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NATURE

A WEEKLY JOURNAL OF SCIENCE

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

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NATURE PRESERVATION AND NATIONAL LIFE

THIS War, like the War of 1914–18, with its demand for sacrifice from all the people, has given a jolt to the easy-going tolerance which, in times of peace, permitted the development and the continuance of social conditions universally regarded as intolerable. In Great Britain, at any rate after the War, a reawakening of the nation to its needs, with insistent urge for their satisfaction, are foregone conclusions, and promise of some readjustment of conditions is implicit in the post-war reconstruction policy of His Majesty's Government.

But if post-war reconstruction is not to miss a great opportunity it must not limit its efforts to re-arrangements of industry and populations as between town and country, restoration of security to the basic food-raising industries of husbandry and fishing, banishment of slums and reduction of disease, and similar essays to improve the material welfare of the nation or of its constituents. For the welfare of man's spirit, as well as his material good, demands forethought and planning, and the "nation of shopkeepers" is certain, and properly so, to put the latter first, and perhaps forget the other altogether in the difficulty of attaining throughout the nation even the lowest decent standard of economic independence and health, to say nothing of happiness.

Indeed we can say that one aspect of this more subtle welfare has been forgotten, or almost forgotten, by the Governments which have represented our people—the opportunity for sharing in that pleasure, mental uplift and healthy recreation which is associated with great open spaces and the beauty of Nature. It is a matter in which the Governments of most civilized countries have far out-distanced the leaders of our own nation. Rightly our legislators may plead that the people has never with one voice demanded such amenities, and this cannot be gainsaid, but the position is no different in other lands, for even of the United States, with its enormous area of Nature reserves, it has just been written, "a great part of the public is indifferent to the success of wildlife conservation"*. There the Government, itself guided by a few enlightened pioneers, gave the lead, and now it expends much thought and money in endeavouring to educate the people to make the best use of their own Nature possessions, although of course there is a nucleus of the American nation which takes full advantage of its opportunities.

We plead, therefore, for the inclusion in His Majesty's Government's review of post-war planning, of consideration of the value and the possibility of setting aside as national heritages areas

* Ira N. Gabrielson, "Wild-Life Conservation". 1941, p. 241.

for the people. The difficulties do not appear to be greater than those which have been surmounted in less wealthy nations. Density of population and the area under cultivation offer no greater obstacles here than in many European countries. Indeed, of land which may be regarded as almost unproductive the U.S.S.R. and Spain have about 20 per cent, France 14 per cent, Italy 13 per cent and Germany 9 per cent, while the proportion in Great Britain is roughly 18 per cent. Surely there is room here for the areas we have in mind.

These areas should be of three kinds, conveniently specified in a memorandum just issued as the result of a conference of representatives of British organizations interested in the provision of national parks and the preservation of the native plants and animals of Great Britain*.

(1) *National parks and national reserves*, of considerable size, open to and providing facilities for the recreation and enjoyment of the public with no more restriction than is necessary to preserve the amenities of the area. Their objects are various, but in general their purpose is to ensure to the people access to areas of wide appeal and to preserve these unspoiled for future generations. Such are typical mountain regions, moorlands and downs, stretches of sea-coast, fen-land, which have some peculiar interest because of their scenic beauty, their geological structure, their association with human history, their plant and animal life, and above all, their suitability for recreation and rest.

(2) Intermediate areas, which we may call *national wards*, "notable alike for their natural beauty and for their scientific interest and often including agricultural areas of great charm, in which all that is requisite for the preservation of their amenities is that they should not undergo any fundamental change". Such areas, and presumably only exceptional areas would be selected, would have to be delimited and preserved from unsightly or injurious industrial development, the operations of the speculative builder and the advertiser. Land in such areas need not be purchased from its owners ; the essential is simply that present usage should be continued or should not be replaced by usages less in keeping with the peculiar charm of the place.

(3) *Nature reserves and sanctuaries.* These are areas to be set aside for a very special purpose, the preservation of representative samples of our native wild plants and animals, and of geological features of particular significance. They would include typical marsh and fen such as the Broads, beaches such as Blakeney, woodland such as the ancient pine forest of the Spey Valley, mountain and sea-cliff. Naturally, their special purpose would restrict their appeal to a limited section of the people, and the safety of the plants and animals would demand the least possible disturbance even by naturalists and the Nature-loving public ; but the experience of the past, with its tale of the extermination and disappearance of native species, calls for the determined protection of wild life.

Of these three types of area the grandest in dimensions and in purpose is the national park, with its offer to the people of temporary release from the rush and strain of the daily round and of recreation of mind and body by contact with the peace and beauty of unspoiled Nature ; and if national parks are to fulfil this object they must be made reasonably accessible to centres of population, and must have within easy reach, if not within their bounds, rest-houses where accommodation is comfortable and food inexpensive. The success of this part of the scheme will rest largely upon careful selection and subsequent planning. But even more will the success of the Nature reserves depend upon the proper selection of areas, for just as their purpose is specific, their locality must be defined by fine adjustment of environment to the needs of the wild inhabitants, plants or animals.

While the selection of the national parks and national wards, therefore, should be in the hands of a composite body including representatives of the Government Departments concerned, of bodies whose interests are in art and amenity, in touring and camping, and in wild life in its broader aspects, the choice of Nature reserves could be most fittingly made by scientific workers, especially biologists, familiar with detailed distribution and the conditions which influence particular species or assemblages of species.

The recent conference, the place and date of the meeting of which, curiously enough, are not mentioned in the Memorandum, made certain recommendations regarding the management of the areas. It suggested that the national parks and national reserves should be administered and managed locally "so far as may be desirable", a qualification which seems to leave the recommendation very much in the air. On the other hand, as regards the specialized Nature reserves and sanctuaries, the management "should be placed only in the hands of persons fully conversant with the highly technical problems included in the maintenance of the balance of life, and the general control should be vested in a central authority representative of the different interests concerned". Since no one has yet fathomed the intricacies of the reactions which make up the balance of life

* Nature Preservation in Post-War Reconstruction. Conference Memorandum No. 1. Issued on behalf of the Conference of the Society for the Promotion of Nature Reserves. November 1941.

in any area, it may be difficult to constitute the "fully conversant" management committee. Indeed the great value to scientific knowledge of these ecological oases will be the opportunity they afford of continuous study under known conditions of the interplay of weather, soil, vegetation and fauna. How much that is required is indicated by the confession of the director of wild-life conservation in the United States: "the research undertaken in this country [U.S.A.] has never yet been great enough to meet the needs of conservation in any of its phases" (*op. cit.*, p. 243).

So far as wild life is concerned, there are three broad principles which must guide the national park authorities to be created to determine general policy, if the report of the National Park Committee (1931) is followed. They are clearly set out by the Director of Fish and Wild-life Service in the United States Department of the Interior (*op. cit.*, p. vi). The first is that wild-life conservation is not an isolated problem but is inseparably linked with problems of soil, water and forest, and that all must be regarded together in a comprehensive policy. The second is that wild life must have an environment, animate as well as inanimate, suited to its needs if it is to survive. The third is that any use that may be made of any wild creature must be limited to the destruction of not more than the annual increase if the breeding stock is to be kept up, with the correlative that those animals and plants which are inordinately successful in the competition of life and tend to oust less robust neighbours must be kept ruthlessly within bounds. The successful sanctuary is not necessarily a place where *all* animals and plants are protected, for indiscriminate protection may well lead to the survival of the only species of plants or animals which need no protection, and to the consequent disappearance of the very forms for which a sanctuary was necessary.

It is unlikely that even the national parks, the areas of which are bound to be limited, will satisfy the craving for variety of scene and for the stimulus of unexpected prospects which is the inheritance of most men and particularly of such as the artist and the Nature wanderer. So that, with the formal reservations which have been mentioned, it behoves an enlightened Government to take further steps to preserve, and encourage appreciation of, the grander aspects of our varied scenery. A danger lies in the clash between business and Nature—the spread of industry to an unspoiled valley with perhaps the consequent pollution of miles of river and other deteriorations, the construction of ponded valleys in the Highlands as a source of electric power, entailing changes in the water supply of a watershed, the felling of great stretches of forest without compensatory planting. While no negative policy should be allowed to stand in the way of efforts which are to benefit vast multitudes of people, nevertheless a wise control would see to it that the benefits mentioned here were gained without serious disturbance to scenery.

