undertakings, collective farms, and many other labour organizations have services of their own, again supplementing those generally available. Soviet medicine is therefore a national medical service in its widest sense rather than a State medical service; its distinctive feature is its stress on preventive treatment.

The organization of research facilities is essentially parallel to those of the health services. Not all research institutes are under the control of the Commissariat of Health of the U.S.S.R. The newly established Academy of Medicine, the successor to the Gorky Institute of Experimental Medicine (Viem), controls a large number, and there are also institutes controlled by the governments of the autonomous republics. Furthermore, the medical schools and the universities play a significant part in medical research, so that there is no lack of research facilities or of variety of opportunity and service. Though there is intensive specialization, rigid departmentalization does not appear to be prominent; if anything, the opposite applies. This is apparent from such typical institutes in Moscow as those devoted to neurology, neuro-surgery, occupational diseases and ophthalmology. Each of these institutes consists of a large clinical unit balanced by well-equipped clinical and research laboratories. While these institutes employ many full-time laboratory research workers, they also have many others with both clinical and laboratory duties. Planned research, as it is understood in these institutes, consists of the co-ordinated activities of different workers approaching an agreed problem from their own special angle. The close contact that an institute and its planned work makes possible ensures that laboratory workers are fully acquainted with clinical needs, while the clinicians know the possibilities and limitations of the laboratories. Though working in a team, the individual worker does not lose his identity, as is obvious from the publications in the journals, which are not more frequently than elsewhere collective reports. While of necessity the bulk of the research in a clinical speciality is concentrated in the institutes exclusively devoted to it, all clinical institutes are broadly planned and have many special departments. Thus impressive work in ophthalmology was proceeding at the Institutes of Neurology, Neuro-Surgery and Occupational Diseases, and no doubt in other institutes too, in addition to the Institute of Ophthalmology. Some institutes are devoted exclusively to laboratory work in special fields, but these too do not appear to be narrowly conceived; at the Institute of Microbiology there was considerable work on pharmacology.

The team spirit and the organization of planned research probably ensure that in the Soviet Union more is known to research workers of unpublished work and its progress than is the rule elsewhere, and it is possible that publications as media for the dissemination of knowledge are relatively less important in the Soviet Union than they are in Britain. It is therefore all the more regrettable that there is so little personal contact between British workers and those of the Soviet Union.

Soviet medicine has grown rapidly, and in the course of its development has had to adapt itself to rapidly changing conditions. The training of medical men is as good an example as any of the empirical nature of much Soviet organization. No attempt is made to arrive at an ideal solution at any particular stage. When the need for numbers was urgent the training was not particularly exacting; and how urgent the need was is obvious from the fact that in 1913 there were less than 20,000 medical men in the Czarist Empire, whereas in the Soviet Union to-day there are about 150,000 and the number is still inadequate. As more physicians became available, the standard of training was persistently raised, and now has been fixed at a six years course. This is already operative in Moscow, and will become effective over the whole of the Union in the course of four years. This new level has rendered unnecessary such temporary makeshifts as specialization introduced at an early stage of the student's career. When the need was still pressing there was no general qualification in medicine; final-year students were trained for either public health activities, general practice, or children's diseases. While raising the standard of medical training, the Soviet authorities are still creating 'feldschers', relics of the old barber surgeons. They are given a practical training and are allotted much of the routine work of medicine, generally under supervision. In the course of time the 'feldscher' will no doubt disappear, but for the present his persistence is the price that has to be paid for the more intensive training of physicians.

It is the aim of Soviet educationists to produce 20,000 well-qualified medical men a year. The fifty-two medical schools at present available scarcely seem adequate for such numbers, but there is no shortage of candidates. Students for the medical schools are recruited from the secondary school population, and there are two systems of entrance. Those secondary school students who have a good record gain admission to the medical schools automatically; the remaining places are then filled by competitive examination from among the secondary school students whose record has not been so good. Stipends are paid throughout the student's career and they increase with each year of study. On qualification, students are expected to undertake three years service wherever the need is greatest; but many of those who have done well are expected to specialize immediately as clinicians or research workers. All who have given three years service are encouraged to "improve their qualifications", so that

postgraduate study is a normal feature in the life of the Soviet physician. Soviet medicine has no fear about the standard and qualifications of its personnel.

A glance at Russian medical journals, and, still more, visits to hospitals and research institutes, show clearly that Soviet medicine is not 'practical' in the crude sense of the word. Though there is an ever-present need for personnel, and attention to the immense public health problems of the Soviet Union requires many routine workers, much of the work in the laboratories is of a highly abstract character. None the less, practical results are constantly sought. The immense flora and variety of soil conditions of the Soviet Union have been pressed into service. Systematic exploration of the pharmacological properties of the higher plants and soil bacteria is proceeding, while such institutes as that of balneology with its great variety of laboratories illustrates the use that Soviet physicians are making of the curative properties of springs and muds.

Although Russian workers have much to contribute to the rest of the world, they are borrowing freely from abroad, and, in some instances at any rate, have extensively developed work that was begun elsewhere and not carried to any conclusion. The production of lysozyme on a massive scale from a large variety of biological substances is an example. This achievement has been rather overshadowed by the coming of penicillin, but the Russian preparation of penicillin from *Penicillium crustosum* and their intensive exploration of the possibilities of producing synthetic penicillin illustrate once more that they not only borrow but also develop and improve on work from abroad. In the comity of civilized nations, Soviet medicine holds its place as an equal.

AGROCHEMISTRY

By Dr. E. M. CROWTHER

Rothamsted Experimental Station, Harpenden, Herts

RUSSIAN translations into English of the names of institutes and journals produce many uncouth phrases, such as "Chemisation of Socialist Agriculture" and others mentioned below, but occasionally they produce a word which we might well take over. Thus 'agrochemistry' describes fairly satisfactorily one of the halves into which our old science of agricultural chemistry is splitting up under the influence of increasing specialization. The subject covers crop nutrition and those branches of soil science concerned with soil fertility rather than soil formation and classification. The grand old man of Russian agrochemistry is D. N. Prianischnikow who, with a few other members of the Academy of Sciences, had received the highest Soviet award, Hero of Socialist Labour, a few days before our arrival. We were delighted to find him fitter and more lively in his eightieth year than when he last visited England in 1935 for the Third International Soil Congress at Oxford.

An outstanding feature of Russian agricultural science is the elaborate organization of team-work in a large number of institutes responsible to independent authorities. Considerable overlapping in programmes is not only allowed but also clearly encouraged. The necessary co-ordination is secured and a high standard of work maintained by requiring many research workers to divide their time between two or more institutes or colleges, and by giving a few overworked authorities responsibility for a broad group of problems in several institutes. Thus we saw one of Prianischnikow's teams at Dolgoprudnoye in the Gedroiz Institute of Fertilizers, Soil Management and Soil Science under the Lenin Academy of Agricultural Sciences, and another in the Department of Agrochemistry in the huge Timiriazev Academy of Agriculture, which has some sixty professors and 3,000 students. We also came across his pot-culture work in collaboration with the radioactivity section of the Institute for Geochemical Problems. Another example is afforded by the work of Prof. I. W. Tiurin on soil organic matter in the soil science departments of the University and the Forest Technical Academy at Leningrad and the Biochemistry Department of the Dokuchaiev Soil Institute at Moscow. Even Prof. Joffe, with all his other commitments in pure and applied physics, manages to find time to direct an admirable Institute of Physical Agronomy in Leningrad under the Lenin Academy of Agricultural Science. By means of his improved thermocouples, it was found that during August the night temperatures of potato leaves in the northern regions are often as much as 7° below those of the soil surface. This led to a new method of planting potatoes in wide high ridges across the direction of the prevailing wind, to transfer as much heat as possible from the soil to the leaves and so avoid late frost damage.

Prianischnikow has been checking his early work on nitrogen metabolism in plants and has confirmed that plants of all ages take up ammonium ions more rapidly than nitrate from dilute solutions of ammonium nitrate, though from unduly concentrated solutions nitrate may be taken up and ammonium excreted. In view of the acute shortage of nitrogenous fertilizers, which was manifest in all the crops we saw, Prianischnikow has great hopes of the benefits likely to accrue in the north from the rapid extension as a green manure crop of a frost-resistant Canadian strain of the blue garden lupin, *Lupinus polyphyllus*.

During the War, fertilizers could be spared only for a few industrial crops, such as cotton and irrigated sugar beet, but research on both the production and efficient use of fertilizers is well advanced. At Salikamsk there are larger reserves of potash than in Germany, and it is claimed that the U.S.S.R. now has larger reserves of phosphate than any other country. Until recently the only known deposits were low-grade rock phosphates and crystalline apatites, both unsuitable for making superphosphate. Brilliant work by Kazakov in the Institute for Fertilizers and Insecto-fungicides under the Commissariat for Heavy Industry has led to the discovery of vast deposits of high-grade rock phosphate in the Kara Tau region of Kazakstan. This discovery is also of considerable geological interest, for it was the outcome of a new theory of the formation of rock phosphate by precipitation from cold deep waters upwelling against a continental shelf.

Preparations are well advanced for using fertilizers on a vast scale. Thousands of field experiments have been conducted over a variety of crops, soils and regions, and individual collective farms are being mapped to show the best amounts and forms to use. Fertilizer consumption and crop yields should increase rapidly, especially in the leached soils of the centre and north, as soon as new factories and railways can be built.

The need for lime is still acute. About half the isolated limestone deposits are dolomitic, but recent

work in the U.S.S.R., as in the United States and Great Britain, has shown that the old agricultural prejudice against this form is ill-founded. Indeed, it has been shown that some sensitive crops, such as serradella, lupins and potatoes, may safely receive full dressings of magnesian, though not of high-calcium, limestones.

Great importance is attached by the Mechanization Institute to a double plough in which a half-size plough precedes the usual digger plough. It is claimed that this buries turf and weeds more completely and avoids dead air spaces, and it was stated that no other type of plough is to be made.

Much work is being done on the difficult problem of analysing the production of tilth and the stability of soil aggregates. It will come as a shock to exponents of ley-farming in Britain to hear that several Russian workers hold that leys should not be grazed, at least for three years, lest trampling by stock should annul the granulating action of the grass roots.

(*To be continued*)

OBITUARIES

Major C. E. S. Phillips, O.B.E.

By the death of Charles Edmund Stanley Phillips on June 17, many will mourn the death of a very interesting personality.

Phillips was born on February 18, 1871, his father being Samuel E. Phillips, one of the founders of Johnson and Phillips, the firm which made some of the earliest electric marine cables. He was educated privately and studied, for a short time only, at the Central Technical College, South Kensington. It may be that it was owing to his rather unorthodox education that he was so versatile.

After the discovery of X-rays in 1895, Phillips devoted much time to the making of vacuum tubes and in studying their performance in his own laboratory at Shooters Hill. His friend, H. O. Mance (now Brigadier-General Sir Osborne Mance), who was working with him, has preserved some of Phillips's letters written to him early in 1896 describing his difficulties. In a letter dated May 4, 1896, Phillips says, "this afternoon I made a Röntgen tube myself but afterwards found the glass used was lead glass so gave it up as useless". In July of the same year he writes: "I've got an experimental vacuum tube nearly finished which takes to pieces and can be cleaned and exhausted. . . . There seems no doubt that the X-rays consist of rays having various different properties and are by no means homogeneous".

Phillips continued to experiment with vacuum tubes and published in 1901 a paper, which created a good deal of interest at the time, on the effects produced by a magnetic field upon the distribution of ions within a highly evacuated space (*Phil. Trans.*, **A, 197**, 135; 1901). In 1908 he produced an electrical conducting glass (*Proc. Roy. Soc. Edin.*, **28**, 627; 1908) from which the windows of electroscopes could be made. Unfortunately, the glass was never made commercially. In 1910 he delivered a discourse at the Royal Institution on the electrical and other properties of sand. In this he showed some striking and original experiments which might well be repeated.

Phillips was one of the founders of the Röntgen Society and read several papers before it. He served as its president in 1909. During 1914–17 he was in charge of the X-ray Department of the Royal Herbert Hospital, Woolwich, and during 1915–18 was physicist to the X-ray Committee of the War Office. Towards the end of 1915 he gave, at the 2nd London General Hospital, a course of lectures to the orderlies of X-ray departments on the physics of X-rays, Dr. Russell Reynolds dealing with the medical side of the subject. These courses of lectures may well be regarded as the initiation of the movement for training radiographers. Phillips was much concerned at the need of protection for those working with X-rays, and served as a member of the Inter-Services X-ray Advisory Committee from its inception until its dissolution in 1939. He was appointed brevet major (on reserve to the 5th Battalion Royal West Kent Regiment) in 1918 and received the O.B.E. for his services.

Phillips was one of the founders of the British Institute of Radiology and was its president during 1930–31. He was for some time lecturer on radiology at University College, London, and was also physicist to the Royal Cancer Hospital.

In 1909 Phillips suggested the use of a trace of radium with zinc sulphide for luminizing the dials of night-marching compasses, and the first model made by him is preserved in the Science Museum at South Kensington. It is unnecessary to stress the importance of this invention.

Phillips was one of the founder fellows of the Institute of Physics, and, if he was not the first to suggest the formation of the Institute, played the leading part in its formation in 1918. He was a member of the first Board and, except for one brief interval, served on it until his death; he had been treasurer since 1925. From 1929 until a few weeks before his death he was also honorary secretary of the Royal Institution.

Phillips was an excellent violinist and enjoyed playing on his Stradivari violin. In a discourse given before the Royal Institution in May 1935, he showed how he had tried to elucidate the secrets of the tone of the violins made by the old masters. He was also a good amateur artist; his portrait of Sir William Bragg now hangs on the walls of the Royal Institution. He gave great pleasure to many friends by his facility in depicting them in caricature. He was a delightful companion with a keen appreciation of a practical joke, especially if it had a scientific background. He was at his best at the dinners of the Physical Society Club, of which he was one of the founders.

In 1903 he married Winifred, the elder daughter of the late Mr. John Baines. R. S. Whipple.

Mr. R. W. F. Harrison and Mr. A. G. Hastings White, C.B.E.

The association of the main work of a lifetime with the affairs and traditions of an old foundation is, happily, not yet rare. With the recent deaths of Mr. Robert William Frederick Harrison (July 15) and Mr. Alfred George Hastings White (July 8), at the ripe ages of eighty-seven and eighty-six years, the Royal Society has lost links with a bygone generation. Both had made its interests the centre of their own and had become steeped in its traditions, though the manners of their service and the periods over which it was rendered differed widely.

Mr. Harrison was already a man of thirty-eight,

with varied experience behind him, when he became assistant secretary; and when he retired, early in 1920, he had held the position for just under twenty-four years. He was born in the house of the London Library, St. James's Square, where his father was librarian. After schooling at Westminster he studied for and was called to the Bar, but never practised. At the age of twenty-four, in 1882, he became secretary to the Royal Society Committee arranging for observation of the transit of Venus. Then, after acting for a period as tutor to Lord Porchester, who became Earl of Carnarvon, he was secretary to the City and Guilds of London Institute and to the Art Union of London.

Fellows of the Royal Society still living will remember Harrison's entry there in 1896, when he succeeded the late Mr. Herbert Rix as the last assistant secretary to occupy the residential quarters designed for such use on the top floor of the Society's apartments. He did important services to the Society in a number of directions. The publication of the annual Year Book was due to him, he did essential work for the first three editions of the historical "Record of the Royal Society", and the attendance of the assistant secretary as minute-clerk at the Council meetings appears to have been an innovation due to him.

In those days of relative ease and leisure in the Society's affairs, Harrison, a man of rather striking personality, found time for a number of other interests. He was known as a violinist and a yachtsman. The article on the violin in the "Encyclopædia Britannica" (11th edition) was written by him, and, being a skilful carpenter, he converted a twenty-foot open boat into a yacht largely with his own hands, details of the structure, it is said, being actually fabricated in the Royal Society's rooms.

Harrison's knowledge of the Society's traditions grew with his devotion to its interests, and the devotion, as the years went by, not unnaturally took a rather possessive tinge in a man of his masterful temperament. Officers whose own experience had grown with his were easily tolerant of this, but those who had to face the changes and developments which came into view with the end of the War in 1919 doubted Harrison's adaptability to the new needs. He retired on pension, and the Council recorded the thanks due to him for his conspicuous zeal and devotion to the Society's interests; but he had not gone willingly, and he kept aloof for his remaining twenty-six years from the Society which he had so well served in his middle period.

Mr. White was a man of a very different style and temperament, whose services to the Royal Society extended over no less than seventy-three years in all. His father, Henry White, had graduated at Cambridge and qualified in medicine, but never practised, his interests being predominantly those of a scholar. Henry White had joined the staff of the Society in 1868 to edit its "Catalogue of Scientific Papers", and later undertook also the catalogue of all the books and papers in the Society's own library. By 1872 he needed help with these undertakings; and having perhaps lost faith in the value of a formal higher education, or lacking the means to provide it for his son, he took the boy Alfred at the age of thirteen from the North London Collegiate School and brought him as his assistant into the library of the Royal Society. It is of interest to remember that the Society was then still accommodated in old Burlington House, and did not move to its present quarters until a year later. It was in the Society's library, then, under his father's tuition and by dint of his own eager and unending diligence, that Alfred Hastings White obtained all that he ever had of secondary or higher education. He attained, in fact, to a fine though unusual scholarship, including a quite remarkable reader's command of languages, both ancient and modern, and a wide and detailed knowledge of the library in which he worked and which was to be for so many years under his care. Henry White died suddenly in the Society's meeting room in 1880, leaving his son, a young man of twenty-one, to be responsible alone for completing the catalogue of the library which was published in the following year.

In 1885 the Council appointed A. H. White "to assist the Secretaries in the work of publication and the work of the library pertaining to the office of Assistant Librarian", and this was his official position until he retired in 1930. In those forty-five years he had become the friend and helper of every fellow of the Society who used or took interest in the library, and of many whose papers he saw through the press. He had none of the system or technique of modern librarianship; but Nature, assisted, perhaps, by the manner of his training, had given him an extraordinary faculty of memory. References which he had once traced—shelf, volume and page—he seemed to retain indefinitely without written record and to produce at will. His unique knowledge of the library which he loved and cherished, his accumulating fund of varied information and bookish gossip, were almost too readily available to any fellow or visitor who showed interest. For many years he continued also to carry out the duty of formal editing and proof correction of all the Society's scientific publications, in addition to his library duties, and he retained this for the biological papers until he retired.

