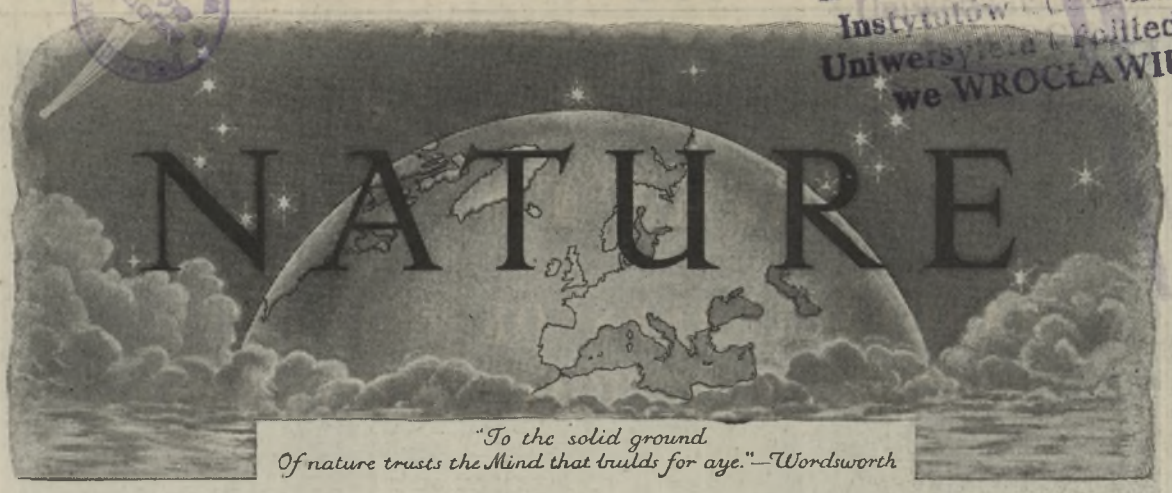
SUPPLEMENT: INDEX to VOLUME 156



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MUSEUMS AND ART GALLERIES AS A NATIONAL SERVICE

A PUBLICATION of considerable importance to museum and art gallery officials and committees, and all municipal and county authorities contemplating the establishment or reorganization of museums and art galleries, appears in the *Museums Journal* of June 1945, pp. 33–45. Entitled "Museums and Art Galleries in the Post-war Period : a Survey and Proposals by the Museums Association", it sets forth the contents of a document submitted last May to the Minister of Reconstruction after a discussion had taken place between representatives of the Ministry and the Museums Association, London.

This document surveys the present position of the museums and art galleries of Great Britain, and makes far-reaching proposals for their future development. It points out the general inadequacy of these services outside London, and calls for an all-round improvement of existing buildings, administration, staffs and finance, wherever necessary. The financial figures given for 1938 are illuminating : in that year, approximately £1,000,000 was spent on the thirteen national institutions in London, while the 770 institutions in other parts of the country received about £450,000. In other words, the average expenditure on museums and art galleries in the provinces only amounted to about threepence per head of the population. These figures do not include the national museums in Edinburgh and Cardiff which, like those in London, are supported by the State. Further analysis shows that, of the provincial museums, as many as 470 were—and presumably continue to be—in receipt of incomes of less than £300. (Nearly half of these, however, are attached to libraries or colleges and have not a separate income, so that their financial position may not be so bad as at first appears.) Nevertheless, these figures serve to expose a further unsatisfactory condition relative to the welfare of the average British museum, namely, the entirely disproportionate and low rates of pay for work which requires a high standard of education, specialized training and technical ability. Except in the national museums and in those of the larger provincial centres, a director's or curator's salary, for example, is (to quote from the document), "always among the lowest given to the chief officers of the corporation, and it is more often than not smaller than that given to deputies in other departments". In the case of officials of smaller museums, it is sometimes even less than that allotted to the local dustmen ! Consequently, little but a devotion to the work encourages men and women of the right calibre to take up museum or art gallery work at the present time.

Section V of the document is particularly concerned with the ways and means of improvement of the museum services of Britain as a whole. It is recognized that the much-needed development rests upon the provision of adequate funds ; for new or reconstructed buildings, staffs adequate in training and numbers, and a wide range of facilities and equipment are involved. Suggestions are made

regarding the method of financial support, the most favoured being the establishment of a Museum and Art Gallery Grants Board on the lines of the University Grants Committee. The Board would consist of experts sympathetic with museum and art gallery problems, and these would "assess schemes, allocate grants, and impose conditions which, under a scheme of inspection, would ensure the maintenance of suitable standards, and so assist in raising the status of museums and art galleries throughout the country".

Museums and art galleries form cultural centres: they educate, and provide for the intelligent use of leisure; they are in contact with a very wide public, and are, therefore, in a particularly favourable position for the diffusion of knowledge based on scientific principles: they have (or should have), therefore, a very definite place within any intelligent community. In this light, the direct appeal for government support and encouragement which this document puts forward is worthy of the closest consideration.

WAVE-LENGTHS FOR EUROPEAN BROADCASTING

THE wave-lengths or frequencies used by broadcasting stations in Europe in normal times were the result of discussions and conferences held under the auspices of the International Broadcasting Union formed about twenty years ago. It was as a result of the activities of this Union that the Lucerne plan was formulated and put into practical operation during the night of January 14–15, 1934, when a general re-distribution of wave-lengths of European broadcasting stations was conducted by the responsible organizations. In April 1939 a revised plan was drawn up in the form of the Montreux Convention, which was signed by the representatives of thirty-one States; and this plan provided for certain changes in wave-length and power of European broadcasting stations to come into effect in March 1940. Although the operation of this plan was in any case prevented by the War, it is doubtful whether it would have been successful had it been applied; for, as Sir Noel Ashbridge remarked in his presidential address to the Institution of Electrical Engineers in 1941, these international conferences were rendered very difficult by the various political influences involved. Sir Noel expressed the hope that, after the War, it would be possible for a well-based wave-length plan for Europe to be built up on rational principles with due regard to technical facts.

It is with the view of rendering assistance towards this objective that the Radio Industry Council has recently issued a report entitled "Post-War European Broadcasting", prepared by the technical committee of the British Radio Equipment Manufacturers' Association (Radio Industry Council, 59 Russell Square, London, W.C.1). This report outlines a new proposal, based upon technical considerations and on appreciation of the ordinary listener's requirements, for the allocation of wave-lengths among the thirty European countries. The proposal aims at providing for every nation at least one, and in most cases two, programmes which adequately cover the entire country; in addition, a system of regional programmes would be provided to meet local requirements, and in particular the major language groups in each country. The whole scheme would also provide for every listener good signals from some foreign stations in addition to his own national and regional programmes.

For the plan to be successful in attaining these objectives, it is clearly necessary to arrange wave-lengths in relation to the location and power of the transmitters, so as to minimize interference between any two stations, and to permit reasonable quality of reproduction from receivers in all parts of the service area of each station. Power as well as wave-length would have to be specified in order to ensure good service over each area, while still avoiding serious interference with other transmitters.

As a basis for the proposals put forward in the report, the radius of the service area or coverage of a broadcasting station is defined as the distance to which the ground-wave signal is greater than 2 mV./metre, and the ionospheric or sky-wave signal which causes fading is never more than a certain value to be selected on the basis of experience. Based upon such assumptions, the report states that the primary service area of medium-wave broadcasting stations is a circle, the radius of which in miles is approximately equal to one-quarter of the wave-length in metres. Proceeding along these lines, the main national allocations are obtained by using the whole of the existing long-wave broadcasting band of 156–288 kc./s. (wave-lengths 1,040–1,920 m.) together with the extension envisaged in the Montreux plan of 344–432 kc./s. (695–873 m.). In this extended long wave-band, sufficient frequency allocations are proposed, at intervals of 11 kc./s. between stations, to provide two national programme services for each of the thirteen larger countries; European Russia being regarded as two countries as it has two main languages. For the seventeen smaller countries the size of which does not require the use of long waves to secure effective coverage, the national programmes are allocated to some, but not the whole, of the band between 552 kc./s. and 1,157 kc./s. (260–544 m.). The remainder of the medium wave-band, up to 1,553 kc./s. (193 m.), with one or two exceptions, and the portions of the above band not used for national services, are to be divided up for regional purposes, common-wave working being envisaged for stations separated by a distance of at least 1,500 miles. The scheme suggests provision for eleven regional transmitters in Great Britain and Northern Ireland in addition to two national transmitters working on 178 kc./s. (1,685 m.) and 222 kc./s. (1,350 m.).

In brief, the proposed plan claims to give the following facilities: two adequate national channels for every country; an increase in the frequency separation from 9 kc./s. to 11 kc./s., resulting in a material decrease in interference; and a better regional service even in England, and vastly better for the majority of Europe. If the complete scheme is to be satisfactory, however, it is emphasized that it is essential

to have better control and regulation of the power, frequency and modulation of broadcasting transmitters all over Europe than has been the case in the past.

In presenting the report summarized above, the Radio Industry Council makes it clear that its proposed solution of the problem is by no means rigid or final, since considerable elasticity is offered in the exact wave-length allocations without affecting the general scheme. It is, however, commended to the earnest consideration of those who are able to influence the future development of broadcasting, in the belief that the present phase in Europe presents a valuable opportunity and, in the view of the British radio engineers represented by the above Council, an obligation to correct past mistakes.

SYNTHETIC RUBBER FROM ALCOHOL

Synthetic Rubber from Alcohol

A Survey Based on the Russian Literature. By Anselm Talalay and Michael Magat. Pp. xiii+298. (New York: Interscience Publishers, Inc., 1945.) 5 dollars.

THIS book is well written and printed, free from typographical mistakes, and generally very readable. It is divided into four chapters. The first chapter deals with the chemistry of the Lebedev process for preparing butadiene from alcohol, the second with the technology of the process, the third with the fundamentals of polymerization, including a sub-section on the technology of sodium polymerization, and the fourth with the physico-chemical properties of the polymer, including a most important section on determining the structure of the polymer. While the book as a whole was a co-operative effort of both authors, Chapters 1 and 2 were mainly the responsibility of A. Talalay and Chapters 3 and 4 of M. Magat. It is to be regretted that a further chapter dealing with Russian experience in handling polybutadiene in the rubber factory was not added. Useful author and subject indexes are appended.

The writing of the book is justified by the fact that so few English-speaking technical men can read Russian. A survey must always suffer from lack of authoritative information, and this book is no exception. While the authors have done a good piece of work in bringing together so much valuable information locked away in journals difficult to obtain and more difficult to translate, the reader has the impression that the authors are no better informed on what real progress has been made in the development of synthetic rubber in the U.S.S.R. than he is himself.

This doubt arising from the reviewing of the work of others is quite frankly expressed in the text by the use of the word 'apparently'. This is really a great virtue on the part of the authors, since less honest writers might have been tempted to identify their own views with those of the original authorities.

It is also regrettable that Russian references to more recent work (most of the references are more than ten years old) are not very numerous.

Attention should be directed to the statement on p. 145: "the Germans soon abandoned this method of polymerisation" [sodium polymerization]. This is, of course, untrue since the Germans only abandoned it for the production of products which could be made more efficiently by the dispersion technique. Conversely, more attention could have been paid to the reasons why emulsion polymerization offered difficulties in the case of straight butadiene polymerization.

The practical side of the book (that is, the technology of production) deals almost exclusively with the production of butadiene and polybutadiene. This, naturally, is to be expected from the second part of the title of the book. The reviewer is somewhat surprised that the authors have not mentioned in their introduction Smirnov's book, which covers largely the same ground, at least from the technological angle. It is also rather to be regretted that the title (save for the second conditional part) and contents may lead beginners in the field to the wrong conclusion that polybutadiene is the most important rubber produced from alcohol. Buna *S* (or its analogues) is, of course, the most important synthetic rubber produced from alcohol in the past and present, although there are some indications that polybutadiene may be the most important in the future. This possible misunderstanding might have been avoided by employing a more limited title such as "Polybutadiene Rubber from Alcohol". The authors have, indeed, pointed out that the co-polymers with styrene and acrylonitrile are important, but, in the view of the reviewer, with insufficient emphasis. It is true that some specific information regarding the American processes is still restricted, but no one could deny that far more has been published regarding the general position of synthetic rubber development in the United States than in the U.S.S.R.

A considerable amount of the material contained in the theoretical sections of the book is derived from non-Russian sources, and this makes it even more regrettable that more attention was not given to the production of Buna types from alcohol in the early technological sections of the book. A correspondingly large proportion of non-Russian references in the early part of the book would have made this possible.

The book is essentially one for the chemist interested in the development of synthetic rubber. It is feared that the average rubber technologist will find the treatment of the subject too academic. On the whole it is a book to be recommended.

W. J. S. NAUNTON.

PRACTICE AND SCIENCE IN THE SHEEP INDUSTRY

(1) The Merino

Past, Present and Probable. By H. B. Austin. Second edition. Pp. 247. (Sydney: Grahame Book Co., 1944.) n.p.

(2) Sheep

By J. F. H. Thomas. With Chapters by Moses Griffiths, Martin Jones and A. R. Wannop. Pp. 196+44 plates. (London: Faber and Faber, Ltd., 1945.) 15*s*. net.

"THE sheep has golden hooves, and wherever the print of them appears, the soil turns to gold." This old Swedish proverb is quoted by Mr. Austin; Mr. Thomas could equally well have taken it for one

of his texts. The former is concerned with the role of the Australian Merino stud sheep in leading commercial wool production ; the latter covers the great complexities of breeds, crosses, methods of management, and diseases which are compounded in the sheepbreeding industry of Great Britain.

Both authors are practical men who have earnestly set out to assess the contributions that science has made, makes, and could make towards technical progress in matters of sheep-breeding and husbandry. Both are optimistic regarding the future of the sheep industry, with important reservations as to policies and methods. Both are quite ready to enliven their matter by interjecting subjective views, criticisms and personal opinions. While each has written primarily for practical men specially interested in the industry of their own country, the scientific reader can be advised to regard the books as complementary, to forgo criticisms of many of the obvious weaknesses and deficiencies, to accept the sincerity of the authors' arguments, and to appreciate the valuable contributions each makes to the literature of the livestock industries.

(1) Breed history is a proper background for the study of breeding methods, and Mr. Austin has performed a remarkable service in amassing so much in the way of contemporary records, opinions and data on those strains of sheep which have gone to make the modern Australian Merino. His main interest is focused upon the history of the important strain of Peppin Merinos, so that his history does not cover all, or even most, of the other varieties or sub-breeds of Merino. In this sense the book appears somewhat unbalanced, but it would have been an excessively formidable task to give such a history of all Merino strains. However, it is certainly safe to say that this account can never be neglected by anyone wishing to learn the story of any kind of Merino. Apart from the quotations from the literature, the author's analyses of the trends and dictates of fashion or whim in changing breed type and form are of special interest and fascination, enhanced in value by the remarkable collection of illustrations showing the different stud types favoured in the various eras of Merino breeding.

The fashion in one era is fiercely attacked. The disastrous craze for the "heavily wrinkled horrors" of the Vermont type which pervaded much of Australian Merino breeding for about thirty years from 1890—although it had previously begun to ebb in the American home of this strain—had seriously disturbed the steady development of the plain-bodied Merino sheep yielding a sound and fairly uniform fleece of good commercial wool. Though this craze has now passed and been replaced by more sensible breeding aims, Mr. Austin claims, with good evidence, that the mating and selection methods introduced and publicized by the Vermont enthusiasts have left an unfortunate legacy of belief in the value of "corrective matings". He argues convincingly that there has been no great genetic improvement in the Australian Merino, that there is an urgent need for the establishment and wide use of objective tests of wool-producing ability, and that a near-worship of pedigree must be replaced by a realistic and thorough application of performance and progeny tests.

In support and elaboration of this last argument, and in his hearty enthusiasm for applied genetics, Mr. Austin devotes four of his thirteen chapters to a discussion of the principles of genetics and their application to Merino breeding. He has made a serious attempt to understand some of the recent advances in this branch of biological science, but unfortunately he appears to have gained more respect than true understanding or discrimination. Unfortunately, because while the geneticist will not be misled by his discussion, or by the illustrations and diagrams from well-known text-books here reproduced as hallmarks to the accompanying matter, the layman might. Yet, in spite of this danger that the book might be accepted by some breeders as an authoritative statement of genetical fact and theory, it is significant and symptomatic that so much of the genetical approach should be included and presented as a practical means towards the future development of this important breeding industry.

(2) Mr. Thomas, on the other hand, gives us only an account of the actual application of progressive methods in everyday sheep husbandry in Great Britain, and incidentally shows forcibly at times how the scientific worker has neglected some important phases of the farmers' problems. His book is "an attempt to give a picture of the sheep and sheep farming of Great Britain at the present time". While his three collaborators deal with the special regional aspects of sheep farming in Wales, in the mountains and hills of Scotland, and in the Scottish Border counties, he covers the wider field in a practical, and often provocative, manner. Mr. Thomas is happiest when dealing with the methods and complexities of the industry at large as judged against the background of an intimate knowledge of management under that most intricate system of sheep husbandry, the arable flock. The all-too-short outline of his own practices is a highly valuable contribution. When, however, he sets out to deal with specific technical subjects, as in Chapter 5, "Flock Hygiene : Diseases and Other Causes of Loss", he is not so happy and his presentation will appear weak to the specialist. Yet even in this chapter his concluding paragraph shows his whole attitude directly and convincingly : "From this long and depressing catalogue of the ills to which sheep are subject, one salient fact emerges—many of the causes of loss in sheep are directly due to man's ineptitude. Good management and good shepherding result in healthy flocks, a minimum of loss, contented sheep, and less harassed flock-owners".

Sheep and sheep-farming methods are not the exclusive theme ; the picture given of the industry is that of only a part of British agriculture. The author believes, deeply and strongly, in livestock as a most potent factor in the general agricultural situation of Great Britain. He argues for an expansionist policy for agricultural production, in which he sets as a reasonable target 31,000,000 sheep in 1949, some six million more than we had in England, Scotland and Wales in 1939. For the development of the sheep industry he requires firm governmental action and a progressive agricultural policy, with stabilized prices, guaranteed markets, and organized marketing as "obvious essentials". Intensified and extended research and technical education are also needed. But this is not all ; there is the other side, on which the sheep farmer must "accept responsibility by striving in every way to improve his methods of breeding and management". Mr. Thomas means, and plainly reasons in this stimulating book, that "the future of our sheep industry depends upon the team-work of the State, the flock-owner, and the shepherd".

J. E. Nichols.

A PLAN FOR DECENTRALIZING ADMINISTRATION IN GERMANY

The Regions of Germany

By Dr. Robert E. Dickinson. (International Library of Sociology and Social Reconstruction.) Pp. ix+175. (London: Kegan Paul and Co., Ltd., 1945.) 10*s.* 6*d.* net.

HAVING in mind the need to curb the aggressive strength of a united, highly centralized Germany, the author claims for his regional scheme the means of preventing the continued domination of the country by Prussia. His advocacy of a partition of Germany into autonomous or semi-autonomous areas leaves doubt, unfortunately, as to whether a federated or a confederated Germany is recommended, and there is vagueness as to the extent of devolution proposed. Indeed, the proposed relationships of the individual regions with the central government and with each other are scarcely, if at all, discussed, despite their importance to the statesman and administrator, for whom presumably the book is primarily intended; while, in view of the author's fear of Prussian hegemony, we should expect an alternative to Berlin to be proposed as the supreme headquarters of government.

Economic geography provides the principal criteria for the author's system of regions. Social considerations, by contrast, are granted negligible importance. Moreover, the emphasis laid on partition tends to obscure the closeness of the economic and social associations which draw the provinces of Germany together, and if the advice offered were to be followed it might well result in the 'balkanization' of Central Europe. The experience of the Soviet Union, which may usefully be cited on this point, is that nations (for example, the Ukrainian and the Belorussian) are stoutly opposed to the subdivision of their territories into 'economic regions' for purposes of convenience in administration. In the same way, a too-ruthless departure from the boundaries of traditional units is not likely to gain the willing sanction of the German people.