It is sometimes forgotten that the great steps in the progress of civilization transformed the aboriginal landscape: the development of agriculture drained the marshes, destroyed the lowland forests, and replaced variety of vegetation by uniformity, just as the domestication of animals contributed further to the disappearance of woodland for the sake of pasture, and intensified the changes in plant life. What we now look upon as natural landscape is not the landscape of our forefathers, and it may be that the increasing comforts of civilization can only be gained by some sacrifice of aboriginal Nature. There is the more reason that further encroachments should be guided and localized, and that certain selected areas should now be set aside and should be preserved for all time as representative of the scenery and of the haunts of the wild life of the British Isles.

THE SCIENCE OF MERCERIZING

Mercerising

By J. T. Marsh. Pp. xv+458+56 plates. (London: Chapman and Hall, Ltd., 1941.) 32*s*. net.

WHEN cotton hairs are treated with a concentrated solution of sodium hydroxide in the cold, they combine with alkali and undergo a remarkable series of changes. The cellulose swells in such a way that the flattened cross-section becomes elliptical, with fairly complete disappearance of the lumen, and lateral swelling is accompanied by a decrease in length. Such phenomena, and the increased affinity for dyes of the alkali-treated hairs, as well as their increased strength, were first observed by a Lancashire chemist, John Mercer, in 1844–1850. After an interval of some thirty years, Mercer's observations were turned to practical advantage in the manufacture of crêpes, but the mercerizing process proper did not come into being until 1890, when a twenty-year-old chemist, Horace Lowe, discovered that cotton acquires a greatly increased lustre when the hairs are tensioned so as to prevent shrinkage during the caustic soda treatment.

As one of the most important processes in the cotton textile industry, mercerizing has occupied the attention of numerous research workers, especially during the past twenty years, and published work on the subject now exceeds in volume that on any other aspect of cellulose chemistry. Systematic studies of the changes in form undergone by cotton and related fibres in solutions of the caustic alkalis have been undertaken ; the mechanism of swelling has been elucidated, largely as a result of Neale's investigations ; changes in fine structure have been examined by X-ray methods ; and the properties of the mercerized product have been defined.

These achievements are, to a large extent, due to the awakening of the industrialist during the War of 1914–18 to the advantages which would accrue from the application of the scientific method even to such well-established processes as those of the textile industry. From the resulting activities of the private research laboratories, research associations and research workers in the universities, textile technology has been advanced from a state of simple empiricism to that of an exact science. The pace of recent advances in knowledge has been such that the man of science, having much to learn from the craftsman, has had little opportunity of collating his new-found knowledge in the form of text-books suitable for use by the student. Even now, most of the books in common use belong to the empirical age in textiles, and are unworthy of the new dignity of the subject. No such criticism, however, can be applied to Mr. J. T. Marsh's recent work on mercerizing. Out of his long experience as a research worker in the field of cellulose chemistry, he has compiled a survey of the literature of mercerizing which is both authoritative and interesting.

Commencing with a vivid account of the work of Mercer and Lowe, Marsh proceeds to discuss the growth and structure of cotton hairs and their dimensional changes in caustic soda solution, as a preliminary to a comprehensive account of mercerizing practice. This half of the book contains many illustrations of the beauty of the scientific method in textile technology, such as the proof that the swelling of cotton hairs in aqueous solutions of alkaline hydroxides depends on the degree of hydration of the alkali ion, and Adderley and Oxley's discovery that tables of doubling twists may be replaced by the simple rule that maximum lustre is obtained when the doubling twist is seven tenths of the original twist in the component yarns. The second half of the book is concerned mainly with the theoretical aspects of the action of caustic alkalis on cellulose. Neale's work on the swelling of cellulose, and Urquhart and Williams' studies of the moisture relations of mercerized cotton, receive exhaustive treatment in chapters which are among the most interesting in the volume. The methods which may be employed to assess the efficiency of the mercerizing process, and to identify causes of faults in the finished product, are discussed in the concluding pages.

In the main, the author has adopted the historical method in developing the different sections of his book ; no important paper fails to receive discussion, but undue space seems to be given to the now discarded work of early investigators. In addition, the reader is left with the impression that the author has had some difficulty in deciding the order in which the different sections of his subject should be treated. There are re-entrant points in the argument, and a more logical development might have been first to discuss the theoretical aspects of the action of caustic alkalis on cellulose, then the dimensional changes undergone by cotton hairs, followed by mercerizing practice and the evaluation of the finished product. Despite these defects, the book forms a most welcome addition to the literature of textile technology. It is particularly well illustrated, and besides being helpful to the research worker, should play an important part in the training of the future industrialist.

J. B. SPEAKMAN.

FUTURE OIL PROVINCES OF NORTH AMERICA

Possible Future Oil Provinces of the United States and Canada

A Symposium conducted by the Research Committee of the American Association of Petroleum Geologists, A. I. Levorsen, Chairman. Papers read at the Twenty-sixth Annual Meeting of the Association, at Houston, Texas, April 1, 1941, and published in the Association Bulletin, August 1941. Edited by A. I. Levorsen. Pp. vi+154. (Tulsa, Okla. : American Association of Petroleum Geologists, 1941.) 1.50 dollars.

THE authors of this symposium, in their review of possible additional sources of oil in Canada and the United States, are not concerned with the discovery of single fields or leases, nor yet with extensions of existing fields. Rather are they grappling with the problem of discovery of reserves in areas as yet only partly explored and in which there is every prospect of finding, not one pool, but many pools, sufficiently large to be of significance in assessment of the nation's total reserves.

The views expressed are for the most part not those of individuals, but represent the collective findings of committees appointed by various geological organizations to compile this inventory. There are, for example, contributions from the Rocky Mountain Association of Petroleum Geologists and the Pacific Section of the American

Association of Petroleum Geologists; also from the Geological Societies of Tulsa, West Texas, etc. Each of the nine articles contained in the symposium includes a description of provinces, in the region for which the authors are responsible, which have been selected as favourable from the point of view of future oil resources. Considered reasons are given for their selection, and beliefs substantiated by sketch maps and sections showing the general geography, structure and stratigraphy of potentially productive provinces. Moreover, to stimulate cohesion and enable the reader to frame an opinion of total reserves of this character throughout the United States and Canada, unexplored territory is critically reviewed from the point of view of four criteria considered, if present, as being favourable to oil accumulation. These are: areas of sedimentation, preferably marine, variable and unmetamorphosed; seepages; unconformities; and the known presence of wedge belts of porosity.

A map depicting regions of possible future oil provinces as described in the symposium indicates that approximately two fifths of the total area of the North American continent falls into the category of potentially favourable territory. It is refreshing to visualize the magnitude of unexplored reserves in this way rather than to be faced, as one so often is, with quantitative estimates of potential reserves running into billions of barrels and having little claim to accuracy. Surely the bugbear of the industry, fear of exhaustion of resources, will loom less large when it is realized that there are such vast areas of untried territory. Calculations of reserves cannot properly be made until geologists have completed the almost limitless task of exploring such mighty terrains as are described in this symposium. Even then, no claim could be laid to have exhausted possibilities of new resources in these two countries.

CANADIAN ARCTIC BOTANY

Botany of the Canadian Eastern Arctic

Part I: Pteridophyta and Spermatophyta. By Nicholas Polunin. (National Museum of Canada, Bulletin No. 92.) Pp. vi+408. (Ottawa: King's Printer, 1940.) 1 dollar.

WORK on the flora of the Canadian Eastern Arctic has been dogged by misfortune. James M. Macoun, chief botanist of what is now the National Herbarium of Canada, made several expeditions into the western part of the area, collecting a wealth of material, but died before his father in 1910. His prospective collaborator, Theo. Holm, had in 1902 promised at an early date a work on the Hudson Bay flora, but died before he completed it. Thorild Wolff died in 1917 crossing the extreme north of Greenland before he reached the area he chiefly set out to explore. M. O. Malte, successor to Macoun as chief botanist at the National Museum, in 1927 began work in earnest in collaboration with C. H. Ostenfeld, director of the Botanical Garden, Copenhagen, a well-known specialist in the Arctic flora. Ostenfeld died in 1931 and Malte in 1933, but during these few years Malte made three voyages in the Canadian Eastern Arctic, collecting more than ten thousand sheets of specimens.