When he retired in 1930, after fifty-eight years of service, White was full of gratitude for the arrangement made, and anxious only for assurance that he would still have access to his beloved library. The Society gave him this with the appointment of 'consulting librarian', which he retained until his death, and only the failure of his eyesight restricted his enjoyment of it.

White is known to have contributed items to such publications as *Notes and Queries*, and sets of questions on general knowledge to the more popular Press, but he published little under his own name. The best-known publication attributable to him was his scholarly edition, which appeared in 1936, of William Stukeley's "Memoirs of Isaac Newton", the original manuscript of which had come into his possession. This treasure he later presented to the Society's library—a last token of a lifetime's affection.

To the memories of both these old friends, in such different ways its devoted servants, the Royal Society pays grateful tribute. H. H. Dale.

We regret to announce the following deaths:

Mr. R. C. Porter, for thirty-seven years lecturer in the Department of Mechanical Engineering of the University of Birmingham, on July 28, aged seventy-three.

Mr. L. G. S. Reynolds, C.B., C.B.E., formerly Assistant Under-Secretary of State, Air Ministry, and since 1944 secretary to the Standing Commission on Museums and Galleries, on June 29.

Prof. Gustav Senn-Bernoulli, professor of botany in the University of Basel, on July 10, aged seventy.

NEWS and VIEWS

New President of the Academy of Sciences of the U.S.S.R.: Academician Sergei Vavilov

On July 17, Sergei Vavilov was elected as the new president of the Academy of Sciences of the U.S.S.R., in succession to Vladimir Komarov, the botanist. Vavilov, who is a comparatively young man—he graduated in 1914—is one of the leading physicists in the U.S.S.R.: he is director of the Lebedev Institute of Physics, named after his former teacher, and directs the research at the State Institute of Optics. His own work has been mainly in various branches of the science of light. On the more academic side he has carried out important researches in the field of luminescence and fluorescence, having not only put forward a theory of luminescence of solutions but also developed a method of analysis, based on luminescence, which is being widely used in the U.S.S.R. On the applied side he has done much to develop in the U.S.S.R. the fluorescent discharge lamps for domestic and factory lighting which are now becoming so popular in Great Britain and the United States. Vavilov has also carried out distinguished work on the influence of the quantum nature of light on vision and on physiological optics in general. Reference to his active interest in the history of science, and in particular to his studies on Newton, is made in the article by Prof. E. N. da C. Andrade on the recent visit of British men of science as guests of the Academy of Sciences, which appears on p. 223 of this issue. In the jubilee celebrations of the Academy, Vavilov played an active part, and his British colleagues who met him will be delighted to hear of the great honour that has accrued to him.

In addition to his distinguished and varied scientific experience, Vavilov is well acquainted with the tasks of general administration. He is a member of the Supreme Soviet of the Russian Federation, to which he was elected in 1938, and his services as a scientific worker and as a man of affairs have been recognized by the award of the Stalin Prize, the highest scientific distinction in the U.S.S.R., and the Order of the Red Banner of Labour and the Order of Lenin, which are very high distinctions. Vavilov is thus accustomed to solving both difficult scientific problems and wide problems of general organization and administration and is, in general, admirably fitted by temperament and training for the very important position that he is now to fill.

Chair of Botany at Leeds: Dr. Irene Manton

With the appointment of Dr. Irene Manton, at present lecturer in botany in the University of Manchester, to the chair of botany in Leeds, in succession to the late Prof. J. H. Priestley, the Leeds Department may be expected to maintain its record of scholarship and vigorous research activity. Although Dr. Manton's published work lies chiefly in the sphere of cytology, her extended studentship—Cambridge, with additional courses pursued in Switzerland and Spain—her subsequent tenure of postgraduate studentships (the Ethel Sargant and Yarrow) in Sweden, Germany, Cambridge and the Royal Botanic Garden, Kew, and further collecting journeys to France, the Mediterranean and Egypt, entitle her to be regarded as a botanist of wide general experience. This, together with her long teaching experience at Manchester (1930–45) and her skill as a cytologist will, without doubt, be seen to advantage as the Leeds Department develops under her guidance.

Dr. Manton's earlier work includes contributions to the cytological analysis of evolution. More recently, in collaboration with members of the staff of the National Institute for Medical Research, she has developed new technical methods whereby ultraviolet microscopy can be applied to problems of chromosome structure and in the resolution of nuclear problems, where the minute size of the objects under investigation has hitherto proved an insurmountable difficulty. This work, together with a comprehensive cytological survey of the Pteridophyta which is now approaching completion, will undoubtedly constitute a substantial contribution to botanical science.

Chair of Chemistry at University College, Dublin: Appointment of Dr. T. S. Wheeler

The Senate of the National University of Ireland has appointed Dr. T. S. Wheeler to the chair of chemistry in University College, Dublin, in succession to the late Prof. T. J. Nolan. Dr. Wheeler was educated at the Royal College of Science for Ireland, and served on the staff of the Royal Technical College, Glasgow (1920–21), and as a research chemist at the Royal Naval Cordite Factory, and at the Research Department, Woolwich. In 1928 he joined the staff of the Winnington Research Laboratories of Imperial Chemical Industries, Ltd., and was concerned with the investigation of a number of processes involving gas reactions at high temperatures and pressures. In 1931 he went to India as principal and professor of organic chemistry, Royal Institute of Science, Bombay. He took an active part in the scientific life of India, being for some time dean of the Faculty of Science of the University of Bombay, and a foundation fellow (sometime a vice-president) of the National Institute of Sciences of India. His research work in Bombay dealt mainly with the chemistry of chalkones and flavones. In 1938 Dr. Wheeler returned to Ireland as State chemist. He has been for the last seven years head of the State Laboratory, and has served on the Eire Emergency Research Bureau. Though primarily interested in organic chemistry, Dr. Wheeler has also published work on the theory of liquids. In this age of specialization Dr. Wheeler has had a varied career, typified by the fact that he is one of the few holding the three professional qualifications of fellowship of the Royal Institute of Chemistry and of the Institute of Physics and membership of the Institution of Chemical Engineers.

American Chemical Society, New York Section: Dr. Cornelia T. Snell

Dr. Cornelia T. Snell, of Foster D. Snell, Inc., consulting chemists and chemical engineers of Brooklyn, N.Y., has been appointed chairman of the New York Section of the American Chemical Society. Dr. Snell, who succeeds Dr. Ross A. Baker, professor of chemistry in the School of Business and Civic Administration of the College of the City of New York, is the first woman to preside over the New York Section, which with 4,148 members is the largest of the Society's 106 local sections. She has been serving as chairman-elect of the Section and would have succeeded to the chairmanship in 1946 upon the expiration of Dr. Baker's term of office. Dr. Baker

resigned to serve as civilian educational specialist at a U.S. Army university study centre in Europe.

Dr. Snell, a native of Binghamton, N.Y., has been active as teacher, research worker, author and leader in chemistry. She received the degree of bachelor of science from Syracuse University in 1919, and for the next two years taught mathematics in a high-school. Her career in chemistry began after her marriage to Dr. Foster D. Snell in 1921. She took undergraduate courses at Barnard College, and pursued graduate studies at Columbia University, from which she received the M.A. degree in 1925 and the Ph.D. in 1930. Dr. Snell became research assistant in the pediatric department of the Fifth Avenue Hospital, and then spent a short period in the pathology department of the College of Physicians and Surgeons, eventually joining the organization headed by her husband. Dr. Snell was secretary of the New York Section of the American Chemical Society during 1937–44, and is chairman of the Women's Service Committee of the American Chemical Society. She is the author, with Foster D. Snell, of "Colorimetric Methods of Analysis", in two volumes; "Chemicals of Commerce" and "Chemistry Made Easy", in four volumes.

Men of Science in the Modern State

In his speech at the closing plenary session of the Commonwealth and Empire Conference on Radio for Civil Aviation on August 20, Lord Winster, Minister of Civil Aviation, said that among several myths which have been destroyed during the War has been that of the superiority of German men of science and of the degree of co-ordination which had been arrived at in Germany between science and industrial and war production. The course of the War showed not only that the United Nations have men of science second to none, but also that we have been far more successful in marrying their knowledge and their labours into the national war effort. Furthermore, it is now acknowledged that in future provision must be made in Britain for the training in its colleges and universities of far more scientific and technical workers than in the past, and that the pursuit of a scientific career must be made much more attractive in such matters as status and salary. These facts, Lord Winster said, are now recognized "and recognition will, I believe, be translated into action".

Lord Winster continued in a vein which will recall many an article in these columns. We have seen, he said, in the field of research what teamwork backed by unlimited funds can do. We have entered into a field in which the man of science will bring us knowledge which not merely enriches and facilitates the progress of the world but also determines the lines which progress shall take. If this is so we must alter our outlook upon the man of science; no longer can he be regarded as an interesting but unpractical individual. Even in the War of 1914–18 he did not achieve any very tangible recognition; in this War, thanks largely to Mr. Churchill, he has been coming into his own, and from now on he will be part of the warp and woof of the national life. In the future, the scientific worker by his discoveries will be determining the course the world will take. For this reason he must be brought out of the 'backroom' and brought in at the very highest level, not only for consultation about national affairs but also as regards the actual direction of those affairs.

Research in Animal Breeding and Genetics in Great Britain

As part of the survey which the Agricultural Research Council, in conjunction with the Agricultural Improvement Councils for England and Wales and Scotland, has been making of fields of research in which expansion is needed, special attention has been given to animal breeding and genetics as a subject of outstanding importance. After considering advice on developments in this field given by a special survey group, for which the American Government generously made available the services of Dr. R. T. Clark of Montana, and after consultation with the departments of agriculture, the Agricultural Research Council has appointed to its scientific staff Prof. R. G. White, professor of agriculture in the University College of North Wales, Bangor, and Dr. C. H. Waddington, of the Department of Zoology, University of Cambridge. Their first task will be to prepare a scheme for the creation of a national organization for research in animal breeding and genetics, covering the needs of Great Britain. Prof. White will be the director and Dr. Waddington will be chief geneticist.

It will be necessary for Prof. White and Dr. Waddington to investigate the systems adopted in other countries for the development of research in this field, so that a complete scheme cannot be ready for some time, though certain investigations of a statistical and fundamental character can be started in the near future. It cannot, of course, be indicated at present what centre or centres will be chosen for the development of research. The Council is, however, anxious that in any new developments full advantage should be taken of the experience of the Institute of Animal Genetics at the University of Edinburgh, which for so long has contributed to knowledge of these subjects and has been the centre of postgraduate training for workers from many countries. Similarly, it is the Council's intention, by close co-operation with practical breeders and the representatives of the agricultural industry throughout Great Britain, as well as with Milk Marketing Boards and other interested organizations, that arrangements shall be made whereby records are kept in such a form as to give the greatest measure of assistance to research workers in the new organization, and to be of real value in guiding the improvement of livestock. Research on such slow-breeding animals as farm stock must necessarily be lengthy, and results which can be applied with confidence in breeding practice cannot, therefore, be expected to emerge quickly.

International Co-operation in Social and Economic Fields

A pamphlet, "The New I.L.O", issued by the British Association for Labour Legislation, with an introduction by Barbara Ward, considers the position of the International Labour Organisation in relation to the Economic and Social Council of the Dumbarton Oaks plan, with the object of stimulating discussion on the planning of international co-operation in social and economic matters. Reviewing the past experience of the International Labour Organisation, the pamphlet is critical of the tripartite structure and questions the value of representation of employers except on the managerial or technical basis. A government should be the representative of the community as a whole, but governments should admit the workers also to the discussion of economic as well as of social problems, primarily to provide tech-

nical and constructive advice. In view of the clash and overlapping between general economic and social questions, the pamphlet appears to be dubious as to the continued existence of the International Labour Organisation as an entity, though this is not made clear. It is suggested, however, that the whole of the positive functions of the Economic and Social Council of the Dumbarton Oaks plan for constructing peace, as distinct from preventing war, should be discharged by bodies corresponding to those set up in 1918—an assembly, or conference, a council or governing body, and a secretariat or office, with committees to provide technical advice as required. The council would include representatives of the workers as well as governments and would take the place of the governing body of the International Labour Organisation. Its functions would include determining the agenda of the assembly, which itself would not be limited to government representatives. The secretariat would be divided into departments dealing, for example, with conditions of labour, with economic problems, with health and housing, with dependent territories and so forth, but with close inter-departmental relations. This plan would telescope the constructive functions of the old League of Nations secretariat and those of the International Labour Office, while employers or managers would find their place along with other professional men in the special committees created to advise on technical and practical issues. Although the Dumbarton Oaks plan is now, of course, submerged in the United Nations Charter, this pamphlet provides useful material for careful consideration.

Religion and Science

THE conventional "conflict between religion and science" has concerned itself with questions which are not of themselves fundamental, and which are consequently incapable, as they stand, of any solution, as their perpetual recurrence indicates. The truth is, in Prof. H. Dingle's view, "that most of us have two different, and largely incompatible, attitudes towards what is essentially a homogeneous body of experience, and that we are, in the main, unconscious of this" ("Science and Religion." Modern Pamphlets on Religion, Life and Thought, No. 5. Union of Modern Free Churchmen, 92 Blake Road, London, N.11. 6*d*.). Both scientific and religious interpretations, in spite of their divergence from one another, are "attempts to interpret experience in rational terms". Their difference lies in their being concerned, in the main, with different kinds of experience, so that the interpretations which in either case seem most suitable are different. The scientific descriptions of the world are most appropriate for the particular limited fields of experience with which the respective sciences deal. The religious descriptions are those most appropriate for the different but also limited fields of experience with which religions deal. As knowledge grows, it may be expected that the two descriptions "will develop and ultimately coalesce into a single description capable of expressing all experience"; though we need not expect this ultimate description "to be identical with, or even greatly to resemble, any of the descriptions we can at present give"; and we shall therefore regard without concern any incompatibility between religious and scientific thought to-day. For we must recognize that the time has not yet come when we can construct a single comprehensive world-picture that will interpret all experience. We must be content with partial pictures, each limited to the experiences which provide its justification.

The Night Sky in September

NEW moon occurs on Sept. 6d. 13h. 45m. U.T. and full moon on Sept. 21d. 20h. 46m. The following conjunctions with the moon take place: Sept. 2d. 11h., Saturn 1° S.; Sept. 3d. 11h., Venus 3° S.; Sept. 4d. 22h., Mercury 4° S.; Sept. 8d. 00h., Jupiter 4° S.; Sept. 29d. 00h., Mars 0·2° S.; Sept. 29d. 20h., Saturn 2° S. In addition to these conjunctions with the moon, the following conjunctions take place: Sept. 9d. 12h., Mercury in conjunction with Regulus, Mercury 0·3° N.; Sept. 23d. 19h., Venus in conjunction with Regulus, Venus 0·4° N. Occultation of μ Gem (*D*). takes place on Sept. 1d. 3h. 39·2m., and of 147 B Aries (*R*) on Sept. 25d. 3h. 10·4m. On Sept. 29 there is a grazing occultation of 44 Gem. Mercury can be seen in the morning hours, rising at 3h. 51m., 4h. 13m. and 5h. 47m. at the beginning, middle and end of the month, respectively. The planet is at its greatest westerly elongation on Sept. 6. Venus can be seen in the morning hours, rising at 1h. 51m., 2h. 28m. and 3h. 07m. at the beginning, middle and end of the month respectively. Mars rises at 22h. 42m. on Sept. 1 and at 22h. 10m. on Sept. 30. Jupiter is unfavourably placed for observation. Saturn rises at 0h. 52m. at the beginning and at 23h. 12m. at the end of the month. Autumn equinox commences on Sept. 23d. 10h.

Announcements

A CONFERENCE on "Friedel-Crafts Catalysts and Polymerization" has been arranged at the Department of Chemistry, University of Manchester, to be held on September 15. Those taking part include Prof. M. Polanyi (Manchester), Dr. P. H. Sykes (I.C.I. Billingham), Prof. H. W. Melville (Aberdeen) and Prof. M. G. Evans (Leeds). Notification of attendance should reach Prof. Polanyi by September 1.

THE annual conference of the Association of Special Libraries and Information Bureaux will be held at the Portland Hall, London, W.C.1, during September 15–16. The opening address will be delivered by Prof. J. D. Bernal, who will speak on the information service as an essential factor in the progress of science; there will also be a symposium on "Links with the U.S.A." and a discussion on the effects on education, research and cultural relations of the shortage of books. Application forms can be obtained from the office of the Association, 52 Bloomsbury Street, London, W.C.1.

THE National Institute of Agricultural Engineering intends to recommence publication of the *Agricultural Engineering Record*, as a quarterly journal dealing with developments in the mechanization of agriculture. Publication was begun in 1940, but ceased after the first number because of war-time difficulties. The *Record* will contain accounts of the research and development work carried out at the Institute; and it is hoped that other workers in this field will also contribute to its pages. A new feature will be the inclusion of summaries of test reports issued by the Institute, when these have a general interest. The first number will appear in September, and thereafter on January 1, April 1, July 1 and October 1 each year (1*s*. per copy, or 4*s*. 4*d*. per year, post paid; subscriptions to the Secretary, National Institution of Agricultural Engineering, Askham Bryan, York; or to H.M. Stationery Office, York House, Kingsway, W.C.2).

LETTERS TO THE EDITORS

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

Further Observations on the 'Incomplete' or 'Blocking' *Rh* Antibody

We would like to record a few more observations on the 'incomplete' or 'blocking' *Rh* antibody recently found in human serum[1,2]. 'Incomplete' antibody differed from other *Rh* antibodies in that it failed to agglutinate red cells carrying the equivalent antigen. It did, however, block this antigen, so that subsequent exposure to the homologous 'complete' or agglutinating antibody failed to result in the agglutination of the treated cells. The antigen involved is that called *D* in Fisher's notation[1]; other *Rh* antigens and the antigens *A*,*B*, *M*,*N* and *P* are not blocked by this antibody.

Since the earlier communication, it has been found that the 'incomplete' antibody is more thermostable than the 'complete' agglutinin. Heat just insufficient to cause coagulation of a serum (65°–70° C. for 5–10 minutes) will destroy all detectable *Rh* agglutinin but leave the 'incomplete' antibody apparently unchanged in quality or quantity. Heating a serum containing only *Rh* agglutinins has not so far produced 'incomplete' antibody. This greater thermostability of 'incomplete' antibody compared with agglutinin has also been reported by Diamond and Abelson[3].