Although it cannot be conceded that the author's purpose is fulfilled—and considerable ambiguity does not help the reader—this essay on the economic geography of Germany should prove useful to students, especially those without direct access to the work of the German regional geographers, whose authority Dr. Dickinson freely acknowledges. The confidence of the reader would be increased by the careful revision of inaccurate or loosely worded statements, only one or two of which are here indicated. The geographical interpretation in the text of the population density map (p. 37) is not borne out by the evidence which the map itself provides. The two 'belts' of high density to which particular reference is made are by no means obvious, even if due allowance is made for generalization. Admitted that geography suffers from a paucity of technical terms, it should nevertheless be possible to avoid such a statement as (p. 70) "The belt has about 3¼ million inhabitants. . . . It falls into 3 belts". The suggestion that the aggressions and barbarities of German policy are attributable to a wicked Prussia which, by its domination, has prevented the development and expression of the latent democracy of non-Prussian Germany, is confuted by the history of the totalitarian Nazi creed, in which the part played by Bavaria does not seem to have been inconsiderable.

W. FITZGERALD.

THE BLACK WIDOW SPIDER

Black Widow

America's Most Poisonous Spider. By Raymond W. Thorp and Weldon D. Woodson. Pp. xi+222+16 plates. (Chapel Hill, N.C.: University of North Carolina Press; London: Oxford University Press, 1945.) 18*s.* 6*d.* net.

THE 'black widow' has for long been the popular name of the American spider *Latrodectus mactans*, notorious above all others for the reputed virulence of its bite. In 1934 there was a remarkable increase in the numbers of the species, and the recorded cases of spider-bite, or arachnidism, so alarmingly multiplied that the 'black widow' acquired a 'news value' in the popular Press. Messrs. Thorp and Woodson then undertook a comprehensive study of this spider, the results of which are contained in this book.

It opens with a somewhat irrelevant account of spider myth and legend, including such extremes as the words of the Koran and the story of Little Miss Muffet, followed by a most interesting chapter on the Tarantula and a very incomplete survey of other poisonous spiders. Thereafter the book deals only with *Latrodectus mactans* and other species of the genus which occur in other parts of the world.

An admirable historical account of medical experience occupies eight chapters. After the earliest recorded spider-bite in America, on September 3, 1726, the first extensive collection of cases was published in 1901 by Dr. C. C. Browning. A quarter of a century later, Dr. Emil Bogen of Los Angeles produced the first of his well-known papers on arachnidism, establishing it as a clinical entity and reviewing all available information. Dr. Bogen, who has continued this work, contributes a foreword to this book, and is acknowledged by its authors to have been most helpfully associated with their studies. There are now records of 1,291 cases, involving 55 deaths. Thus it is fair to say that arachnidism, like hydrophobia and the rattlesnake bite, causes a few deaths each year; but it is essentially avoidable and is surprisingly infrequent in view of the wide dispersal of the spider. We are told that by far the commonest cases are those in which the spider's web has been spun beneath a lavatory seat and the patient has been bitten in the genitalia; that the poison spreads with extreme rapidity; that it particularly affects the nerves; and that the very severe pain is felt throughout the body; that wrong diagnosis is frequent; and that more than ninety different remedies or treatments have been recommended.

The latter half of the book is less scientific. It includes a review of the public interest in the spider, which mentions several trivialities, an elementary account of the class Arachnida and a popularly written description of the habits of the 'black widow', in captivity and elsewhere, as observed by the authors. There is also a survey of the distribution of the spider, which resists equally the cold of Denver and the heat of California, the drought of Yakima Valley and the moisture of Alabama, and has been found from sea-level to an altitude of 8,000 ft.

Some rather inconclusive suggestions for natural and artificial control of the 'black widow' bring to an end an interesting and generally successful example of popular treatment of a scientific subject.

T. H. SAVORY.

SCIENCE IN THE U.S.S.R.*

EVOLUTIONARY BIOLOGY AND RELATED SUBJECTS

By Dr. JULIAN HUXLEY, F.R.S.

IN the U.S.S.R., a convergent attack on the evolution problem is being made from many angles simultaneously—from that of genetics, of taxonomy, of ecology, of cytology, of field studies and behaviour, of mathematical analysis, of comparative anatomy, of palæontology. In this, the U.S.S.R. resembles Britain, the United States and other countries, though it is interesting to find that during the War a good deal of the work has been carried on independently, in total or partial ignorance of research elsewhere. The approach has in general been along the same neo-Darwinian lines, involving acceptance of neo-Mendelism, as in Britain and the United States, though perhaps with even greater emphasis on strict selectionist principles. This is all the more interesting, since in the U.S.S.R. neo-Darwinism is in sharp contrast with the revolutionary views of the botanist and agriculturist Lysenko. Lysenko's conclusions and theories demand an article to themselves. Here we can only say that though Lysenko claims to be a true Darwinian, his contentions involve a sweeping form of Lamarckian inheritance, as well as remarkable effects of scion on stock in grafting, and their hereditary transmission. Further, he expressly states his disbelief in Mendelism or any other particulate principle of heredity. Lysenko is in a powerful position, both scientifically, as president of the Lenin All Union Academy of Agricultural Sciences, and politically, as vice-chairman of the Supreme Soviet. However, in spite of this, the neo-Mendelian and neo-Darwinian selectionists continue to turn out large quantities of excellent work (thus disproving the contention sometimes advanced by non-Russian men of science, that scientific theory in the U.S.S.R. is always subject to political considerations). Indeed, in Lysenko's own Institute are to be found research workers on *Drosophila* genetics and cytology, and a former member of the staff of Vavilov, the eminent plant geneticist (now dead), who was Lysenko's most prominent antagonist before the War.

In what follows, I propose to mention some of the work in the more important fields of research which I came across during our two weeks in the U.S.S.R., in the hope that this will facilitate that renewal of contacts which is so desirable after the isolation caused by the War.

Work on *Drosophila* is in progress in numerous institutions. In Dubinin's Laboratory of Genetics in the Institute of Cytology (Moscow), Dubinin himself is studying the selective effects of various inversions in natural populations. One inversion has a selective advantage over the normal at low temperatures. Several others are at a *disadvantage* at low temperatures, and are much more numerous in urban conditions: the result is to produce a balanced polymorphism as between urban and rural populations, similar to that found with industrial melanism in moths, though the selective agencies are quite different. Berg and Dubinin have also found a seasonal balance as regards the mutant wing-vein character *extra-analis*. All the polygenes responsible for this character are in one chromosome, a state of affairs which Dubinin maintains must be due to selection. Dubinin has also some very interesting work on mutation-rate—its general control by selection; the existence of strains highly mutable for yellow; etc.

In conversation, Dubinin recalled the fact that in 1931 he (with Romashov), had, simultaneously with Sewall Wright but quite independently, enunciated the principle of non-adaptive evolution in small populations. (Unfortunately, he used the cumbersome phrase 'genetical-automatic processes', and the convenient American term 'drift' has quite superseded this.) Siderov is studying the position-effect with regard to yellow. The frequency of yellow mosaics is related to contiguity of the yellow locus to the 'inert' region of the chromosome; it is also related to development—thus the manifestation of yellow-mosaicism is less frequent on the head than on the body. Other problems of physiological genetics will be investigated by Rappaport on his return from service.

Work on mutation is also being carried on by Shapiro in Academician Serebrovsky's Department of Genetics in the University of Moscow (though mainly on a new genetic object, the melichid fly *Dermemetopa*); by Olenov in the Genetics Department of the Roentgen Institute in Leningrad; and by Miss Berg in Schmalhausen's laboratory in Moscow. Berg is also doing interesting work on natural populations, especially on the evolution of dominance, and on the effects on different mutants of the varying types and intensities of selection which prevail at different periods of the annual cycle.

In Academician Lysenko's Institute of Genetics, apart from Lysenko's own work (with Glushchenko and others) on grafting and the inheritance of its effects, which I do not propose to discuss here, Prokofieva is making an extremely interesting study, from the cytological aspect, of the metabolic cycle of chromosomes (which she has christened 'heterocyclicity'), notably in regard to the difference between the paternal and maternal genomes. Nujdin is working on *Drosophila* here, and on his return from military service, Belgovsky will continue his work on the pure genetics of *Drosophila*.

In mathematical genetics and evolution theory, important work is being done by Kolmogorov, Malinovski, Smirnov, Ignatiev, Romashov, Schmalhausen and others. Schmalhausen is working on what he calls 'stabilizing selection' and the different reaction-norms to be expected in different types of environment.

It was of great interest to find that the Pavlov Institute at Koltushi (Leningrad) has a department devoted to the genetics of behaviour. Here, Dr. Masing is studying the inheritance of phototaxis in *Drosophila*, and has also obtained valuable results on the genetic basis of egg-laying preferences, which help to explain the origin of 'biological races' and monophagous species. Meanwhile, Promptov is studying the effects of environment and of heredity on activity and other aspects of behaviour in finches. This, I believe, is the only work that has been done on the genetics of behaviour in wild bird species. The study of the inheritance of temperamental types in dogs, begun under Pavlov, will be continued, and is to be extended by similar work on pure breeds, the material so far having been genetically quite heterogeneous.

In the Institute of Cytology, Sacharov, using colchicine, has produced a valuable new tetraploid

* Continued from p. 228.

form of buckwheat. He has also found that in an artificial poppy tetraploid, the tapetal cells of the anthers remain octoploid, as in the normal diploid—an interesting example of regulation. Frolova, as well as studying the cytology of these tetraploids, is doing work on the digestion of different parts of chromosomes by different enzymes and other agencies, which should be of general importance. Peshkov has obtained what appears to be conclusive evidence of chromosomes and their division in a bacterium (a giant form, *Karyophanon*), and is also studying the peculiar endomitosis of *Chara*. In Navashin's laboratory in the same Institute, a giant and highly fecund tetraploid of a valuable rubber-producing composite has been artificially produced. Navashin himself is now studying the dynamics of mitosis in *Crepis*.

In the Institute's Laboratory of Experimental Embryology (besides interesting work on morphogenesis which cannot be discussed here) Astaurov, working on silkworms, has obtained both parthenogenetic males and females. Schmidt is continuing his well-known researches on the nemertine *Lineus*, which showed the existence of two modes of development, one where the eggs are larger and all develop, producing Desor larvæ and green adults, and the other where the majority degenerate after early segmentation, and are ingested by the remainder, which develop into large-mouthed larvæ and red adults. He now considers these as separate but close species, differentiated after genetic isolation. In the red species (*L. ruber*), he now finds that the percentage of degenerating eggs is the same (87 per cent) in two widely separated subspecies with slightly different-sized eggs and markedly different egg-totals. He suggests that this depends on a genetic mechanism involving balanced lethals—if so, a remarkable case of lethals being utilized to produce an adaptive result.

'Close species' in plants and other botanical species-problems are being studied by Rosanova in the University Genetics Laboratory. Here also, Khostova has been independently repeating some of Lysenko's work on the effects of grafting on tomatoes, I understand with largely negative results; Alikhanyan is studying structural mutations; and the director, Serebrovsky, has been working on the genetics of parasitoids for practical purposes. Among other results he has obtained a wingless strain of *Sitotroga* to serve as food (host) for the useful *Trichogramma*; this is of importance as reducing the danger of spread of *Sitotroga*, which is a pest.

In Schmalhausen's laboratory, Mashkovtsev and his colleagues are doing a good deal to generalize the modern thesis that courtship and display (and other external stimuli connected with the breeding habitat) have a physiological effect in ripening the female gonads in birds and mammals.

Very interesting work is being done by C. F. Gause. Employing ciliates, he has given the first experimental proof of the efficacy of organic selection. He finds that both salinity and temperature changes normally induce modifications in body-size; when conjugation is induced, segregants appear with a large range of body-size, but only those survive which are of the same type as the modifications. Gause is now devoting himself mainly to medical research on gramicidin, but hopes to give some of his time to evolutionary studies.

Alpatov has shown that the correlation which he had previously established between tongue-length and latitude in bees is found only in the workers, not in queens or drones, and is thus presumably an adaptation to the flowers visited. He proposes to extend this work to bumblebees. He has also established the important fact that the irreversibility of the transformation of the head-louse to the body-louse is a selection effect. The head-louse shows a great range of variability; in the five or six generations required to transform it into the body-louse, heavy mortality occurs and the variability is reduced, so that the reverse process is impossible. The body-louse is thus a specialized type, produced by a selection which Alpatov considers is mainly one for tolerance of lower temperature.

Work on the genetics of cancer is being done in the Genetics Department of the Oncological Institute in Moscow under Martinova, and on the genetics of coarse fish by Romashov in the Genetics Department of the Freshwater (Pond) Fish Institution in Moscow. I was informed that information on the genetics of fur-bearing animals and on their variation and polymorphism in Nature was to be obtained from the Central Fur Laboratory of the People's Commissariat for Foreign Trade (Profs. Petrayev and Manteufel), but was unable to make contact with them.

In taxonomy, excellent work is being done, both in the University Museum of Zoology, Moscow, and in the large Museum of Zoology in Leningrad (famous for its specimens of mammoth and woolly rhinoceros with skin and hair), to which is attached the Zoological Institute of the Academy.

In Moscow, Dementiev told me that he had been so stimulated by the publication of the "Handbook of British Birds" during the War, that he and a team of collaborators are now preparing a handbook of the birds of the U.S.S.R., which will aim at very full ecological treatment. This will be a formidable task, as there are 675 species to cover; but it will be of the greatest value to ornithology and to taxonomy in general. Heptner, the mammalogist here, is pursuing zoogeographical studies, as is Turov. Heptner is also working on polymorphism in *Mustela*, *Myospalax*, *Arvicola*, etc. The marten (*Martes martes*) and the sable (*M. zibellinus*) show a 'hybrid zone' very similar to that between the carrion and hoodie crows. There is also a chair of zoogeography in the University of Moscow, held by Bobrinskoi, who has just published a book on the mammals of the U.S.S.R., while Puzanov of the University of Gorki has published a text-book of zoogeography. Lukin, professor of biology at the University of Kharkov, is also working on biogeography and has published a book on Darwinism and the geographical variation of organisms.

In Leningrad, much work is being done on the taxonomy of the various main groups of animals, and numerous books are being published, including many volumes of the detailed Fauna of the U.S.S.R. (chiefly anatomical and systematic). At the Leningrad Museum an interesting feature (unfortunately rare in Britain) was the linking of museum systematics with physiology and ecology. Thus the entomologist Kushentsov is writing a book on the comparative physiology of insects, and Rubtzov works chiefly on the ecology of Diptera. The curator of mammals, Vinogradov, is also professor of vertebrate systematics and ecology in the University of Leningrad, and maintains a field station for his students. In the University Department of Entomology, Shvanvich has perfected a new method for demonstrating the true value of 'ruptive' coloration in Lepidoptera, in breaking up the flat plane of the wings into a number of apparently different levels: in some cases the result simulates a

foreground of grass stems against a dark background. He has also made a valuable study of the evolution of wing pattern within single families—a veritable comparative anatomy of pattern and its elements.

To return to ecology, the leading animal ecologist in the U.S.S.R. is Formosov. Unfortunately, he and his staff were away in the field at the time of our visit, so that I had no opportunity of hearing of their current researches, nor did I make contact with Sinskaya or other plant ecologists. Attached to the Zoological Gardens in Moscow is a small but interesting institute, the Laboratory of Experimental Ecology, under Kalabukhov. He and his assistant Afonska are making quantitative studies of the activity, temperature preferences, respiration, and oxygen consumption of various mammals—bears, foxes, field mice, hamsters, martens, etc.—and finding adaptive correlations with local environmental conditions. Work is also being done on the change of colour to winter white in *Cricetulus* and *Lepus*.

At the Museum Darwinianum in Moscow, in addition to the remarkable exhibition methods (which include a large number of striking paintings and sculptures by the artist Vatagin), Kohts, the director, has an extraordinary collection of aberrations in various species of birds and mammals. The most interesting are in blackcock, where more than 200 million specimens from the markets for some four hundred years had been gone through! As a result, Kohts is able to say that a dilute ('blue') form occurs once in about $2\frac{1}{2}$ million specimens, a form with checked black-and-white belly once in 10 million, and so on. Mme. Kohts is continuing her work on the behaviour of chimpanzees (a subject which is also being studied, with interesting results, at the Pavlov Institute at Koltushi).

Boris Zavadovsky also has a Museum of Evolution in Moscow, but this is more popular and takes in more general biology. It comprises a number of living exhibits. Zavadovsky writes a good deal on theoretical biology and on Marxism in biology, as well as doing practical work on artificial insemination, on pregnancy tests, and tests for the sex of unborn mammalian offspring.

In general, much less research is being carried on in university departments than in the special institutes of the Academy of Sciences and other non-university institutions. However, the disparity does not seem to be so great in biology as in the physical sciences. Genetics is at present taught only in the University of Moscow: specially able students from other universities may be sent to Moscow to take this course. Genetics is studied during the last two and a half years of the five-year undergraduate course in biology; there are now about twenty genetics specialists. During their final year, students are encouraged to do small pieces of research under guidance. The courses in plant and animal genetics are different, but all genetics students do some work with *Drosophila*, as well as cytology, biometry and phenogenetics.

As we only had a short time in the U.S.S.R. and did not visit many cities, the above account of work in progress is very incomplete (though it appears that a large percentage of the more important research is concentrated in Moscow and Leningrad). Thus I was unable to see anything of the work in agricultural genetics, notably the genetical research being carried on in the huge agricultural institution, the Timiriazev Academy near Moscow (where I understand much valuable work on polyploidy and on the genetics of cereals is in progress under Academician Jebrak); nor could I see that in the equally huge Forestry Research Institute near Leningrad, or the work on polyploidy in Breslavetz's department at the Botanical Garden of the University of Moscow. Karpechenko, the well-known plant geneticist, is unfortunately missing, presumed dead.

I had not the time to discover what had happened to the remarkable programme of work on the evolution and genetics of crop plants initiated by Vavilov (except that some of the seed-collections left at Leningrad were eaten during the siege). The abundant and valuable work in palæontology is being described by Prof. D. M. S. Watson and Dr. Edwards. Here I will only record the excitement of seeing a fossil Paleoniscid fish larva from the Jurassic, with eyes and yolk-sac beautifully preserved.

In general, I may sum up my impressions as follows. In spite of the insistence during the last four years that Russian biologists, like other men of science in the U.S.S.R., should do some work of importance for the war effort, pure research seems to have been kept going to a somewhat greater extent than in Britain during the War (and, according to some of the American delegation, than in the United States.)

In some branches of Russian science, a certain spirit of scientific nationalism is to be observed. There is little of this, however, in general biology, apart from the efforts made in certain quarters to elevate Michurin from the position of an agricultural and horticultural empiricist to that of a great scientific pioneer and discoverer (there is even a town which has been re-christened Michurinsk, where much of Lysenko's work is now being carried on).

If in the U.S.S.R. no outstanding discoveries appear to have been made, no new principles established, in the field of general biology during the last few years (again I defer any discussion of Lysenko's work until later), yet the work has been of high quality, many-sided in its approach, and of great volume (though not so voluminous as, for example, in geology or agriculture).

In spite of the War, my Russian colleagues seem to have managed to obtain rather more knowledge of British and American results than we did of their work, though their supply of foreign and scientific books and especially journals is still very inadequate. They all showed the greatest courtesy and friendliness and were anxious to tell us of all they had been doing and thinking. They are hoping for a rapid improvement in the facilities for interchange of personnel, as well as of reprints, journals and books.

The U.S.S.R. is taking its place as one of the foremost countries in biological research, and I anticipate that they will soon be leading the world in some fields, notably in the relation between ecology, field study, taxonomy, genetics and evolution, where their vast continuous territory, with its extremes of environmental conditions, provides them with unrivalled opportunities.

CRYSTALLOGRAPHY

By Dr. W. A. WOOSTER

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ONE of the evil effects of the War has been the virtual isolation of scientific workers from their colleagues in foreign countries, and it was a particularly welcome invitation which the Russian Government extended to British crystallographers. During the War the laboratories in Moscow and Leningrad

were largely evacuated to Kazan and other places in the east, and the resettling process is not yet complete. In spite of these difficulties, much fundamental and applied work has been carried on during the whole of the war period. The laboratories under the Academy of Sciences are well equipped with apparatus and have many trained scientific workers on their staffs.