The field therefore lay open ready for Nicholas Polunin, a young botanist with a bent for Arctic travel, who in 1930, when a college student, made a botanical trek across Arctic Norway and Lapland; in 1931 as botanist to the Oxford University Expedition investigated Akpatok I. (Labrador); and in 1933 alone crossed and recrossed Spitsbergen in $2\frac{1}{2}$ days. In 1934, on the Hudson Bay Company's supply ship, he visited all the more important northern ports in the Eastern Canadian Arctic, and in 1936 made a similar voyage with the Eastern Arctic Patrol. From autumn 1935 he had spent more than a year revising all the Arctic material in the Gray Herbarium of Harvard University, and in some Canadian museums. The Canadian authorities, finding so much work already done, offered their support if Polunin would complete, for them to publish, a flora of the Canadian Eastern Arctic, of which, after more than two years' further solid work, the volume before us is the first part. Parts II, "Thallophyta and Bryophyta", and III, "Vegetation and Ecology", are ready for printing, and Part IV, "Subarctic Regions", is well advanced. The Canadian authorities deserve thanks for producing this useful volume in these difficult times, and it is hoped that the remaining parts will appear with as little delay as possible, for the systematic keys for the identification of the flowering plant species—greatly needed by students of the Arctic flora, who at present are forced to acquire the necessary knowledge by laborious and time-consuming delving in an extensive and scattered literature—were relegated to Part IV, as that part would include a much greater number of species, some of which will probably be discovered in the area covered by the present volume.

As it stands, however, this work will be invaluable to students, since it collates all material from the area in fourteen American and European institutions, which together house the greater part of the specimens ever collected there, and in addition provides an extremely full bibliography of the literature, which has been thoroughly digested by the author. The work is not, however, a dull compilation of already published material. Polunin has himself revised all identifications, and in addition contributes to the account of individual species valuable notes resulting from his own field observations and herbarium study. As a result, the book is full of useful and interesting information, not only taxonomic but also ecological and miscellaneous. All doubtful records have been investigated, and when species have been excluded the nature of the error is exposed as fully as possible.

The introduction begins with the geography of the area, which includes "all land in Canada lying north of the 60th parallel of latitude and east of longitude 95 degrees west, with the exception of Axel Heiberg Island, Boothia Peninsula, and the inland parts of Keewatin". For the grouping of individual records, this area is divided into ten districts: Ellesmere; Devon, Cornwallis, and Somerset Islands; Northern Baffin; Central Baffin; Southern Baffin; Melville Peninsula; Northernmost Labrador; Northern Quebec; Islands in Hudson and Ungava Bays; West Coast of Hudson Bay (Keewatin). The boundaries of these districts are shown on a sketch map in the text, but not on the larger map supplied, and unfortunately the authorities did not see their way to arrange for the insertion on the latter of the numerous localities mentioned by collectors on labels, although the inclusion of these would have greatly increased its value. The difficulty of tracing place-names so used without any indication of their whereabouts—such as 'Shift-rudder Bay', 'Floeberg Beach', 'Dumbbell Harbour', and the like—is here solved by the inclusion (pp. 3–11) of the latitude and longitude of almost all such localities. The necessity of this is shown by the fact that even when such essential names as Baffin Island are counted, less than two-fifths of the names in these lists are shown on the map, and it is to be hoped that the authorities will reconsider their decision and issue a more satisfactory map with a subsequent part.

The second part of the introduction gives a brief summary of the "History of Exploration" in the area, and includes an alphabetical list of collectors with dates and localities, extremely useful to workers in herbaria. An undeserved slur is cast on Robert Brown, of whom it is said that he, "in compiling a botanical appendix to Ross's report (1819), 'lumped' the Greenland plants with those of our area, so that with a few exceptions I am unable to cite them." Robert Brown was a most meticulous worker, and the 'lumping' was due to the fact that for the most part the specimens—now in the British Museum—apparently never had any indication of the place where they were collected. It may even be that Robert Brown made such strong comments on this that the specimens collected on Parry's voyages a few years later were precisely localized, for in those days it was commonly considered that a very general indication of locality was sufficient.

Except for the acknowledgments of help, the remainder of the introduction deals with the plan, scope, and methods of the catalogue itself. The author estimates that he has examined and determined between fifty thousand and sixty thousand records. He writes: "It will be noted that my conception of species is rather broad—that I tend to be a 'lumper' rather than a 'splitter'. My varieties are the subspecies of some authors, and even the microspecies of others—entities which in possessing several 'characters' of distinction from the rest of the species, and in having a geographical distribution of their own, are 'on the way to becoming species'." (It may be remarked that these features, namely, correlation of distinct characters and a distinct distribution, are precisely those which I have frequently insisted on as being the twin essentials of specific difference, and these groups are better termed subspecies.) "My *formæ* are entities which, in our own state of ignorance concerning the genetics and cytology of most groups, are assumed to be of lesser taxonomic significance. They are often striking enough in their differences from the typical . . . form, at least in the apparently less conservative characters, but still are presumably mere phases, which lack on the one hand a real *group* of hereditable characters, and on the other a geographical range distinct from the rest of the species." (The term *variety* would be more appropriately applied to such still unresolved *variations*.)

All critical groups have been investigated by the author himself, a course possible in dealing with the reduced flora of the Arctic regions. Although the order and nomenclature are in general those adopted in the Gray Herbarium, Polunin has preferred to investigate these matters for himself, rather than to adopt them without question. The care with which both kinds of investigation have been conducted is shown throughout the volume by the usefulness of the notes which embody these researches.

The catalogue itself comprises 297 species, of which four are new, and a total of 399 named forms, including ten new varieties and nine new forms; most of the novelties are illustrated. Of all these, not one appears to have been introduced by the agency of man, although the area dealt with is some 420,000 square miles of land. Man is, however, a rarity in these regions. Of the 297 species, nearly two hundred occur also in the European Arctic, and between eighty and ninety in Britain. The severity of the climate of this part of boreal

America is indicated by the fact that in Europe north of the 60th parallel more than a thousand species occur, and even in Greenland about four hundred species are known.

Each species in the catalogue is dealt with in a uniform manner. The name is followed by only such important references and synonyms as are required for identification, the rest of the nomenclature being obtainable through the index. Then follows, in most species, "a discussion of the systematic position, with special reference to the range of variation that it exhibits in or near our area; also, when possible, notes on its morphology, flowering and fruiting, and on any other features of special interest."

These discussions of taxonomy and variation are much more informative than the usual bald citation of names in synonymy, and the readable and vivid style in which they are written is more likely to impress the information on the mind than the stereotyped frigidity which is nowadays so often considered to be required in scientific publications. For example, of *Carex bicolor* All. (recently recorded from the Outer Hebrides), "This most characteristic and attractive little sedge, with its more or less pendulous spikes of rounded, pastel-green fruits peeping out from behind dark scales, although not uncommon in places, appears never before to have been recorded from within our area, or, indeed, from anywhere in the Arctic Archipelago . . . ; also *Lycopodium Selago* L. . . . it is reported by Victorin of this species that 'toutes les tribus sauvages du littoral de l'Alaska mâchent les tiges en avalent le jus pour produire une sorte d'intoxication'; but I can neither find any confirmation of this in the literature or by enquiry from travellers in the region, nor obtain any such effect on myself. Certainly the Eskimo of the Eastern Arctic regions do not use it or any other plant in this manner; indeed, except for the occasional dressing of wounds with *Sphagnum* and the use of various plants both higher and lower for food (generally quite irregularly; they will eat almost anything at times), they do not seem to apply any plants or plant products to their bodies either internally or externally, in marked contrast to their Indian neighbours. . . ."

After these notes the "General Distribution" of the species outside the area is given, followed by the "Eastern Arctic Distribution", or general distribution within the area. Then, under "Occurrence", come "details of the relative abundance of the species in the various parts of its range in our area; also notes on its habitat and ecology, and on its importance as a component of the vegetation. [The ecological notes are mainly based on the author's own observations.] The consideration of each species is concluded by the detailed citation, under the ten major districts headings mentioned . . . of the specimens of it that have been found within our area, or, in the case of the commoner plants, by generalized statements under the same headings."