An early observation that, when antigen was added to a mixture of 'complete' and 'incomplete' antibody, the latter was absorbed preferentially shows that the 'incomplete' antibody is the more strongly adsorbed of the two. It was found that the 'incomplete' antibody would not pass through a collodion ultra-filter, of a type used for osmotic pressure measurements and known to be impermeable to proteins of molecular weight 30,000 if not less. The filter was a semi-permeable membrane prepared from a solution of collodion in equal volumes of ether and alcohol, by Mr. H. Gutfreund of the Biochemistry Department, Cambridge, after the method of Adair[4]. Two thirds the volume of the serum was filtered using a pressure of one atmosphere. The ultra-filtrate contained no 'incomplete' antibody, which was still present in the ultra-residue. Thus it would seem likely that the incomplete antibody is of a protein nature.

We thought we might get some further information about the 'incomplete' antibody by noting the change n surface charge of red blood cells after being exposed to serum containing this antibody. The measurements were made using a cylindrical micro-electrophoresis cell.

The suspending fluid for the blood cells was the standard saline phosphate solution used by Furchgott and Ponder[5], in their electrophoretic studies on human red cells. This solution was made up of nine parts of a 1 per cent solution of sodium chloride ('Analar'), and one part $M/15$ phosphate buffer at *p*H 7·38. This gave a solution having a final *p*H of 7·24 at 18° C., an ionic strength of 0·172, and a specific resistance of 70·13 ohms at 18° C. The readings were taken at room temperature (17–18·5° C.) at the 'stationary level' of the micro-electrophoretic cell. The specific resistance of the solution over this temperature range had been previously determined. The red blood cells used were of the genotype Rh_2rh, having the *Rh* antigenic structure $\frac{cDE}{cde}$ (Fisher[1]). These were obtained just before use by ear prick, suspended in saline and washed three times. Saline was then added to give a 0·5 per cent suspension. 0·4 c.c. quantities of this suspension were then treated as follows: (1) no further treatment; (2) 0·4 c.c. saline added; (3) 0·4 c.c. added of human serum (group *AB*), which contained no demonstrable *iso*-agglutinins of any kind; (4) 0·4 c.c. added of human serum (of the type now called by Wiener anti-*Rh'*) containing the incomplete antibody corresponding to the *D* antigen, but containing no agglutinin for Rh_2rh cells. (On removal of the 'incomplete' antibody from this serum, the absence of any masked corresponding agglutinin could be disclosed); (5) 0·4 c.c. added of human anti-*Rh* serum, of the type called anti-Rh_0, which contained only the agglutinin corresponding to the antigen *D*. All the sera had been previously heated to 56° C. for half an hour. Tubes 2–5 were incubated for half an hour at 37° C. The tubes were then centrifuged and the supernatant fluid replaced by an equal volume of saline. On resuspension, agglutination was present only in tube 5. The cells were then washed twice with saline and resuspended in the standard saline phosphate solution to give a 0·01 per cent suspension.

The electrophoretic migration of these five suspensions was then measured using a current of 3 milliamp., which gave a field strength of 5·85 volts/cm.

The cells were found to have the following mobilities (towards the anode):

(1)	$0{\cdot}91_4$	μ/sec./volt/cm.		(cells untreated).
(2)	$0{\cdot}91_4$	,,	,,	(cells treated with saline).
(3)	$0{\cdot}90_5$	,,	,,	(cells treated with 'inert' human serum).
(4)	$0{\cdot}85_0$	,,	,,	(cells treated with 'incomplete' antibody).
(5)	$0{\cdot}85_1$	,,	,,	(cells treated with agglutinin).

These results are only qualitative as they are the effect produced by the undiluted sera, and are not based on any definite sensitizing dose, which in the case of the 'incomplete' antibody is difficult to express. However, it would seem justifiable to conclude that there would have been ample sensitizing substances, in both the undiluted sera, to saturate all the homologous receptors on the blood cells: for the agglutinating serum had a titre of 1/128, and the serum containing the 'incomplete' antibody, in a dilution of 1/8, was capable of blocking the action of a strong agglutinating serum.

The interesting fact was that the effect on the charge of the red blood cells produced by the serum containing the 'incomplete' antibody was of the same order as that produced on the charge of the cells by the serum containing the 'complete' agglutinin. Also the cells sensitized with the agglutinin and the cells 'sensitized' with the 'incomplete' antibody had exactly the same charge; yet the former agglutinated and the latter did not. This shows definitely that the surface charge is not the one and only factor causing the actual agglutination (second stage).

The above experiments seem to show that the 'incomplete' antibody is probably of a protein nature, although remarkably thermostable. It appears to act in the same way as a true agglutinin, sensitizing the cell; but differing in that it lacks something in its structure which is essential for the agglutination of the sensitized cells.

We should especially like to express our sincere thanks to Dr. A. E. Alexander, of the Colloid Science Department, Cambridge, for his continued help and

advice in the microelectrophoretic studies recorded in this paper.

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R. R. Race.

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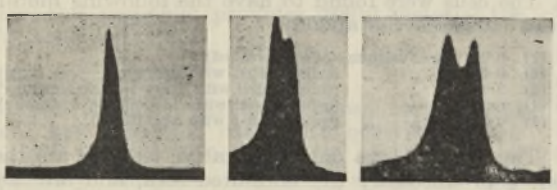
University of Cambridge,
and Medical Research Council,
Emergency Blood Transfusion Service.
June 18.

[1] Race, *Nature*, **153**, 771 (1944).
[2] Wiener, *Proc. Soc. Exp. Biol. and Med.*, **56**, 173 (1944).
[3] Diamond and Abelson, *J. Clin. Invest.*, **24**, 1, 122 (1945).
[4] Adair, *Proc. Roy. Soc.*, A, **108**, 627 (1925).
[5] Furchgott and Ponder, *J. Gen. Physiol.*, **24**, 447 (1941).

Heterogeneity of Human Serum Albumin

The existence of more than one serum albumin in the horse has been demonstrated by chemical fractionation by several workers. We have now examined human serum in the Tiselius electrophoresis apparatus under conditions designed to detect heterogeneity of the albumin fraction, and find that it consists of at least two components. The experiments were carried out at the high potential gradient of 10·0 volts/cm. in phosphate buffer of *p*H 8·0 and ionic strength 0·1, and extended up to 26 hours.

Some evidence of heterogeneity can be detected in the ascending albumin boundary after six hours, while after twelve hours definite separation into two components was observed.



6 hr. 12 hr. 22 hr.
Electrophoretic migration of human serum albumins at *p*H 8·0. Serum diluted 1 : 2 with buffer. Philpot-Svensson optical system.

We have also observed a small third peak migrating faster than the albumins. This is associated with pigment and lipoids. It is not yet possible to say whether it represents a true protein component.

The two albumin peaks have now been observed in all the five normal sera examined up to the present. The ratio of the mobilities of the two albumins is 1·01, and this value remains constant throughout the experiment.

Previous workers have reported only one albumin boundary at *p*H 8·0, although Luetscher[1] observed a complex pattern between *p*H 4 and 6. Moyer and Moyer[2] separated two albumins from horse serum by fractional crystallization and showed that the difference in electrophoretic mobilities was greatest at *p*H 8·0. The present observations show that human serum also contains at least two albumins, which have not previously been differentiated on account of the small difference in their mobilities.

We suggest that the faster component be termed A_1 and the slower A_2, pending their further characterization, on which we are now engaged.

H. Hoch.
C. J. O. R. Morris.

Hale Clinical Laboratory, and Endocrine Unit,
The London Hospital. June 2.

[1] Luetscher, J. A., *J. Amer. Chem. Soc.*, **61**, 2888 (1940).
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An Antibiotic Substance in the Chinese Water-chestnut, *Eleocharis tuberosa*

In our search for the presence of antibiotic substances in the higher plants used in China for food or for drugs, we have examined the tubers of the waterchestnut, *Eleocharis tuberosa*.

The waterchestnuts, bought in the local market, were washed and crushed in a Carver laboratory hydraulic press. In a typical experiment, 1,650 gm. of waterchestnuts yielded 300 ml. of a milky liquid with a slightly acid reaction (*p*H 6·3). This was neutralized with a few ml. of *N*/10 sodium hydroxide solution and the antibiotic action of the solution was tested with the 'ring test' method of Heatley[1] for penicillin. Positive results were obtained with *Staphylococcus aureus*, *B. coli* and *Aerobacter aerogenes*. *Bacillus graveolus* was found to be unaffected under the conditions of our experiments.

The active principle has not yet been extracted, and concentration of the liquid extract has thus far been effected by a crude technique[2] because of lack of a proper vacuum pump. The active substance is thermolabile, being destroyed when subjected to a water-bath temperature of 95° C. for more than 10 minutes. It is not destroyed when kept at *p*H 3 or *p*H 8 for at least 30 minutes. In slightly alkaline, acid or neutral media, it is not extracted by ether, petroleum ether, chloroform, benzene, carbon disulphide, ethyl acetate, acetone, etc. It is not adsorbed by the sample of animal charcoal which we used or by kaolin. The activity of the solution appears to be destroyed by ethyl alcohol. When the milky solution is cleared of its protein and other substances with lead acetate, and the latter is removed with hydrogen sulphide, the clear neutralized solution gives no activity.

The partially concentrated extract when added to *B. coli* in microrespirometer vessels of the Warburg type inhibited the respiration of the culture more than 80 per cent after about ten hours.

For convenience, we shall designate the active antibiotic principle in *Eleocharis tuberosa* as 'puchiin', from the Chinese characters for *Eleocharis tuberosa*.

We are indebted to Dr. G. S. Fan of the China Blood Bank for his assistance in carrying out some of the tests on the antibiotic effects of puchiin.

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W. K. Cheng.
P. S. Tang.

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[1] Heatley, N. G., *Biochem. J.*, **38**, 61 (1944).
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Utilization of Carotene from Oils

Variations in the growth-response of vitamin A-deficient rats to carotene dissolved in different oils has been partly attributed to their linoleic acid content[1]. While trying to discover the causes of the variations, it was felt that it would be of interest to test this hypothesis by equalizing the intake of linoleic acid. Rats depleted of vitamin A reserves on a low-fat diet similar to that of Sherman[1] were divided into five groups and fed the supplements indicated in the accompanying table by *a* and *b* by means of calibrated droppers.

Group	No. of rats used	Supplements	Gain in wt. (gm.)		Pigment excreted (%)		
			5 wks.	7 wks.	Total	Non-carotene	Carotene
I	7	*a*: 3 μgm. β-carotene and 100 mgm. cottonseed oil *b*: 100 mgm. cottonseed oil	25	31	40·5	24·0	16·5
II A	6	*a*: 3 μgm. β-carotene and 100 mgm. arachis oil *b*: 100 mgm. arachis oil	24	32	—	—	—
II B	6	*a*: 3 μgm. β-carotene and 100 mgm. arachis oil *b*: 80 mgm. ethyl linoleate and 20 mgm. arachis oil	24	30	34·2	17·1	17·1
III A	6	*a*: 3 μgm. β-carotene and 100 mgm. coco-nut oil *b*: 100 mgm. coco-nut oil	17	22	26·1	16·2	9·9
III B	7	*a*: 3 μgm. β-carotene and 100 mgm. coco-nut oil *b*: 100 mgm. ethyl linoleate	18	23	23·2	14·6	8·6

The supplements *a* and *b* were fed on alternate days to overcome the antagonism between carotene and linoleate[1]. The oils were free from carotene, since control rats receiving 500 mgm. of each in their diet continued to decline in weight and died. Since cotton seed oil contains 48 per cent, arachis oil 21 per cent and coco-nut oil 2 per cent approximately of linoleic acid[2], the total linoleic acid intake of rats in groups I, II *B* and III *B* on two consecutive days was almost the same. The ethyl linoleate was kindly prepared by Mr. P. R. Aiyar from sesame oil and had an iodine value 165.

The growth-response in coco-nut oil was much less than in arachis or cottonseed oils. The latter were equally efficient in spite of the wide variation in linoleic acid content. Further, increase in the intake of linoleic acid did not improve the response. It appears that the causes for the variations in response have to be sought elsewhere.

Ramasarma and Hakim[3] reported that rats excreted carotene even when it was administered at the level used in biological assays. Analysis of the fæces of the different groups of rats, collected for a number of days during the experimental period, confirmed their results, and showed that differences in fæcal excretion were too small to explain the variations in growth-response. The non-carotene pigment in the fæces could be separated from the carotene by chromatographic adsorption on a column of Brockman's alumina. The necessary correction was applied by determining the pigment excreted on a carotene-free diet.

The response to carotene has been shown to be improved by vitamin E (tocopherol)[4]. The tocopherol contents of the cottonseed, arachis and coco-nut oils determined by a modification of Moore's[5] procedure were 260, 286 and 0 gm. per gm. respectively. The utilization of carotene, therefore, appears to depend on the tocopherol content. A similar hypothesis has been put forward independently by Guggenheim[6], and experiments are in progress here to test this theory. The higher excretion of carotene with cottonseed and arachis oils may be explained by the anti-oxidative action of tocopherol in the gastro-intestinal tract. Incidentally, it was confirmed that no loss of tocopherol occurred during the saponification of the oil with alkali in the presence of pyrogallol. The details of these investigations will be published elsewhere.

I am grateful to Prof. V. Subrahmanyan for his interest in the work, and to the Lady Tata Memorial Trust for the award of a scholarship.

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[1] Sherman, W. C., *J. Nut.*, **22**, 153 (1941).
[2] Hilditch, T. P., "The Chemical Constitution of Natural Fats" (1941).
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Control of Internal Boll Rot of the Cotton Plant, caused by Insect Punctures (*Dysdercus* sp.), through Selection of Resistant Strains

One of the main problems related to cotton production in the irrigated valleys of the northern coastal part of Peru is connected with damage to the crop produced by the cotton stainer (*Dysdercus ruficollis*, L.), which in some years causes a loss of many million soles (1 sol = 1*s.* 1¾*d.* nominal value). The cotton crops of the valleys of Pativilca, Supe, Huarmey, Casma, Santa and Piura-Chira are the most affected annually by the "Arrebiatado" insect.

The known methods of control for cotton stainer damage, such as the strict observation of the time of planting and picking, in order to have a period of clean fields during the year, or the destruction of host plants (*Sida panniculata*, *Malachra* sp., and other Malvaceæ), the trapping of insects (a method scarcely used in Peru), or the use of special insecticides like "Babbini", recently developed in this country have had only partial success. Except for the Piura-Chira valleys, where the strict observation of time of planting and picking has led to very encouraging results, there is not known at present a method which will protect cotton plants against that pest.

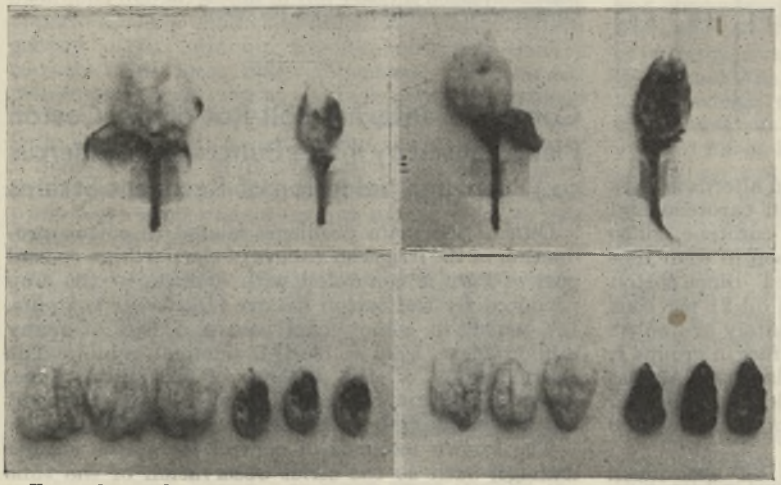
Following the very interesting results obtained in the Belgian Congo by Dr. R. L. Steyaert[1], we submitted for the approval of the superintendent on February 8, 1945, "A project of phytotechnical investigations concerning the selection of Tangüis cotton strains resistant to the internal boll rot caused by the punctures of the arrebiatado (*Dysdercus ruficollis*, L.) insect". After approval of the project, the investigation started on April 13 in La Molina Agricultural Experiment Station.

The preliminary work dealt with the micro-organism found in rotten bolls, naturally infected in the field, through the cotton stainer punctures, and was conducted by the Plant Pathology Service. Isolations from internal diseased bolls and cultures were made from the following micro-organism: *Y*-1 = Bacteria sp.; *Y*-2 = a fungus not yet identified; *Y*-3 = *Alternaria* sp.; *Y*-4 = *Acremonium* sp. Of these, *Y*-3 and *Y*-4 micro-organisms seem to be

the most virulent. *Nematospora* sp. have not yet been found.

Then a series of inoculation tests were made on a total of 160 plants, selected from the best strains of the Plant Genetics Department. Four bolls from each plant were artificially infected, each one with a different micro-organism. The work was conducted in the laboratory after taking off the bolls from tagged plants and by submerging the peduncle of the bolls in water to keep them in good condition for an eight-day period. For inoculation, the technique of Dr. Steyaert was followed with minor modifications and proved to be very useful.

Examination of artificially inoculated cotton bolls after eight days showed in a large percentage that their contents were completely rotted. However, a few plants (twelve) from four strains showed 'resistance' to infection, especially the strain No. 16–38 (LM # 7–35 group), as demonstrated by the accompanying photographs.



Upper photographs: COTTON BOLLS ARTIFICIALLY INOCULATED WITH PURE CULTURES OF *Acremonium* SP. (LEFT) AND *Alternaria* (RIGHT). RESISTANT PLANT ON LEFT OF EACH PAIR. *Lower photographs:* LINT FROM BOLLS INOCULATED WITH PURE CULTURES OF *Acremonium* SP. (LEFT) AND *Alternaria* (RIGHT). RESISTANT PLANT ON LEFT OF EACH PAIR.

This investigation was begun on April 13 and continued until the end of the month. It will be continued in the next cotton season, toward the end of the year, with the four strains which were apparently 'resistant' to infection.