The laboratory for morphological crystallography is in the Crystallographic Institute in Moscow. Part of the work of this laboratory consists in the routine examination of crystals derived from the numerous mineral deposits of the U.S.S.R. X-ray crystallography is carried on in at least four departments in Moscow. The substances studied in the Institute of Crystallography and in the Karpov Institute for Physical Chemistry are mostly minerals or inorganic substances. Among the former is included dioptase, the structure of which has recently been worked out, and among the latter, a number of cyanides, ferrocyanides and compounds containing other complex ions (Belov, Zdanov, Boky, Popova). Electron diffraction apparatus is being used for the study of crystals which occur in very thin flakes, for example, cadmium iodide and clay-forming minerals (Pinsker). Work, both theoretical and experimental, on certain inter-metallic phases and on the structure of thin metallic films is being carried on in the Physical Institute of the University under Prof. Konobievsky. The study of the influence of the state of chemical combination on the X-ray absorption edges and on the emission lines of certain elements is conducted by Prof. Borovsky in the Department of Petrology.

Crystal physics is much studied in the U.S.S.R. The school established more than twenty years ago by Academician A. Joffe has pursued its study of the properties of crystal and other solids with undiminished vigour. The work of Mrs. Joffe and other members of the Physical-Technical Institute in Leningrad, under the direction of Joffe, has shown the existence of new types of semi-conductors. A systematic survey of oxides and sulphides, particularly those of titanium (TiO_2), copper (Cu_2O), vanadium (V_2O_5), tungsten (WO_3), lead (PbS) and tantalum (Tl_2S), has shown that much more efficient rectifiers and photo-cells can be made with new combinations of metals and semi-conductors than can be obtained from the usual selenium-iron combination. The current per unit light intensity obtained with a tantalum sulphide – iron combination is twenty-five times greater than that given by the selenium – iron combination. Such photo-cells have now become sufficiently efficient to make it practicable to set up large batteries of them in desert places for the conversion of solar radiation into electrical energy.

It has also been shown that lead sulphide may give electronic or hole-conduction according as there is an excess or a defect of lead in the crystal structure, and that conductivities up to a thousand times that of the pure substance may be obtained with the material containing non-stoichiometric proportions of lead and sulphur. Work on these semi-conductors may have far-reaching effects on the manufacture of photo-cells and dry rectifiers.

Prof. Schubnikov (Institute of Crystallography, Moscow) has developed a new field by the study of piezo-electric textures. A cloth or wire gauze is stretched on a frame and molten Rochelle salt is brushed on, the direction of movement of the brush being always the same. In this way a plate looking rather like a plaster plate is built up in which the needle-shaped crystals of the salt are preferentially orientated in the direction of movement of the brush. Such a plate when coated with tinfoil or other electrodes forms a piezo-electric element suitable for the acoustic range of frequencies. Its internal damping is too high for it to be used in the supersonic range, but it can be used satisfactorily for microphones. Such plates may be made with the preferential orientation in one direction only or in two directions according to whether the plate is to be used for bending or twisting. These plates are strong and can be made of almost any size. Prof. Schubnikov has given the necessary extension of the theory of piezo-electricity to cover these preferentially orientated textures. Methods have also been found in the same laboratory of growing large single crystals of substances suitable for piezo-electric apparatus, for example, Rochelle salt, potassium dihydrogen phosphate and cane sugar. In relation to the latter crystal, it has been shown (Scheftal, 1941) that a change in the degree of supersaturation from 2·4 to 2·1 per cent makes all the difference between the development of a bad or a good crystal.

The mechanical properties of crystals have been studied intensively in the U.S.S.R. in recent years. A number of investigations by Miss Classen-Nekludova have demonstrated many of the fundamental facts concerning the plastic deformation and the rupture of rock-salt and certain metallic crystals. She has shown that rock-salt, when subjected to intense compression in one direction at a high temperature, twins according to a spinel law. Further studies on artificial corundum have shown how to determine the orientation of the crystallographic axes by optical means, what strains are present in the boules and how these strains influence the breakage of the specimens. A novel development in the study of the plastic properties of metals has been introduced by Stepanow (Physical Technical Institute, Leningrad), who uses fused silver chloride as a 'transparent metal'. The elastic and plastic properties of this substance have been shown to be of the same type as those of a metal. It shows a photo-elastic effect in polarized light, and this opens up possibilities of new studies on the plasticity of metals. A special plastic called 'Escapon' has been developed during the War, and it has excellent electrical and mechanical characteristics. It is made from butadiene rubber by compression at 20–50 atmospheres and between 16° C. and 200° C. according to the hardness required in the final product. A development which Joffe described as the 'vulcanization' of cellulose consists in acting on cellulose with certain quaternary ammonium bases to form oxygen bridges between the cellulose chains. Filter paper subjected to the action of these bases is rendered incapable of disintegration by water and it retains its strength even when immersed in hot water.

The following text-books in Russian have appeared recently: "The Elements of Crystallography", by A. V. Schubnikov, E. E. Flint and G. B. Boky (1940); "Elementary X-Ray Structure Analysis", by G. S. Zdanov (1940); "X-Ray Analysis of Metals", by G. S. Zdanov and Y. S. Umansky (1941); "Symmetry", by A. V. Schubnikov (1940); "Quartz and its Applications", by A. V. Schubnikov (1940); "New Apparatus for Crystal-Optical and Petrographic Investigations", by the staff of the Institute of Crystallography, Moscow (1940); "Crystals", by M. Shaskolskaya (1944); and "Analysis of Crystals by their Optical Properties, Part I", by G. B. Boky (1944).

In conclusion, it may justly be said that the study of the properties of crystals is in a very flourishing state in the U.S.S.R. at the present time, and it is to be hoped that the move towards co-operation so generously started by the Soviet Government will be reciprocated in the coming years.

PEDOLOGY

By Dr. ALEX MUIR
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THE development of pedology or soil science owes much to the initiative of Russian men of science, foremost among whom was V. V. Dokuchaiev, who laid the foundation of modern methods of soil classification. It is appropriate, therefore, that the principal centre of soil study in the U.S.S.R., the Dokuchaiev Soil Institute of the Academy of Sciences, founded twenty years ago, should bear his name. Many well-known figures in soil science have been associated with this Institute—Glinka, Gedroiz, Neustruev, Lebedev—and the British soil workers attending the recent Academy celebrations have had close contacts with the Institute since its foundation. We were given a great welcome on our arrival, and made honorary members of the staff for the duration of our stay so that we could come and go as we pleased. The present director, Academician L. I. Prasolov, and his staff had made careful preparations for the visit, and all the accounts of work in progress were fully illustrated with maps, diagrams and apparatus.

The activities of the Institute include research work on theoretical problems of soil science such as the genesis, geography and cartography of soils, soil systematics and classification, soil chemistry, physical chemistry, biochemistry and physics; but the practical side is not forgotten, and there are departments of agrochemistry and soil erosion, while saline soils and their utilization receive considerable attention.

Prasolov, who recently celebrated his seventieth birthday and forty years of scientific activity, is ably assisted by some 116 scientific and technical workers. A number of the senior members hold chairs in other institutions, which ensures close collaboration between the different organizations. In addition to this overlapping of staff, the Dokuchaiev Institute has a number of affiliated institutes in the various republics and some out-stations for the study of soils *in situ*.

Prasolov himself directs the work of the section on geography, cartography and classification, the activities of which are not confined merely to Russian soils. The Russians have long been interested in the application of their ideas of soil zonality to the rest of the world, and Prasolov has recently produced a new soil map of the world for inclusion in the Large Soviet Atlas. More detailed studies of the literature on the soils, vegetation, etc., of other regions have led to the production of new soil maps of Africa, South America and Australia. These maps and their accompanying memoirs, when they become generally available, should give a good picture of the extent to which the Russian conceptions of soil types can be applied to the more tropical countries.

For the U.S.S.R., one of the principal tasks of the cartography department is the preparation of a soil map of the Union on the scale of 1 : 1,000,000 which will be the standard map for the whole country. During the War, the surveys of the Institute were found of great use in the transfer of agriculture to the eastern regions, and considerable work is being done in the Urals, Kazakstan and Uzbekistan. While general soil surveys form an important part of the Institute's work, special surveys in connexion with erosion and salinization are also made and form the basis for the study of these phenomena and of methods of dealing with the practical aspects.

The weathering of rocks and minerals is the first stage in soil formation and is receiving considerable attention in the Institute. An interesting study is being made of the ash content of plants and the rock or soil on which they grow, and it has been shown that in the red Georgian soils there is a considerable movement of aluminium between the soil and certain plants in the natural vegetation; for example, hornbeam, beech and rhododendron. This fact has an obvious bearing on the relative movement of the soil constituents during development of the soil. In a study of rock weathering and soil formation under lichens, it is concluded that biological influence may be an important factor in the formation of clay minerals of the montmorillonite type.

The study of the nature and distribution of the clay minerals in soils has received close attention and a large body of data has been obtained. In addition to the usual X-ray and thermal methods of examination, use is being made of an electron diffraction method with some success. Other laboratory studies include exchange reactions, the nature of soil acidity, soil solution by high-pressure extraction and the nature of soil aggregates. The study of aggregates is made from the physico-chemical aspect with the view of elucidating their structure and origin in the various soil types, and also from the purely physical aspect to obtain a measure of their resistance to the destructive influences of erosion. The first aspect is an elaborate study involving microscopic examination of the aggregate at the different stages of the chemical treatment. The interesting result of the case of chernozem aggregates is that the clay minerals seem to be wrapped round the organic matter, resulting in a very stable aggregate.

Of the out-stations set up for the study of soils *in situ*, the best equipped, namely, those in the podzol and chernozem zones, suffered greatly during the War and work on them has had to be begun afresh. Some valuable results had, however, been obtained. It has been found that there is a seasonal shifting of the carbonate horizon of the chernozem up and down in the soil, the range of movement depending on meteorological conditions, but in one year reaching as much as 17 cm. This seasonal migration of carbonates impedes the loss of calcium from the rooting zone and so results in the chernozem being an extremely stable type.

While this account of the work going on in the Dokuchaiev Institute is necessarily brief, mention must be made of the soil museum which is still housed in Leningrad. It is one of the most complete collections of Russian soils and forms a valuable guide to the soil geography of the country. Since soil excursions were not possible during our visit, it was a most useful refresher to be conducted round the museum by its curator, Miss Shokalskaya, and have its contents explained by her in excellent English.

Recent articles in *Nature* have referred to the very fine geochemical studies being carried out in the U.S.S.R., and since these have an obvious bearing on

certain soil problems, we were glad to have the opportunity of visiting the Vernadsky Laboratory of Geochemical Problems of the Academy. In this institute, under A. P. Vinogradov, there is going on a great amount of work on the distribution of the minor elements in soils and biological materials. The laboratories are very well equipped with modern physical apparatus, including X-ray spectrographs and recording photometers. One of the principal tasks of the institute is the construction of a map showing the geochemical provinces of the U.S.S.R., and considerable attention is being paid to the relation of endemic diseases and minor element distribution.

(*To be continued.*)

THE INFERIORITY COMPLEX AND THE PARANOID TENDENCY: WITH A BRIEF REFERENCE TO NAZI PSYCHOLOGY*

By Dr. WILLIAM BROWN
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THE subject-matter of this essay has a very important bearing upon the world problems of the present day. The popular conception of the inferiority complex has become a scandal in modern psychology. It is a term easy to use, and it has suffered a fate somewhat similar to that of the word 'idea' in John Locke's "Essay Concerning Human Understanding" (1690). In that work he used the term 'idea' in a special sense, as illustrated in his definition ("Essay", Bk. I, Chap. i, § 8): "whatsoever is the object of the understanding when a man thinks". The general line of his argument was "the new way of ideas", of which Stillingfleet spoke—disapprovingly—on the first appearance of the "Essay". But Locke himself used the word in several different ways, and very soon it got into the general vocabulary of English literature in a large number of senses. That is an aftermath of Locke's important work.

Misuse of the Term 'Inferiority Complex'

It seems fated that the term 'inferiority complex', which had a fairly definite meaning when originally developed by the late Dr. Alfred Adler and some of his followers, should come into general use in so vague a form as to be of practically no value for the man of science. It is misleading because it gives an air of profundity to statements which are extremely elementary and superficial. Here I am not criticizing Adler's general position in the succession of the great medical psychologists, Sigmund Freud and C. G. Jung. We have much to learn from all three of them. Each has a message and to each belongs much solid research work on the mind. But it is a little unfortunate that Adler's position in psychology should be so much easier to understand at first blush than the systems of Freud and Jung. The result has been that it has attracted popular thought and opinion because of its simplicity, and has discouraged deeper consideration of these problems by the general educated public.

I am not at all sure that it was Alfred Adler himself who first used the term 'inferiority complex'. He spoke first of 'organ-inferiority' (*Minderwertigkeit von Organen*), a physical deficiency to which individuals react physiologically and psychologically in different compensatory ways. Adler's book on "The Neurotic Constitution"† contains much fundamental discussion along this line of thought. But when he came to deal more closely with the mind and its reactions, someone or other—I do not know who—introduced the term 'complex' in popularizing his psychological point of view: a word much used in those days, starting with Freud's 'Œdipus complex', and Jung's use of the term as meaning a repressed system of ideas with an emotional colouring, revealing itself in consciousness in a *disguised* form. So the word became attached to inferiority—*Minderwertigkeit*. This 'feeling of inferiority', *Minderwertigkeitsgefühl*, which in some respects we all share in one direction or another, undergoes (through repression) transformation in various ways to become an 'inferiority complex'—in other words, the total mind reacts to the feeling of inferiority, with all manner of results in thinking, feeling and behaviour.

Every one of us is, of course, inferior in some direction or other. No one can do everything well. A man may be a genius in some directions, but a dunce in others. We have to accept our limitations, recognize them for what they are, realize that nothing can be done about it, and push on with those lines of activity in which we are outstanding, or relatively normal and efficient. If we attach an excessive value to certain abilities and powers, artistic or intellectual or whatever they may be, which we ourselves do not possess to any great extent, but wish we did, we may come to imagine ourselves possessing them in a greater degree than we do, so that a certain distortion appears in our mental outlook. We are no longer single-minded, honest-to-goodness people moving forward with all the forces at our disposal; we begin to pretend to be something which we are not, and we deceive ourselves, and perhaps—which is less likely—deceive others. Man is the only animal capable of deceiving himself, and that self-deception accounts for many of the troubles of the world. We do not like to admit our inferiority even to ourselves, and in hiding it, we develop an inferiority complex. We pass from a '*feeling* of inferiority', which is straightforward and unblamable, to develop an 'inferiority *complex*', a reaction which is not straightforward, which is a sin against our own nature, by pretending to be what we are not, and putting up a mere façade in the sight of the world.

Compensation and Over-compensation

In trying to hide our inferiority from ourselves we may over-compensate. There is an automatic tendency in any organism to compensate for deficiency, but it is easy to compensate to excess. A familiar example is the youth who is by nature diffident, retreating, and shy; and who, as a result of over-compensation, develops a blustering and swaggering attitude. Again, many people compensate for lack

* Based on a lecture delivered at Christ Church, Oxford, on November 25, 1944.

† Translation by B. Glueck and J. E. Lind (New York: Moffat, Yard and Co., 1917).

of success by imagining it, and as they give way to their phantasies and day-dreams, they come at last to believe that they have the power or to pretend that they have it, while at the same time retreating from any actual test.

An alternative reaction is just to fall ill, when confronted with a real test. The person concerned may suffer with headache, anxiety, depression, sleeplessness, loss of appetite—general symptoms which cannot in his case be explained in terms of physical disease, but are quickly understood by one who knows the real situation. There are these various possible reactions to the feeling of inferiority, and they are evidence of the existence of the complex—a complex involving self-deception, which nevertheless is not quite complete. The term should be used only to describe *a distorted conscious reaction in the mind of the individual to a repressed or rejected feeling of inferiority*.

The general public, including some journalists, in seizing upon this term, have used it almost invariably in the wrong sense. They talk of 'inferiority complex' when what they have in mind is simply the fully conscious awareness by an individual of his inferiority in some direction or other—a very different thing. But although the inferiority complex is a further stage of complication in the mind, a stage beyond the clear consciousness of inadequacy, a disguise, a mask, a distortion, a camouflage, it is a very superficial form of disguise. The inferiority complex—using the term in its exact sense—is not very important and is easily dealt with. Those, for example, who wish to become psychotherapists, and get themselves analysed in order, so to speak, to have a mental cleansing before starting work, get rid of their inferiority complexes fairly quickly in the course of their analysis. The inferiority complex is at a relatively superficial level of the mind, and the more unconscious levels have yet to be reached.

Deeper Analysis

I found it not surprising, when in 1926 I came to know Alfred Adler personally, that he did not consider it necessary to carry out really deep and prolonged analyses, even in special cases. I think that that attitude was unfortunate for the Adlerian development of psychology. Adler stated that he could generally sum up his patient in one or two interviews—an insult, really, to human nature to suggest that it can be so casually explored. To go deeper one must have recourse to Sigmund Freud's analytical method and general explanatory system (whatever one may think of his central theory), with its conception of *libido*, sexual energy in its widest sense, which supports and sustains the world, the Ἔρως of Greek philosophy and myth, rooted in the physical, and yet transcending this in æsthetic and spiritual insight and inspiration.

Directly the *libido* is brought in, we reach a much deeper level of the mind. The *libido* is relatively impersonal, as contrasted with the organized ego ; it is the *Id* (*das Es*), it is something below and beyond the individual and for the most part unconscious. The individual, as Jung said, is rather like a frail craft floating on the turbulent waters of the unconscious. Jung took the *libido* in a wider sense than that of Freud, as meaning instinctive energy in general, somewhat, though not exactly, like the *élan vital* of Bergson's philosophy. Using the conception in the narrower, Freudian sense, we find reactions of a complex nature, where love may be linked up at a primitive level with aggressiveness or destructiveness, with *sadism* as a result. Later, mental reactions to this sadism may produce an obsessed type of personality. At the level of the inferiority complex there is just wounded self-love, self-centredness. Self-love or narcissism, according to the Freudian theory, is a fixation of *libido* upon oneself. But it should be projected upon others and should result in the linking up of individuals in the group, sustaining the loyalty of the individuals of the group to a leader, where a leader is involved, and making the individuals "members one of another", to use the Pauline phrase.

This love or *libido* in its original form is both homosexual and heterosexual. It can be felt for individuals of the same as well as for those of the opposite sex. Freud held that there is a homosexual constituent of the *libido* in everyone, which normally becomes sublimated before and at adolescence. It emerges in feelings of friendship, good-fellowship and group loyalty. It is expressed in that beautiful lament of David for Jonathan (Samuel II, Ch. i, §§ 17–27), and in Shelley's "Adonais", his elegy on the death of Keats. On the heterosexual side, however, love or Eros is more deeply held, because here it has a physical function to serve, that of handing on the torch of life to the next generation, but it too becomes spiritualized in its higher forms. There is such a thing as "a love passing the love of women", and, higher still, that *Amor intellectualis Dei* which Spinoza took as the goal and guiding star of his system of philosophy.

The Paranoid Tendency

This leads me to the consideration of a mental tendency which in my research work in medical psychology I am learning to regard as of great importance, namely, the paranoid tendency. It is rooted in unconscious mental activity, at a deeper level than that supporting an inferiority complex, in relation to the development of the super-ego (the primitive psychological basis of conscience) by the processes of introjection and projection. This deeper root is its relation to the *libido*, mainly though not exclusively to the homosexual element in it. I am not yet sure to what extent the paranoid tendency may be linked up with heterosexual *libido* ; it may be not infrequently so. But in full-blown paranoia, where the paranoid tendency appears in, as it were, pure culture, repressed homosexuality seems to be invariably present and the main cause of the delusional system (*Wahnsystem*).

This condition of paranoia, which has a hereditary basis, is not so rare a mental illness as the few cases seen in mental hospitals would suggest. It is more a general type of character and personality than a special mental disease or psychosis, with *fanaticism* as an outstanding characteristic. The paranoiac is born rather than made, and if his family history be inquired into there will generally be found some evidence of the same tendency in previous generations, showing itself sporadically in the family tree. The trouble about the paranoiac is that he is detected and dealt with only when he becomes an evident danger to himself and to others. It is then that he is placed in a mental hospital. But few paranoiacs are found in mental hospitals—the broken-down failures in this line of personality ! The majority of them escape general notice and detection and are out in the world, causing a great deal of family and social disturbance. I venture to say that they are a greater danger to world peace than any other type of mental

abnormality. The earlier they are tracked down the better.