In the detailed citation of records in critical groups, including as it does indication of the herbaria in which specimens exist and of previous identifications, lies one of the great values of this work. For until the end of last century the existing material was generally scanty and widely scattered, the literature equally so, and consequently identification, especially in critical genera, was frequently very unsatisfactory, wherefore systematists using herbarium material as a basis for their own determinations were often misled and the already existing confusion became worse confounded. Robert Brown, pioneer in the field, working out the results of the first of Parry's voyages, of which his "Chloris Melvilliana" still stands unshaken as the foundation of the literature of the American Arctic, worked with such care that Parry, anxious to obtain quicker determinations to include in his report for the Admiralty, became impatient, and sent the material of his subsequent voyages to W. J. Hooker. Hooker, who was not, as a critical botanist, of the calibre of Brown—*botanicorum facile princeps*—"lumped" together the species of critical genera. From this it followed that, in precisely those genera where the need for well-named material was greatest, herbaria normally contained different plants mixed under the same name, until it was unfortunately too true, as Dr. J. Lid of Oslo once remarked to me, that most Arctic collections were very badly named, and require thorough revision by a specialist in the Arctic flora. This revision has now been admirably made for the Eastern Canadian Arctic. The debris of the past has been cleared up and a good foundation for the future laid down. In an area so extensive a great deal must still remain to be done, but a much-needed work has been accomplished.

One may disagree with the treatment of certain genera or species. My own experience convinces me that the Arctic Cochlearias are not all one species; but every student of this difficult genus seems to produce a different solution of its undoubted intricacy. The "*Zostera marina*", isolated in Hudson Bay in water "probably almost always below 10 C.", is more likely to be the more boreal *Z. Hornemanniana* Tutin. But specialists will be able to criticize any comprehensive work for yet a long time to come, and the present volume certainly calls for compliment on its general soundness rather than criticism in detail. It remains but to add that it is well set out, well printed (with few misprints), and very thoroughly indexed.

A. J. WILMOTT.

Herbs for Daily Use in Home Medicine and Cookery

By Mary Thorne Quelch. Pp. 328. (London: Faber and Faber, Ltd., 1941.) 8*s.* 6*d.* net.

THERE are here numerous pleasant anecdotes of the useful plants of our islands, culled from authorities both ancient and modern. The range is from Dioscorides through the herbalists—Gerard and Culpeper especially—to a gypsy woman "whose herbal lore I shall quote many times". This promise is amply fulfilled. There are recipes for unusual dishes and cosmetics. Among the former "the boiled nettles, as described, may be surrounded by poached eggs". Among the latter, to prepare a cold cream, "if two ounces of glycerine are purchased". Alas, 'tis "if" indeed. The bulk of the book is concerned with medicinal purposes. As it is for the home, safety is wisely put first and the drug plants of the pharmacopœia are dismissed under the entry "poisonous plants". The use of the yellow flowers of celandine as a cure for jaundice is derided as an example of the doctrine of signatures; but, on reading later that beetroot is "of value to anæmic women and girls", you wonder if the superstition is so dead after all. Old wives' simples may be traditionally mated with old wives' tales, but they include (p. 272 under review) raspberry-leaf tea as an aid to easy labour, a prescription which has recently been lifted into official respectability. Here is a good half-hour's browsing to be taken over the nuts and wine.

Butterflies

A Handbook of the Butterflies of the United States, complete for the Region North of the Potomac and Ohio Rivers and East of the Dakotas. By Prof. Ralph W. Macy and Prof. Harold H. Shepard. Pp. vii+247. (Minneapolis: University of Minnesota Press, 1941.) 3.50 dollars.

THIS handbook forms an admirable short guide to all species of butterfly inhabiting the region it is intended to cover. The area in question includes the United States and adjacent Canada lying to the east of Nebraska and the Dakotas and as far south as the northern borders of Missouri, Kentucky and Virginia. The only other book that treats in any detail of the butterflies of the territory referred to is the large, expensive and long out-of-print work of S. H. Scudder.

The chief purpose of the present book is to make identification as easy as possible. Keys to the species of each family are followed by individual descriptions, notes on habits, on distribution, on the larva and its food plants, times of appearance, manner of flight and so forth. The collector will consequently find a good deal of information written in an attractive style and in a brief, concise form. The book should have a ready sale among individuals, secondary schools, and colleges of the United States and parts of Canada. The price is very reasonable considering there are four good-quality coloured plates and a number of photographic text-figures. A. D. I.

British Scientists

By Sir Richard Gregory. (Britain in Pictures Series.) Pp. 48+12 plates. (London and Glasgow: Wm. Collins, Sons and Co., Ltd., 1941.) 3*s.* 6*d.*

THIS little book puts in the simplest possible way some of the facts about the life and work of the great British men of science. Though containing only fifty pages, it is illustrated with twelve coloured plates and nineteen other illustrations. It is the sort of book which might be distributed in large numbers to soldiers and other large sections of the population who wish to know something of those who have had, it is increasingly realized, a most profound influence on the destiny of the human race. The book should also be suitable for readers in foreign lands, who are hazy about the existence and achievements of British men of science.

The information in the book will generally be known to scientific workers. They may not, however, have seen before coloured reproductions or the originals of several of the illustrations. For example, the picture of the third Lord Rayleigh working in his shirt sleeves in his laboratory is reproduced in colour. Then there is the painting from the University of Birmingham of Sir Oliver Lodge; the long, red doctor's robe, emphasized by his great height, comes out brilliantly. In black and white, there is Francis Dodd's drawing of Rutherford.

There are some misprints in the list of dates given at the end. These might be corrected in future editions. J. G. CROWTHER.

Physics of the Air

By Dr. W. J. Humphreys. Third edition. Pp. xiv+676. (New York and London: McGraw-Hill Book Co., Inc., 1940.) 42*s.*

THIS book has reached the status of a classic of meteorology; the few weaknesses of the first edition having been for the most part remedied in the second, the third edition needed little more than bringing up to date by the addition of references to the advances of the last ten years. These additions have necessitated the writing of a number of new paragraphs, notably on the effect of clouds on incoming and outgoing radiation, energy equations of evaporation, and zones of silence in meteorological acoustics, the latter remedying a serious omission in the second edition, while throughout the book existing paragraphs have been expanded to take in work published up to 1939. In a few cases the additions are disappointing; for example, the subject of air-mass identification was surely worth more than a half-page, and the "principal Ice-age theories" do not include the well-known solar pluvial theory associated with the name of Sir George Simpson. As a whole, however, the book remains equal to its expressed purpose of providing an orderly assemblage of facts and theories, equally valuable as a text-book for advanced study or a work of reference on a meteorologist's shelves. One unfortunate misprint has crept into the list of contents, where atmospheric refraction has been included under "Reflection phenomena".

The Second Yearbook of Research and Statistical Methodology :

Books and Reviews. Edited by Oscar Krisen Buros. Pp. xxi + 383. (Highland Park, N.J. : The Gryphon Press, 1941.) 5 dollars.

THE second issue of this Yearbook maintains the high standard of the first issue, covering the years 1933–38. Being greatly enlarged, it exhibits more fully the advantages of this original method of gathering in a single work of reference the critical and descriptive reviews which have appeared upon the literature in this branch of science. The excerpts presented in this Yearbook are longer and more informative than those in the first volume. The material covered has been extended, especially in mathematical economics, population studies and general histories of science. The appearance of the volume has been improved in many ways, including the use of larger type, and, although a work of this kind was particularly needed in respect of statistical methodology, the value and convenience of this venture should encourage the application of the same principles with respect to other branches of scientific literature.

Within the field with which the reviewer is most familiar, the excerpts from reviews have been made judiciously, and adequately represent the point of view and critical contributions of the reviewers, in addition to giving indirectly a good idea of the works noticed.

Since review notices are particularly liable to be scattered and inaccessible, it is a very great convenience to have them collected, reproduced, and well arranged. R. A. F.

An Introductory Course in College Physics

By Prof. Newton Henry Black. Revised edition. Pp. viii + 734. (New York : The Macmillan Company, 1941.) 3.75 dollars.

THIS is a revised edition of the author's "College Physics" first published in 1935. The course is one which would suit most schools, though the author had in mind the needs of definite types of students. In this connexion, there is a slight bias towards physiology and medicine. Also it is pleasing to note that consideration is given to those students studying physics for the sheer joy of it, not with the view of taking any special examination ; hence many applications to modern machinery and household devices are included.

Throughout the book emphasis is laid on fundamental laws and principles, and theories are introduced only in so far as they seem helpful in understanding significant facts. There is a good selection of numerical examples graded in difficulty, and the many labelled diagrams are very good ; such diagrams are most helpful to students, and they save much descriptive matter.

The book runs to 734 pages, and a lot of ground is covered, but one feels that in some cases more should have been made of certain topics. For example, in view of the great importance of sound in modern applied physics, this section is rather thin ; in a book covering the whole field of elementary physics, however, it is obviously impossible to treat all the subjects fully. The book is very well produced, and it is certainly a most useful addition to school physics books.