Comparing the results obtained by Dr. Steyaert, who worked with American varieties of cotton (*G. hirsutum*, L.) and those obtained by us, working with Peruvian varieties (*G. barbadense*, L., var. *peruvianum*, Cav.), it may be assumed that the latter varieties are genetically more 'resistant' to infection by fungus producing internal rot of the cotton bolls, transmitted by the "arrebiatado" punctures, than the former varieties.

A very interesting field of investigation appears to be opened up by the preliminary results mentioned here for the control by plant selection of cotton stainer damage.

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[1] Steyaert, R. L., *Pub. Inst. Nat. Etude Agron. Congo Belge.*, Serie Scient. No. 16 (J. Duculot, Gembloux, 1939).

Inheritance and Acquired Characteristics

IN his recent book, "Habit and Heritage" (Kegan Paul, 1944), Wood Jones has again directed attention to the subject of hair-tracts in mammals with special reference to direction of growth and scratching habits in hairdressing. He points out that in certain marsupials, the habits of which have been observed and recorded in detail, the characteristic adult deviations from the primitive cranio-caudal direction of the body pelage are already established in the pouch-young. The inference to be drawn from the obvious correlation between direction of growth and scratching habits of these species, and their predetermined appearance in the pouch-young, is that the modified direction, originally induced through habit, has become inherent in the genetic constitution during the course of evolution.

I am indebted to Mr. Albert Hochbaum, director of the Experimental Duck Station at Delta, Manitoba, Canada, for directing my attention to the following analogous, yet essentially different, case in ducks. All adult ducks have well-developed pterylæ (feather-tracts) and do their preening as systematically as mammals do their scratching, running their bills along only certain defined lines of the contour plumage in conformity with the distribution of the pterylæ. Preening is, in fact, not a random operation, but determined by the extent of the tracts and directions of the feathers. At the time of hatching, however, the duckling is clad in down which exhibits no pterylosis, being evenly distributed over the body as in the supposedly primitive arrangement of adult Ratites and the *Sphenisci*. The contour feathers make their first appearance as sprouts at three weeks and are not fully developed until much later. As early as the age of five *hours* the ducklings (incubator-hatched) may commence to preen. From the start they go through the specific adult motions, although these are quite meaningless during the period of weeks in which the uniformly distributed coat of down is their sole covering. In this case it is not a morphological structure that precedes the appearance of a controlling habit, but a habit that precedes the development of a morphological character, to the topography of which the practice appears to be directly adapted.

Mr. Hochbaum has also pointed out that a young duckling, incubator-hatched and isolated from grown birds, when stretching, does it in the familiar adult fashion as if the primaries were already present; yet it then possesses merely rudiments of wings and no wing-feathers against which to press its outstretched leg. The leg nevertheless goes through the motions appropriate to the adult state.

I should point out that while these facts emanate from Mr. Hochbaum, he is not to be held responsible for the suggested interpretation.

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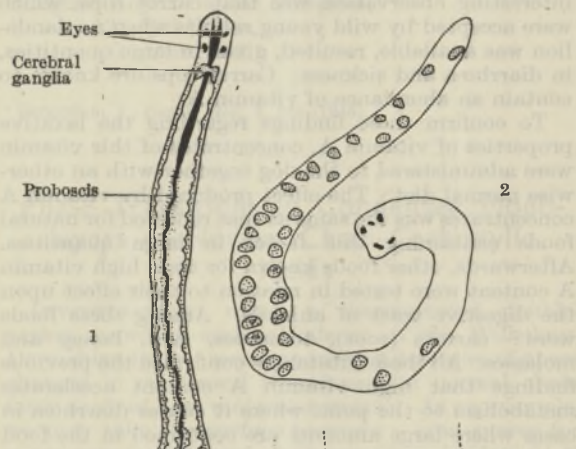
A British Freshwater Nemertine

On July 12, 1944, while collecting planarians in the Cam at Cambridge, we found a small orange-coloured worm in the leaf axils of *Glyceria aquatica* stems. Afterwards many more were found. The general structure, including the proboscis, showed clearly that it was a nemertine. The only freshwater nemertine previously recorded from Great Britain was a single specimen found by Benham[1] in the River Cherwell, of which, however, there is no full description. There is also a single record of a freshwater nemertine from Ireland in Co. Dublin[2]. The present record is therefore of interest.



Prostoma Græcense: 1. Dorsal view. 2. Diagram showing distribution of ova. 3. Main and reserve stylets.

The worms were not uncommon in association with *Glyceria*, it being an easy matter to collect some six specimens in an hour. It was distributed widely in the Cam and its tributaries between Cambridge and Harston, although weirs occur along this stretch of the river. We did not have an opportunity to search beyond these limits, but we were informed that a single specimen had been found in the Great Ouse near Over (September 13, 1944). The worms were still abundant in the Cam throughout the autumn, but had disappeared by November 24, by which time the *Glyceria* with its associated turbellarian fauna was dying down. In July nearly all the individuals contained eggs, though none was found in specimens collected during November. Small isolated specimens have again been found this year, the first on March 21. It is of interest that one of these specimens contained actively moving sperm in the testes.

The worms ranged in size from 5 mm. to 20 mm. in length, and from 0·5 mm. to 1 mm. in width. They were usually orange-red in colour, but yellow and almost colourless individuals were found. In addition the surface was often flecked with brown pigment. The accompanying drawings indicate the general structure of the worms. The mouth and rhynchodæum have a common opening. There are four to eight eyes, the number and degree of development of which is very variable. The few specimens so far sectioned have ten proboscis nerves. There appear to be commonly two stylet sacs, each containing three to five reserve stylets, on either side of the main stylet. The length of the main stylet including the haft is approximately 95 μ.

Allowing for the variability in colour and eye number, the worms agree with the description of *Prostoma* (=Tetrastemma=*Stichostemma*) *græcense* (Bohmig). This species is characterized by the possession of a common opening for the mouth and rhynchodæum (differentiating it from *P. clepsinoides*), and by the possession of ten proboscis nerves (differentiating it from *P. eilhardi*). Bohmig records[3] *P. græcense* from the Botanic Gardens at Graz, and from mud in a stream at Prague. The nemertine recorded by Southern in Ireland was referred by him to the species *P. clepsinoides*. As Hallez points out[4], the two species are closely related. Unfortunately, Benham's single specimen from Oxford was accidentally destroyed before it could be fully identified.

We should be glad to receive any information about the distribution of this freshwater nemertine in other parts of the British Isles.

We wish to thank Dr. C. F. A. Pantin for his interest and help in making these observations.

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[1] Benham, W. B., *Nature*, **46**, 611 (1892).
[2] Southern, R., *Nature*, **79**, 8 (1908).
[3] Bohmig, L., *Biol. Centrabl.*, **30**, 561 (1910).
[4] Hallez, P., *Bull. Soc. Zool. France*, **35**, 62 (1910).

The Popliteal Facet in Men who Habitually Squat

Some interest has centred around the variations in the lower end of the femur occasioned by the squatting posture[1-4], and the present communication is to record yet another variation in the lower end of femora from Punjabis of lower classes, who adopt the squatting posture not only during work but also during rest. In a series of two hundred femora examined, a curved facet, covered with cartilage, was detected in all of them in the posterior part of the lateral aspect of the lateral condyle. It was well marked in some, less so in others, but was present in all. This facet may be looked upon as an extension of the femoral condylar articular cartilage on the lateral aspect posteriorly, just as the quadriceps facet[1] is an extension of cartilage anteriorly.

The popliteal muscle arising from the anterior end of the popliteal groove on the lateral side of the lateral femoral condyle, and being inserted on the upper end of the posterior surface of the tibia, lies in the popliteal groove during flexion of the knee joint but moves in an arc on the lateral side on the lateral femoral condyle during the movement of extension, until the tendon lies obliquely from before

backwards, bevelling the anterior part of its lower border. The friction between the tendon and the side of the condyle is obviated by the synovial membrane acting as a bursa.

As the movements of the knee joint are more frequent in squatting than non-squatting races[1], the popliteal tendon rubs against the lateral condyle much more frequently in the former than in the latter. The popliteal facet seems to owe its existence to this fact.

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[1] Martin, C. P., *J. Anat.*, **66**, 371 (1932).
[2] Siddiqui, M. A. H., *J. Anat.*, **68**, 331 (1934).
[3] Siddiqui, M. A. H., *J. Anat.*, **70**, 410 (1936).
[4] Shah, M. A., *J. Anat.*, **77**, 110 (1942).

Effect of High Vitamin A in the Diet of Domestic and Non-Domestic Animals

The purpose of this study was to learn the specific effect of diets containing medium and large amounts of vitamin A upon the digestive equipment of domestic animals, and of wild animals kept in captivity. Vitamin A has been found to be essential for the development and growth of young animals; quite characteristically it has been found to enhance metabolism and promote assimilation, and thus it is obvious that this very quality results in the promotion of growth and development, for the latter is based upon normal metabolism and the elimination of residual matter in the living body.

The first study was made in connexion with the diet of a thoroughbred German Shepherd bitch which had developed a chronic diarrhœa which had persisted over a long period of time. This dog was fed regularly and was not exposed to infection or to contaminated food. She had no intestinal parasites; her food consisted of the cooked lights (lung), liver and heart from sheep, and the broth therefrom. Evaporated milk diluted with water and dog biscuit were given for the second daily meal. The dog was apparently perfectly well, the coat was heavy and lustrous, her vitality unimpaired. However, the persistent diarrhœa left no doubt that her diet contained something which had the effect of a laxative.

In order to trace the offending factor in the diet, the milk was eliminated first, but put back when found to be inoffensive. The dog biscuit was tested in the same manner, and finally the heart, lung and liver. By the process of elimination it was determined that liver was the substance which was responsible for the diarrhœa. Only two days after elimination of the liver from the diet, the dog had perfectly normal bowel discharges and has remained perfectly well ever since.

Liver is one of the organs of the animal body which stores up vitamins in large amounts. Vitamin A, apparently, contained in the liver, was responsible for the accelerated metabolism resulting, in turn, in diarrhœa in the dog. Other organs, like kidney and spleen, also rich in vitamins, but probably containing less vitamin A, had a similar effect, but not quite so pronounced. The liver, kidney and spleen were more laxative when fed raw than when given cooked, some of the effect of the vitamin being destroyed when exposed to heat.

Later dietary studies were extended to wild rabbits kept in captivity. Many experiments to raise these animals in captivity have failed because of the mistake made of feeding them standard domestic rabbit rations. Wild rabbits, due to their extremely rapid growth during the first few weeks of their life, require unusual amounts of vitamin A. The milk of rabbit does is known to be richer in butter fat (containing vitamin A) than the milk of most other animals. As the rabbits are weaned, they select for their first solid food such weeds which are richest in vitamins A and C, like dandelion and clover, while delicacies such as fresh peas, lettuce and cabbage were steadily rejected by the experimental animals. Another interesting observation was that carrot tops, which were accepted by wild young rabbits when no dandelion was available, resulted, given in large quantities, in diarrhœa and sickness. Carrot tops are known to contain an abundance of vitamin A.

To confirm these findings regarding the laxative properties of vitamin A, concentrates of this vitamin were administered to the dog together with an otherwise normal diet. The effect produced by vitamin A concentrates was the same as that reported for natural foods containing this factor in large quantities. Afterwards, other foods known for their high vitamin A content were tested in relation to their effect upon the digestive tract of animals. Among these foods were: carrots (root), tomatoes, suet, honey and molasses. All these substances confirmed the previous findings that high vitamin A content accelerates metabolism to the point where it causes diarrhœa in cases where large amounts are contained in the food ingested.

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Spontaneous Regression of Histologically Malignant Tumours Induced in Rabbits by 9 : 10-Dimethyl-1 : 2-Benzanthracene

Berenblum has reported[1] the induction of squamous carcinoma in rabbits with 9 : 10-dimethyl-1 : 2-benzanthracene.

The ears of eleven rabbits were painted with a solution in acetone of 0·3 per cent 9 : 10-dimethyl-1 : 2-benzanthracene (which was kindly supplied by Prof. J. W. Cook), for sixteen weeks, without immediate effect. The strength of the solution was then increased to 2 per cent, after which papillomas in five rabbits appeared within three to six weeks. Clinical evidence of infiltrating growth was noted in three rabbits after further periods of four, seven and sixteen weeks respectively. The tumours measured 1·5–4 cm. in diameter, and extended from their origin on the inner side of the ear to the subcutaneous tissue of the outer side, bulging out the skin. Biopsy of one tumour was done, and reported by Dr. P. R. Peacock as having the appearance of a squamous carcinoma penetrating lacunæ in the cartilage.

Two rabbits were used for therapeutic experiments, but the attempt was abandoned after one injection in one rabbit, and after two injections in the other, because the solution used caused phlebitis. No therapeutic effect was observed within three weeks

in the first rabbit, and within four weeks in the second rabbit. After this period, painting was discontinued, and both tumours, as well as the untreated control tumour, regressed completely within five weeks.

The observation suggests that in tumours induced by 9 : 10-dimethyl-1 : 2-benzanthracene in rabbits, as in tar carcinoids, histological malignancy is not necessarily irreversible. These tumours, therefore, may not be classified as truly malignant, in spite of their histological appearances, and are not suited for therapeutic experiments.

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[1] Berenblum, I., *Cancer Res.*, 5, 265 (1945).

Phase Transitions in Condensed Monolayers of Normal Chain Carboxylic Acids

INVESTIGATIONS using a thermostated double-acting recording surface balance of the Wilhelmy-Dervichian type[1,2] reveal an interesting series of phase changes in condensed monolayers of normal chain fatty acids of high molecular weight. As an example, we may take the surface pressure – area curves for *n*-docosanoic (behenic) acid[3] spread on acid (0·01 *N* hydrochloric acid) substrate shown in Fig. 1. At the lowest temperature the solid film gives a smooth pressure – area curve and the area can be reduced down to about 18·6 sq. A. per molecule before a gradual collapse sets in. At this area the chains are evidently vertical and as closely packed as in the normal three-dimensional hydrocarbon crystal, in which the cross-section of the chains[4] is about 18·4 sq. A. This close-packed solid phase may be denoted by *CS*. When the temperature is raised, another phase, L_2, appears[5], the stability range of which increases with temperature. At 8·2° a new phase, which we may call L'_2, appears and is quite marked in the curve for 10° in Fig. 1. At 13·8° the high-pressure phase *S* appears and the curve for 14·8° shows a transition $S \rightleftharpoons CS$ which is rapidly displaced towards higher pressures with raising temperature. Above 18°, *CS* has disappeared and *S* shows a sharp collapse at about 55 dynes pressure. The smallest area at which the phase *S* is stable is about 19·3 sq. A. It seems likely, therefore, that the molecules are vertical and perform strong torsional oscillations[6] or complete rotations, as the area per chain corresponds to that found in hydrocarbon crystals near the melting point[4]. (A few degrees below the melting point some hydrocarbons show a gradual, others an abrupt, change from a state of lower symmetry into one of hexagonal symmetry, in which the vertical chains are rotating about the long axis.)

As the temperature is raised, the transition $L_2 \rightleftharpoons L'_2$ becomes less marked. The transition $L'_2 \rightleftharpoons S$ is of the second order from its first appearance at 13·8°–22°, but over the temperature range 22°–29° the transition from the L'_2 phase is of the first order. Harkins and Copeland[7] have recently studied a similar phenomenon in monolayers of *n*-octadecanol-1. They found a triple point at 7·5° with the appearance of a new

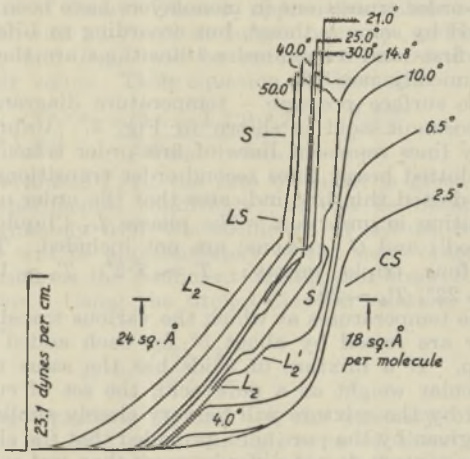

Fig. 1.

phase called *LS*, characterized by a very low viscosity. Over a certain temperature range the transition $L_2 \rightleftharpoons LS$ was of the first order. The existence of an *LS* phase in monolayers of *n*-docosanoic acid is suggested by a decrease in film viscosity (or rigidity ; when the chains are very long, both L_2 and L'_2 are solid) at the transition from the L'_2 phase at temperatures above 22°, and by the break in the high-pressure portion of the curves above this temperature (more marked at higher temperatures, see Fig. 1) which is probably due to an $LS \rightleftharpoons S$ transition. It is difficult to determine the order of this transition, owing to instability of the film at the high pressures involved, but it appears to be a second order one. The same also applies to the $S \rightleftharpoons CS$ transition.

Experiments with the Langmuir-Adam balance show that on compression the pressure remains constant over a certain area range during the transitions $L_2 \rightleftharpoons CS$ and $L'_2 \rightleftharpoons CS$, and these are therefore of the first order. There is a certain amount of hysteresis, however, and the curves in Fig. 1, which have been redrawn from automatically recorded curves, are not quite horizontal during the transitions. The transition $L_2 \rightleftharpoons L'_2$ is also of the first order below about 23°, but probably becomes second order above this temperature. The changes in the pressure-area curves are very small, however, and it is difficult to determine the order exactly. Diffuse first-order transitions and

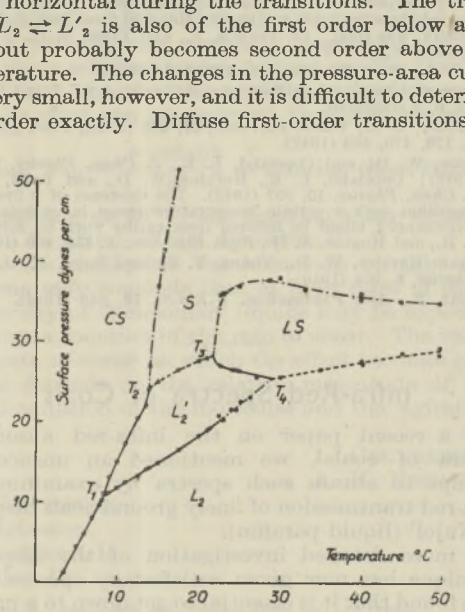

Fig. 2.

third-order transitions in monolayers have been considered by some authors[8], but according to Lifshitz[9] only first- and second-order transitions are thermodynamically possible.