But the 'paranoid tendency', which is not identical with paranoia, is still more widespread, and may appear in everyone at some time or other, manifesting itself unmistakably under some particular mental stimulus or provocation. I mean by the paranoid tendency a general disposition to misjudge people, to become suspicious without adequate grounds, to feel that people are working against one when they are not really doing so. The main psychological mechanism involved is that of projection—a projection of the person's aggressiveness and hostility upon others. The tendency is to be explained by the fact that the individual does not fully understand himself and has inadequate control of his excessive aggressiveness.

A person suffering from paranoia, as distinct from the more general paranoid tendency, is usually of a very aggressive temperament, and because of that, his *libido* has a very rough passage in his mental development. Usually he does not 'get on with' the other sex. The homosexual constituent in his *libido* is more pronounced than the heterosexual. His aggressiveness also is linked up with feelings towards his own sex, with homosexual tendencies which have been repressed instead of being adequately sublimated. The homosexuality is not admitted by the person concerned; it is rejected and denied. Under repression, the love is actually turned to hate in the unconscious. This hate is then 'projected' upon the other person. He believes that this other person hates him and therefore persecutes him. The person whom he was ready to love but would not allow himself to love becomes in imagination his persecutor.

Thus the development of persecution mania begins. It is one stage in the development of the average paranoiac. But he may go further and for two alternative reasons develop megalomania. The ordinary explanation of the development of megalomania is that the individual supposes himself persecuted and then asks himself, "Why are all these people against me?" He comes to the conclusion that he must be a very important person if all these others find it necessary to combine against him in this way. He may go so far in his vision of himself as to consider that he is a kind of Messiah, with a special mission.

The other alternative is Freud's explanation, that the *libido* in such a case is withdrawn altogether from the outer world, and fixed upon the self or ego, thus narcissistically inflating the ego, and producing a regression to infantile narcissism. Megalomania, in Freud's view, is of an infantile nature, and represents a regression or step back from sublimated homosexuality to the infantile stage of narcissism, or fixation of *libido* upon the ego*.

Thus we have the two fundamental characteristics of full-blown paranoia: persecution mania (*Verfolgungswahn*), and megalomania (*Grössenwahn*). Paranoia is well defined in Kraepelin's words as "the insidious development, following from inner causes, of a lasting unshakable delusional system (*Wahnsystem*), which proceeds with complete preservation of clearness in thinking, willing and acting".

But the paranoid tendency is of much wider incidence, revealing itself in relatively normal individuals in special mental situations, with wrongful imputing of motives and misunderstanding of intentions, so that such people are unnecessarily suspicious and 'on the defensive', taking offence where none is intended and "fleeing where none pursueth". The tendency is linked up with aggressiveness and possibly with the (incompletely sublimated) homosexual constituent of the *libido*, and with a distorted development of the super-ego through the processes of introjection and projection which occur in the young child's mind in relation to parents, nurses, etc.

* Sigmund Freud, "Collected Papers", 3, 449–452 (Hogarth Press, 1925).

The Situation in Germany

This discussion has an important bearing on the psychological situation in Germany to-day. Many people are content to sum up the problem from the psychological side by saying simply and baldly, "Germany has an inferiority complex", "Hitler had an inferiority complex". No doubt both leader and nation had inferiority complexes in full measure, but these superficial distortions of their minds are not adequate to explain their outrageous behaviour in the last few years. It is something deeper than an inferiority complex which is concerned in the German problem, namely, a paranoid tendency. I have always said that Hitler was a paranoid personality. He was already suffering from some degree of persecution mania and megalomania in the days of his rise to power. The state of his mind was very characteristically shown in his reactions to the Jewish problem in Vienna, as described in Chapter 2 of "Mein Kampf". Hitler's reactions to Jewry and to Bolshevism were paranoid reactions. The line he took, that "terror must be met by terror", is the attitude of the paranoid personality. He was always in a state of defence, arming himself against what must have been at first an imaginary situation, however real it may have become later on owing to his own acts.

No one can be paranoid who fully understands himself. Hitler did not understand himself. To himself he was a knight in shining armour; and the people of Germany, after long-continued disappointment and frustration, came to accept him at his own valuation, especially when he received the support of the military and of 'big business'. The nation had lost its way, and here it found someone who seemed to believe in himself, and accordingly it came to believe in him. The paranoid person, on the surface, does believe in himself; so, for that matter, does the real Messiah, but Hitler was a false and not a real Messiah*.

The people rallied to him, step by step—I need not go into the history of the rise of National Socialism in Germany. He collected around him a number of paranoid individuals, or at any rate psychopathic personalities. The Nazi leaders seem all to be, or to have been, more or less abnormal.

Spread of the Paranoid Tendency

The psychological consequences of all this in the development of the German nation are clear. The people had become desperate and had lost their way. They were encouraged to be aggressive because they were told, and believed, that they were encircled again, and that others wanted to wipe them out. That was the very simple propaganda repeated by Goebbels on every occasion. "This war which was forced upon us. . . ." Goebbels revealed himself most clearly as a classic example of 'acquired paranoia'

* Hitler was also hysterical, and suffered from hysterical blindness at the end of the War of 1914–18 (see "Mein Kampf", p. 223 in the German edition).

(if one may coin such a phrase) in some of his weekly articles in the Nazi publication, *Das Reich*. In the literal sense, of course, paranoia cannot be acquired; it is inborn in the individual, but it can take a collective form which is acquired in the group. It has been pointed out by psychologists that as soon as a group is formed the paranoid tendency may spring up as a collective characteristic*. It seems to be a fundamental tendency in group psychology. One group may become paranoid in relation to another. Groups of all kinds link up or develop hostilities towards one another; and if their members are put into uniform the paranoid tendency is magnified.

Germany is going to be one of the great political and psychological problems of the next generation. It is a problem which will require to be dealt with in a strictly scientific way, by the accumulation of facts, not of phantasies or rumours, and the arrangement of such facts in relation to possible hypotheses, which must be tested and confirmed. To this problem some Germans themselves will make valuable contributions. It will be a problem for us all for a generation, for it cannot be left unsolved. We cannot leave a political vacuum in the middle of Europe.

The above essay was written before the cessation of hostilities. But now that Germany and Japan have been completely defeated and the atomic bomb has been invented and used, national mentality and the group mind are in need of understanding and control as never before. It is easier for an atom bomb to wipe out a city than a mental complex. The sciences of psychology, sociology and politics must not fall too far behind the physical sciences in their future development, if ultimate disaster is to be avoided.

* H. Schulte: "Versuch einer Theorie der paranoischen Eigenbeziehung und Wahnbildung", *Psych. Forsch.*, 5 (1924).

NEWS and VIEWS

New Sibthorpian Professor at Oxford: Mr. G. E. Blackman

Mr. Geoffrey Blackman, son of Prof. V. H. Blackman, goes to Oxford next term as Sibthorpian professor of rural economy. He succeeds Prof. J. A. Scott Watson, who last year joined the Ministry of Agriculture as chief education and advisory officer. Mr. Blackman was educated at King's College School, and at Cambridge (St. John's) where he took both parts of the Natural Sciences Tripos. After a year of postgraduate work in the Soil Physics Department at Rothamsted, he took up, in 1927, the headship of the Botany Section of the Jealott's Hill Research Station, Berkshire, then newly established by Imperial Chemical Industries, Ltd. In one sense his researches during his eight years tenure of the post were directed to practical ends, such as the improvement of pasture by various combinations of fertilizer and grazing treatments, and the use of various chemicals in the control of weeds. But he contributed materially to the application of modern statistical methods to the botanical analysis of pastures and, what was more important from the long-term point of view, played his part, along with the Aberystwyth workers and others, in developing the ecological approach to grassland problems and to those of weed-crop competition.

Since 1935, Mr. Blackman has been lecturer in plant ecology at the Imperial College, London. He was also, for three years before the War, assistant science editor of the *Gardeners' Chronicle* and, since 1942, has been honorary secretary of Biology War Committee. Also, since 1941, he has headed a team of workers, under the Agricultural Research Council, who have been engaged on two major projects. One is the introduction from overseas of improved varieties of oil seeds (sunflower, soya bean and linseed) and maize. This work is still in progress, but has already shown that certain North American linseeds are greatly superior to the mixed La Plata type previously grown; that sunflower seed of good quality can be produced in Britain; and that certain of the new hybrid types of maize, from the northern United States and Canada, have great promise as forage crops, and especially as silage crops, in southern England. The other project has been a continuation of the long search for more effective and more highly selective herbicides. The practical results already achieved are very important. For example, sulphuric acid, in appropriate concentration, has almost eliminated the laborious process of weeding onion crops; copper nitrate, copper chloride and the sodium salt of di-nitro-*ortho*-cresol can be safely and effectively used on flax. Sulphuric acid, applied before the emergence of crop seedlings, is of great value in the case of crops such as carrots and beet which, on account of their slow initial growth, are specially liable to be smothered by quick-growing annuals. But most remarkable has been the discovery that certain plant-growth substances, applied at rates of the order of a pound per acre, completely destroy certain species and leave others quite unharmed. One of these materials (C.L.C.), which will soon be available in quantity, is very strongly toxic to a large number of dicotyledonous plants, and harmless to cereals and most other monocotyledons. It is to be hoped that Mr. Blackman will find at Oxford time and facilities to continue this extremely profitable line of work.

Advisory Committee on Atomic Energy

In reply to several questions asked in the House of Commons, the Prime Minister has stated that many questions involved in the future of atomic energy, including that of the international handling of the subject and its possible development for industrial purposes, are engaging the attention of the Government. To assist the Government in dealing with the far-reaching questions raised by the discovery, both as regards its international treatment and its further development in Britain, whether for industrial or military purposes, the Government has appointed the following advisory committee: Sir John Anderson (chairman), Sir Alexander Cadogan, Permanent Under-Secretary of State, Foreign Office; Field-Marshal Sir Alan Brooke, chief of the Imperial General Staff; Sir Alan Barlow, Second Secretary of the Treasury; Sir Edward Appleton, secretary of the Department of Scientific and Industrial Research; Sir Henry Dale, president of the Royal Society; Prof. P. M. S. Blackett, Langworthy professor of physics in the University of Birmingham; Sir James Chadwick, professor of physics in the University of Liverpool; and Sir George Thomson, professor of

[None of the vacancies in these columns relates to a Man between the ages of 18 and 50 inclusive or a Woman between the ages of 18 and 40 inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1945, or the vacancy is for employment excepted from the provisions of that Order.]

COUNTY BOROUGH OF ROTHERHAM EDUCATION COMMITTEE

COLLEGE OF TECHNOLOGY

Principal: F. C. CLARKE, Esq., B.Sc., A.R.C.Sc., A.M.I.E.E.

Applications are invited for the following posts:

(i) LECTURER IN ELECTRICAL ENGINEERING. Candidates should possess an Honours degree or equivalent qualification in Electrical Engineering or Physics (with Radio) and should preferably have specialized on the light current (Radio, Telecommunications and Measurements) branch. Industrial experience or Technical experience in the Services will be an advantage. Salary will be in accordance with the new Burnham Technical Scale.

(ii) LECTURER IN ELECTRICAL TECHNOLOGY AND MAINTENANCE. Candidates should possess a degree or equivalent qualification in Electrical Engineering and should have had considerable practical experience in the Maintenance of Electrical Equipment. Salary will be in accordance with the new Burnham Technical Scale.

(iii) INSTRUMENT MECHANIC. Candidates should have had considerable experience in the repair and maintenance of electrical, physical and optical instruments and apparatus. Salary £5 10s. to £6 10s. per week according to qualifications and experience.

Further particulars and application forms may be obtained from the undersigned and should be returned immediately.

J. A. MAIR,
Director of Education.

Education Offices,
Rotherham.

UNIVERSITY OF BRISTOL

DEPARTMENT OF AGRICULTURE AND HORTICULTURE,
LONG ASHTON, BRISTOL

Applications are invited for the post of Organic Chemist at Long Ashton Research Station, which will become vacant on September 1, 1945.

The appointment will be in the Scientific Officer grade under the scheme of the Ministry of Agriculture Research Institutes with a commencing basic salary in the £500–£600 range with superannuation and bonus added.

Candidates should possess a University Degree and have had considerable research experience in Organic Chemistry. Further particulars may be obtained from the undersigned, to whom applications, together with copies of three recent testimonials, should be addressed not later than September 15, 1945.

WINIFRED SHAPLAND,
Secretary and Registrar.

The University,
Bristol, 8.

GORDON MEMORIAL COLLEGE, KHARTOUM

LECTURESHIP vacant as from January 1, 1946, in CHEMISTRY. Preference would be given to a candidate of considerable seniority and of exceptional qualifications who has done a good deal of research in addition to University teaching. In this case the post would be combined with that of Dean of the School of Science. Non-pensionable, salary £E.900 to £E.1,500 per annum, depending on age, qualfications and experience. (£E.1 = £1 0s. 6d.)

In the event of a suitable senior candidate not being available a highly qualified younger man would be accepted. In this case the post would not be combined with that of Dean and the salary would be in the scale of £E.675 to £E.1,350 non-pensionable, the point of entry depending on age and experience.

Write, quoting F.4717.A, 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.

THE ROYAL TECHNICAL COLLEGE, GLASGOW

APPOINTMENT OF DIRECTOR

The Governors invite applications for the Directorship of the College, which will shortly become vacant owing to the retirement, under the Superannuation Rules, of the present Director.

The commencing salary will be £1,750 per annum.

Further particulars may be obtained from the Secretary, to whom applications must be sent not later than October 20, 1945.

CHELSEA POLYTECHNIC

DEPARTMENT OF BIOLOGY
LABORATORY STAFF

The following posts are vacant:

For General Physiology.

LABORATORY STEWARD, salary scale £190 to £250 p.a.

LABORATORY ASSISTANT, wages 35/- a week at 16, 40/- at 17, and a minimum of £140 p.a. at 20 years of age or over, rising to £215 p.a.

A war bonus (varying according to age—23/- per week at 21 years) is at present payable in addition to the basic scale of pay.

For Zoology.

LABORATORY STEWARD, scale as above.

LABORATORY ASSISTANT, scale as above.

Applications for the posts, with details of experience, should reach the Principal, Chelsea Polytechnic, Manresa Road, S.W.3, not later than September 8.

NATAL UNIVERSITY COLLEGE PIETERMARITZBURG

Applications are invited for the post of LECTURER IN PSYCHOLOGY. Special qualifications in Experimental Psychology, experience in research methods and/or in Child Guidance work would be an additional recommendation. Salary scale: Men, £450 × 25 — £600; Women, £350 × 25 — £500; plus current cost of living allowance. Initial salary will be determined in accordance with qualifications and experience. Appointment in first place for probationary period of one year. Further particulars may be obtained from the Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1.

Closing date for receipt of applications, October 7, 1945.

THE PHARMACEUTICAL SOCIETY OF GREAT BRITAIN

BRITISH PHARMACEUTICAL CODEX and EXTRA PHARMACOPOEIA: Applications are invited from pharmacists for the post of EDITOR of these publications. Applicants should have had wide general pharmaceutical experience and the possession of a medical qualification will be an advantage. Salary £1,000 to £1,500 per annum according to experience. The holder of the post is required to join the Society's superannuation scheme which is in accordance with the Federated Superannuation System for Universities. Applications should reach the Secretary, 17 Bloomsbury Square, London, W.C.1, not later than October 15.

THE UNIVERSITY OF MANCHESTER

ANGLO-SAXON PETROLEUM COMPANY'S SCHOLARSHIP IN GEOLOGY

Applications for the above scholarship should be sent to the Registrar, The University, Manchester, 13, before September 15, 1945. The scholarship is of the annual value of £140 plus fees, and is tenable for not more than three years. The Scholar will be required to take the Honours Course in Geology. Applicants should give full name and address, date of birth, a short summary of schools attended, and full particulars of any examinations taken. Candidates may be required to attend for interview.

THE UNIVERSITY OF SHEFFIELD

Applications are invited for the post of ASSISTANT LECTURER in GEOLOGY. Salary £350 to £400 (according to qualifications and experience) in the first year, with Superannuation provision under the Federated Superannuation Scheme for Universities. A higher salary might be offered to a specially qualified candidate. The duties of the post will begin on December 1, 1945 (or as soon afterwards as may be arranged). Applications (three copies) including, if possible, three testimonials and the names and addresses of three referees, should reach the undersigned (from whom further particulars may be obtained) by October 31, 1945.

A. W. CHAPMAN,
Registrar.

UNIVERSITY OF ABERDEEN

Session 1945–1946

WINTER TERM, 1945

The WINTER TERM will OPEN on Tuesday, October 16, 1945, and will CLOSE on Friday, December 21, 1945.

SPRING TERM, 1946

The SPRING TERM will OPEN on Tuesday, January 15, 1946, and will CLOSE on Friday, March 22, 1946.

SUMMER TERM, 1946

The SUMMER TERM will OPEN on Tuesday, April 16, 1946, and will CLOSE on Friday, June 21, 1946.

H. J. BUTCHART,
Secretary.

UNIVERSITY OF ABERDEEN

ASSISTANT IN BOTANY

Salary £300 to £350 according to qualifications.

Applications should be sent as soon as possible to the Secretary to the University, from whom further particulars may be obtained. The Assistant will take up duty on October 1, 1945.

H. J. BUTCHART,
Secretary.

The University,
Aberdeen.

UNIVERSITY OF ABERDEEN

APPOINTMENT OF ASSISTANT IN MATHEMATICS

Salary £300 to £350 according to qualifications.

Applications should be sent not later than September 15, 1945, to the Secretary to the University, from whom further particulars may be obtained. The fact that a candidate has applied for, or been appointed to the, Assistantship will not prejudice his application for the Lectureship in Mathematics.

H. J. BUTCHART,
Secretary.

The University,
Aberdeen.

THE POLYTECHNIC

REGENT STREET

DEPARTMENT OF MATHEMATICS AND PHYSICS

Courses of Lectures on elementary and advanced MATHEMATICAL STATISTICS, designed to meet the needs of scientists and engineers, will commence on Tuesday, October 2, 1945.

Full particulars may be obtained on application to the undersigned.

J. C. JONES,
Director of Education.

The Polytechnic,
309 Regent Street,
London, W.1.

ABERDEEN UNIVERSITY VACANCY

REGIUS CHAIR OF NATURAL HISTORY

The Secretary of State for Scotland announces that he proposes to invite applications for the office of Regius Professor of Natural History at Aberdeen University, which will become vacant on January 1, 1946.

Applications for the Chair, accompanied by two copies of recent testimonials, should be addressed to the Private Secretary, Scottish Office, Fielden House, 10 Great College Street, London, S.W.1, and should reach him not later than October 15, 1945. A note of the terms and conditions of the appointment will be supplied on request.

MASSEY AGRICULTURAL COLLEGE

(UNIVERSITY OF NEW ZEALAND)
PALMERSTON NORTH, NEW ZEALAND

LECTURER IN VETERINARY SCIENCE

Applications are invited for the above position. Commencing salary £675 per annum (New Zealand currency).

Conditions of appointment may be obtained from the High Commissioner for New Zealand, Strand, London, W.C.2.

C. C. YATES,
Registrar.

MASSEY AGRICULTURAL COLLEGE

(UNIVERSITY OF NEW ZEALAND)
PALMERSTON NORTH, NEW ZEALAND

ASSISTANT LECTURER IN DAIRY TECHNOLOGY

Applications are invited for the position of Assistant Lecturer in Dairy Technology. Salary £335–£515 per annum (New Zealand currency) according to qualifications.

Conditions of appointment may be obtained from the High Commissioner for New Zealand, Strand, London, W.C.2.

C. C. YATES,
Registrar.

LONDON (ROYAL FREE HOSPITAL) SCHOOL OF MEDICINE FOR WOMEN

(UNIVERSITY OF LONDON)

8 HUNTER STREET, BRUNSWICK SQUARE, W.C.1

Applications are invited from men and women holding degrees in Physiology or Medicine for the post of DEMONSTRATOR IN THE PHYSIOLOGY DEPARTMENT, from October 1, 1945, at an initial salary of not less than £300 per annum with superannuation benefits.