Intermediate Electricity

By Robert W. Hutchinson. Pp. viii + 628. (London : University Tutorial Press, Ltd., 1941.) 12*s.* 6*d.*

THIS book is intended to replace the author's well-established "Text-book of Electricity and Magnetism", and it must be said at once that it is an exceedingly useful book.

The treatment is on modern lines, and a pleasing innovation is an introductory chapter on the modern theory of electricity and electrical phenomena ; here the facts are stated simply, and they form a useful background for the student's future work. Another pleasing feature is the stress laid on the fact that magnetism itself is merely a phase of electricity, and it is refreshing, though unusual, to find the topics of terrestrial magnetism and atmospheric electricity discussed in the same chapter.

There are numerous fully worked examples ; this is a good feature, especially for those students working alone. Emphasis is also rightly laid on the importance of units ; neglect of this work often leads to confusion when students tackle numerical problems. The author does not set out to cater for any particular examination, but the book more than covers the needs of those students preparing for the Intermediate Science, Higher School Certificate and Scholarship examinations. The mathematics in the book should be well within the compass of these students, though the average student may find the mathematics in the chapter on alternating current and varying currents rather formidable.

In spite of its rather high price, the book is excellent value, and if a student can afford it he will find it extremely helpful and useful.

Handbook of Economic Entomology for South India

By Dr. T. V. Ramakrishna Ayyar. Pp. xix + 528. (Madras : Government Press, 1940.) 4.12 rupees.

KNOWLEDGE of South Indian insects has greatly increased since the publication of T. B. Fletcher's book on the subject in 1914. This work is now out of print and there is a growing demand for its replacement by a more modern book. As a desideratum it has been filled by the appearance of Ramakrishna Ayyar's volume that is now before us. This writer is very well qualified for the task, having many papers and bulletins on South Indian economic entomology to his credit. The book is divided into two parts, and Part I deals with general aspects of the subject such as anatomy development and classification. Part II is in the main a conspectus of the chief injurious insects of South India and the best-known methods for combating them. The book is well printed and seems to be very free from errors, while its numerous illustrations add materially to its value. It should meet with a wide and speedy acceptance and fill a definite place in the literature of Indian economic entomology.

ANGLO-AMERICAN CO-OPERATION IN SCIENTIFIC RESEARCH

By PRESIDENT JAMES B. CONANT, For. Mem. R.S.

THE following address by President James B. Conant, of Harvard University, was arranged to be given on September 26 before the Conference on Science and World Order, under the auspices of the British Association for the Advancement of Science, in London. The address was made on a record in Washington and flown across the Atlantic for rebroadcast to the Conference. Unfortunately, it failed to arrive, but the following copy has recently reached us.

I assume that through the United States Ambassador, Mr. Winant, you have asked me to address you because of the fact that I am chairman of the National Defense Research Committee, an arm of the United States Government. In that capacity, it is perhaps fitting that I should have something to say about the mobilization of science in the United States and the co-operation of British and American men of science for the war effort. On the other hand, many things that I have said as a private citizen of the United States concerning the foreign policy of my country would be entirely inappropriate in this address. To some of you my views are known. I can only say that I hold them with greater conviction every day. Many of my fellow men of science and academic colleagues on this side of the water are of the same opinion—others have disagreed. That a great debate has raged in the United States about the extent and nature of our participation in the war against Hitler will be no surprise to a British audience. For if I read your recent history rightly, it was not a matter of weeks or even months, but rather of years before the citizens of your country were able to resolve the deep conflict between the ideal of peace and the ideal of freedom, between their hatred of war and their hatred of the Nazi philosophy of tyranny and fear. For I take it these were the elements which determined the development of your own foreign policy before the War.

But in one matter I can brush aside all harassing ambiguities. On one point all American men of science are agreed. They unite in saluting the bravery of the British nation; they applaud unanimously your gallant stand. Moreover, as scientific workers they are proud of the vital parts their fellow-workers of Great Britain are playing in the struggle now in progress. They realize, though often only dimly, that history will surely record this heroic struggle as a defence against overwhelming odds not only of Great Britain but also of individual liberty throughout the world.

In June 1940 the first realization of a world crisis aroused the United States. Amidst violent debates on foreign policy, a vast programme of rapid rearmament was initiated. As to the necessity of producing at top speed a great quantity of instruments of war there could be but one opinion. In these circumstances it was essential to mobilize the scientific talent of our country with all haste. The National Defense Research Committee, with Dr. Vannevar Bush as chairman, was then created by Presidential order. Its task was not advisory, for the scientific advisory bodies of the Government had long been in existence. The National Academy of Science, a parallel of your Royal Society, has by Congressional charter the duty of advising the Federal Government on scientific matters. The National Research Council, a creation of the Academy, has functioned effectively to that end for many years and still continues to play an active part, particularly in the field of medical research. What was needed was not another advisory body but an executive agency capable of bringing available scientific talent as soon as possible in touch with the army and navy; an executive agency to speed up the scientific research on instrumentalities of war by drawing on the existing laboratory facilities of the whole country. This was the function the National Defense Research Committee was created to fulfil.

The new Committee was composed of six civilians together with a representative of the Secretary of War and a representative of the Secretary of the Navy. Rather than establish any large organization of its own, the National Defense Research Committee decided to use its available appropriations through contracts with universities and industrial firms which would carry on specific research and development on secret matters pertaining to modern warfare. Through various sub-committees or divisions, each headed by a Committee member, the work was soon divided. To my lot fell chemistry, to Prof. K. T. Compton, of Massachusetts Institute of Technology, fell one branch of physics, to Jewett and Tolman were assigned still others. Liaison officers from the Army and the Navy were attached to the various sub-committees. In this way the men of science brought into the new work were kept in active touch with members of the Armed Forces.

During the past year, more than ten million dollars have been spent through 270 contracts placed with 47 different universities and technical colleges and 153 contracts placed with thirty-nine industrial firms. Needless to say, great precautions have been necessary to insure the secrecy of the work. No man has been brought into the organization either as a member of a sub-committee or as a contractor without the approval of the Army and the Navy. Great care has also been taken to ensure secrecy in the placing of the contracts either with academic workers or industrial firms.

In both physics and chemistry the effort has been to distribute so far as possible the problems to different investigators throughout the country. In this way, during the initial year at least, the normal functions of our universities were, so far as possible, undisturbed. In a few cases the nature of the work has made such an arrangement quite impossible. In one case in particular, the Radiation Laboratory at the Massachusetts Institute of Technology, it was essential that a large group of physicists should be assembled to work on a highly confidential and important subject with the greatest possible speed. Therefore, more than 150 different physicists from twenty-five different universities in all parts of the country have been brought together to work towards a common goal. We estimate that approximately a thousand scientific workers, ranging all the way from senior professors to young research workers, are now at work in one way or another in academic institutions under contracts with the National Defense Research Committee. In addition, more than seven hundred scientific workers of the same grades are at work in industrial firms in connexion with the contracts which have there been placed. As in your own country, we have found that the nature of the problems in this War are such that physicists and certain types of engineers are in greater demand than chemists. Indeed, it would appear from a survey that has recently been made that probably 75 per cent of the more distinguished research physicists of the country (those starred in the "American Men of Science") who are available are now at work on war problems. I hazard the opinion that it will be only a few months before the remaining 25 per cent are equally involved.

The success of the undertaking has been due in no small measure to the effectiveness of Dr. Vannevar Bush, both as a man of science and as an administrator. Dr. Bush was the chairman of the Committee during the first year of its existence and shouldered the responsibilities for the enormous task. Three months ago, by order of the President, he was made director of a newly created Office of Scientific Research and Development. In this capacity Dr. Bush was charged not only with many of the responsibilities which he had formerly carried as chairman of the National Defense Research Committee, but with the further task of co-ordinating scientific research on medical problems affecting national defence. Most important of all, he has the charge of co-ordinating, and where desirable, supplementing the scientific research activities carried on by the Departments of War and Navy and other agencies of the Federal Government. The National Defense Research Committee now becomes a part of the new Office of Scientific Research and Development, and I, as the new chairman, am responsible to Dr. Bush.

Parallel to our Committee is a newly formed one on medical research, of which Prof. Alfred N. Richards is chairman. Together these two Committees will be the main instruments which the Office of Scientific Research and Development will use to carry out the task entrusted to it by order of the President of the United States.