The surface pressure – temperature diagram for *n*-docosanoic acid is shown in Fig. 2. Unbroken heavy lines represent lines of first-order transitions and dotted heavy lines second-order transitions. A dash-dotted thin line indicates that the order of the transition is uncertain. The phases L_1 ('liquid expanded') and G (gaseous) are not included. There are four triple points: $T_1 \sim 8{\cdot}2°$, $T_2 \sim 13{\cdot}8°$, $T_3 \sim 22°$, $T_4 \sim 29°$.

The temperatures at which the various transitions occur are raised by about 5° for each added CH_2 group. If a mixture of acids has the same mean molecular weight as a pure acid, the set of curves given by the mixture will be very closely similar to that given by the pure acid, provided that the chains in the mixture do not differ by more than two carbon atoms in length.

The close-packed *CS* phase has also been found for methyl and ethyl esters of long normal acids and for alcohols and acetates, and will probably be found in other cases, provided that the chains are long enough or the temperature low enough, and the cross-section of the head group is less than that of the chain. *n*-Docosyl acetate shows all the transitions described above for *n*-docosanoic acid. The L'_2 phase has so far been found only for acids and acetates.

A detailed account of the investigation will be published elsewhere.

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[1] Andersson, K. J. I., Ställberg-Stenhagen, S., and Stenhagen, E., article in "The Svedberg 1884–30/8 1944" (Uppsala, 1944), p. 11.

[2] The instrument used in the work described is a modification of that described in ref. 1. The monolayer is compressed symmetrically with respect to the Wilhelmy glass slide by two barriers moving in opposition to each other. This arrangement is necessary when very solid monolayers are investigated.

[3] A very pure specimen of *n*-docosanoic acid (impurityp resent amounting only to a few parts per 10,000) obtained from Prof. F. Francis, Bristol, was used. Cf. Francis, F., and Piper, S. H., *J. Amer. Chem. Soc.*, **61**, 577 (1939).

[4] Müller, A., *Proc. Roy. Soc.*, A, **138**, 514 (1932).

[5] The nomenclature used by Harkins and Copeland, ref. 7, and Lifshitz, ref. 9, is employed.

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[7] Harkins, W. D., and Copeland, L. E., *J. Chem. Physics*, **10**, 272 (1942); Copeland, L. E., Harkins, W. D., and Boyd, G. E., *J. Chem. Physics*, **10**, 357 (1942). The existence of a first-order transition over a certain temperature range in monolayers of *n*-eicosanol-1 might be inferred from earlier work by Schulman, J. H., and Hughes, A. H., *Proc. Roy. Soc.*, A, **138**, 430 (1932).

[8] Compare Harkins, W. D., Young, T. F., and Boyd, E., *J. Chem. Physics*, **8**, 954 (1940).

[9] Lifshitz, E., *Acta Physicochim. U.R.S.S.*, **19**, 248 (1944).

Infra-Red Spectra of Coals

In a recent paper on the infra-red absorption spectra of coals[1], we mentioned an unsuccessful attempt to obtain such spectra by examining the infra-red transmission of finely ground coals dispersed in 'Nujol' (liquid paraffin).

A more detailed investigation of the dispersion technique has now given satisfactory spectra. We have found that it is essential to get down to a particle size of the order of 1 μ and to use an effective path-length of at least 50 μ. Although under these conditions the energy transmitted by a 'coal-Nujol' film is so low that large slit widths are necessary to measure the transmission, spectra with quite well-defined bands are obtained.

Using this technique, the spectra of a series of coals supplied by the British Coal Utilisation Research Association have been recorded and characteristic differences in the spectra of coals of differing rank and origin have been detected.

A detailed account of this work, which forms part of a programme of fundamental research on the spectra of coals carried out for the British Coal Utilisation Research Association, will be published elsewhere in the near future.

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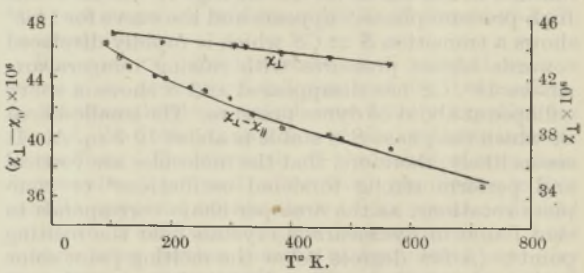
[1] Cannon and Sutherland, *Trans. Far. Soc.*, **41**, 280 (1945).

Effect of Temperature on Magnetic Susceptibility of Molybdenite Crystals

The structure of the molybdenite crystal has been determined by Pauling and Dickinson[1] and Hassel[2]. They found that the molybdenum and sulphur atoms in it are arranged in separate layers perpendicular to the *c*-axis. Each layer of molybdenum atoms has two layers of sulphur atoms on opposite sides of it. The whole structure is then built up by the repetition of composite layers each of which is formed by a molybdenum layer sandwiched between two sulphur layers. The excellent cleavage in a plane parallel to the layers themselves may be regarded as a natural consequence of the large distance between these successive composite layers. In layer structures of this type, it seems that the major portion of the primary valencies is exercised within the layers themselves, and only secondary forces hold the layers together to form the crystal lattice.



In view of the above considerations, magnetic studies on single crystals of molybdenite were undertaken and interesting results[3] have been obtained. The difference between the two principal susceptibilities $\chi_\perp - \chi_\parallel$ has been found to be $42{\cdot}8 \times 10^{-6}$ per gm. mol; and $\chi_\parallel$, the absolute value of the susceptibility along the *c*-axis, being $-87{\cdot}1 \times 10^{-6}$ per gm. mol. Thus the anisotropy is found to have the high value of about 72 per cent. Recently these measurements have been extended to various temperatures both high and low. The results are shown

diagrammatically in the accompanying graph. It has been found that there is a large temperature variation of $\chi_\perp - \chi_\parallel$, the difference between the principal susceptibilities. It varies from $46{\cdot}4 \times 10^{-6}$ at about 90° K. to $36{\cdot}8 \times 10^{-6}$ at about 700° K. On the other hand, $\chi_\perp$, the susceptibility at right angles to the symmetry axis, has been found to vary quite slowly with temperature, namely from $-45{\cdot}01 \times 10^{-6}$ at 90° K., to -43×10^{-6} at 566° K. Details of these investigations will shortly be published elsewhere.

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May 17.

[1] Pauling, L., and Dickinson, R. G., *J. Amer. Chem. Soc.*, **45**, 1466 (1923).
[2] Hassel, O., *Z. Krist.*, A, **61**, 92 (1924).
[3] Dutta, Ajit Kumar, *Ind. J. Phys.*, **18**, 249 (1944).

Viscosity of Ordinary Liquids at High Rates of Shear

THE viscosity, η, of a fluid can be represented by[1]

$$\eta = \left(\frac{N}{V}\right)^{2/3} \cdot \frac{c.(2.\pi.m.k.T)^{1/2}\, R.T}{E_T} \cdot e^{\frac{E_{visc.}}{R.T}}, \quad . \quad (1)$$

where N is Avogadro's number; c is a packing factor; m is the mass of a molecule; k is Boltzmann's constant; $E_{visc.}$ is the energy of activation of viscous flow; V is the molecular volume; E_T is the sum of the potential and the kinetic energy of the molecules. We have found that E_T can be expressed as the sum of the latent heat of vaporization ($\triangle E_{vap.}$) and a multiple of $R.T$ ($d.R.T$). It has been shown[2] that $E_{visc.}$ equals the work of cohesion for non-associated liquids, and from this fact it was deduced that $E_{visc.}$ equals the bond energy between two interacting molecules. Further, it has since been deduced that $\triangle E_{vap.} = b.E_{visc.}$, where b is a factor depending on the mean co-ordination. Thus both $\triangle E_{vap.}$ and $E_{visc.}$ depend on the number of bonds per mole, formed by the interaction of the molecules.

The number of closed bonds, N', will, apart from the mean co-ordination, be a function of the co-ordination frequency, z, that is, $N' = f(z)$, and to a first approximation $N' \propto 1/z$. In a stationary liquid the molecules are in thermal agitation and z will have a certain value, depending on the temperature. In a liquid under flow, 'agitation of flow' will be superimposed on the thermal agitation. If z_1 is the co-ordination frequency in the stationary liquid and z_2 that frequency in the moving liquid, then f, the ratio of the number of closed bonds in the moving liquid, n, to that in the stationary liquid, N', will be given by

$$f = \frac{n}{N'} = \frac{z_1}{z_2} \quad . \quad . \quad . \quad . \quad . \quad (2)$$

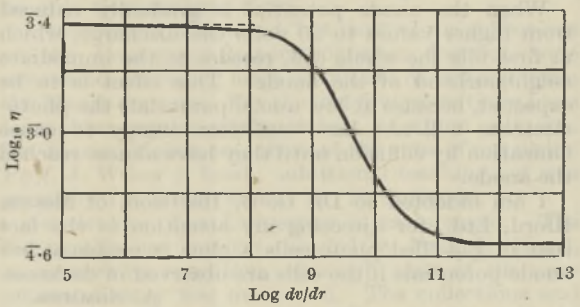
For z_2 one may write $z_1 + z_3$, where z_3 is the increase in co-ordination frequency due to viscous flow. If the molecular layers are moving with relative velocity v_r and the intermolecular distance is λ, then $z_3 = v_r/\lambda$. It is to be noted that z_3 according to this definition is also equal to the rate of shear in the liquid. So long as $z_1 \gg z_3$, the factor f will be practically equal to 1 and $\triangle E_{vap.}$, $E_{visc.}$ and η will be independent of the rate of shear. When z_3 approaches values comparable with z_1, f will no longer be unity, and both $\triangle E_{vap.}$ and $E_{visc.}$ will be reduced to a fraction f of their value. Then equation (1) becomes

$$\eta = \left(\frac{N}{V}\right)^{2/3} \cdot \frac{c.(2.\pi.m.k.T)^{1/2}\, R.T}{f.E_{vap.} + d.R.T} \cdot e^{\frac{f.E_{visc.}}{R.T}} \quad . \quad (3)$$

To evaluate $f : z_3$, the rate of shear, is given by the experimental conditions; z_1 can be obtained approximately from the coefficient of self-diffusion, D; D will be approximately of the same order of magnitude as the coefficient of diffusion observed in solutions. Using the Stokes-Einstein relation, one obtains

$$z_1 = \left(\frac{N}{V}\right) \frac{k.T}{6.\pi.\eta} \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Using equations (3) and (4), the viscosity of n-pentane at 30° C. and at high rates of shear was calculated (see graph). One can see that the viscosity of n-pentane will reveal its dependence on the rate of shear at a value of approximately 5×10^6 sec.$^{-1}$ of the latter.



From equation (4) one can deduce that

$$z_1 \times \eta_0 \times V = \text{constant},$$

at constant temperature and very nearly

$$z_1 \times \eta_0 \times M \sim \text{constant}, \quad . \quad . \quad . \quad (5)$$

where η_0 signifies the 'Newtonian' viscosity and M the molecular weight. The value of z_3 at which the viscosity will become markedly dependent on the rate of shear will be about 10^3 times smaller than z_1. Let $(dv/dr)_{lim.}$ be the value of the rate of shear at which the effect can be observed, then one may write

$$(dv/dr)_{lim.}\ x\eta_0 = \frac{\text{constant}}{M} = \text{limiting shear stress}.$$

For n-pentane at 30° C. the limiting shear stress is found to be about 10,000 dynes/cm.^{2}.

From the theoretical considerations brought forward, one may conclude that at high rates of shear the viscosity of 'Newtonian' liquids may be expected to become a function of the rate of shear. The value of the rate of shear at which the effect becomes perceptible depends on the relative magnitude of the thermal agitation of the molecules and the 'agitation of flow'.

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[1] Guareschi, P., *Atti Acad. Sci. Torino*, Disp. 2a, 118 (1939).
[2] Grunberg, L., and Nissan, A. H., *Nature*, **154**, 146 (1944).

Visible Glow Discharge at Very Low Potentials.

It is a well-known phenomenon in gas-filled photo-electric cells that, if the cathode is exposed to illumination, a faint glow is visible within the cell at anode potentials well below the striking potential, that is, below the potential at which the self-maintained discharge starts. Owing to the fact that, as a rule, this glow is of low brightness as compared with the light source which is used to cause the photo-electric emission, it is difficult to establish the anode potential at which the glow begins.

This glow can, however, be observed in complete darkness if a photo-cell of the silver–oxygen–cæsium type, which is sensitive to infra-red radiation, is exposed to a light source through an infra-red filter. By experiments with such a photo-cell containing argon, it was found that a glow is visible at anode potentials as low as 18 volts (the current in this case was 1 μamp.), that is, at a potential only slightly above the ionization potential of argon. This means that a glow commences as soon as ionization by collision takes place.

When the anode potential is gradually reduced from higher values to 20 volts the discharge, which at first fills the whole cell, recedes to the immediate neighbourhood of the anode. This effect is to be expected, because at low anode potentials the photo-electrons will not have sufficient energy to cause ionization by collision until they have almost reached the anode.

I am indebted to Dr. G. B. Harrison, of Messrs. Ilford, Ltd., for directing my attention to the fact that in gas-filled photo-cells a glow is visible at low anode potentials if the cells are observed in darkness.

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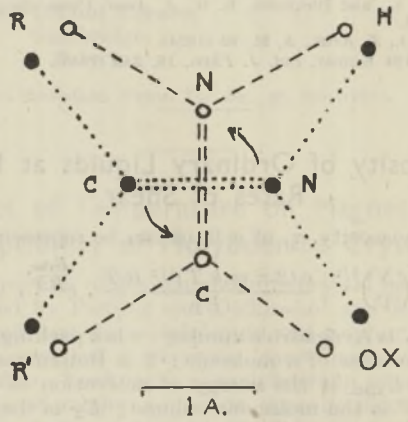
Mechanism of the Beckmann Rearrangement

I have recently received my copy of *Chemical Reviews* for December 1944 and find in it yet one more survey of the Beckmann rearrangement and confession of failure to 'explain the mechanism' in the classical sense.

The diagram shows scale drawings of the oxime before rearrangement (full circles and dotted lines) and the *R*N : C*R*′OX resulting from the change (open circles and dashed lines) superimposed so as to have the same centre of gravity, and minimum rotational movement of the heaviest parts. Both compounds are represented with a proton attached to the nitrogen atom : this is probably the case under most reaction conditions, but is not a necessary feature of the views advanced here. It will be seen that it is only the carbon and nitrogen atoms which move an appreciable distance. The only other movements required are of the atoms directly attached to these, and these movements can all be taken up in the first instance by a 10° bending of the links. The contribution of this to the activation energy can be estimated from the spectroscopic data on bending frequencies —which are mostly of the order of 600 cm.$^{-1}$—and amounts to between 20 and 50 kcal./mole depending on the masses of the attached atoms.

The 'mechanism' of a reaction in the classical sense means the order in which valency bonds are broken and made. We are familiar with a partial abandonment of this in the recognition that in a reaction such as halogen exchange between halide ions and alkyl halides there is a simultaneous 'make' of one link and 'break' of another, and it is further recognized that whenever the activation energy of a reaction is less than the dissociation energy of the bonds which are broken, some such simultaneous make-and-break occurs. In more detail, as the nuclear configuration passes from that of the reactants to that of the products, it passes through an intermediate or transition form which may be regarded as a distortion of either. Therefore distorted forms of the initial and final bond systems are both possible approximately canonical forms for the



electronic configuration in the transition state, and the actual configuration will be a resonance hybrid of these. This results in a diminished restoring force or 'weakness' towards any thermal vibration which tends to carry the reactant over into the product.

The description of the previous paragraph applies word for word to the Beckmann change. However, (1) it is probably necessary for the slow thermal movements of the attached groups to be in a favourable phase for reaction to occur (otherwise larger bending of the links is involved) and (2) when reaction does occur the number of bonds made and broken is relatively large, so that the reaction appears complicated. But it is essentially a one-stage mechanism defying further analysis, and, moreover, the word 'migration' is an extremely misleading term. The mechanism as outlined explains all the qualitative features of the Beckmann and allied reactions—the intramolecularity, the *trans* migration, and so on, and also semi-quantitatively the effects of substituents in the groups. It may be added that a similar explanation can be drawn up for the pinnacol-pinacoline group of rearrangements, including as a natural consequence the Walden inversion which occurs on the carbon atom which remains capable of optical activity.

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SOME FRENCH AND GERMAN GEOGRAPHICAL AND GEOLOGICAL INSTITUTIONS

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THE following notes, which may be useful to geologists and biologists, were compiled during a series of visits in the past few months to several museums and universities in Europe, while I was attached to the U.S. Army. I have been to all of those mentioned below, with the exceptions of Monaco and Berlin. All German universities seen were operating at about half pre-war enrolment during the winter semester 1944–45.

France

Monaco. The director of the Oceanographic Museum, Dr. Richard, died in February. His successor is Commandant Rouch. The Museum is said to have been slightly damaged by the explosion of a 'porpoising' torpedo last summer.

Paris. Prof. E. de Margerie, now in his early eighties, is well, and is actively engaged in the publication of his memoirs ("Critique et Géologie"), a four-volume quarto historical survey of the development of some aspects of geological and geographical science since 1884. The first volume has appeared recently (Armand Colin, 500 fr.). The others are in advanced stages of preparation and publication.

No important changes have occurred at the Sorbonne or the École des Mines. At the Jardin des Plantes the director of the Laboratoire de Paléontologie is now Dr. Arambourg.

Strasbourg. Most of the University staff, including the Service Géologique d'Alsace, headed by Dr. G. Dubois, were evacuated to Clermont-Ferrand during 1939–40. Geological and geographical books, maps and specimens left in Strasbourg were used by the Germans, and the choice things taken into Germany proper. Prof. O. Haas, whose personal library and collections from central Africa are intact, alone remained behind throughout the occupation. The geological building is undamaged by bombing.

Germany

Berlin. At the Bavarian Geological Survey, I met two geologists, one Dutch, the other German, who had been in Berlin as late as February 1945. They stated that: the Preussische Geologische Landesanstalt and the Museum für Naturkunde are quite destroyed; the library and archives of the former were safely evacuated, but only a few types were saved from the Museum; the splendid skeleton of *Brachiosaurus* is lost; at that time both Prof. O. H. Schindewolf and Prof. H. Stille were well and active. This information seems authentic.