Further particulars may be obtained from the Warden and Secretary, to whom applications should be sent by September 10, 1945.

Applications are invited for the post of Laboratory Assistant in the Division of Histology, Royal Veterinary College. Some knowledge of histological technique desirable. Applications, stating age, experience and pay required, should be sent to The Bursar, Royal Veterinary College, Camden Town, N.W.1, not later than September 15.

For sale.—Petrological Microscope Bausch and Lomb, Model LCH; Occulars 7, 5, 10 and 12.5; objectives 32 mm., 16 mm. and 4 mm. Offers to Allan, 10 Warrender Park Crescent, Edinburgh.

Grade B. Technician required in Physiology Department to commence duty end of September. Salary not less than £220 per annum with opportunities for advancement. Applications should be sent to: Vice-Dean, St. Bartholomew's Hospital Medical College, at Queens' College, Cambridge.

Woman Graduate in Chemistry and Metallurgy, Linguist, 8 years experience abstracting, translating, editing, seeks responsible post. Box 397, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM

THE LABORATORY, PLYMOUTH

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

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

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physics at the Imperial College of Science and Technology, London. In response to further questions as to the precise functions of this committee, Mr. Attlee stated that it will advise the Government both with regard to the scientific progress and the general background of the whole subject, but that the Government itself will decide questions of policy arising out of the discovery.

The True Foundations of Peace

THE recently published draft proposals for an Educational and Cultural Organization of the United Nations (London: H.M. Stationery Office. 2*d.* net) have received the welcome due to a document answering to one of the first needs of the hour. Ever since 1942, discussions among Ministers of Education or their equivalent in the United Nations have taken place, and the organization now proposed has developed therefrom. In these discussions, Mr. R. A. Butler took an active part from the first. The draft proposals will form the basis of discussion at a conference to be opened in London on November 1. That conference will be one of the first results of the San Francisco deliberations, and the organization in question will be the first "specialized agency" to come into being under the relevant clause of the United Nations Charter.

The cardinal aim of the organization is "to develop and maintain mutual understanding and appreciation of the life and culture, the arts, the humanities and the sciences of the peoples of the world". This truly magnificent aim the organization will seek to further by various means. It will facilitate consultation among leaders in educational and cultural life, assist the free flow of ideas and information through every established medium with special attention to the exchange of information on educational and cultural developments, including advances in scientific knowledge, foster the growth in each country of measures to give support to international peace and security, conduct and encourage research into the problems related to the maintenance of peace and advancement of welfare, and assist countries that need and request help in developing their educational and cultural activities. The organization will operate through a conference, an executive board, and a secretariat. It is intended that the conference shall meet at least once a year and that all activities related to the functions of the organization shall be reported periodically. It is to be hoped that the conference to be opened in London on November 1 will be the beginning of great things in the cause of human progress and welfare.

Books and Journals for Holland and Denmark

INFORMATION regarding the conditions of life in scientific departments is beginning to come from Central Europe. After privations of various kinds Prof. O. Winge, Dr. Westergaard, Dr. A. Skovsted and Dr. C. A. Jorgensen in Denmark have now returned to their posts. One of their greatest difficulties is that they have been cut off from all knowledge of science in the rest of the world, and they are in great need of scientific journals, reprints and similar information. The conditions in Holland and France are even worse, since in many cases the Germans removed anything of scientific value that they could lay their hands on. It is possible to send letterpress to Sweden, Denmark, France and Holland through the Censor in Charge, Postal and Telegraph Censorship Dept. Permit Branch, Aintree, Liverpool, if these are marked "Paragraph 42" and the weight does not exceed 1 oz. for Holland and Denmark, or 4 lb. for Sweden and France. Dr. F. W. Sansome, Botanical Department, University, Manchester, 13, to whom we are indebted for the above information, states that he would be glad to aid in the transmission of such parcels if any difficulty is met with in transmission through the normal channels.

Nietzsche and Science

MARIO BUNGE (*Revista Continental de Filosofia*, 2, No. 4, Nov.–Dec. 1944) has written a useful perspective of Nietzsche's attitude towards science. Nietzsche's main ideas are both anti-scientific and anti-rational, and his own confession, "I know very little about the results of science", was quite unnecessary, as is obvious from the puerility of his views on different sciences. Apart from his great influence on contemporary thought—which is not always recognized—he was a typical product of the decadence of European culture, and in general of the decadence of the philosophy which originated with positivism and culminated in the modern anti-intellectualism. Hence, Bunge says, we may say that Nietzsche is not only the direct forerunner, but also to a large extent the characteristic exponent, of so-called modern philosophy. He attempted to destroy standards of values and to create others, and he made no secret of the fact that those he wished to destroy were cultural—the scientific, philosophical, ethical, æsthetic, religious, etc., and above all, the social and political values which were an obstruction to the *junker* class. His attitude towards cultural interests is seen in his reply to the question, "What is science ?", and the whole epistemology of Nietzsche is summed up in this reply: "It is the experience of men for their instincts and the instinct to know their instincts." The *summum bonum* is the instinctive life, not just an animal existence, but the free manifestation of the desire for domination; not the longing for quiet joy, but the peril of action, the struggle, and through this the ascendancy. Nietzsche had no desire for science but for knowledge; though not knowledge of the contemplative kind, but a knowledge active and authoritative. His ideas do not constitute so much a system of philosophy as a vague and obscure vision of the world, more suitable to a demoniac than to a philosopher seeking truth. In short, one might say that his attitude to science is, generally speaking, negative; and when it is not that, it is something much worse—a restrained pretence but brutal and also pragmatic in the worst sense, namely, that of the prostitution of science as a priestess of Moloch.

British Universities

IN *Britain To-Day* of May 1945 (No. 109), Sir Charles Grant Robertson, in an article entitled "The Idea of a University", analyses some of the characteristics of British universities as a whole. He discusses their claim to contribute an interpretation of life, built up through centuries of effort and travail, which has enabled them to survive grim ordeals and emerge stronger and purified by the struggle and which embodies the fundamentals of any civilization worth the name. First, Oxford and Cambridge and, through them, the modern universities represent in an unbroken tradition and growth the medieval ideal. Secondly, no British university has been created, endowed or maintained by the State, and until 1920

the State did not contribute either to capital or to income expenditure. Thirdly, British universities are now co-educational, and the one imperative condition imposed on them is that unqualified persons should not be let loose on the community. Fourthly, the universities, if not the sole, are the main avenues to the professions and to all branches of teaching. They are second to none in the range and quality of their studies, equipment and teaching, and the demand for strengthening every form of research comes primarily from the universities, because their staffs know what can and ought to be done, and enlighten the community by doing it. Finally, after emphasizing that the freedom and independence of British universities are a sure guarantee of their capacity to meet the needs of the future, Sir Charles insists that, in accordance with the medieval ideal, a university is not a real university unless its members pray together, work together and play together.

New Film-Strip Projector

In the field of education, the post-war period is likely to be characterized by a marked increase in the use of visual aids. The ordinary lantern will most probably be replaced, except for large audiences, by the film-strip projector. The advantages of this newer form of projector are many and do not require elaboration. Further, it is likely that the film-strip projector will be used for educational purposes in conjunction with a sub-standard cinematograph projector; for, to-day, the complete visual unit comprises a film together with film-strips, charts, etc. Although a few associations have concerned themselves with visual education during recent years, progress has not been possible because of the lack of projectors for films and film-strips. To-day, the outlook is brighter, and Messrs. Dufay-Chromex, Ltd., 14 Cockspur Street, London, S.W.1, announce that they will have a new film-strip projector on the market in the near future. It is of attractive design and incorporates many new ideas which have been developed while the machine has been in use with various Service Departments. Several features are worthy of special mention. The gate is modelled on that of a cinematograph projector, and traction of the strip is effected by a lever which, with a single movement, advances the strip one frame. The gate is adaptable for three sizes of frame which are in common use. The optical unit merely slides in the lamp house, thus permitting the easy replacement of a projection lamp. The film is kept flat in the gate by a glass plate, the pressure on which is removed as the film is passed through.

Earthquakes During the First Quarter of 1945

During the first quarter of 1945, fourteen earthquakes were registered by the seismographs at King's College Observatory, Aberdeen, and Dr. A. E. M. Geddes reports that the instruments were not working during March 7–21. The largest shock was on February 10, registered at Aberdeen at 05h. 9m. 48s. G.M.T. from an epicentre estimated distant 77·4°, and developed a maximum ground amplitude on the east component at Aberdeen of 178 μ at 05h. 36m. 11s. G.M.T. At the Dominion Observatory at Wellington, New Zealand, six strong earthquakes were registered during February and five during March. The earthquake on February 26, with epicentre about 77° from Wellington, was a deep-focus shock, the focus being 180–200 km. below the surface of the earth. The earthquake of March 18 had its epicentre south of the Kermedecs, only about 7 km. distant from Auckland, New Zealand. The greatest felt earthquake in New Zealand during February occurred on the 18th and was felt in north-west Nelson with intensity on the modified Mercalli scale of 4. During March fifteen earthquakes were felt in New Zealand, the greatest intensity being scale 4 at New Plymouth on March 11, in the northern part of South Island and the Cook Strait region on March 12, at Wairoaton on March 19 and at Masterton on March 19 (separate shock).

During March, twelve earthquakes and tremors were registered by the seismographs at the geophysical observatory at Toledo, Spain. The strongest of these was on March 18; *iPz* registered at 00h. 09m. 33s. G.M.T. from an epicentre some 76° distant, and a ground amplitude of 35 μ was attained at Toledo at 00h. 33m. 21s. G.M.T. The United States Coast and Geodetic Survey, in co-operation with Science Service and the Jesuit Seismological Association, has determined the provisional epicentre of the earthquake of March 17, using reports from ten seismographic observatories, to be at lat. 6·9° N., long. 78·0° W., which is off Colombia.

Announcements

The centenary celebrations of the Imperial College of Science and Technology, London, will take place during October 25–27. The opening meeting will be held in the Albert Hall, and will be attended by the King, as visitor of the College, who will be accompanied by the Queen.

The fifth series of postgraduate lectures arranged by the London Section of the Oil and Colour Chemists' Association will be delivered by Prof. E. N. da C. Andrade, who will speak on "Viscosity and Plasticity". The lectures will be given at the Royal Institution, Albemarle Street, London, on October 11, 18 and 25, at 6.30 p.m. Admission will be by ticket only (price 10*s.*), applications for which must be sent to David E. Roe, c/o Atlas Preservative Co., Ltd., Fraser Road, Erith, Kent.

The following appointments in the Colonial Services have been made: J. McA. Todd, to be plant pathologist, Gold Coast; R. E. T. Hobbs, agricultural officer, Kenya, to be senior agricultural officer, Kenya; A. C. Maher, agricultural officer, Kenya, to be senior soil conservation officer, Kenya; O. S. Swainson, principal agricultural officer, Nigeria, to be senior agricultural officer, Zanzibar; T. Y. Watson, agricultural officer, Kenya, to be senior agricultural officer, Kenya; I. R. Dale, assistant conservator of forests, Uganda, to be senior assistant conservator of forests, Uganda; A. Foggie, assistant conservator of forests, Nigeria, to be senior assistant conservator of forests, Nigeria; J. C. Rammell, senior assistant conservator of forests, Kenya, to be conservator of forests, Kenya.

The Museum Book Store, Ltd., 45, Museum Street, London, W.C.1, state that they have acquired the library of the late Prof. Hans Sachs (see *Nature*, May 19). The collection includes long runs of the *Centralblatt für Bacteriologie, Zeitschrift für Immunologie*, etc., and some ten thousand reprints in 119 labelled boxes. Particulars will be sent on request.

LETTERS TO THE EDITORS

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

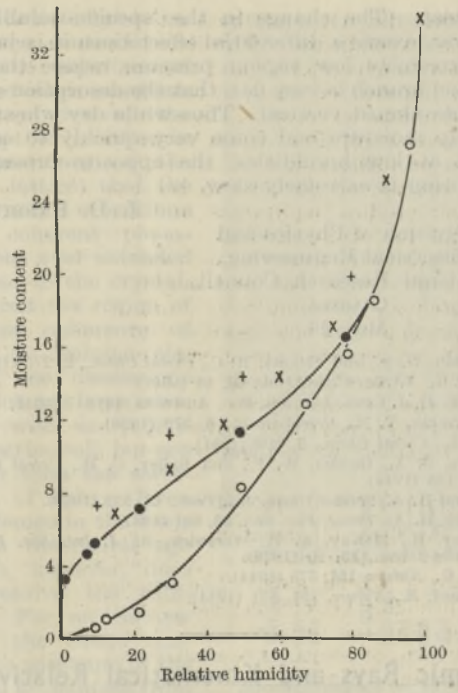
Hysteresis in the Adsorption of Water Vapour by Wheat

THE water-vapour adsorption isotherm for wheat has been measured by several workers[1,2,3]. These measurements have been made under similar conditions; the wheat, which was initially at a moisture content corresponding to average storage conditions (~ 13·5 per cent of dry weight), was exposed to a series of atmospheres maintained at definite relative humidities. The equilibrium was attained in all measurements from a relatively high moisture content, and no attempt was made to study the phenomenon at extremely low relative humidities. In particular, no distinction was made between adsorption and desorption, so that it was not clear whether hysteresis was present or not.

Fairbrother[4] has reported that dried wheat flour does not completely regain its moisture content when re-exposed to the original relative humidity. He also found that wet and dry wheat, when mixed, do not reach equal moisture contents, that of the dry wheat always remaining about 2 per cent below that of the wet. Pap[5] and Ankers, Geddes and Bailey[6] have substantiated these observations. It appears from this that hysteresis is present in the adsorption of water vapour by wheat, and Fairbrother has suggested it as an explanation of his observations.

In the course of some work in this laboratory, we have measured the equilibrium moisture content for some No. 1 Garnet wheat at various relative humidities for both increasing and decreasing relative humidities; a very definite hysteresis has been found. This is shown in the accompanying graph, where for comparison purposes the results of Coleman and Fellows[1] and those of Gane[2] have been reproduced. The measurements in this work were made by means of a McBain sorption balance, and all moisture changes were carried out in an atmosphere of water vapour, the air being completely exhausted from the apparatus. The relative humidities were maintained by means of saturated solutions and were measured with a vacuum oil manometer. The temperature of the measurements was 24·5° C.

The slope of an adsorption isotherm at any point gives the change of moisture content per unit change in relative humidity. This quantity is analogous to the specific heat in the corresponding relation between heat content and temperature, and Daynes[7], in considering adsorption by rubber, has called it the 'specific solubility' and designated it by the symbol S_h. Daynes[8] has pointed out that with an adsorption isotherm such as that of rubber, which is convex towards the humidity axis, S_h increases rapidly as the moisture content increases, and the approach to equilibrium at high humidities is a very slow process. On the other hand, in drying, S_h becomes progressively smaller as the humidity is reduced, and desorption proceeds rapidly and quickly approaches an end-point. The reverse of this effect has been observed with leather, which has been found to take up moisture quickly and to be very slow in drying[9]. On Daynes' reasoning this is the result of the fact that the isotherm for leather is concave to the humidity axis.



○, adsorption; ●, desorption; ×, Coleman and Fellows' average for hard red winter wheat at 25° C.; +, Gane, weak wheat at 20° C.

When hysteresis is present, the 'specific solubility' will not be the same for adsorption and desorption. With an isotherm such as that shown, the adsorption curve is convex to the humidity axis throughout, while the lower part of the desorption branch is concave. We should therefore expect a progressively slow up-take of moisture such as is found with rubber and, equally, a slow drying corresponding to that observed with leather. In point of fact, moisture changes do take place slowly with wheat, but it is with the drying of wheat at low humidities where the effect is most noticeable. It is a long and difficult process to extract the last few per cent of water from wheat by means of a desiccating agent or a vacuum; if the wheat is to be dried within a reasonable time, it is necessary to use a vacuum oven-drying method. The shape of the isotherm offers an explanation of these facts, for at low humidities the desorption branch becomes very steep and it would be necessary to extract a relatively large amount of moisture with a very small pressure difference. On the other hand, the adsorption curve is very flat at low humidities and in that region wheat will adsorb moisture very rapidly; it is only at high humidities that the adsorption process becomes slow.

It should be pointed out that the high 'specific solubility' is not necessarily the only factor which tends to make the drying of wheat at low moisture contents so difficult; it is probable that the coefficient of diffusion of water vapour through the wheat decreases very rapidly at low humidities. King[10] has shown that the diffusion constant for keratin becomes extremely small at moisture contents below 6 per cent, and Glückauf[11] has pointed out a similar effect with a hair hydrometer. For these substances then, moisture changes at low relative humidities would take place at a slow rate owing to the small value of the coefficient of diffusion, and it is exceedingly probable that a similar effect exists

in wheat. The change in the 'specific solubility', however, exerts a differential effect since it is just at the extremely low vapour pressure, where the adsorption branch is very flat, that the desorption curve becomes almost vertical. Thus while dry wheat will take up moisture and come very quickly to equilibrium at low humidities, the opposite process of desorption is extremely slow.

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May 28.

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Cosmic Rays and Kinematical Relativity

Milne[1] suggests that the undulatory component of cosmic rays may be the remains of the radiation of very high frequency the existence of which in the remote past I postulated[2] in connexion with the origin of the planets. I do not think that this idea can be accepted without a slight modification which, however, covers the particulate component as well. Consider a photon such as I postulated which had an energy of 6×10^{45} ergs at time $t=2 \times 10^{63}$ sec. If it reached the earth to-day, then at that time in the past it was in the neighbourhood of a galaxy receding from our own with almost the speed of light. Now, that is to say, with $t = 6 \times 10^{16}$ sec., its energy has been degraded by a factor of 3×10^{-80} by the Doppler effect, and is therefore only 2×10^{-34} erg. This is so even if it has undergone reflexion or refraction. Whereas the energies of cosmic ray photons may exceed an erg ($0{\cdot}6 \times 10^{12}$ electron-volts) and certainly exceed 10^{-6} erg. Moreover, each of the postulated past photons must now be represented by a very large number of photons, perhaps of the order of 10^{40}.

All these difficulties can be overcome if the energy of the cosmic rays has spent a large fraction of the dynamical time since the origin of the solar system not as the electromagnetic energy of radiation, but as the kinetic energy of moving particles, which, according to kinematical relativity, undergoes no degradation like that due to the Doppler effect. During dynamical time τ the energy of a photon relative to matter in its neighbourhood is degraded by a factor $e^{-\tau/t_0}$, where t_0 is about 2×10^9 years. In 3×10^{11} dynamical years most cosmic rays would pass through many galaxies, encountering gas or dust clouds much denser than any matter which may exist between the galaxies, giving opportunities for the transfer of energy between particles of different types, and between particles and photons, and also for the sharing of the energy of one particle or photon among a number of particles. All these events occur in our own atmosphere. Without further data one cannot be precise, but it would seem that most cosmic rays have spent most of dynamical time as particle energy rather than photon energy.

In fact, once the energy spectra of the several cosmic ray components which enter the atmosphere are known, it may be possible to calculate the corresponding spectra at a much earlier date by processes similar to those which are used in calculating the spectra of the 'primary' extra-atmospheric radiation from that at sea-level. If such calculations lead to reasonable consequences, it will be possible to accept the above hypothesis as a provisional account of the history of cosmic rays.

In a recent letter[3] Prof. Dingle suggests that I have been wasting my time in making unverifiable deductions from kinematical relativity. If these deductions are unverifiable I have certainly wasted my time, however true this theory may be. I venture to think that, since the theory which I have briefly adumbrated has fairly wide consequences for stellar evolution, it will be capable, if not of complete verification, at least of observational disproof if it is untrue. If it is so disproved, it may constitute a *reductio ad absurdum* of Milne's theory. In this case I am sure that Prof. Dingle will agree that the time spent in slaying such a Jabberwock has not been wasted.