Such, in brief, is the organization which has been created to bring about the rapid mobilization of scientific talent in the United States to aid the Armed Forces of the Federal Government. Those who are interested in problems of organization and administration will note that the scheme is both flexible and temporary. It is clearly designed to last only during the period of national emergency. No new permanent organizations are created, no new Government laboratories are built or staffed, no large administrative offices are established. Rather a method was devised by which with all speed possible the available scientific talent and available laboratories of the country could be used to supplement the already existing research establishments of the Army and the Navy.

One of the happiest results of the past year's labours has been the ever-increasing Anglo-American co-operation in scientific fields. This was at first made possible on our side of the water by the National Defense Research Committee; it is now a function of the new Office of Scientific Research and Development. The Executive Order which established this office with Dr. Bush at its head provided that the Director should initiate and support such scientific research as may be requested by the Government of any country the defence of which the President deems vital to the defence of the United States under the terms of the Lease-Lend Act of March 11, 1941. As many of you know, we have had in London since last March American scientific liaison officers, Mr. Hovde and Mr. Lewis. It was my privilege to come to England with Mr. Hovde and to initiate the exchange of research information on instrumentalities of war. From the first moment of our arrival, we met a cordiality and openness of welcome that made evident your whole-hearted interest in co-operation. I trust the British representatives in Washington have formed a similar opinion of the American attitude.

After more than six months of work our interchanges of information and of workers have yielded results of considerable importance. I believe that we on our side of the Atlantic have contributed something to your great effort, and I hope and pray that our contribution before many months are past will be of the first order of importance; for I know I am speaking for my fellow-workers in the National Defense Research Committee when I say that nothing would give us more satisfaction than to feel that through our work we had contributed directly to the effectiveness of the war effort. Our eagerness to help can scarcely be over-estimated; may the future demonstrate that our capacities have been equal to our desires!

I cannot conclude without referring briefly to what must be to some extent in everyone's mind at this Conference—the world we are going to live in after the War is over. It is not for me to outline a world order or even to express views on Anglo-American policy. But no intelligent man who on one hand loves peace, and on the other places the highest value on individual liberty, can doubt that without some form of co-operation between our two countries no peace worth fighting for can be established. Similarly, no intelligent man who consults his head as well as his heart can fail to note great obstacles that stand in the way of effective co-operation and collaboration. It should be the duty of all trained thinkers, particularly men of science, on both sides of the water, to study these obstacles coolly and impartially. For only by knowing their nature may we hope to overcome them. Only by dispassionate study may we hope to reduce these barriers.

I say particularly men of science, for they realize more than many others the potentialities that lie hidden in the future. Men of science realize as many cannot the extent to which modern technology has diminished effective distances around this planet. They know, too, that the end of this revolution in transportation is not yet in sight. The world contracts before their eyes. To them dreams of new adventures and new conquests of the material universe wait for realization only on the sustained labour of free men. To-day, the men of science of Great Britain and the United States are working almost as one group with the purpose of improving instruments of war. Is it fantastic to hope that in the not too distant future the men of science of all free countries may be joined in effective action to improve, not instruments of war, but those of peace? I like to see in the present scientific liaison that runs through the centre of London, Ottawa and Washington a hopeful omen of a long period marked by the friendliest relations between the British Commonwealth of Nations and the United States. If this be so, our work foreshadows a time when professional talent in many diverse societies of free men will strive for effective co-operation to the end that we and our children may walk boldly along the paths of liberty and peace.

AGRICULTURE AFTER THE WAR

By SIR JOHN RUSSELL, F.R.S.

Director, Rothamsted Experimental Station

THE invention of the submarine has profoundly affected the development of British agriculture, bringing it out of its accustomed obscurity into a very high position both in the War of 1914–18 and in this War. British peace-time dietary is more varied and effective than that of any other country in Europe, but it requires so much land for its production—on the average some 1·6 acres per person—that the total area of agricultural land suffices only to provide 40 per cent of the nation's food. The remaining 60 per cent has to be imported, and it was brought in from almost all quarters of the world. This method of feeding the nation postulates peace and the smooth working of international trade, and it breaks down in war-time. Home production then becomes much more important, and the national dietary is changed so as to make less call on the land; in place of the 1·6 acres of peace-time, the aim is to get nearer to the 1·1 acres that suffice for the German dietary. Further, there is widespread recognition that British agriculture is a major industry, and that unless it is sufficiently prosperous to attract and retain a vigorous and intelligent body of farmers and farm workers, there will always be trouble in the country-side. Under the chastening influence of war, politicians and writers become very penitent about their past attitude to agriculture and full of good resolves for the future.

We are somewhat in this position now, and we passed through the same phase in the War of 1914–18. Then it was resolved that British agriculture really should be developed, and wages boards were set up to impose a minimum wage which would ensure the workers' efficiency and do away with the hardships which some of them had suffered. Prices were to be at such a level that these wages could be paid.

There arose the difficulty that has always proved oppressive and for which no satisfactory remedy has yet been put into operation. Agricultural produce can be raised very cheaply by peasants in almost any country in Europe and by farmers using ranching or other 'extensive' methods in some of the new countries, and trading organizations can collect it and bring it to our markets at very cheap rates. The peasant is, of course, poorly paid, but his standards are low, and the 'extensive' methods may be harmful and even destructive to the soil; but they answer for a time. In other producing countries where sound intensive methods were used, special arrangements were often made on the home market so as to enable the commodity to be sold cheaply on the English market. Finally, whenever a specially bountiful harvest had provided a large excess over the usual supply, this was put on to the British market as being the only one that would take it. In consequence the prices of agricultural produce here had no relation to the cost of production on farms in Great Britain, and moreover they were quite unpredictable, so that British farmers had no idea when they sowed their crops what prices they would receive for them. The only exceptions were milk and potatoes, of which there was little or no import, and a few commodities such as high-quality meat, malting barley, seeds and certain fruits and vegetables, for which a special demand existed.

For the rank and file of the farming profession there was no security, and most farmers adopted the traditional safeguard of laying down their land to grass and cutting down all expenditure, thereby reducing the outgoings to the point at which returns, though also greatly reduced, would balance them. Farmers put up the best fight they could; they lowered costs of production by reducing the numbers of their workers but increasing the output per head from the survivors, so that finally the average output per worker was equivalent to the feeding of seventeen persons, this being higher than in any European country. Some farmers went in for considerable mechanization, but this had its disadvantages. On one farm the new system reduced the cost of wheat-growing by nearly half. But while on the old system the farm had produced 630 cwt. of meat per annum, on on the new one it produced none. Much more serious: on the old system forty men had been regularly employed, on the new one only four were needed and the remaining thirty-six were 'released': and of these, twenty-two became a charge on public funds. Obviously one-sided arrangements of this sort are not desirable. The fall in area of arable land became so serious that steps had to be taken against it: these were in the nature of contracts, and unfortunately were called subsidies.

All history shows that British agriculture cannot stand up against the unrestricted imports of foodstuffs at low prices, and if farmers are left to solve the problem unaided no better way has yet been found than lowering the level of agricultural operations. It can safely be assumed that this same difficulty will arise after the present war, and that the same method of coping with it will be adopted unless a better one has in the meantime been adopted.

Fortunately a number of people are trying to design alternative solutions. During the War of 1914–18 it was thought that small holdings would solve the problem: the small man, it was said, would work with greater economy and be content with less reward than the large farmer and so might survive. But he did not, and although many small holdings were set up, an even larger number closed down, so that this solution does not appear to be general. Clearly some new proposal is now needed, and Sir Daniel Hall supplies this in his latest book*. He advocates large units, which would mean so much regrouping of the land, alterations of buildings and redistribution of implements and stock that the present landowners could not possibly undertake the task. He therefore suggests that the State should purchase the whole of the agricultural land of the country, that a commission should cut it up into units of suitable size, provide appropriate buildings and carry out the reclamations necessary, then hand the finished farms over to the Commissioners of Crown Lands, who would pass them on to land agents, who would let them to farmers. The proposal will certainly receive the serious consideration which Sir Daniel's distinguished authority requires.

An important reason for the failure of the promised development of agriculture after the War of 1914–18 was that no decision was ever reached as to the part that agriculture should play in the national life.

The prime need in any agricultural policy is to decide what proportion of our different foods we should aim at producing; and from what countries and in what amounts we should draw the foods that we propose to import. As the largest buyers of agricultural produce in the world, we are in a position to exert a very potent influence on post-war economy in a large number of countries, and our influence will be good if we work out a proper plan and stick to it.