Bonn. The Geographisches Institut is a total loss, but its contents had been mostly evacuated across the Rhine. The Geologisch-Paläontologisches Institut is damaged somewhat by blast, but all important collections, such as that of Goldfuss, were safely evacuated. Prof. H. Cloos is still director.

Cologne. The Geographisches Institut is badly damaged, and the contents were not evacuated.

Darmstadt. The Geologisches Institut and Hessische Geologische Landesanstalt were totally wrecked.

Erlangen. Undamaged. Nothing evacuated from the Geologisches Institut. Most of the staff, with the exception of Prof. L. Krumbeck and another, in the German army.

Frankfurt A/M. The Geologisches Institut of the Goethe University is wholly demolished, and the Senckenberg Museum is reduced almost to a hollow shell. The material was mostly evacuated, and, in the case of the Senckenberg, all research collections and stocks of publications and library are safe. Dr. R. Richter, the director, was in Bucharest when that city capitulated, and is now interned by the Russians. Two years ago he published an extensive paper on the rules of zoological nomenclature and nomenclatural problems, "Einführung in die Zoologische Nomenklatur durch Erläuterung der Internationalen Regeln", *Senckenberg. Naturf. Gesellsch.*, 1943 [a copy is now in the British Museum (Natural History) Zool. Dept. Library]. The acting director is Dr. H. T. Reuling. The only actual losses at the Senckenberg Museum, besides the building, were a number of large plaster casts (including the large one of *Diplodocus carnegiei*) and a large ornithological collection. The Senckenberg authorities have carefully saved their publications ordinarily destined for the countries of the Allied Nations, and are hoping to be able to distribute them.

Heidelberg. Undamaged, but most of the collections of the Geologisch-Paläontologisches Institut were evacuated, including large quantities of material from the Mauer deposits. For the last few years there have been three regular staff members, of whom only one, Dr. Florian Heller, was there at the time of my visits. Prof. J. Wilser is head; additional teaching aid was given by Dr. Salomon and Dr. E. Jaworski.

Innsbruck. The University is undamaged. The Geographisches Institut, headed by Prof. H. Kinzl, is in working condition, although most of the non-current library was evacuated. The collections and library were largely evacuated from the Geologisch-Paläontologisches Institut in the Alte Universität, and are now being moved in again. The Mineralogisches lund Petrgraphisches Institut, still presided over by Prof. B. Sander, is carrying on.

Jena. The Mineralogische Anstalt is totally demolished and apparently was not wholly evacuated before the main bombing three weeks before the fall of the city. The Geographische Anstalt, mostly evacuated, was somewhat damaged by blast. The building temporarily houses the Geologisches Institut of the University of Breslau. No information about staff.

Munich. The main University building is very badly damaged. The Geographisches Institut is relatively undamaged, but rooms have been taken over by the Universitäts-Kanzlei. The Technische Hochschule is not badly damaged; Dr. Wilhelm Credner has been very active during the War, like most German geographers.

The Bayerische Akademie building is a total wreck, and of the vast geological, palæontological and mineralogical collections, only about 250 cases, a very small part, were saved. All the fossil vertebrate collections were destroyed, as well as the Zittel Collection. The building of the Geographische Gesellschaft was wholly destroyed and the entire library lost.

Würzburg. The Geographisches Institut is completely demolished, but most of the equipment had apparently been moved to the country. The Mineralogisch-Geologisches Institut was slightly damaged by blast, nothing evacuated; and, being one of the few habitable buildings in the city, is now used for billeting. No staff members seen.

USES AND LIMITATIONS OF PENICILLIN

RECENTLY brief summaries were given in this journal of some of the work which has been done on the absorption, excretion and local application of penicillin (*Nature*, **155**, 341, March 17, 1945) and on its remarkably successful use for the treatment of syphilis and other spirochætal infections and also of gonorrhœa (*Nature*, **155**, 459, April 14, 1945). Since those articles were written, many reports on its use have appeared, and some of them are summarized below.

Much recent work has been concerned with the limitations of penicillin. Apart from the failure of penicillin to act upon the organisms which cause tuberculosis, cholera, plague, malaria, smallpox and other serious diseases of man and animals, one of its limitations is the inadequacy of the supply of it and the difficulties of the large-scale manufacture of it. There are, however, many indications in the medical and scientific Press that enough penicillin will, before long, be available for dealing with all the illnesses which can be successfully treated with it. The *Lancet* (408, March 31, 1945) notes that the largest plant in the world for the production of penicillin is now being erected at Speke, near Liverpool, but the Ministry of Health does not expect that penicillin will be available just yet through ordinary commercial channels. E. W. Flosdorf (*Brit. Med. J.*, 216, Feb. 17, 1945) gives a technical account of the process of drying penicillin by sublimation as used in the United States and Canada; he discusses, with references to the literature, the problems encountered, and compares them with those presented by the drying of blood plasma. H. Welch *et al.* (*J. Inf. Dis.*, **76**, 55; 1945) have studied the relative toxicity of seven different salts of penicillin and have placed them in the following order of increasing toxicity: sodium, lithium, ammonium, strontium, calcium, magnesium, potassium. All seven salts were equally effective in the treatment of pneumococcal infections of mice.

One limitation of penicillin is its instability (see *Brit. Med. J.*, 272, Feb. 24, 1945), especially when it is made up in the form of pastilles, creams and ointments. It seems likely (see below) that this difficulty may soon be overcome. Of some importance also is the report by S. T. Cowan (*Lancet*, 178, Feb. 10, 1945) that some kinds of rubber inactivate a considerable portion of the penicillin exposed to them and that there is ample time, during the intramuscular administration of penicillin through some kinds of rubber tubing, for the destruction of 25–50 per cent of the penicillin. Cowan describes a simple method of testing the action of rubber tubing on penicillin. Possibly this difficulty will be overcome by the use of tubing made of plastic materials which is now becoming available for surgical work.

Another limitation of penicillin, less easy to overcome and requiring the use of relatively large quantities of the drug, is the fact that, although it rapidly enters the blood and quickly establishes an antibacterial concentration there, it is very rapidly excreted, so that it must be administered continuously (see *Nature*, **155**, 341, March 17, 1945). For this reason it has been found that the best method of giving penicillin is to inject it into the muscles, either by continuous drip or at intervals of three hours or so. This method necessarily gives the subject much pain and discomfort, and disturbs the rest necessary for recovery. Further, penicillin given systemically in this way may fail to reach organisms walled off by inflammatory reactions or lying in the recesses of septic wounds and in bony tissues. Efforts have therefore been made to devise better methods of getting penicillin into that close contact with infecting organisms which it requires for its action. Such methods would at the same time avoid the use of the large quantities of the drug required by systemic administration.

One method of avoiding the pain and disturbance of parenteral administration which has had some success is giving by the mouth. The difficulty here is that penicillin is destroyed by the acid of the gastric juice and by enzymes of the bacteria commonly present in the lower bowel (*Lancet*, 214, Feb. 17, 1945). C. H. Rammelkampf and C. S. Keefer (*J. Clin. Invest.*, **22**, 425; 1945) showed that penicillin *in vitro* is not destroyed by saliva, bile, succus entericus or pepsin, and that, if it is given by duodenal tube, more of it enters the blood than if it is given by the mouth. A. H. Free *et al.* (*Science*, **100**, 431; 1944) showed that, if large doses (100,000 units) are given by the mouth to normal people, 8–33 per cent of the penicillin can be recovered from the urine; but if an alkali (sodium bicarbonate) is given with the penicillin, the amount of penicillin recovered from the urine is reduced, not increased. Penicillin is, however, inactivated more quickly by alkali than by acid. C. J. H. Little and G. Lumb (*Lancet*, 203, Feb. 17, 1945) mixed penicillin with raw egg, milk, plasma and other substances in an endeavour to overcome the effects of the *p*H of the alimentary canal upon it and reported that, if volunteers were given a dose of alkali (sodium bicarbonate or magnesium trisilicate) followed by a quarter of a pint of milk, and ten minutes later penicillin dissolved in saline and mixed with raw egg, a satisfactory antibacterial concentration is obtained in the blood. Their treatment of cases of tonsillitis by this method appeared to be satisfactory and they are trying it with cases of pneumonia, gonorrhœa and surgical sepsis. The same result was obtained with patients suffering from both achlorhydria and hyperchlorhydria. N. G. Heatley (*Lancet*, 590, May 12, 1945) repeated the methods of Little and Lumb and found that his results agreed in general with those of Rammelkampf and Keefer, but he could not confirm the levels of blood concentration and urinary excretion obtained by Little and Lumb. He suggests that the differences may be due to the methods of assay used. He did find, however, that the administration of penicillin in raw egg after bicarbonate and milk produced considerably higher levels of blood concentration and urinary excretion than administration of it in water; he suggests that this method may be effective for the treatment of gonorrhœa, although a dose at least three times as great as that now given by injection for this disease may be necessary. Gyorgy *et al.* (*J. Amer. Med. Assoc.*, **127**, 639; 1945) obtained cures of gonorrhœa by giving doses of 15–20,000 units of penicillin every three hours for two or three days with sodium citrate. J. C. Krautz, jun., *et al.* (*Science*, **101**, 618; 1945) find that aluminium aminoacetate is suitable for the oral administration of penicillin.

It does not follow, as the *Lancet* (597, May 12, 1945) points out, that results obtained with gonorrhœa will apply to other diseases, because gonorrhœa responds more consistently and rapidly to peni-

cillin than any other infection. However, R. L. J. Libby *et al.* (*Science*, **101**, 178; 1945) obtained an inhibitory level of penicillin in the blood for six hours by giving penicillin in cotton-seed oil by the mouth. W. MacDermott *et al.* (*Science*, **101**, 228; 1945), on the other hand, had no success with the method of Romansky and Rittman (see *Nature*, **155**, 341, March 17, 1945) of giving penicillin by the mouth in peanut oil and beeswax in order to prolong its action in the body.

Other methods of administration which seek to eliminate the pain and disturbance of parenteral administration of penicillin, and also to put the penicillin into closer contact with the organisms concerned, develop the principle of its local application. The necessity for the close contact of penicillin with the organisms concerned, which arises perhaps from its apparent mode of action, has been often demonstrated by the failures of penicillin given parenterally to affect organisms walled off in abscesses or protected by other tissue reactions, by dead tissue and by their position in the recesses of bone. R. Mowlem (*Brit. Med. J.*, 517, April 15, 1945) discusses the use of penicillin in infections of the mandible, concluding that it is not likely to control infections there when sequestra and unfavourable surgical conditions are present. It is no substitute for surgery, as contributors to the penicillin issue of the *British Journal of Surgery* (see *Nature*, **154**, 677, Nov. 25, 1944) have also pointed out.

Very recently Lady Florey and N. G. Heatley (*Lancet*, 748, June 16, 1945) reported an important development of the local application of penicillin. They set out to discover whether penicillin injected into abscess cavities (in which, as several other workers have also shown, it may rapidly produce a sterile pus and promote healing) would not only act locally but also would be absorbed into the blood and would establish an antibacterial concentration there. They injected it into the pleural cavity of most of their patients, but they injected it also into the knee-joint and intrathecal space of others, as well as into abscess cavities. They found that penicillin injected at the rate of 120,000 units in 24 hours into the pleural cavity, after aspirating off the pleural effusion there, produces an antibacterial concentration in the blood which lasts for 24 hours or more; injection of 120,000 units into two intact but infected knee-joints also produced an antibacterial concentration in the blood for at least 13 hours in one patient and for 24 hours in the other. The dose for children up to eight years is calculated on the basis of 1,000 units per lb. of body weight per 24 hours. An antibacterial concentration in the blood was also obtained by the injection of penicillin into an abscess cavity in a case of streptococcal septicæmia with multiple foci of osteomyelitis. Penicillin given every three hours through a tube leading into the abscess cavity kept up an inhibitory level in the blood and cured the patient. Later an abscess of the breast was successfully treated by local instillation of penicillin. The publication by these authors of their successful clinical trials of this method of combining the local action of penicillin with its "protracted systemic effect due to the slow absorption" from abscesses and serous cavities will be awaited with great interest. These authors also injected penicillin into the intrathecal space and again obtained an inhibitory level in the blood. After injection of 120,000 units into two adults and its equivalent into one infant, this level lasted for fifteen hours. The authors do not, however, recommend this intrathecal route until purer forms of penicillin are available and until we know more about the effects of penicillin on brain tissue.

Dorothy Russell and Diana Beck (*Lancet*, 497, April 21, 1945), as a result of their work on the local action of penicillin and sulphamezathine on the brain of rabbits and of a mixture of these two drugs, do not recommend the use of penicillin alone for local application to the brain, although sulphamezathine alone is very bland in its effects and is in this respect comparable to sulphanilamide and sulphapyridine. The *Lancet* (439, April 7, 1945) states that J. V. Cooke and D. Goldring (*J. Amer. Med. Assoc.*, **127**, 80; 1945) have found that after repeated intramuscular injections of penicillin into children with chronic nephritis, penicillin was found not only in the blood but also in the ascitic fluid and in the fluid of the subcutaneous œdema, although the concentration of it in the cerebrospinal fluid was much lower than that in the blood, and intrathecal injections of penicillin did not increase its level in the cerebrospinal fluid.

Work of this kind has an obvious bearing on the treatment of various forms of meningitis with penicillin. Its use for this purpose has already been noted in *Nature* (**155**, 341, March 17, 1945). The treatment of meningitis with penicillin and sulphonamides was discussed at a meeting of the Royal Society of Medicine (see the *Brit. Med. J.*, 378, March 17, 1945) and some of the difficulties encountered are there noted. Sir Alexander Fleming (*Lancet*, 434, Oct. 9, 1943) successfully treated streptococcal meningitis by intrathecal injection of penicillin by the lumbar route. C. H. Rammelkampf and C. S. Keefer (*Amer. J. Med. Sci.*, **205**, 343; 1943) found that after the injection of 10,000 Florey units penicillin was detected in the cerebrospinal fluid for 31–35 hours, and that it was more rapidly absorbed into the cerebrospinal fluid in subjects with meningitis and was detectable there for twenty-hour hours after the injection. The meningitis subjects showed no untoward effects after intrathecal injection, but normal subjects suffered from headache, vomiting and increased intrathecal pressure. C. Pilcher (*Ann. Surg.*, **119**, 509; 1944) found that intrathecal injection of penicillin causes transitory but not serious meningeal irritation, and is most effective for treatment of staphylococcal and meningococcal meningitis when it is given intrathecally; but that sulphathiazole applied locally to the brain may cause convulsions. D. Genge (*Brit. Med. J.*, 369, March 17, 1945) has reported on the treatment by the intrathecal route of two cases of pneumococcal meningitis.

In an Annotation, the *Lancet* (696, June 2, 1945) notes that R. L. Nelson and L. Duncan (*Bull. Johns Hopkins Hosp.*, **75**, 327; 1944) treated syphilitic meningitis by intramuscular injection of 600,000–4,000,000 units of penicillin with excellent results. They preferred intramuscular injection to the intrathecal route. Very recently, P. Forgacs and R. I. Hutchinson (*Lancet*, 786, June 23, 1945) recorded the cure of one case of meningitis due to *Hæmophilus influenzæ* of the smooth type (Pittman type *b*) by giving a combination of intramuscular penicillin and sulphadiazine. The rough type of *H. influenzæ* is not penicillin-sensitive. A. J. Waking and M. H. D. Smith (*J. Amer. Med. Assoc.*, **126**, 418; 1944) consider that penicillin and sulphonamide given together act better on pneumococcal meningitis than either alone.

Reports of allergic reactions to penicillin are not numerous. W. Mitchie and H. W. C. Bailey (*Brit. Med. J.*, 554, April 21, 1945) point out that they are much less numerous than allergic reactions to the sulphonamides. These authors record one case of sensitivity which was confirmed by application of penicillin to the undamaged skin of the arms, with the production five hours later of a kind of weeping eczema similar to that which had appeared on the wounded leg of this subject after treatment of the wound with penicillin dressings.

For the treatment of septic burns penicillin cream is regarded by the Medical Research Council's Burns Unit working at Glasgow (Med. Res. Council Special Report Series, No. 249. "Studies of Burns and Scalds." H.M. Stationery Office, 1944. 4*s*. net) as being the most certain method of eliminating haemolytic streptococci and staphylococci. Propamidine creams were also very good but were not so effective as the penicillin creams, of which the formulæ are given. After application of a cream containing about 120 units of either sodium or calcium penicillin per gram of cream, haemolytic streptococci disappeared from 41 out of 54 burns and did not reappear. One advantage of penicillin creams as compared with sulphonamide creams is that the serious risk of absorption of too large a dose of sulphonamide from the raw burned area is eliminated. Penicillin creams may, however, become infected by airborne organisms, such as *Pseudomonas pyocyanea*, which produces a penicillinase which decomposes penicillin. Prof. H. Berry (*Lancet*, 410, March 31, 1945) suggests that this difficulty may be overcome by the addition of 2 per cent of phenoxetol to the cream. Phenoxetol (see *Nature*, **154**, 631, Nov. 18, 1944) attacks especially some of the Gram-negative and penicillinase-producing organisms which are not affected by penicillin, so that such a cream would not only help to preserve the potency of the penicillin cream but would also enhance its value by attacking organisms in it not sensitive to penicillin.

The administration of penicillin by inhalation of it in the form of an aerosol is described by N. Mutch and R. C. Rewell (*Lancet*, 650, May 26; 1945) and by F. A. Knott and W. H. Clark (*Lancet*, 468, April 14, 1945); R. B. Coles, A. N. Barker and E. A. Robertson (*Lancet*, 720, June 9, 1945) describe their use of penagar, which is 0·5 per cent watery agar containing the required dose of penicillin. It is not sticky, it retains its potency for a month in a refrigerator and can be put up in sterile bottles and collapsible tubes. Penicillin readily diffuses through the agar. The authors quote work which indicates that penicillin given in oils, creams and ointments is released too slowly and its diffusion is not good.