For I cannot help suspecting that it has survived Prof. Dingle's vorpal blade. He writes that kinematical relativists cannot legitimately explain the Doppler effect by the relative motion of a light source and an observer, since a change of time-scale reduces relative motion to rest, and "we cannot attribute an objective fact to a cause destructible by an arbitrary act on the part of the thinker". This is only true if the arbitrary act does not substitute an equally valid cause (using his terminology, which is perhaps not the best possible in this context). If I break my nose on a lamp-post in the black-out I usually say that it was at rest and I ran into it. If I adopt egocentric co-ordinates I can say that I was at rest and it ran into me. If I use geocentric co-ordinates, I can say that it was moving eastwards at 648 m.p.h. and overtook me since I was only moving eastwards at 645 m.p.h. But all these accounts of the collision lead to the same calculable impulse on my nose. Milne's transformation is a deeper one, since relative motion is not invariant under it. But provided it leads to the same predictions of observable events, as (*pace* Prof. Dingle) it does, it would seem to be scientifically legitimate.

I do not think that it will be rejected on such grounds as Prof. Dingle suggests. But it will certainly be rejected if it consistently leads to false predictions of observable phenomena. At present our most powerful telescopes can only photograph light about 200 million years old, that is to say Permian light. As our backward range in time increases, the divergence between datings on the kinematical and dynamical scales will also increase, and it will become increasingly easy to reject theories which depend on this divergence, should they prove incorrect.

The agreement or disagreement with fact of calculations concerning cosmic rays will also serve as a test of the correctness of Milne's theory.

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[1] *Nature*, **155**, 135 (1945).
[2] *Nature*, **155**, 133 (1945).
[3] *Nature*, **155**, 511 (1945).

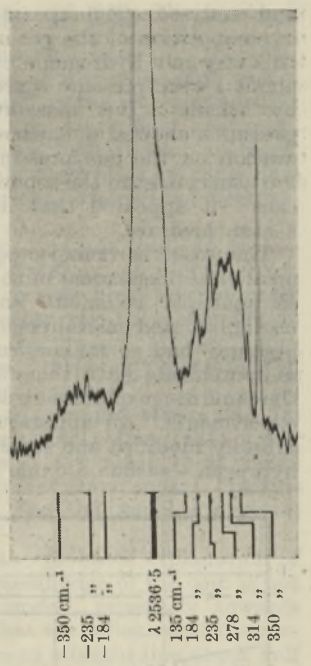
Raman and Infra-red Spectra of Rock-salt

RASETTI[1] succeeded in recording a Raman spectrum with rock-salt, using the 2537 A. radiations of the mercury arc as exciter. But as neither his preliminary report nor his subsequent paper with Fermi[2] gives quantitative details of the spectrum, it appeared desirable to investigate the subject afresh. In seeking to record the Raman effect with rock-salt, the presence of a disturbing effect became evident, namely, a luminescence exhibited by the crystal attended by the development of a fugitive coloration under the action of the ultra-violet rays. As the Raman spectrum is itself feeble, it is partially masked or even completely overpowered by the continuous spectrum of the luminescence. Ultimately, however, a specimen of rock-salt was found which was non-luminescent. Using this specimen, and with a fine slit which made prolonged exposures necessary, a spectrogram was obtained in which much more detail could be seen than in the picture reproduced with Rasetti and Fermi's paper. As is evident from its microphotometric record here reproduced, the spectrum consists of a series of Raman lines distinctly resolved from each other. The frequency shifts from the parent radiation of the more prominent of them are 135, 184, 235, 278*, 314* and 350* cm.$^{-1}$, while there are feebler lines with frequency shifts 202 and 258 cm.$^{-1}$. Further, there are indications that the three lines marked with an asterisk possess imperfectly resolved components.

It is worthy of note that Barnes and Czerny[3], investigating the infra-red absorption spectrum of sputtered films of rock-salt, found, besides the principal absorption peak at 163 cm.$^{-1}$, other absorption peaks at 190 and 245 cm.$^{-1}$, the latter being the more prominent. The experimental method of locating these peaks is sufficiently uncertain to justify our identifying their positions, at least tentatively, with that respectively of the two lines with frequency shifts 184 and 235 cm.$^{-1}$ which appear very prominently in the Raman spectrum. There is no Raman line with a shift 163 cm.$^{-1}$ corresponding to the frequency of the principal infra-red absorption; but this is not surprising as symmetry considerations[4] indicate that it should not appear in light-scattering. We may, however, tentatively identify the Raman line with frequency shift 314 or one of its components as the octave of the principal infra-red active vibration frequency.

The appearance with rock-salt of numerous clearly defined and well-resolved Raman lines, other than the octave of the so-called 'fundamental frequency' of the lattice, is clearly a matter of great theoretical interest. The theories of light-scattering in crystals[5,6] which are based on Born's postulate of the cyclic lattice, lead to the result that only the infra-red vibrations the length of the phase-waves of which satisfies the well-known Bragg formula in relation to that of the light waves, can give an observable effect. This is equivalent to the statement that only the so-called 'fundamental vibration frequencies of the crystal lattice' can appear in the Raman effect, and that all others are excluded. Pursuing the same train of thought to its logical conclusion, it can readily be shown that if the second-order terms in the variations of optical polarizability and/or the anharmonicity of the vibrations are considered, octaves and/or combinations of the 'fundamental vibration frequencies' may appear, and no others.

In the attempt to escape the contradiction with the experimental facts which is manifest, we may give up the assumption (inherent in the postulate of the cyclic lattice) that the infra-red vibrations have coherent phase-relations over extended volumes in the crystal, and limit the region of assumed coherence of phase to volume elements the dimensions of which are large compared with an individual lattice cell, but are smaller than the wavelength of light. Even this change in the basis of the theoretical approach, however, does not resolve the difficulty. For, on the new basis, the entire continuous spectrum of the crystal as deduced from the Born dynamics should manifest itself as a second-order Raman spectrum of octaves and combinations. What we actually get, however, is something very different, namely, a set of discrete lines.



Microphotometric record of the Raman spectrum of rock-salt

The contradiction between the experimental facts as observed with rock-salt and the consequences of the Born crystal dynamics would, therefore, seem to be inescapable.

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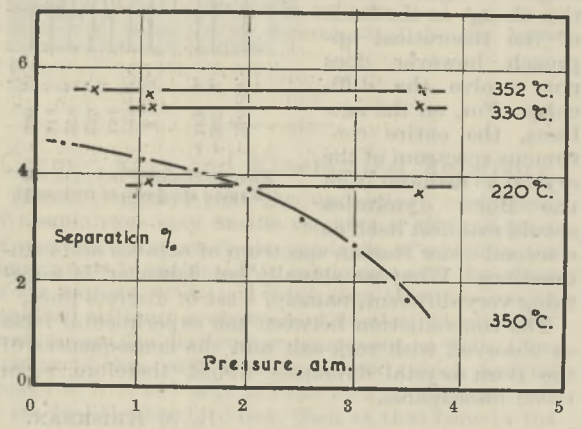
Effect of Pressure on Thermal Diffusion in Gases

BECAUSE of the present interest in the industrial application of thermal diffusion to the separation of gases, it is perhaps desirable to report some work concerned with the effect of pressure on the thermal diffusion process.

Schmahl and Schewe published measurements[1] of the separation produced by thermal diffusion in mixtures of hydrogen and hydrogen sulphide, and of hydrogen and carbon dioxide. The gas mixture was contained in two cylindrical bulbs, 2 cm. in diameter and 21 cm. and 7 cm. in length respectively. The bulbs were connected by a 5 mm. bore tube, 12 cm. long, which included a stopcock. While the larger vessel was heated in a furnace, the other was maintained at 20° C., and when equilibrium was attained the contents of the two bulbs were separately removed

and analysed. The separation, that is the difference in composition of the gas in the two bulbs, found in this way in a hydrogen – carbon dioxide mixture at about 1 atm. pressure agreed well with values found by others. But measurements made at higher pressures showed a marked dependence of the separation on the gas pressure. Between 1 atm. and 3·5 atm. pressure the separation decreased by 50 per cent; it appeared that it would vanish at about 4 atm. pressure.

This result is unexpected. Theoretically, the separation is independent of the pressure, at least so long as multiple collisions among the molecules are negligible, and measurements over a small range of pressure[2] had so far confirmed the theory. Further measurements have therefore been carried out over the same range of pressure as in Schmahl and Schewe's experiments. An apparatus already described[3] was suitably modified and separation measurements for a hydrogen – carbon dioxide mixture containing 44 per



SEPARATION AS A FUNCTION OF PRESSURE FOR HYDROGEN – CARBON DIOXIDE MIXTURES.

— . — . — Schmahl and Schewe; 32 per cent hydrogen.
— x — x — Present results; 44 per cent hydrogen.
Temperatures refer to heated bulb; other bulb at 20° C. in all cases.

cent hydrogen were made at pressures up to 3·6 atm. The gases were taken directly from cylinders, but the small amount of impurity is unlikely to be important. The results are shown in the accompanying graph, together with those of Schmahl and Schewe for a hydrogen – carbon dioxide mixture containing 32 per cent hydrogen. There is no indication of a pressure effect in the present measurements.

The explanation of the results of Schmahl and Schewe is not obvious, though it seems possible that insufficient time was allowed for equilibrium to be reached before the analyses were made. Experience in the present work suggests that, at the higher pressures, even the ten hours which Schmahl and Schewe sometimes allowed might be inadequate for separation to become complete in the long bulbs of small cross-section which they used.

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Logarithmic Scales

THE suggestion recently put forward[1] that a logarithmic scale should be used for high-vacuum measurements directs attention to the fact that, while increasing use is being made of logarithmic scales as a basis of comparison, there is no generally recognized notation for this purpose.

The convenience of the decibel, as used in electrical communications, has prompted workers in other fields to adapt it to their own requirements; but in many cases this cannot be done, owing to the restrictions with which the decibel has, very properly, been circumscribed, making it solely a measure of relative energy flow. These restrictions increase its utility for the purposes of the telephone engineer, but preclude its use as a general method of expressing a ratio on a logarithmic basis.

Some form of logarithmic notation, corresponding to the decibel, can often be used with advantage wherever the response to a given excitation is either basically exponential or conveniently predictable as the product of a number of component factors. But to be most effective the notation should be as free from special restrictions as the older percentage basis of comparison.

For such a purpose, it is suggested that the term 'decilog' might be used, the decilog (dL) being analogous in all respects to the decibel, except that there is no restriction on the nature of the quantities being compared.

In most cases, one of these two quantities would be the reference level. Thus, a vacuum measurement would be expressed as so many decilogs below one bar, and the intensity of a physiological stimulus as so many decilogs above the threshold intensity, giving, incidentally, a linear response in terms of the Weber-Fechner law.

Again, in the design of technical amplifiers and electrical networks for purposes other than communications, voltage is frequently of more significance than power, and the impedance level may vary widely. In such circumstances, the gain or loss in decibels is meaningless, and the performance could more usefully be expressed in decilogs on a voltage basis.

There does, therefore, appear to be a need for some notation of this kind, and its general adoption would avoid the creation of a multiplicity of special 'units' to meet each individual application.

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[1] *Nature*, **155**, 545 (1945).

Frictional Properties of Wool Fibres

IN the course of work on the felting properties of wool a simple apparatus has been devised to examine the frictional properties of individual fibres in selected fluids. To each end of the clean fibre is fixed a copper hook (0·1 gm.) by means of molten shellac. The fibre is then suspended over a cylindrical rod of polished keratin (in the present experiments rhinoceros hide, diameter 7 mm., was used), and the requisite solution is allowed to drop rapidly on to the fibre-rod junction. A bent glass rod in contact with the underside of the cylinder carries away the used solution. Weights made from calibrated pieces of wire are then gradually added to one of the hooks

until, with careful observation, preferably through a magnifying eyepiece, the fibre just commences to slide. The experiment is then repeated using the other hook and causing the fibre to move in the opposite direction.

In this way the forces required to slide the fibre with the scales and against the scales can be determined to the nearest 0·01 gm. The coefficient of friction in either direction is then calculated from the formula $W_1/W_2 = e^{\mu\pi}$, W_1, being the total load in the direction of motion and W_2 the weight of the hook plus shellac on the other end of the fibre. The above formula is dependent upon continuous contact between the fibre and the fixed surface and would not be applicable if the fibre is held at a few isolated points on the surface. That there is a continuous contact is evident from the reproducibility of results and from the gradual motion of the fibre, which is usually of the order of 0·5–3·0 cm. per minute. The effect of variations in the total load has been studied, and it has been found that variations within the range used (0·25–0·70 gm.) do not seriously alter values for the coefficient of friction. The method has been found to be inapplicable to dry surfaces.

Results obtained with fibres from untreated wool (64's quality Merino) and from the same wool when treated by some of the commercial unshrinkable processes are set out in the accompanying table. The solution used contained 0·2 per cent soap and 0·1 per cent sodium carbonate, and had a *p*H value of 10·7, the temperature being 30–35° C.

FRICTIONAL MEASUREMENTS ON UNTREATED AND NON-FELTING WOOLS.
Anti-scale coefficient = μ_1
With scale coefficient = μ_2
Directional coefficient = $\frac{\mu_1 - \mu_2}{\mu_1 + \mu_2}$ (term adopted by Mercer[1]).

Treatment	μ_1	μ_2	$\frac{\mu_1 - \mu_2}{\mu_1 + \mu_2}$
Untreated	0·28	0·10	0·47
	0·37	0·16	0·40
	0·34	0·15	0·39
Sulphuryl chloride	0·16	0·15	0·03
	0·18	0·13	0·16
	0·19	0·15	0·12
Aqueous bromine	0·16	0·13	0·10
	0·15	0·11	0·15
	0·17	0·13	0·13
Alcoholic KOH	0·38	0·20*	0·31
	0·49	0·20*	0·42
	0·39	0·22*	0·28

* Fibre tended to slide abruptly during these measurements.

The results for sulphuryl chloride and bromine treatments agree in general with those of previous workers[1,2] using other techniques, and show that these reagents markedly reduce the directional coefficient of friction.

Treatment with alcoholic potash has caused no major reduction in the directional coefficient, which indicates that this reagent probably produces its unshrinkable effect in a manner different from the others. Further work is in progress on this subject.

I am indebted to Messrs. M. R. Freney and E. H. Mercer for helpful discussions, and to Miss P. Howard for assistance with the experimental work.

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May 8.

[1] Mercer, E. H., *Nature*, **155**, 573 (1945).
[2] Whewell, C. S., Rigelhaupt, L., and Selim, A., *Nature*, **154**, 772 (1944).

An Illusion of Size

I READ Dr. A. Loewenstein's letter[1] at the time of publication, and some of my colleagues and I repeated his experiment and, on the whole, confirmed his observations. Prof. H. Hartridge[2], however, appears to have experienced "An Illusion of Size" much greater than we could observe. I am quite at a loss to see how Prof. Hartridge obtained the measurements he quotes.

The nickel-brass threepences are made to a diameter across the flats of 0·823 in. or 21·082 mm.; from 1942 onwards the corners have been slightly rounded, so that the diameter over these is 0·860 in. or 21·844 mm. instead of the theoretical 21·872 mm. calculated for a dodecagon; earlier coins had nearly, but usually not quite, sharp corners.

These coins are struck from round blanks and are expanded into a dodecagonal steel collar in the coining press. A working tolerance of + 0·005 in. (0·077 mm.) is allowed in the dimensions of these collars, but this difference is, of course, far too small for visual observation.

It appears to me that the probable explanation of the 'illusion' is that the raised edge of the coin is not flat but considerably rounded, especially towards the edge of the coin, so that the reflexion of narrow-angle illumination appears as a bright line about half the width of the raised edge; the outside of this line would, in suitable conditions, be perceived as the edge of the coin, thus giving the illusion of smaller diameter.

When the coin is placed on a black surface, the reflexion from the extreme edge will be of that surface, and in suitable conditions would not be visible.

The edges of all coins become rounded in circulation, which may explain Dr. Loewenstein's observations on shillings.

J. PHELPS.
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London, E.C.3.

[1] *Nature*, **155**, 672 (1945).
[2] *Nature*, **156**, 118 (1945).

Occurrence of Hexadecatrienoic Acid in the Glycerides of Rape (*Brassica napus* L.) Leaf

THE unsaturated acids of leaf lipids have been shown to consist of octadecatrienoic (linolenic) and octadecadienoic acid[1], together with traces of oleic and palmitoleic acid[2].

In the course of ester fractionation analyses of leaf glycerides, it was found that the C_{16} unsaturated methyl esters of rape had abnormally high iodine values (*c.* 190) as compared with 94·8 required for methyl palmitoleate.

Crystallization of the methyl esters from 15 volumes of methyl alcohol at − 15° C. and fractionation at 0·1 mm. through an efficient column yielded a fraction with sap. equiv. 264·0 and iodine value 225·9. Further concentration of the C_{16} polyethenoid fraction was achieved by systematic crystallization of the lithium salts of the acids (8·4 gm.) from acetone. The less saturated acids were removed by crystallization from 90 per cent acetone at 10° C. and then the lithium salt of hexadecatrienoic acid was precipitated from 95 per cent acetone at − 5° C. Under these conditions impurities of lower iodine value remained in solution. From this concentrate methyl esters

were prepared which on distillation at 0·1 mm. yielded 4·4 gm. of esters (sap. equiv. 263·2, iodine value 271·9; theory for methyl hexadecatrienoate, sap. equiv. 264, iodine value 288·5).

Hydrogenation of the methyl esters in the presence of nickel formate at 230° C. yielded methyl palmitate (m.p. 29°, not depressed by admixture with genuine methyl palmitate).

Bromination of the acids in ether at − 10° C. yielded 72 per cent ether-insoluble bromides, m.p. 181° C. (per cent Br = 64·3, as compared with 64·5 per cent required for hexabromopalmitic acid).

Ester fractionation analysis showed the following composition for two samples of rape fatty acids from the lipids soluble in acetone at 0° C. The fatty acids comprised respectively 1·14 and 1·15 per cent of the total dry matter and 24·3 and 23·1 per cent of the total lipids.

	Saturated	Unsaturated		
	(mainly palmitic)	C_{14}	C_{16}	C_{18}
Weight	16·0	0·7 (2·0 H)	11·3 (6·0 H)	72·0 (5·4 H)
per cent	15·1	0·5 (2·0 H)	17·1 (6·0 H)	67·3 (5·2 H)

The value for the mean saturation of the C_{16} unsaturated acids has been calculated as 6·0, but this figure is only approximate, since small proportions of other less unsaturated acids may be present.

Apart from the inclusion of hexadecatrienoic acid, the fatty acid composition of rape glycerides is shown to be not dissimilar from that of forage grasses[2], which from investigations to be reported elsewhere do not contain significant proportions of this constituent.

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Animal Research Division,
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Wellington, N.Z. April 23.

[1] Smith and Chibnall, *Biochem. J.*, **26**, 218 (1932).
[2] Shorland, *Nature*, **153**, 168 (1944).

Rate of Entrance of Ammonia into Muscle Fibres in Relation to Carbon Dioxide Tension

From previous considerations[1] the following Donnan relation may be expected to apply across the muscle fibre membrane:

$$k_1/k = [NH_4]_1/[NH_4]$$

where k_1 and k are the potassium concentrations within and without, and similarly for the ammonium ion.

In a communication some years ago[2], it was pointed out that with an external concentration of 1 mgm. of ammonia nitrogen per 100 ml. a ratio of about 2·1 was reached across the membrane when the external concentration was 30 m.eq. per litre, and the k_1/k value could be expected to be about 4·0 (the high external K was used to prevent K losses). The result was interpreted then as a probable damage to the membrane resulting from high internal ammonia concentrations.

Later investigations have brought to light some striking facts. First, if the external ammonia be decreased below 1 mgm. ammonia nitrogen per cent under the same conditions, the ammonia ratio increases more and more until it equals that of potassium. This would be in agreement with the view that high internal ammonia concentrations were in some way affecting the balance or the permeability of ions. In addition, when we came to measure the rate of passage of the ammonium ion as described in a previous communication[3], and using no carbon dioxide or bicarbonate but a little phosphate, we got no measurable rate of ammonia entrance over several hours at room temperature. We varied in turn the details of the experiments and obtained the same results. We then carried out experiments with 5 and 15 per cent carbon dioxide, maintaining the *p*H constant by substituting the required fraction of sodium chloride by sodium bicarbonate. A great difference resulted in the rate of ammonia entrance, and with 15 per cent carbon dioxide it exceeded that of potassium chloride (without the latter being appreciably affected). This was proved by direct analyses as well as by observing the volume change.