Whatever agricultural systems are adopted the contract price method is essential now that wages are fixed by agricultural wages boards without reference to prices of produce. When adequate prices are assured it becomes possible to decide whether we should continue the classical system in which about 50 per cent of the arable land is in grain, 25 per cent in temporary clover and grass leys, and 25 per cent in root crops and potatoes, proportions which held generally right up to the War, or whether some more intensive systems should be adopted, such as that recommended by the Astor-Rowntree group, in which farmers aim at high quality and what one might call high potential: the protective foods, milk, fruit, eggs, vegetables and high-quality meat. These gain in value by being fresh, that is, by being produced locally: they employ more people per acre and

* Reconstruction and the Land: an Approach to Farming in the National Interest. By Sir A. Daniel Hall. Pp. xi+287. (London: Macmillan and Co., Ltd., 1941.) 12*s*. 6*d*. net.

give a larger output per acre than other kinds of produce.

Account must also be taken of the part that agriculture can play in solving social problems such as unemployment and the rehabilitation of the unfit, and also of the vitally important problem of safety in war-time.

Science must always play an important part in agricultural development, though it needs careful management because of the wide difference in outlook between scientific workers and agriculturists. Agricultural operations are so dominated by weather and by other disturbing factors, including pests and diseases, that no rigid rules can be laid down. An experimental result can never have quite the same validity as in a chemical or physical laboratory. It may always be profoundly affected by some wholly unexpected and perhaps unobserved factor, and until it has been confirmed over a wide range of conditions it is liable to the suspicion that it may be abnormal. When all results are assembled they can be subjected to statistical analysis and an average obtained with its appropriate standard error, but it may not apply on any particular farm even though over a hundred farms it might hold good for a majority. Frequently the farmer has arrived at a general fund of knowledge about his own farm, which he is reluctant to disturb except on very convincing evidence. 'Good husbandry' is his ideal, and he firmly believes in its 'rules', even though some of them very inadequately express the facts. The agricultural departments of the colleges necessarily reflect this attitude: farmers and students alike are usually more interested in practice than in science and so more influenced by experience than by experiments: indeed not infrequently they are prepared to ignore or at least heavily discount experimental evidence if it does not fit in with established ideas. Their outlook on Nature is usually vitalistic, and special virtue is always supposed to reside in anything of organic origin as against substances of mineral or synthetic origin.

So a difference in outlook tends to arise between the agricultural research institutes and the agricultural community they are hoping to serve, and the difference is widened by the circumstance that the research institutes, if they are to keep their science at a serious level, have almost always to draw their staff from the science departments of the universities; usually the candidate who is otherwise most suitable has no rural background and no knowledge of agriculture; to acquire this is generally very difficult. It is necessary also to distinguish between the good research man and the good adviser, and to determine the place the adviser should have in the research institute. Broadly speaking, the good research man can see his problem, study it in full detail and find a solution, going on with the work until he has rounded it off properly and written it up for publication. But often it is not immediately useful for practical farming, though, of course, new knowledge is bound to find its place in agricultural science and practice. The good advisory officer can also see his problem and study it in detail; he, too, finds a solution, which may be of more immediate service on the farm than the scientific investigation. But he rarely goes beyond the stage of the interim report, so that his work is never rounded off and much of it never published, to the loss of public funds and the detriment of the juniors who also participated.

In the days when they were small, the research institutes necessarily kept close touch with the farming community and had to do both types of work: the individual members of the staff knew many farmers personally and well. As agricultural science has developed and expanded, it is the advisory officer rather than the research man that has had most to do with practical farming problems. This is in part the explanation of the curious decrying of science by some agricultural writers and the elevation into prominence of some of the mystical hypotheses of plant growth and human and animal nutrition which cannot be tested scientifically. These serious problems in the relation of science to agriculture require fuller study.

SCIENTIFIC CENTENARIES IN 1942

By ENGINEER CAPTAIN EDGAR C. SMITH, O.B.E., R.N.

SCATTERED through the coming year are days which will mark the centenaries of some of the most famous men of all time. In happier circumstances, it may be presumed that already arrangements would be in progress for the commemoration of some of these centenaries on an international scale. But more urgent tasks lie ahead. Yet it may, perhaps, be hoped that such events as the tercentenary of the death of Galileo, the tercentenary of the birth of Newton and the bicentenary of Halley will not be allowed to pass quite unnoticed. It is unnecessary to recall how the researches and discoveries of these great pioneers are closely interwoven, but it may, perhaps, be permitted to recall Rigaud's words regarding the publication of Newton's "Principia". In his essay on that immortal work Rigaud wrote: "Under the circumstances it is hardly possible to form a sufficient estimate of the immense obligation which the world owes in this respect to Halley,

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By RALPH R. WENNER, Ph.D.

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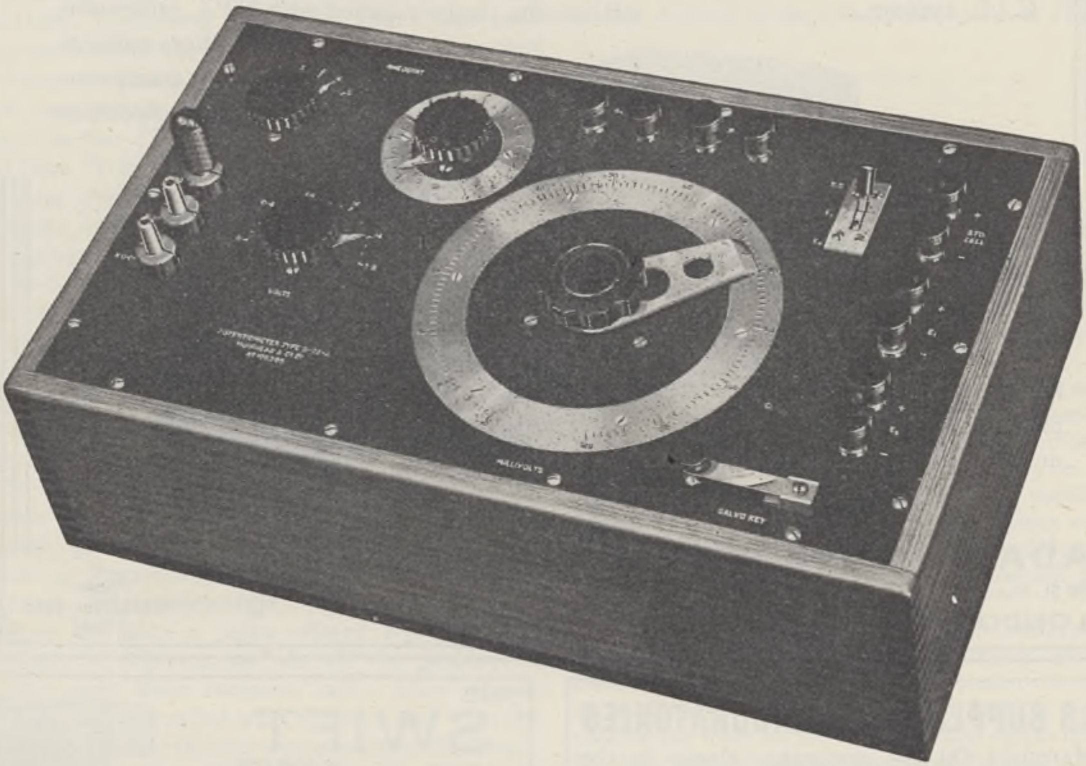

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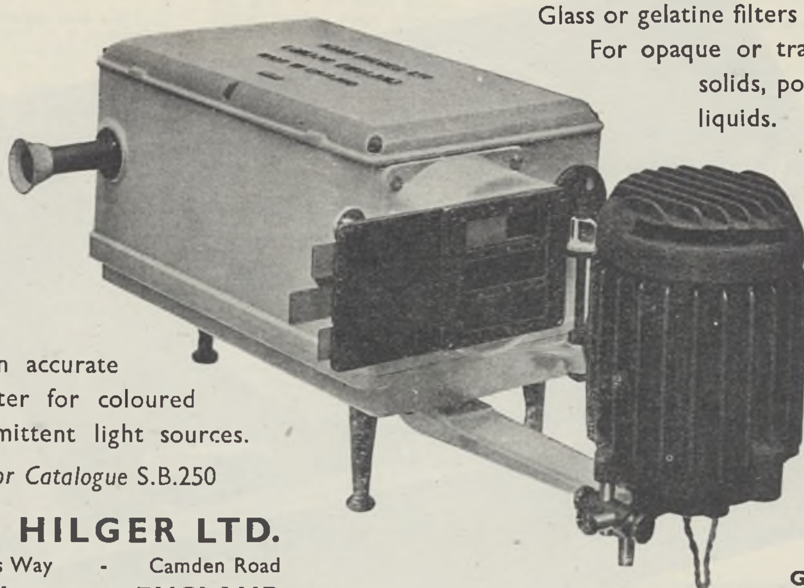

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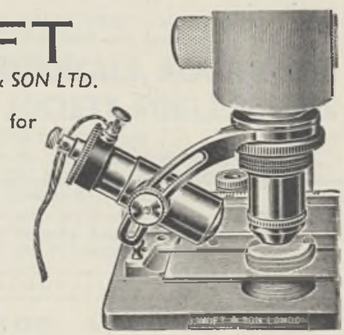

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without whose great zeal, able management, unwearied perseverance, scientific attainments and disinterested generosity the Principia might never have been published."