The use of penicillin for gas gangrene has been already noted (*Nature*, **155**, 341, March 17, 1945; and **154**, 677, Nov. 25, 1944). G. H. Fisher, M. E. Florey *et al.* (*Lancet*, 395, March 31, 1945) discuss in an important paper its use against clostridial infections. They argue that penicillin should be given for the prevention of gas gangrene rather than for its treatment when it is established, and record evidence which indicates that an inadequate prophylactic dose of penicillin may cause a serious clinical picture very different from that of gas gangrene or anærobic cellulitis. After a short interrupted course of penicillin, a profound and protracted toxæmia may result and the diagnosis of gas gangrene may be missed; so that the patient fails to get either gas gangrene antitoxin or further doses of penicillin. The local application of penicillin provided protection until surgical treatment was possible. C. Grimshaw and L. Stent (*Lancet*, 434, April 17, 1945) report on the successful treatment with penicillin of one case of post-operative cutaneous gangrene.

The use of penicillin for the purpose of obtaining bacteria-free cultures of protozoa has been known since 1944. A. H. Mahmoud (*Ann. Trop. Med. Hyg.*, **38**, 219; 1944) successfully used penicillin to eliminate bacteria from cultures of *Trichomonas fœtus* of cattle. Penicillin added to Kerr's medium for the cultivation of this protozoan to give a final dilution of 30 units per c.c. eliminated streptococci and staphylococci, but did not remove *Proteus pseudovulgaris*. *Tr. fœtus* grew in the absence of bacteria, and cultures of it were maintained. Penicillin has also been used by S. Adler and R. J. V. Pulvertaft (*Ann. Trop. Med. and Hyg.*, **38**, 188; 1944) to obtain bacteria-free cultures of *Trichomonas vaginalis* of man. Sterile cultures of *Trichomonas hominis* can be obtained by the method of S. Adler (*Trans. Roy. Soc. Trop. Med. and Hyg.*, **35**, 219; 1942), by which this organism is first grown on media containing prontosil rubrum and then injected with prontosil into the peritoneum of mice; whereupon the mice get rid of the remaining bacteria and the Trichomonas can then be grown on sterile media. But the method is not applicable to *Trichomonas vaginalis*, because this species does not survive in the mice for longer than twenty-four hours. The use of penicillin removes this difficulty and makes bacteria-free cultures possible. G. LAPAGE.

PLANT STUDIES IN SYRIA

IN the scientific world, Syria is gaining prominence chiefly with several important botanical studies made by the botanists of the Hebrew University at Jerusalem, where a representative Syrian collection has been compiled in the Herbarium, and by several expeditions of naturalists in the British Army who have collected specimens of fauna and flora for the British Museum under an Army organization known as the Middle East Biological Scheme. There are four great deserts in the Middle or Near East—Sinai, Negeb (Palestine), Judea and the adjacent Ghor (the 'Avrah), southern Iraq and the Syrian desert (which includes part of Transjordania)—available for investigation.

In the course of recent floristic studies in Syria and Palestine, several stations of an interesting tree, *Pistacia atlantica*, Desf., previously unknown in Asia, have been discovered (Zohary, *Palestine J. Bot.*, Rehovat Series, **3**; May 1940). This is one of the most important North African trees. Thousands of the trees were found by Prof. Zohary covering mountain-sides in northern Syria, and desert specimens were well developed. The tree was formerly more abundant, and is limited to more or less mild Irano-Turanian conditions, at altitudes from −30 m. to +1,400 m. Its discovery in a steppe region not suitable for irrigation culture of other plants has given rise to economic interest.

Prof. Zohary has also identified the "Ghada" tree of travel literature from the north Arabian and south Syrian deserts as *Haloxylon persicum* Bge. (*Palestine J. Bot.*, Jerusalem Series, **1**; 1940). This tree, which is of economic value for fuel, is of considerable phyto-geographical interest, for its discovery in these

deserts suggests affinities of these deserts with those of Central Asia. It is the only tree dominant for thousands of square miles which does not normally receive more than 25 mm. of rainfall annually and is entirely destitute of aboreal plant communities away from wadis, except for *Haloxylonetum persici*; the discovery of this tree also suggests possibilities of economic development of the sterile deserts for fuel, charcoal, food for desert livestock and checking sand movements.

Considerable knowledge of the flora of the Syrian desert in general is being accumulated in the Department of Botany of the Hebrew University, where a mass of new material awaits publication and adds considerably to the information in Dinsmore's 1932 edition of Post's classic "Flora of Syria, Palestine and Sinai", which the American University of Beirut published. Prof. Zohary has carried on the field studies of the late Prof. Eig and notable publications have been his "Geobotanical Analysis of the Syrian Desert" (*Palestine J. Bot.*, Jerusalem Series, 2; 1940) and "To the Knowledge of the Flora of the Syrian Desert" (1; 1939) which covers the flora of the central part of the desert, with a rainfall of 95–210 mm. annually, and where 175 species were collected, 75 per cent of which were annuals, sometimes exclusively predominating over immense stretches. Some three hundred new species have been added to the flora of Iraq, of which about two hundred are new to science. The Syrian desert flora has been divided into three territories: Mediterranean, Irano-Turanian (the most important) and Saharo-Sindian with 520, 588 and 239 species respectively; also there are 24 Sudano-Deccanian species, 10 Euro-Sibero-Boreoamerican, and 659 species belonging to two or more groups. Prof. Zohary's paper was the first to treat the vegetative character of the country.

MASS MOVEMENT OF THE WATER SHREW, *NEOMYS FODIENS*

IN the *Journal of the Society for Preservation of the Fauna of the Empire* of June 1945 is a remarkable account by Lady Seton (a keen field naturalist and wife of that well-known observer the late Sir Malcolm Seton) of a movement of the water shrew, *Neomys fodiens*. In it she tells how she saw large numbers of this little mammal swimming up a small stream in Upper Teesdale in what appeared to be a mass migration. Migration is so exceptional among land mammals, if not marine ones (unlike birds in which it is so usual we may say it is the rule rather than the exception), that any instance is of outstanding interest.

Such mammalian migration as occurs is of two types: seasonal on the lines of bird migration, the North American caribou being the classic example, and occasional as in the case of the lemming, *Lemmus lemmus*, with its periodic emigrations from the high fields to the low country. These are seemingly initiated by pressure of numbers and scarcity of food, and the travellers appear to be driven by an urge to go downhill. I have watched the little animals scuttling along, each taking its own course and acting independently of fellow lemmings. I have never seen them moving in droves.

The especially interesting part of Lady Seton's account of the shrews she watched is the mass of animals. This is the more noteworthy for the fact that though *Neomys fodiens* is widely distributed throughout the mainland of Britain, it is usually only met with in sparse numbers. The only reference to water shrews in any number I can find is in Barrett-Hamilton's "History of British Mammals", wherein he refers to them living in family parties, and adds, "Probably, also, the breeding season brings these shrews together in companies, which would account for the party of nine or ten encountered by the late Canon H. B. Tristram on May 6, as well as for a concourse of twenty or thirty observed in Yorkshire by Mr. W. B. Arundel on the 10th of the same month". But these are not described as being on the move. Migration does not appear to have been noted by previous observers in this or allied species. Thirdly, Lady Seton's water shrews were swimming upstream and therefore uphill, though why and where to we have no clue. FRANCES PITT.

SERUM PROTEINS IN THE ULTRACENTRIFUGE

THE monograph on the proteins of blood serum by Kai O. Pedersen*, from Prof. Svedberg's laboratory at Uppsala, brings home forcibly the present complexity of the subject. Although any one of the usual methods of analysis gives apparently clear-cut fractions, each fraction when analysed by some other method usually turns out to be a mixture. The obvious remedy, to fractionate by each method in turn, is impracticable because some of the analytical methods are difficult to use in a preparative way. After a heroic attempt to achieve a complete separation, chiefly by means of ammonium sulphate with ultracentrifugal analysis, Dr. Pedersen had to confess defeat.

But a wealth of new knowledge has been gained, such as Dr. Pedersen's discovery of the new low-molecular globulin 'fetuin', which was described in *Nature* of November 4, 1944. This is present in fœtal serum of ruminants to the almost complete exclusion of the ordinary globulins and antibodies, which only appear after the animal has received colostrum. The same is true to a less marked extent in rodents and man. The discovery of fetuin is due to the ultracentrifuge, because in salting-out and in electrophoresis it behaves like ordinary α-globulin. A fœtal hæmoglobin has been known for some time; but a fœtal serum globulin was unsuspected.

Dr. Pedersen's study of the 'X-protein' is also illuminating. It has long been known that in undiluted serum some of the globulin sediments at the slow rate characteristic of albumin. This is surprising because a complex of the two proteins would normally sediment more rapidly than either component. Dr. Pedersen's explanation is that there is indeed a complex, but that it contains lipide, which decreases its density and therefore its sedimentation rate. The density is so low in human serum that with added salt the complex sediments upwards and can be isolated. This 'density-effect' cannot be observed in other sera, and similar interactions between apparently lipide-free proteins remain unexplained, so that the story still seems incomplete. 'X-protein' seems to be of physiological importance for lipide transport.

J. ST. L. PHILPOT.

* Ultracentrifugal Studies on Serum and Serum Fractions. By Kai O. Pedersen. Pp. 178. (Uppsala: Almqvist and Wiksells Boktryckeri AB, 1945.) 10 Swedish crowns.

FORTHCOMING EVENTS

Tuesday, August 28

QUEKETT MICROSCOPICAL CLUB (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 7 p.m.—Conversation and the Exhibition of Specimens.

Friday, August 31—Sunday, September 2

SCIENTIFIC FILM ASSOCIATION (at the Technical College, Huddersfield).—Conference on "The Film in Science".

Friday, August 31

At 6 p.m.—Civic Reception by His Worship the Mayor of Huddersfield; at 7 p.m.—Dorothy Grayson: "The Science Film in Education".

Saturday, September 1

At 9.45 a.m.—Mr. W. F. Andrews: "The Film in Industry". 1: "Scientific Film Needs in Technical Training"; Mr. H. Richmond: "The Film in Industry", 2: "Film Strip in Technical Training"; at 2 p.m.—Mr. Derek Stewart: "The Film as an Instrument of Scientific Research"; at 7.30 p.m.—Mr. Frank Goodliffe: "Film Production".

Sunday, September 2

At 10.30 a.m.—"The Film in Medicine" (Film Show and Discussion); at 2.15 p.m.—Dr. W. T. Astbury, F.R.S.: "X-Ray Adventures among the Proteins and other Molecular Giants"; at 7.30 p.m.—Programme of New Scientific Films.

APPOINTMENTS VACANT

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

DEMONSTRATOR (full-time) IN PHYSIOLOGY—The Registrar, The University, Liverpool (August 31).

CHEMICAL ENGINEER for a resporsible appointment on the Technical Staff of an established Firm of Contractors to Gas and Allied Industries—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting C.2646.XA (August 31).

DEMONSTRATORS, one in the DIVISION OF CHEMISTRY, and one in the DIVISION OF HISTOLOGY, at the Royal Veterinary College, Camden Town, London, N.W.1—The Bursar, Royal Veterinary College, The University, Reading (September 1).

ENGINEERING ASSISTANT in the County Architect's Department—The County Architect, 4 Alfred Street North, Carlisle (September 3).

PHYSICIST (male) for position as RESEARCH SCIENTIST in Laboratory on work connected with magnetic properties of alloys—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting A.950.XA (September 7).

ASSISTANT INSPECTORS (2, male) OF FISHERIES in the Department of Agriculture—The Secretary, Civil Service Commission, 45 Upper O'Connell Street, Dublin (September 14).

EDUCATIONAL PSYCHOLOGIST—The Director of Education, Education Offices, Deansgate, Manchester 3 (September 14).

FOREST OFFICER in the Forestry Division of the Department of Agriculture, Southern Rhodesia—The Official Secretary, Office of the High Commissioner for Southern Rhodesia, Rhodesia House, 429 Strand, London, W.C.2 (September 14).

LECTURER IN THE DEPARTMENT OF MECHANICAL ENGINEERING—The Registrar, The University, Sheffield (September 15).

ENGINEERING ASSISTANT—The Water Engineer and Manager, Spon House, 21 Allesley Old Road, Coventry, endorsed 'Engineering Assistant' (September 17).

COUNTY ANALYST AND OFFICIAL AGRICULTURAL ANALYST—The Clerk of the County Council, County Hall, Maidstone, Kent (October 6).

SUPERINTENDENT OF WORKSHOPS—The Secretary of the Appointments Committee, Engineering Laboratory, Cambridge (October 22)

GEORGE HOLT CHAIR OF PATHOLOGY—The Registrar, The University, Liverpool (October 31).

LECTURER (Grade B) IN PHYSIOLOGY—The Secretary, The University, Edinburgh (November 10).

LABORATORY ASSISTANTS in the Research Laboratories of the Royal Aircraft Establishment—The Personnel Department, Royal Aircraft Establishment, Farnborough, Hants.

MECHANICAL ENGINEERING ASSISTANT, with good experience of Diesel engines—The Mid-Kent Water Company, High Street, Snodland, Kent.

PRINCIPAL OF THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE, Trinidad—The Secretary Imperial College of Tropical Agriculture, Grand Buildings, Trafalgar Square, London, W.C.2.

HEAD TEACHER OF MATHEMATICS—The Principal, La Martiniere College, Lucknow, India.

GRADUATE TEACHER for GENERAL SCIENCE, PHYSICS and CHEMISTRY—The Principal, Technical College, Wolverton, Bucks.

LECTURERS (2) IN MECHANICAL ENGINEERING SUBJECTS to Higher National Certificate standard at the Crewe Technical College—The Director of Education, County Education Offices, City Road, Chester.

ASSISTANT MASTER to teach ENGINEERING SCIENCE, GENERAL SCIENCE and MATHEMATICS—The Clerk to the Governors, Grays County Technical School, 22 High View Avenue, Grays, Essex.

GRADUATE LECTURER IN ENGINEERING, and a GRADUATE LECTURER with high qualifications in ORGANIC CHEMISTRY to take the subject to A.R.I.C. and Special B.Sc.(Lond.) standard—The Clerk to the Governors, Mid-Essex Technical College and School of Art, Market Road, Chelmsford.

TEACHER OF MATHEMATICS, mainly for Day Technical School—The Principal, Beckenham Technical Institute, Beckenham, Kent.

GRADUATE TEACHER OF SCIENCE (chiefly PHYSICS) with some MATHEMATICS or of MATHEMATICS with some SCIENCE—The Principal, Technical Institute, Darnley Road, Gravesend.

TEACHER FOR ENGINEERING SUBJECTS—The Principal and Secretary, Harris Institute, Preston.

ASSISTANT LECTURER IN THE METALLURGY DEPARTMENT, and an ASSISTANT LECTURER IN ENGINEERING, for Workshop Technology and Practice, in the Swansea Technical College—The Director of Education, Guildhall, Swansea.

LECTURER IN MECHANICAL ENGINEERING for work up to the standard of the Higher National Certificate, particularly in Theory of Machines and Heat Engines—The Principal, Wimbledon Technical College, Gladstone Road, London, S.W.19.

LECTURER IN AGRICULTURE—The Principal, Kent Farm Institute, Sittingbourne, Kent.

ASSISTANT TO THE ADVISORY CHEMIST in the Faculty of Agriculture and Horticulture—The Registrar, The University, Reading.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Royal College of Physicians of Edinburgh. Annual Report by the Curator of the Laboratory for the Year 1944. Pp. 12. (Edinburgh: Royal College of Physicians, 1945.) [237

British Society of Animal Production. Report of Proceedings, Second Meeting, 24th October 1944, General Topic: The British Sheep Industry; Joint Meeting with Institute for the Study of Animal Behaviour, 25th October 1944, General Topic: Animal Behaviour. Pp. 106. (Edinburgh: British Society of Animal Production, 1945.) 4*s*. [267

Our Daily Bread: a Dietetic Survey of Wheat and other Cereals. By Dr. J. Reilly. Revised second edition. Pp. 44. (St. Ann's Hill, Co. Cork: Woodlands Press, 1945.) 1*s*. [267

Conference of Allied Ministers of Education. Draft Proposals for an Educational and Cultural Organisation of the United Nations. Pp. 10. (London: H.M. Stationery Office, 1945.) [317

The Knights of St. George: a Scout Movement for Men and Women. Tracts for Adult Scouts, 5: The First Minister of National Culture, with an Outline of his Policy and Programme. By the Chief Knight. Pp. 12. (London: W. Margrie, 1945.) 6*d*. [18

Other Countries

National Research Council. Bulletin No. 111: Manual for the Study of Food Habits; Report of the Committee on Food Habits. Pp. 142. (Washington, D.C.: National Research Council, 1945.) [177

Proceedings of the United States National Museum. Vol. 96, No. 3192: Three New Sciaenid Fishes of the Genus Ophioscion from the Atlantic Coasts of Central and South America. By Leonard P. Schultz. Pp. 123–138. (Washington, D.C.: Government Printing Office, 1945.) [177

Science, the Endless Frontier. A Report to the President by Dr. Vannebar Bush. Pp. ix+184. (Washington, D.C.: Government Printing Office, 1945.) [187

University of California Publications. Bulletin of the Department of Geological Sciences, Vol. 27, No. 4: An Avifauna from the Lower Miocene of South Dakota. By Alden H. Miller. Pp. iii+85–100. (Berkeley and Los Angeles, Calif.: University of California Press; London: Cambridge University Press, 1944.) 25 cents. [187

Annals of the New York Academy of Sciences. Vol. 46, Art. 1: Animal Colony Maintenance. By Edmond J. Farris, F. G. Carnochan, C. N. W. Cumming, Sidney Farber, Carl G. Hartman, Frederick B. Hutt, J. K. Loosli, Clarence A. Mills and Herbert L. Ratcliffe. Pp. 126. (New York: New York Academy of Sciences, 1945.) [187

Indian Forest Leaflet No. 77; Preliminary Studies on Improved Wood, Part 3, Compregnated Wood. By D. Narayanamurti and Kartar Singh. Pp. ii+11+9 plates. (Dehra Dun: Forest Research Institute, 1945.) 9 annas. [187

Proceedings of the United States National Museum. Vol. 96, No. 3188: New Beetles of the Family Eucnemididae from Central America and the West Indies. By W. S. Fisher. Pp. 79–94. Vol. 96, No. 3189: New Lanternflies (Fulgoroidea) from South America. By R. G. Fennah. Pp. 95–106. (Washington, D.C.: Government Printing Office, 1945.) [187

Occasional Papers of the California Academy of Sciences. No. 21: The Galapagos Finches (Geospizinae); a Study in Variation. By David Lack. Pp. viii+160 (4 plates). (San Francisco: California Academy of Sciences, 1945.) [187

United States Department of the Interior: Geological Survey. Professional Paper 196-E: Geology and Biology of North Atlantic Deep-Sea Cores between Newfoundland and Ireland, Part 8, Organic Matter Content. By P. D. Trask, H. W. Patnode, J. L. Stimson and J. R. Gay. Pp. xv+135–150+2 plates. 20 cents. Professional Paper 197-C: Lower Pennsylvanian Species of Mariopteris Eremopteris, Diplothmema and Aneimites from the Appalachian Region. By David White. (Shorter Contributions to General Geology, 1941–42.) Pp. iii+85–140+plates 8–39. 20 cents. Professional Paper 199-A: Mollusca from the Miocene and Lower Pliocene of Virginia and North Carolina, Part 1, Pelecypoda. By Julia Gardner; with a Summary of the Stratigraphy, by W. C. Mansfield. Pp. iv+178+23 plates. 55 cents. Professional Paper 202: Geology and Ore Deposits of the Metaline Quadrangle, Washington. By C. F. Park, Jr., and R. S. Cannon, Jr. Pp. v+82+34 plates. 1.50 dollars. (Washington, D.C.: Government Printing Office, 1942–1943.) [197

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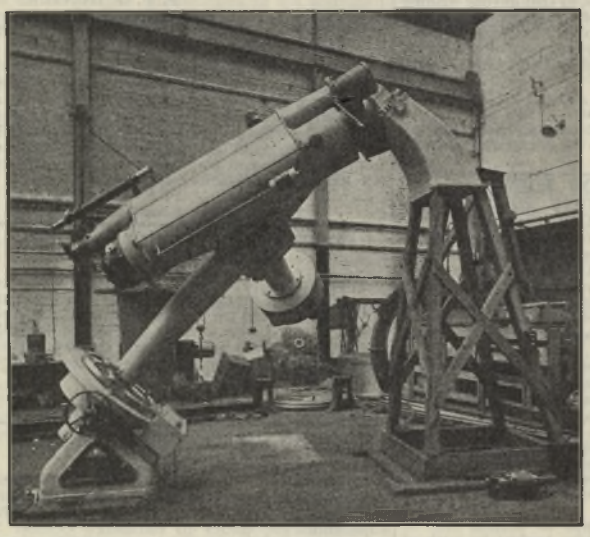

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A Course in Micro-Analytical Methods for both Day and Evening Students will be held. Intending students should attend Enrolment Evenings, September 20 and 21, from 6.0–7.30 p.m.