The experiments recall the interchange of potassium and ammonia in yeast which occurs only in the presence of carbon dioxide. (The effect of carbon dioxide was many times repeated and there appears no doubt about it. A few experiments by Fenn *et al.*[4] under different conditions would appear to indicate a different result, but these cannot be fully considered here.)

From such experiments it is clear that the undamaged muscle fibre membrane is either impermeable to the ammonium ion or is very slowly permeable, but that a great facilitation of entrance can be produced by carbon dioxide. Into ammonia equilibria or steady states across the muscle fibre membrane there enters a complexity quite absent from the simpler potassium, rubidium, chlorine, bromine, bicarbonate and hydrogen ion relationships.

The experiments of Fenn *et al.*[4] are open to question on several important points. For example, under their conditions it can be shown that numbers of fibres are losing their differential permeability for potassium and sodium throughout, and that this loss is irreversible, a very confusing complexity being established. It may also be noted that a misleading statement occurs in their paper to the effect that since potassium diffuses out slowly from isolated immersed muscle (in ordinary Ringer fluid) the ratio of potassium ions across the membrane can be made anything one pleases by changing the external K, and it has therefore no significance. If, by this, it is intended to convey that K ratios in general across the membrane have no significance, we do not see how such can be seriously maintained in view of the evidence already considered[1].

At and above the external maintenance K level, a definite K ratio is reached and maintained for long periods (48 hours in the cold). Such ratios are in full accord with the theoretical treatment of a membrane permeable to potassium ions and small anions, but not to sodium ions and larger anions of the type of sulphate, or phosphate esters. It must be taken now as proved that the muscle fibre membrane is of such a kind, unless we are prepared to entertain very fantastic hypotheses.

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[1] Boyle and Conway, *J. Physiol.*, **100**, 1 (1941).
[2] Conway, E. J., O'Brien, M. F., and Boyle, P. J., *Nature*, **148**, 662 (1941).
[3] Conway and Moore, *Nature*, **156**, 170 (1945).
[4] Fenn, W. O., Haege, L. F., Sheridan, E., and Flick, J. B., *J. Gen. Physiol.*, **28**, 53 (1944).

ROYAL SOCIETY OF CANADA

ANNUAL MEETING

THE meeting of the Royal Society of Canada for 1945 was held at Queen's University, Kingston, Ontario, during May 20–23, under the chairmanship of the president, Prof. J. K. Robertson, professor of physics at Queen's University. In the scientific sections, one hundred and four fellows, and half as many guests, were in attendance.

In addition to sectional and business meetings, there were two largely attended evening meetings. On the evening of May 21, the Society's medals were presented. Prof. R. B. Thomson, University of Toronto, received the Flavelle Medal as a tribute to his work on the comparative anatomy and physiology of plants. The Henry Marshal Tory Medal was presented to Dr. Otto Maass, professor of physical chemistry at McGill University, assistant to the president of the National Research Council, and director of chemical warfare and smoke for the Department of National Defence. He was hailed as a man possessed of experimental skill and scientific imagination, with a fondness for hazardous experiment, who has played a leading part in planning chemical research in Canada since the outbreak of the War. The Willet G. Miller Medal was given to Dr. M. E. Wilson, Geological Survey, Ottawa, who, conspicuous among Precambrian geologists of the world, has done much in Canada in the development of mining. The Lorne Pierce Medal was awarded to L'Abbé Felix Antoine Savard, Laval University, and the Tyrell Medal to Prof. F. Landon, University of Western Ontario.

After the presentation of medals, Prof. J. K. Robertson delivered his presidential address on "Continuity and Discontinuity". The paper was divided into two parts: a discussion of the progress of philosophical opinion down to the eighteenth century, followed by an assessment of the development of the two conceptions by physicists up to the present day. Recognizing that "present-day physics continues to demonstrate the inter-play of continuity and discontinuity", he concludes that "The modern physicist no longer accepts a materialistic philosophy and no longer assumes that, as time goes on, he will learn more and more about the ultimate details of a real objective world. His advances have shown him that measurements and observations can not give him exact knowledge beyond a certain stage, and hence for him, what is beyond has no meaning. His aim now is the more modest one of describing facts and observations in terms of correlating laws, which in the last analysis can be expressed accurately only by mathematical symbols".

On the evening of May 22, following a complimentary dinner given by the Mayor and City Council of Kingston, a popular lecture, "Biological Control of Insect and Plant Pests", was given by Dr. W. R. Thompson, Imperial Parasite Service, Belleville, Ontario. This paper so impressed the audience that a resolution was passed at a general meeting next day expressing to the Imperial Institute of Entomology its appreciation of the work done in Canada during the War, and asking that arrangements be made for its continuation.

In Section I, twenty-one papers were presented on subjects of historical or literary interest in French Canada.

In Section II, the presidential address by Prof. W. H. Alexander was a provocative discussion of some obvious incompatibilities of temperament as between the ideals of a genuine education and the spirit of the ultra-democratic State as suggested by Plato's "Apology to Socrates". Papers were read in the fields of literature, philosophy, history and the social sciences. Anthropology and archæology were represented by papers on "The Distribution of Rubbed Slate Instruments in Eastern Canada" by Dr. Douglas Leechman, and by the myth of "Bear Mother" by Dr. Marius Barbeau. A timely paper was presented by Prof. R. Flenley, "The Results of the Reformation in Germany".

In Section III, the most important feature of the meeting was a symposium on the dimensions of the galaxy. This subject was first treated very ably by Dr. Helen Sawyer Hogg from the point of view of the observations on globular clusters. Dr. C. S. Beals dealt with the obscuring matter between the stars and its influence on estimates of galactic dimensions. These papers led up to the presidential address by Dr. J. A. Pearce, of the Dominion Astrophysical Observatory, entitled "The Dimensions of the Galaxy as Derived from Studies of Galactic Rotation", in which he reviewed the history of the subject from the time of Herschel to the most recent estimates.

Thirty-five other papers were presented to this Section, ten by title. A notable series of ten chemical papers was presented by Prof. Paul-E. Gagnon, of Laval University, Quebec, ranging from the synthesis of amino-acids to the technology of charcoal, and exhibiting the great activity in chemistry at that institution. Prof. William Ure, of the University of British Columbia, described the mechanism of the 'flotation process' of concentrating ores, showing the necessity of a water-repellent layer on the surface of the mineral. Prof. J. K. Robertson, Queen's University, described the effect of high-frequency discharges in producing patterns in thin layers of metal placed in the discharge tube. Five meteorological papers were read by members of the staff of the Meteorological Service of Canada, including a new theory of the mechanism of the 'Chinook' wind (the warm dry wind which frequently descends the eastern slope of the Rocky Mountains in Alberta) by D. H. Smith and C. E. Thompson.

Nineteen papers were presented to Section IV. In the presidential address, Dr. J. S. DeLury gave an outline of a hypothesis to explain crustal movements. In his opinion, the earth's crust is strong to a depth of 450 miles or more. Liquid rock, known as magma, and as lava when it reaches the surface, is formed in shallow levels by frictional heat generated in crustal movements, and is not inherited from a primitive molten earth. These movements are due to failure in the crust caused by thermal contraction followed by a very protracted process of collapse.

Dr. A. W. Jolliffe presented evidence that, geologically, the north-western part of the Canadian Shield may be divided into four sub-provinces. From north to south these are: (1) Great Bear—characterized by Proterozoic formations, north-east faulting with right-hand displacements, and uranium–silver–cobalt–nickel–copper mineralization; (2) Yellowknife—characterized by Archæan formations, north to north-west faulting with left-hand displacements, and gold mineralization; (3) East Arm—characterized by chiefly Proterozoic formations, north-east faulting, and copper–cobalt–nickel–gold mineralization; and (4) Taltson—by both Proterozoic and Archæan

formations, north to north-west faulting, and silver–lead–gold mineralization.

Dr. T. L. Tanton offered a theory, based on a study of conchilites and the work of W. D. Francis, suggesting the steps whereby non-living matter may have evolved into semi-living organisms, which provided the catalyser for the synthesis of protein and the conditions that induced the evolution of primeval forms of life. Dr. M. L. Keith described brucite deposits in the Rutherglen District, Ontario. Franco Rasetti reported the discovery of Middle Cambrian fossils in the Gaspé, the first recorded in the Province of Quebec. Dr. R. F. Legget described the geology of the "Shipshaw" area on the Saguenay River, and reported finding wood and other organic matter imbedded in the clay. Peter Ginn described an ultra-basic rock near Lochalsh, Ontario.

Dr. Robert Newton, president of Section V, in discussing the northern limits of wheat production, pointed out that wheat production in Canada is mainly confined to the southern plains region of the Prairie Provinces. Its possible northward extension concerns not only the potential world food supply, but also the feasibility of northern settlement. The longer summer days of northern latitudes are favourable to growth, but their value is reduced by association with lower temperatures. Rainfall is another important modifying factor. Moreover, the milling and baking quality of northern wheat is generally inferior. This may not destroy its usefulness as a local food resource, but makes it unsuitable as an article of commerce.

Prof. R. B. Thomson, who was awarded the Flavelle Medal, presented a paper entitled "Food Supply and Budding or Twinning Embryogeny". Prof. Thomson believes that the view that the asexual type of embryo initiation involved in budding or twinning embryogeny is due to recent mutation is not supported by sufficient evidence; whereas that for its being an innate or constitutional potentiality is satisfactory. The expression of this potentiality, however, is generally kept under control as indicated by the prevalence of simple embryogeny (one embryo from one zygote) in the main lines of evolutionary advance. Thus the problem of accounting for the sporadic occurrence of budding or twinning at different levels in such advance is concerned with the elimination of established control. This has been effected in animals by various physical and chemical experimental procedures. Up to the present, however, little attention has been given to the influence of food supply, and some experimental and other evidence, particularly the effect of excess nutrition on the production of a free nuclear stage in embryos normally undergoing simple embryogeny, indicates the importance of giving more attention to the possibly broader significance of this factor.

Dr. W. H. Cook, director of the Division of Applied Biology of the National Research Council, discussed some of the War research projects of the Council under the title "Some Wartime Food and Supply Problems". Under war conditions the main problem in feeding civilian or Service personnel is that of transport and distribution, complicated by the perishability of many foodstuffs. To meet the emergency, facilities had to be improvised to preserve the product, or alternatively the foodstuffs themselves had to be rendered less perishable. The dehydration of foodstuffs rich in proteins and fats was discussed in relation to the measurement and maintenance of quality and the type of deterioration that occurs. Several new chemicals required by war industry can be provided by the fermentation of starch. Reference was made to the bacterial fermentation yielding 2,3-butanediol, a material readily converted to butadiene and other chemicals.

Thirty-eight other papers on various phases of biological and medical sciences made up the programme of Section V. These included an important communication by Dr. B. P. Babkin, describing the interference of quinine bisulphate with cholinergic mechanisms in the heart and stomach of the dog, and a demonstration by Dr. C. C. Macklin that venule capacity in the lung is increased on inspiration.

Fifteen new fellows were presented, including the following in the Scientific Sections: Section III (Chemical, Mathematical and Physical Sciences): R. Brauer, E. W. Hewson, O. J. Walker; Section IV (Geological Sciences): V. J. Okulitch, J. E. Thomson, H. V. Warren; Section V (Biological Sciences): E. W. Crampton, J. Labarre, W. Leach, C. A. Mitchell, A. W. H. Needler, D. Y. Solandt.

Officers for 1945–46 were elected as follows: *President*, Prof. E. S. Moore, University of Toronto; *Vice-President*, Prof. H. A. Innis, University of Toronto; *President of Section I*, Dr. S. Marion, Ottawa; *President of Section II*, Prof. D. C. Harvey, Dalhousie University, Halifax; *President of Section III*, Prof. C. T. Sullivan, McGill University; *President of Section IV*, Dr. B. R. MacKay, Ottawa; *President of Section V*, Dr. B. P. Babkin, McGill University.

MODE OF ACTION OF PENICILLIN

SOME of the more recent work on the mode of action of penicillin was briefly reviewed in *Nature* (**155**, 403, March 31, 1945). Work noted there established the fact that penicillin is not merely bacteriostatic but also can actively destroy some micro-organisms. This bactericidal effect appears to be exerted especially upon the young bacterial cell and upon feeding bacteria, and to be therefore conditioned by certain factors in their environment. A leading article in the *Lancet* (276, March 3, 1945) summarizes the facts about this question which were available up to that date.

Important recent papers have since appeared. Thus E. Chain and E. S. Duthie (*Lancet*, 652, May 26, 1945) point out that Fleming, in his original paper on penicillin, recorded its slow bactericidal effect on *Staphylococcus* and its lytic effect under certain conditions. They explain that the original statement by the Oxford workers that penicillin is mainly bacteriostatic was based on the fact that it did not affect the oxygen uptake of resting *Staphylococcus*, for large numbers of viable colonies were found after incubation with penicillin in Ringer solution for twenty-four hours. They then review work done in the United States, which demonstrated that penicillin is bactericidal, but that it is not so under unfavourable conditions (such as low temperature or exhausted media) and that its bactericidal effect can be increased by substances which enhance bacterial growth and decreased by substances which interfere with bacterial growth (for example, sulphadiazine). From the results of their own work recorded in this paper, Chain and Duthie conclude that, during the resting phase of *Staphylococcus*, even large concentrations of penicillin have no effect on the oxygen

uptake. During the early lag phase, however, and during the logarithmic phase of multiplication, penicillin has a strong inhibitory effect, and eventually completely stops the oxygen uptake, even in small concentrations (0·04–0·1 units per c.c.). They also demonstrated a strong bactericidal effect in the early lag phase and the logarithmic multiplication phase, but no measurable bactericidal effect during the resting phase. This confirms American work. Chain and Duthie conclude that penicillin can exert a bactericidal effect on *Staphylococcus* before actual division occurs, but that the organism can undergo at least one division in the presence of penicillin when it is added during the logarithmic phase of multiplication. It appears to interfere with some metabolic function of the early stages of bacterial development. Helvolic acid, the bacteriostatic antibiotic, antagonizes the bacteriostatic and bacteriolytic action of penicillin. Sulphanilamide and sulphamezathine, on the other hand, do not prevent the occurrence of several bacterial divisions and have no antagonistic effect on the bactericidal effect of penicillin on *Staphylococcus* and *Streptococcus*; on the contrary, they have a synergistic effect.

Chain and Duthie compare the modes of action of penicillin and the sulphonamides and review some of the literature upon this subject. They conclude that penicillin can kill *Staphylococcus* in the early lag phase before cell division has occurred, while sulphonamide kills only after several divisions have taken place in its presence. These results may be compared with those obtained by W. S. Miller, C. A. Green and H. Kitchen (*Nature*, **155**, 210, Feb. 17, 1945), who estimated the growth of the Oxford *Staphylococcus* turbimetrically in the presence of penicillin and sulphonamides and also discuss the effects of these two kinds of substance. They suggest that confusion may arise in discussions of bacteriostatic and bacteriolytic action because too fine a distinction is drawn between these two modes of action. Both penicillin and sulphonamides act by inhibiting cell multiplication; but, while sulphonamides inhibit the growth of almost every kind of cell as well as that of bacteria, there is little evidence that penicillin does this. Additional knowledge of the chemistry of penicillin may reveal that its mode of action is, like that of the sulphonamides, related to its chemical structure. It is unlikely that the mode of action of penicillin is unique; it is more likely that it differs from that of sulphonamides only in degree.

P. Bonét-Maury and R. Pérault (*Nature*, **155**, 701, June 9, 1945), using the differential photometer at the Radium Institute, Paris, suggest that, whereas the sulphonamide used by them (Dagenan 1162 F) does not stop but delays proliferation of *Staphylococcus aureus*, penicillin stops proliferation almost immediately, even at low concentrations, and that lysis follows. They found, however, that later a second proliferation occurred regularly, followed by a second partial lysis and then a second post-lytic growth. These results recall those obtained by J. W. Bigger (see *Nature*, **155**, 403, March 31, 1945). Bonét-Maury and Pérault obtained their results with six different penicillins (English, American and French). J. Hirsch (*C.R. Ann. Soc. Turque des Sci. Phys. et Nat.*, **12**; 1943–44) also studied the action of penicillin *in vitro* by manometric methods, and his work is discussed by Chain and Duthie (*loc. cit.* above). R. Knox (*Lancet*, 559, May 5, 1945) also concludes that the action of penicillin can be bacteriostatic, bacteriolytic or bactericidal, and that the young bacterial cell is particularly susceptible to penicillin. A. B. MacGregor and D. A. Long (*Nature*, **155**, 201, Feb. 17, 1945), studying the action of penicillin in relation to their work with penicillin pastilles (see *Nature*, 341, March 17, 1945), conclude that penicillin is bactericidal as well as bacteriostatic.

Very instructive also is the direct microscopical observation by Prof. A. D. Gardner (*Lancet*, 658, May 26, 1945), whose earlier work (*Nature*, **146**, 837; 1940) suggested that weak penicillin inhibited growth but did not prevent it, on the effects of penicillin on the spores of *B. anthracis* and *B. subtilis*. Gardner found that strong penicillin (50–100 units per c.c.) slowly kills the spores. Those of *B. anthracis* were more susceptible than those of *B. subtilis*, but neither were completely eliminated and there was no gross swelling. The spores gradually lost their high refractility and became empty ghosts. Weaker solutions of penicillin (0·1–1·0 units per c.c.) allowed the earliest phase of germination to occur, and the spores of *B. anthracis* then swelled up and became spherical coccoids which burst. Those of *B. subtilis* underwent similar changes, but all were not killed. Nevertheless, even the weakest inhibitory dose of penicillin renders the great majority of the spores non-viable. Spores studied in non-nutrient media were, however, little if at all affected, even by strong concentrations of penicillin, so that penicillin acts upon feeding bacteria and its action begins directly the bacteria begin to feed. Prof. Gardner concludes that the action of penicillin on sensitive species has little or no connexion with multiplication or division, although penicillin did cause abnormal divisions in sensitive *S. typhi* (long waists, spindle-shaped swellings, etc.). The majority of *Staphylococcus aureus* and *Streptococcus pyogenes* growing on agar are checked or killed before any visible growth or division has occurred. These conclusions, based upon direct microscopical examination, must carry great weight. It would seem that what is now required for a better understanding of the mode of action of penicillin is more exact knowledge of the chemistry of penicillin and the correlation of this, by the methods now being used for the biochemical analysis of micro-organisms, with the enzyme systems and other metabolic features of the organisms concerned.

G. Lapage.

RADIO WAVES FROM THE SUN

As the technique of radio-frequency measurement and application has progressed to successively higher frequencies, various investigators have from time to time turned their attention towards a demonstration of the interchangeability of thermal and radio methods of detecting electromagnetic waves. The use of normal radio receiving technique to detect thermal radiation from a hot body has always been an attractive line of experiment; and for this purpose, the sun, in spite of its great distance away from the earth, would appear to offer considerable advantages as a source of radiation of the desired type. The practicability of the reception and measurement of so-called 'cosmic noise' on an ordinary radio receiver has been demonstrated in various investigations, notably those described during 1932–39 by K. G. Jansky, who worked on frequencies of the order of 10–20 megacycles per second, and later (1940–44) by G. Reber, who described corresponding measurements made at frequencies of 160 Mc./s. In these cases, the

investigators concluded that the radiation which they measured originated in interstellar space, and, from observations made of the direction of arrival, it was considered that the source of this cosmic noise was closely associated with the Milky Way. Both Jansky and Reber made attempts to observe any 'noise' radiation received from the sun, but although recently (*Astrophys. J.*, Nov. 1944) the latter investigator claims to have obtained definite evidence of this, the amount of such radiation received at the above frequencies is very small.

In a paper entitled "Microwave Radiation from the Sun" (*J. Franklin Inst.*, April 1945), G. C. Southworth describes some experiments conducted in the summer months of 1942 and 1943 in which a small but measurable amount of radiation from the sun was obtained with a conventional type of radio receiver operating on frequencies between 3,000 and 30,000 Mc./s. (wave-lengths between 1 and 10 cm.).

Following earlier work by Wien, Lord Rayleigh and Jeans, a complete formula for the energy distribution in the spectrum of a black-body radiation was derived by Planck from quantum considerations. At high temperatures and long wave-lengths, a condition of particular interest in the case of radio waves from the sun, the Planck relation reduces to the Rayleigh-Jeans formula. Applying this formula to the calculation of the energy distribution in the solar spectrum gives a result which is in general accord with experimental measurements throughout a considerable part of the visible and infra-red portions of the spectrum. The experimental results now described by Southworth tend to show that the same formula may be extended at least as far as the centimetre-wave portion of the radio spectrum.

These recent measurements were made at three wave lengths between 1 and 10 cm. using an antenna within a parabolic reflector of high directivity and a suitable type of radio receiver. At the longest of the three wave-lengths the measurements of received power agreed to within about $\pm$ 5 per cent of that calculated by the Rayleigh-Jeans formula. At the intermediate wave-length the mean measured value was about 12 per cent below that calculated; while at the shortest wave-length, the mean observed level was approximately one-ninth of that calculated from the above formula. In no case was any marked diurnal variation observed such as occurs at infra-red wave-lengths, but at sunrise and sunset the received power varied more or less proportionally to the area of the sun's disk above the horizon; this transition period was passed through more slowly as the wave-length was reduced.

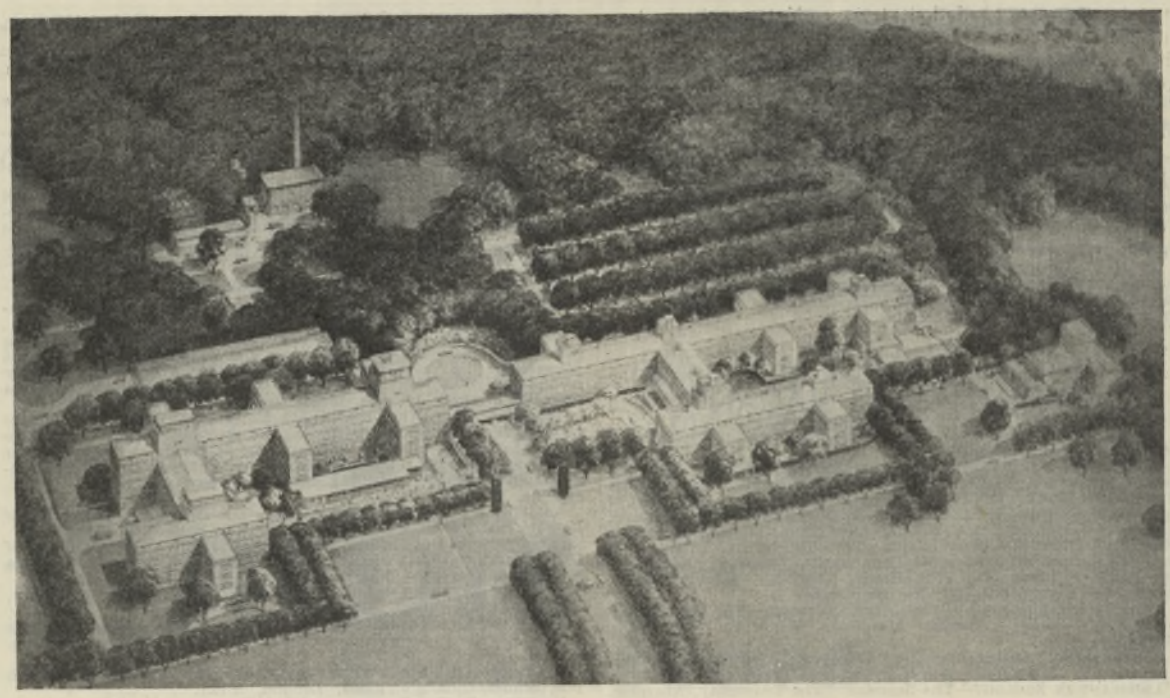
A particularly interesting part of the work described in Southworth's paper consisted of some directional measurements made by adjusting the receiver centrally on the sun and observing the decrease in output as the sun's disk moved out of the aperture of the receiving mirror. The effective angle of the latter, as measured by the displacement for which the received energy from a local source decreased to half the maximum value, varied from $\pm 3^\circ$ for the longest to $\pm 0{\cdot}3^\circ$ for the shortest wave-length used in the experiments. In the measurements of solar radiation, the apparent aperture was much wider than this at the shortest wave-length, where it amounted to more than $0{\cdot}8^\circ$, a result which is ascribed to the fact that the sun is an apparent disk and not a point source of radiation. At the lowest frequency, the angular diameter of the sun is small compared with the aperture angle of the receiver, but at the highest radio frequency used in this investigation, these two angles are comparable with one another. It may be expected that, to a first degree of approximation, the measured solar pattern will have a breadth equal to the sum of the aperture angle and the angular diameter of the sun. The fact that the observed directional pattern is even wider than this sum may be explained on the assumption that the angle of arrival of the waves from the sun varies rather rapidly over a considerable range; so that the sun appears to the receiver as a shimmering body the apparent diameter of which is considerably larger than the true diameter. This increase in apparent diameter may also account in part for the discrepancy between the measured and calculated energy levels already noted.

While carrying out the above work, it was found that the noise appearing in the output of the receiver was sensibly less when the receiver was pointed at the open sky above the horizon than when pointed at nearby objects or when it was located inside a room. The magnitude of this horizon effect for the longest wave used was of the order of 10^{-19} watts per sq. cm. for a band width of 1 Mc./sec. The corresponding energy measured from the sun was about five times as great. At the shortest wave-length used, this 'horizon' effect was barely measurable, while the energy received from the sun was about 5×10^{-18} watts per sq. cm. for the same band-width conditions. Numerous attempts were made to observe cosmic noise coming from the general region of the Milky Way with the view of locating more precisely the source of the noise reported on by Jansky and Reber, but these attempts have so far proved unsuccessful on the higher frequencies used by Southworth. This experience tends to support Reber's view that cosmic radiation varies inversely as the frequency.

Perhaps the most interesting result of all this work is the establishment experimentally of a close relationship between black-body radiation and ordinary radio waves. Receiving from a source some 93 million miles away, it has been shown that the earth's atmosphere is fairly transparent to wave-lengths of the order of a centimetre, although there is evidence of absorption and scattering at the shortest wave-length at which observations were made. The next stage in the programme of investigation contemplated will incorporate the best ideas of both the radio engineer and the designer of astronomical equipment with the hope that additional accuracy will bring out features so far overlooked. Such observations on the transmission of radio waves through the earth's atmosphere from an outside source provide a means of investigating the structure of the atmosphere not previously available.

NEW BUILDINGS OF BELL TELEPHONE LABORATORIES

AS soon as war restrictions permit, the facilities of Bell Telephone Laboratories at Murray Hill, N.J., will be greatly augmented, according to an announcement by Dr. Oliver E. Buckley, president of the Laboratories. The proposed addition is approximately the same size as the initial buildings, which were opened in 1941 and cost more than 2,000,000 dollars. The new building will extend the lines of the present one about five hundred feet in a



BELL TELEPHONE LABORATORIES AT MURRAY HILL, N.J. THE PRESENT BUILDINGS ARE ON THE RIGHT (SEE *Nature*, 151, 674; 1943) AND THE PROPOSED BUILDINGS AT THE LEFT.

north-easterly direction. Old and new buildings will be joined by a bridge with a sheltered bus terminal beneath. The accompanying picture shows the architects' sketch of the complete building group with roadways and tree-shaded parking areas.

Since the present building was opened in the autumn of 1941, about one hundred groups from varied industries, Government departments, and some from abroad have come to study its new features. The unique requirement of a laboratory is that it must be designed for change. Prominent among new features which visitors come to see are the quickly movable partitions and the ease with which wires, cables and pipes may be installed or removed and yet concealed from view.

There are no permanent partitions in the buildings except those around the stair wells and elevator shafts. All others are built of easily movable metal panels. The outside surfaces of these units are sheet steel and they are separated by a 3-in. space which is packed with rock wool to prevent the transmission of sound and heat. Doors and transoms are made in one unit which can be interchanged with a partition in any part of the buildings. Along the outside wall of the buildings there is sheet steel wainscoting under the windows and up the piers between them. This is the same in appearance as the partition panels. The wainscoting is removable without special tools to give access to service pipes and wiring which are installed behind it. Similar wainscoting is applied around interior columns.

At intervals, small wings jut out from the main building providing well-lighted offices for physicists, chemists and engineers conveniently close to their laboratories. Shops, library, medical department and restaurant all fit into the pleasing functional pattern. The fields and woods, courtyards and shaded lawns all tend to make it a pleasant place in which to work.

People are all-important to an institution, the products of which are discovery, invention and design—creations of the intellect. In choosing this 200-acre site, the Bell Telephone Laboratories management sought a pleasant and healthful countryside in the midst of desirable home communities which spread over a wide area in towns along the Orange Mountain Range and the adjoining valleys. There is no intention of creating a Company community in the immediate vicinity of the buildings. Murray Hill is about twenty-five miles from the New York headquarters.

The executive offices of Bell Telephone Laboratories will continue to be at 463 West Street, New York City, and a majority of the employees will continue to work there. With the addition at Murray Hill, however, about two thousand employees will work at the new site compared with more than one thousand employed there during the War. This will include all the research work, and most of the work of apparatus development.

Though designed for peace-time use, the present new laboratory opened just as the United States was entering the War, and its new and adaptable space proved to be a great aid to Bell Laboratories' war service. Within its walls scores of war projects have been started, some small and completed quickly, others large and expanding from a room to whole sections of the building. The completion of the Murray Hill building project will find Bell Telephone Laboratories well equipped to design better and more economical telephone and radio equipment for the Bell Telephone System. It will also be ready and equipped to continue its record of achievement in developments for the U.S. Army and Navy as they may have need for its services in the future.

FORTHCOMING EVENTS

Saturday, September 1—Sunday, September 2

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

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:

MECHANICAL ENGINEERS for OIL REFINERIES (Ref. No. C. 2587.XA), SENIOR RESEARCH ENGINEERS (Ref. No. C. 2622.XA), and SENIOR MECHANICAL ENGINEERS for direction of work on the application of Fuels and Lubricants to I.C. and other Engines and to various types of Industrial Work (Ref. No. C. 2667.XA), for home and overseas service with large Industrial Organization—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting the appropriate Ref. No. (September 7).

ASSISTANT (temporary) to the CHIEF ENGINEER—The Clerk to the Committee, County Mental Hospital, Winwick, Warrington (September 8).

ENGINEERING ASSISTANT—The Engineer, Portsmouth Water Company, 26 Commercial Road, Portsmouth (September 8).

ASSISTANT IN ZOOLOGY—The Secretary, The University, Aberdeen (September 10).

WOMEN EDUCATION OFFICERS (temporary) for NIGERIA: (*a*) FOUR GRADUATES in SCIENCE (PHYSICS, CHEMISTRY or BIOLOGY) for Junior Classes in Secondary Schools, (*b*) TWO FULLY QUALIFIED DOMESTIC SCIENCE SPECIALISTS for administrative, inspecting, and some teaching duties—The Secretary (IER: CA), Ministry of Education, Belgrave Square, London, S.W.1, or The Secretary, Scottish Education Department, 10 Abercromby Place, Edinburgh, 3 (September 10).

FIRST CIVIL ENGINEERING ASSISTANT in the COUNTY WATER ENGINEER'S DEPARTMENT—The County Clerk, Lanarkshire House, 191 Ingram Street, Glasgow, C.1 (September 14).

LECTURER IN CHEMISTRY at GORDON MEMORIAL COLLEGE, KHARTOUM—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting Ref. No. F. 4717.A (September 15).

ORGANIC CHEMIST at Long Ashton Research Station—The Secretary and Registrar, The University, Bristol 8 (September 15).

RESEARCH PHYSICIST (preferably with experimental knowledge of electric circuits), and a BIOLOGIST, to establish and work in a suitably equipped laboratory in London to study and develop sensory devices for the blind under the general guidance of its newly appointed Sensory Devices Committee—The Secretary, St. Dunstan's, 9 Park Crescent, London, W.1 (September 15).

CHAIR OF PHILOSOPHY—The Dean, Faculty of Arts, Fouad I University, Cairo, Egypt (September 15).

ASSISTANT IN MATHEMATICS—The Secretary, The University, Aberdeen (September 15).

LECTURER IN PRODUCTION ENGINEERING to teach Workshop Technology to the standard of Higher National Certificate in Production Engineering in the Denbighshire Technical College—The Director of Education, Education Offices, Ruthin (September 15).

HEAD OF THE DEPARTMENT OF HORTICULTURE—The Secretary, West of Scotland Agricultural College, 6 Blythswood Square, Glasgow (September 15).

PROFESSOR OF VETERINARY SURGERY, OBSTETRICS AND ANIMAL HUSBANDRY at the Veterinary College, Ballsbridge, Dublin—The Secretary, Civil Service Commission, 45 Upper O'Connell Street, Dublin (September 28).

ASSISTANT LECTURER OR LECTURER in (*a*) PHILOSOPHY, (*b*) MATHEMATICS (APPLIED MATHEMATICS: special qualifications in ATOMIC PHYSICS essential), (*c*) ENGINEERING, (*d*) MINING (with special qualifications in COAL PREPARATION)—The Registrar, University College of South Wales, Cathays Park, Cardiff (September 29).

LECTURER in the DEPARTMENT OF MATHEMATICS—The Secretary, Queen's University, Belfast (September 30).

LECTURER (Grade III) in the DEPARTMENT of PURE MATHEMATICS—The Registrar, The University, Liverpool (September 30).

MINING CONSULTANT to advise the Government of Tanganyika on all matters pertaining to mining development in that Territory—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting C.2738.A (October 1).

COUNTY ANALYST and OFFICIAL AGRICULTURAL ANALYST—The Clerk to the County Council, County Hall, Maidstone (October 6).

LECTURER IN PSYCHOLOGY in the Natal University College, Pietermaritzburg—The Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1 (October 7).

REGIUS CHAIR of NATURAL HISTORY at Aberdeen University—The Private Secretary, Scottish Office, Fielden House, 10 Great College Street, London, S.W.1 (October 15).

SIR DORABJI TATA READER in PHARMACEUTICAL CHEMISTRY—The Registrar, The University, Bombay, India (October 15).

DIRECTOR OF THE COLLEGE—The Secretary, Royal Technical College, Glasgow (October 20).

CHEMIST AND BACTERIOLOGIST to the Barnsley Waterworks Department—The Waterworks Engineer and Manager, Town Hall, Barnsley, Yorks (October 30).

DEPUTY COUNTY SURVEYOR and ENGINEER—The Clerk to the County Council, County Hall, Wakefield, Yorks (October 31).

INSTRUMENT MAKERS, experienced, used to high-class Experimental Work, for the Royal Aircraft Establishment, Farnborough, Hants—The Exchange Manager, Ministry of Labour and National Service, High Street, Aldershot.

EXPERIMENTAL ENGINEER with marked ability in design and development of instrument mechanisms, by a Mechanical and Electrical Instruments Manufacturing Company in East Anglia—The Ministry of Labour and National Service, Appointments Office, Lloyds Bank Chambers, Hobson Street, Cambridge, quoting Ref. No. 216.

DIRECTOR OF THE SCIENTIFIC INSTRUMENT MANUFACTURERS' ASSOCIATION OF GREAT BRITAIN—The Secretaries, Messrs. Binder, Hamlyn and Co., River Plate House, 12-13 South Place, London, E.C.2.

CHEMIST, with good general knowledge, capable of undertaking investigation of methods for handling and processing palm oil, fruit juices and other food products, for British West Africa—The Ministry of Labour and National Service, Appointments Department, Sardinia Street, Kingsway, London, W.C.2, quoting Ref. No. O.S. 1034.

MECHANICAL or CIVIL ENGINEERS for Middle East to take charge of sections of extensive construction and erection contract (must have experience of construction of large process plants, oil refineries, or similar works)—The Ministry of Labour and National Service, Appointments Department, Sardinia Street, Kingsway, London, W.C.2, quoting No. O.S. 1050.

ASSISTANT TUTOR in MATHEMATICS—The Secretary, University of London Institute of Education, 42 Portman Square, London, W.1.

INSPECTORS of COTTON CULTIVATION in the Sudan—The Ministry of Labour and National Service, Appointments Department, Sardinia Street, Kingsway, London, W.C.2, quoting Ref. No. O.S. 1028.

COUNTY HORTICULTURAL SECRETARY—The County Secretary, N.F.U., Farmers' Club, Worcester.

ASSISTANT TEACHER of CIVIL ENGINEERING and associated Subjects—The Principal, Birmingham Central Technical College, Birmingham, 1.

LECTURER (full-time) in METALLURGY—The Principal, Borough Polytechnic, Borough Road, London, S.E.1.

LECTURER in GEOGRAPHY, qualified to undertake work to Degree standard—The Registrar, Municipal College, Portsmouth.

LECTURER in ELECTRICAL ENGINEERING (should possess an Honours Degree or equivalent qualification in Electrical Engineering or Physics, with Radio), a LECTURER in ELECTRICAL TECHNOLOGY and MAINTENANCE (should possess a Degree or equivalent qualification in Electrical Engineering), and an INSTRUMENT MECHANIC, in the Rotherham College of Technology—The Director of Education, Education Offices, Rotherham.

LECTURER (graduate) 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.

ENGINEERING WORKSHOP INSTRUCTOR and STEWARD in the Batley Technical College and School of Art—The Education Officer, Education Offices, Batley, Yorks.

LECTURER (man or woman) in MATHEMATICS and PHYSICS—The Principal, Training College, Castle View, Dudley.

REPORTS and other PUBLICATIONS

(*not included in the monthly Books Supplement*)

Great Britain and Ireland

National Trust for Places of Historic Interest or Natural Beauty. Report 1944–45. Pp. 112+4 plates. (London: National Trust, 1945.) [18

The West Indies and the Mountain Uplift Problem. By Dr. C. T. Trechmann. Pp. 26. (Castle Eden: The Author, 1945.) [18

Scottish Marine Biological Association. Annual Report, 1938–39. Pp. 48. Annual Report, 1939–40. Pp. 32. Annual Report, 1940–41. Pp. 32. Annual Report, 1941–42. Pp. 20. Annual Report, 1942–43. Pp. 24. Annual Report, 1943–44. Pp. 24. (Millport: Scottish Marine Biological Association, 1940–1945.) [18

Other Countries

Transactions of the American Philosophical Society. New Series, Vol. 34, Part 3: The Mammalia of the Duchesne River Oligocene. By Prof. William B. Scott. Pp. 209–254+8 plates. (Philadelphia: American Philosophical Society, 1945.) 2.25 dollars. [197

Annual Report of the Research Council of Alberta, 1943. (Report No. 44.) Pp. 14. (Edmonton, Alba.: King's Printer, 1945.) 5 cents. [237

Research Council of Alberta. Contribution 4: Hot-Water Separation of Alberta Bituminous Sand. By K. A. Clark. Pp. 18. Contribution 5: Some Physical Properties of a Sample of Alberta Bituminous Sand. By K. A. Clark. Pp. 8. (Edmonton, Alba.: King's Printer, 1944.) [237

Department of Scientific and Industrial Research, New Zealand. Bulletin No. 87: Eighth Annual Report, for the Year 1940–41, of the Wheat Research Institute, Christchurch, New Zealand. Pp. 24. 1*s*. Bulletin No. 88: Fireclay and Ganister in New Zealand. By J. Henderson. Pp. 40. 2*s*. 6*d*. Bulletin No. 89: The Dairy Industry in New Zealand. By W. M. Hamilton. Pp. 176. 7*s*. 6*d*. Bulletin No. 90: Milburn-Clarendon Phosphate Deposits. By E. O. Macpherson. Pp. 44+7 plates. 2*s*. 6*d*. Bulletin No. 91: Nassella Tussock (*Nassella trichotoma* (Nees.) Hack.); Field Studies and their Agricultural Significance. By A. J. Healy. Pp. 90+6 plates. 2*s*. 9*d*. (Wellington: Government Printer, 1942–1945.) [237

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