Particulars of the above courses on application to the Principal.

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will commence at the above College on Tuesday, October 2, 1945. The course is open to students of physics and geology who possess a B.Sc. degree and may lead to the degree of M.Sc. and to the award of the Diploma of the Imperial College. It consists of lectures and laboratory work on the application of physics to the location of mineral deposits and the elucidation of concealed geological structures. Additional instruction in either geology or physics is arranged according to the requirements of the individual.

Full particulars can be obtained from the Registrar, Imperial College of Science and Technology, South Kensington, S.W.7.

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Physics Department. Technical Optics Section

A course of eighteen Lectures on Colour Vision, Colour Measurement and Colour Reproduction will be given by Dr. W. D. Wright, A.R.C.S., D.Sc., on Mondays and Wednesdays at 5 p.m., commencing on Wednesday, October 10, 1945. The syllabus has been arranged in three parts, so that anyone wishing to omit one or two parts of the course may do so. The lectures will be given in the Small Physics Theatre, of the Physics Department of the Royal College of Science, Imperial Institute Road, South Kensington, S.W.7.

Fee for the whole course, £2 2s.; fee for one part only, £1 1s.; fee for two parts, £1 10s. 6d.

Application for the syllabus for admission to the course should be made to the Registrar, Imperial College, S.W.7.

COUNTY OF KENT

APPOINTMENT OF COUNTY ANALYST AND OFFICIAL AGRICULTURAL ANALYST

Applications are invited for the above-mentioned appointment, which will become vacant on April 1, 1946. The basic salary will be at a rate not exceeding £1,250 a year, the remuneration to be fixed according to experience and qualifications. A war addition, at present at a weekly rate amounting to nearly £60 a year, and travelling and subsistence allowances are payable.

The appointment will be pensionable pursuant to the Local Government Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination.

Applicants must possess the qualifications prescribed by or pursuant to the Food and Drugs Act, 1938, and the Fertilisers and Feeding Stuffs Act, 1926, and the appointment will require the approval of the Minister of Health and the Minister of Agriculture and Fisheries.

The person appointed will be desired also to accept appointment as Public Analyst by such of the autonomous Food and Drugs Authorities within the County as so wish and as the County Council may approve. He will be required to devote the whole of his time to the public offices to which he is appointed by or with the permission or approval of the County Council and to pay all moneys received into the County Fund.

Applications, stating age, qualifications, experience and salary required, accompanied by copies of not more than three recent testimonials, should be received by me not later than October 6, 1945.

Canvassing will disqualify.

W. L. PLATTS,
Clerk of the County Council.

County Hall,
Maidstone.

RADCLIFFE INFIRMARY, OXFORD

Applications are invited for the post of GRADUATE ASSISTANT in the DEPARTMENT OF BIOCHEMISTRY. The appointment is for one year in the first instance with a possibility of renewal, and the salary will be on a scale between £350 and £500 per annum according to qualifications and experience. Applications must reach the undersigned not later than Monday, September 3, and must be accompanied by a full statement of qualifications and the names of not more than three referees. Testimonials are not required. Preference will be given to candidates discharged from H.M. Forces.

A. G. E. SANCTUARY.
Administrator.

THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE

TRINIDAD, B.W.I.

Applications are invited for the post of Principal of the above College. Salary £1,600—50—£1,750 with £400 allowances. F.S.S.U. Scheme. Residence and temporary cost of living bonus. Passages including wife's out and home every other year with four months leave. Candidates should have had considerable academic experience and possess high scientific qualifications, knowledge of tropical conditions preferable. Candidate selected would be required to assume duty about August 1946. Applications should be made to and on forms obtainable from the Secretary, Imperial College of Tropical Agriculture, Grand Buildings, Trafalgar Square, London. Candidates from overseas should apply by air letter giving full particulars and naming three referees.

UNIVERSITY OF ABERDEEN

ASSISTANT IN ZOOLOGY

Salary £300 to £350 according to qualifications. Applications should be sent not later than September 10, 1945, to the Secretary to the University from whom further particulars may be obtained.

H. J. BUTCHART,
Secretary.

The University,
Aberdeen.

UNIVERSITY COLLEGE OF NORTH WALES

Applications are invited for the post of Probationary Assistant Lecturer in Zoology. Initial salary not less than £350 per annum plus superannuation, duties to commence October 1, 1945, if possible. Applications should be lodged with the undersigned from whom further particulars may be obtained, not later than September 10, 1945.

F. P. G. HUNTER,
Bursar and Acting Registrar.

UNIVERSITY COLLEGE OF NORTH WALES

Applications are invited for the post of Probationary Assistant Lecturer in Chemistry. Initial salary not less than £350 per annum plus superannuation, duties to commence October 1, 1945, if possible. Applications should be lodged with the undersigned from whom further particulars may be obtained, not later than September 10, 1945.

F. P. G. HUNTER,
Bursar and Acting Registrar.

UNIVERSITY COLLEGE OF NORTH WALES

Applications are invited for the post of Probationary Assistant Lecturer in Physics. Initial salary not less than £350 per annum plus superannuation, duties to commence October 1, 1945, if possible. Applications should be lodged with the undersigned from whom further particulars may be obtained, not later than September 10, 1945.

F. P. G. HUNTER,
Bursar and Acting Registrar.

UNIVERSITY COLLEGE OF NORTH WALES

Applications are invited for the post of Probationary Assistant Lecturer in Agricultural Botany. Initial salary not less than £350 per annum plus superannuation, duties to commence October 1, 1945, if possible. Applications should be lodged with the undersigned, from whom further particulars may be obtained, not later than September 10, 1945.

F. P. G. HUNTER,
Bursar and Acting Registrar.

UNIVERSITY OF BOMBAY

DEPARTMENT OF CHEMICAL TECHNOLOGY

Applications are invited for the post of Sir Dorabji Tata Reader in Pharmaceutical Chemistry in the scale of Rs. 400—25—700.

Six type-written copies of the application, together with six copies of testimonials, should be forwarded so as to reach the Registrar, University of Bombay, before October 15, 1945.

The post will be on probation for two years and is non-pensionable, but the Reader will be required to subscribe to the University Provident Fund.

The Reader should possess a degree of a recognized University in Pharmaceutical Chemistry and should have adequate experience in research, teaching and works practice. The Reader will be in charge of the section of Pharmaceuticals and Fine Chemicals under the Director of the Department, and he will be required to conduct research in his subject.

The applicants should give full details regarding their age, education and training, teaching, research and practical experience and a list of publications.

By order
S. R. DONGERKERY.
University Registrar.

Bombay.

ARTHUR DUCKHAM RESEARCH AWARD

Applications before September 8, 1945, are invited for the Arthur Duckham Research Award for 1945–46, namely, a FELLOWSHIP of the value of up to £500 for the purpose of an investigation of certain physico-chemical aspects of combustion.

Applicants should not be more than 35 years of age and should possess an Honours Degree of a British University, preference being given to those having experience in the Gas Industry.

Conditions from the Honorary Secretary, Arthur Duckham Memorial Fund Committee, 1 Grosvenor Place, London, S.W.1.

THE UNIVERSITY OF SHEFFIELD

LECTURER IN MECHANICAL ENGINEERING

Applications are invited for appointment as Lecturer in the Department of Mechanical Engineering. Qualifications in Thermodynamics will be a recommendation. Salary £600 per annum with war-time marriage and children allowance, and superannuation provision under the Federated Superannuation Scheme for Universities. Further particulars may be obtained from the undersigned with whom applications should be lodged by September 15.

A. W. CHAPMAN
Registrar.

THE QUEEN'S UNIVERSITY OF BELFAST

DEPARTMENT OF MATHEMATICS

Applications are invited for the Lectureship in Mathematics in the University. The salary offered is £600 per annum, rising by annual increments of £25 to a maximum of £750, with contributory pension rights under the Federated Superannuation System for Universities. The initial salary will depend on the experience and qualifications of the successful candidate, who will have special responsibility for the teaching of Engineering Students. Nine copies of applications and testimonials should reach the undersigned on or before September 30, 1945. Further particulars may be obtained from

RICHARD H. HUNTER,
Secretary.

THE WEST OF SCOTLAND AGRICULTURAL COLLEGE

DEPARTMENT OF HORTICULTURE

The Governors invite applications for the post of Head of the Department of Horticulture.

Candidates should possess the following qualifications:

(a) a thorough training in the science as evidenced preferably by a Degree and/or Diploma in Horticulture;
(b) a sound knowledge of the theory and practice of Horticulture;
(c) teaching experience.

Salary will be on the range £450 to £600 according to age, qualifications and experience, plus appropriate war bonus.

Further particulars of conditions of appointment and forms of application may be had from the undersigned with whom applications are to be lodged on or before 15th proximo.

A. J. WILSON,
Secretary.
6 Blythswood Square,
Glasgow.

UNIVERSITY OF READING

FACULTY OF AGRICULTURE AND HORTICULTURE

The Council will shortly appoint an Assistant to the Advisory Chemist. Grade—Senior Scientific Assistant. Salary £300—20—£400, plus war bonus. Previous experience in the Agricultural Advisory Service will be taken into account in fixing the initial salary. For further particulars apply to the Registrar.

Old-established Publishers require the services of a Scientific Editor (gentleman) to edit and see through the press important scientific and technical publications of a high standard. The post is a full-time one, of a permanent nature. Applicants should possess a high honours degree in Mathematics and in Mathematical Physics, with a subsidiary knowledge of either Physics or Engineering. Experience of editing would be an advantage but is not essential. Ability to read French and German is desirable. Salary would depend upon the experience and qualifications of the successful applicant. Apply Box 394, T. G. Scott & Son, Ltd., 9 Arundel Street London, W.C.2.

The Milk Marketing Board require Assistant to Chief Chemist. Applicants should have an Honours Degree in Chemistry or an F.R.I.C. (Branch E.) and experience of general analytical work preferably in dairy chemistry and bacteriology. Knowledge of the Dairy Industry an advantage. Salary £500 to £600 per annum. Applications to be addressed to the Establishment Officer, Milk Marketing Board, Thames Ditton, Surrey.

Mechanical and Electrical Instruments Manufacturing Company in East Anglia require EXPERIMENTAL ENGINEER with marked ability in design and development of instrument mechanisms. Good technical knowledge and practical skill necessary but degree not essential. Salary: £350–£400 p.a., according to experience, plus War Bonus.

Applications, which must be in writing, stating date of birth, full details of qualifications and experience (including a list in chronological order of posts held) and quoting Reference No. 216, should be addressed to the Ministry of Labour and National Service, Appointments Office, Lloyds Bank Chambers, Hobson Street, Cambridge.

The Scientific Instrument Manufacturers Association of Great Britain Limited proposes to appoint a full-time Director. Applicants must be acquainted with the Scientific and Fine Engineering Industry and accustomed to negotiating with Government Departments. Knowledge of export marketing desirable. Write in confidence for form of application to The Secretaries, Messrs. Binder, Hamlyn & Co., Chartered Accountants, River Plate House, 12–13 South Place, London, E.C.2.

The British Drug Houses Ltd., require a man of sound education, under 35, as assistant manager of their Laboratory Chemical Sales Department. Good English and the training and capacity to undertake responsible executive work are essential; chemical qualifications or experience of the chemical industry are desirable. Write fully, stating age, education, qualifications and experience, and indicating salary required to the Secretary, The British Drug Houses, Ltd., Graham Street, London, N.1.

Overseas Employment: Required for British West Africa, CHEMIST with good general knowledge capable of undertaking investigation of methods for handling and processing palm oil, fruit juices and other food products. Will also be required to undertake a certain amount of routine supervision work of palm oil bulk plants. Age not over 35. Tours will be of two years duration. Commencing salary £600 per annum. Servants allowance of £6 per month. Free passages, furnished quarters, medical attendance, war-time separation and children's allowances.

Applications, which must be in writing, stating date of birth, full details of qualifications and experience, including present employment; also Identity and National Service or other registration particulars, and quoting Ref. No. O.S.1034, should be addressed to the Ministry of Labour and National Service, Appointments Department, Sardinia Street, Kingsway, London, W.C.2.

Physicist (male) required for position as Research Scientist in Laboratory on work connected with magnetic properties of alloys. Applicants should have good degree and some research experience. Salary between £400 and £600 according to experience and qualifications. Write, quoting A.950.XA., to Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, for application form which must be returned completed by September 7, 1945.

Research and Development. Leading firm concerned with Thermal Engineering problems related to metallurgical gas and electrical industries invites applications for position of Director of Research. Academic qualifications and lengthy experience in co-ordinating research, development and design essential. Replies treated in strictest confidence. Should contain record of education, experience, contributions to technical literature, and state age and salary required. Box 396, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

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Laboratory Assistant, preferably with some previous experience in a Technical College Physics Laboratory or in industry, is required. Knowledge of radio an added qualification. Wages according to L.C.C. Scale. Applications, in writing, should be addressed to the Head of the Department of Physics, The Polytechnic, 309 Regent Street, London, W.1, not later than September 1, 1945.

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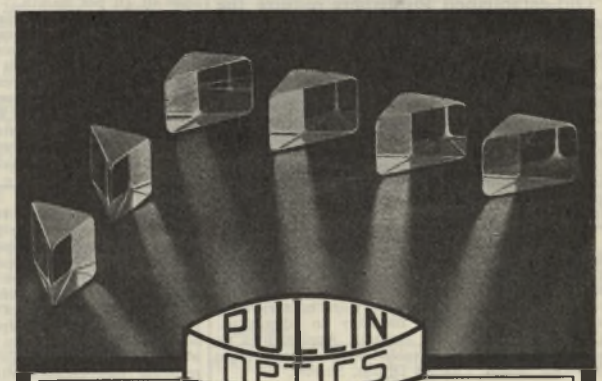

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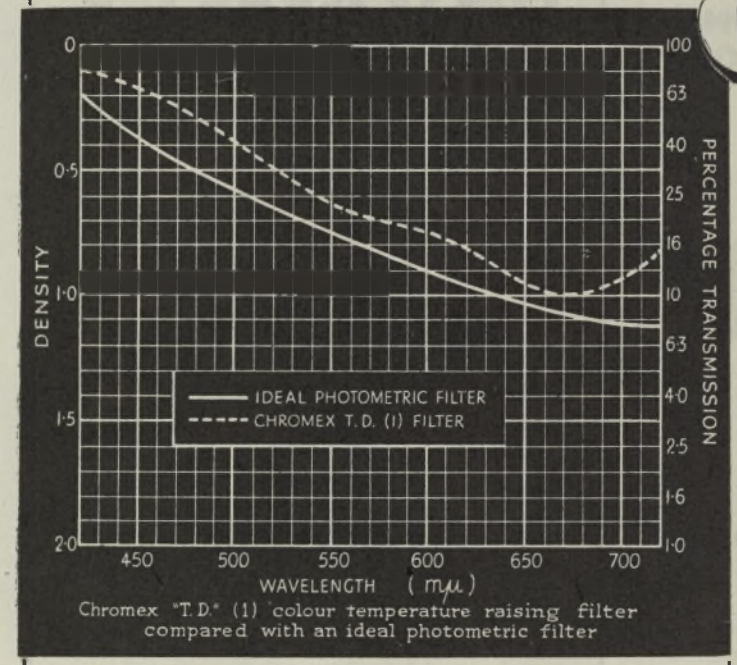

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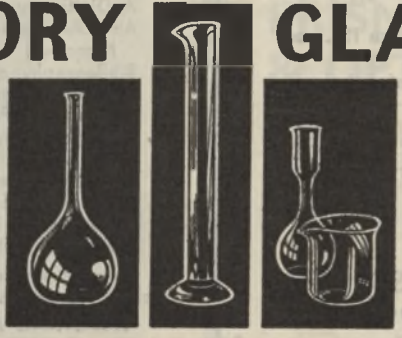

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