When Halley died he had held the office of Astronomer Royal for some twenty years, having succeeded Flamsteed in 1720. His death took place on January 14, 1742, a few months before that of Abraham Sharp, who had furnished Flamsteed with instruments, and of whom Smeaton, in a report in the *Philosophical Transactions* in 1786, said that "I look upon Mr. Sharp as having been the first person that cut accurate and delicate divisions upon astronomical instruments".

Another interesting figure of those times, and one well known in Great Britain, was the Dutch mathematician Wilhelm Jacob 's Gravesande (1688–1742), the first professor of the University of Leyden to teach the Newtonian philosophy, and the author of a work on natural philosophy, Desagulier's translation of which was studied eagerly by James Watt as a boy of fifteen.

The men of science born in 1742 include the famous Swedish chemist Scheele, the German natural philosopher Lichtenberg and the unfortunate French chemist and inventor Nicolas Leblanc. When surgeon to the Duke of Orleans, Leblanc, to gain a prize offered by the Paris Academy of Sciences, set himself the problem of making soda from common salt. After several years he was rewarded with success, and with the aid of the Duke a factory was erected at St. Denis. Then came the French Revolution. The Duke was guillotined, the factory was confiscated and Leblanc forced to reveal his process. After much misery Leblanc, in 1806, died by his own hand. At one time his name was almost forgotten, but to-day his statue stands in the forecourt of the Conservatoire des Arts et Métiers in Paris.

Coming down to 1842 the list lengthens, but it is proposed to refer to only a few of the more important men. In April of that year the British surgeon, Sir Charles Bell, died suddenly at the age of sixty-eight; on September 6 the Belgian chemist Jean Baptiste van Mons passed away at Louvain, having done much to spread a knowledge of the discoveries of Lavoisier and his successors, and on September 21 the British mathematician Sir James Ivory, Copley medallist in 1814, died in Hampstead. The month of February 1842 saw the birth of the French astronomer Camille Flammarion (died, 1925), the month of April the birth of the German astronomer Hermann Carl Vogel (died, 1907). Carl von Linde, the German pioneer of refrigeration, was born in June 1842; the German chemist Albert Ladenburg, in July. Sir William Tilden, Sir James Dewar and Lord Rayleigh were all born in the latter part of 1842, as were also the Norwegian mathematician Marius Sophia Lie, For. Mem. R.S., and the Russian chemist, Nicolai Alexandrovich Menschutkin, one of the outstanding contemporaries of Mendeléeff. Lie died in 1899, Menschutkin in 1907. A memoir of the latter by Tilden appeared in the *Journal of the Chemical Society* in 1911.

OBITUARIES

Prof. Rudolf Schoenheimer

THE death of Rudolf Schoenheimer at the early age of forty-three has removed from our midst a biochemist of outstanding ability. His work, characterized always by originality of conception, has opened up a new, and most fertile, field in biochemistry.

Schoenheimer was born in Berlin in 1898 and he received his M.D. there in 1922. He was associated with the University of Freiburg and became head of its Department of Pathological Chemistry in 1931. He left Germany in 1933 to take up a position as assistant, and later as associate, professor of biochemistry in the College of Physicians and Surgeons, Columbia University. He held this position at the time of his death in September 1941.

Schoenheimer's work, until he went finally to the United States, was concerned primarily with the metabolism of cholesterol. He continued his studies on cholesterol for a few years and in 1934 he commenced his work on the application of stable isotopes to the study of intermediary metabolism. During the following seven years Schoenheimer, usually in co-operation with his colleague D. Rittenberg, developed this new experimental approach to problems of biochemistry.

Much of our knowledge of intermediary metabolism depends on an analysis of the products formed after the administration to an animal of substances which may or may not be normal metabolites. The method has been extended to the use of intact isolated organs (by perfusion techniques) or of surviving tissue slices. Much valuable information has been and is still being obtained by work carried out in this manner. It is recognized, however, that this method of investigation has definite limitations. Administration to the body of relatively large quantities of even normal metabolites may upset the normal balance of events and call forth changes which do not reflect the normal quantitative relationships. Administration of substances, labelled with halogen, phenyl or other groups to facilitate the chemical examination of intermediates in the process of breakdown of the parent substances, involves the use of compounds having different chemical and physical properties from those of normal substrates and metabolites. Such substances, foreign to the body, may be treated, in certain respects, differently from normal substances. Yet the elucidation of the intermediate steps in the course of breakdown of normal substrates in the body or in the living cell represents one of the most important and formidable problems in biochemistry.

The introduction into a metabolite of isotopes of one or more of its elements brings about little or no change in its physical or chemical properties, and hence it is not to be expected that the animal will be able to differentiate between a normal metabolite and one containing isotopes of its elements. Experimental evidence exists which supports this conclusion. Since it is now possible to distinguish isotopes and to estimate them in relatively small quantities and in high dilutions, it is obvious that the use of molecules containing isotopes places a new and most powerful weapon in the hands of the biochemist.

The first to realize the importance of isotopes for biological investigations was von Hevesy, who studied phosphorus metabolism, using radioactive phosphorus. Radioactive isotopes of hydrogen and nitrogen, however, the migrations of which in the body form so important an aspect of intermediary metabolism, were not known, at the time of Schoenheimer's work, with a half-life long enough to permit their use in metabolism experiments. It was necessary to use stable isotopes concentrated from the natural mixtures. Urey, by devising methods of isotope fractionation, made it possible to use such isotopes in metabolism work.

The first series of experiments of Schoenheimer and his colleagues (*J. Biol. Chem.*, 1935–38) was concerned with the use of deuterium. They employed two methods of attack. They administered heavy water to animals over a certain period and then estimated the stable deuterium in the different organic constituents of the body. This gave information on the nature of the substances utilizing hydrogen of the body fluids themselves. They synthesized and administered organic compounds containing deuterium and followed up the fate of the isotope. This gave information on the mode of breakdown of the labelled organic compound.

They were able to show, on feeding fats containing deuterium, that the major part (even if administered in relatively small amounts) is deposited in fat depots prior to utilization. They showed that desaturation of fats, as, for example, the transformation of stearic acid into oleic acid, and that the conversion of stearic acid into palmitic acid, are processes definitely occurring in the animal body. They showed that reversible saturation and desaturation of fats are normal metabolic changes. Schoenheimer and his colleagues further demonstrated, by feeding experiments with deuterobutyric and caproic acids, that these short-chain fatty acids are completely burned in the body and not used for fat formation. They followed fatty acid development in the embryo and in the adult animal and investigated sterol metabolism and synthesis. In all these investigations they were faced with serious difficulties, having to devise methods of synthesis of isotope-containing compounds and to cope with the problem of the stability of the carbon-bound hydrogen *in vivo*.

Schoenheimer and his colleagues turned their attention to the study of protein metabolism using ^{15}N as the isotopic label (*J. Biol. Chem.*, 1939–41). This isotope was estimated by means of the mass-spectrograph. They showed that isotopes ^{14}N and ^{15}N are treated by the body indiscriminately in anabolic and catabolic processes. They found that administered glycine (marked with ^{15}N) may be used partly for hippuric acid synthesis, that animals fed with isotopic ammonium citrate form proteins, the constituent amino acids of which, with the exception of lysine, contain ^{15}N. This made it evident that amino acids can be built up in the body from dietary ammonia. The fate of amino acids such as tyrosine containing ^{15}N, after ingestion by an animal, was investigated and it was shown that part of the ^{15}N is transferred to various other amino acids in the proteins of the animal. The experiments indicated that in a normal full-grown and healthy animal, kept on a normal diet, the nitrogen of the dietary amino acid may only partly be excreted in the urine, the rest being retained in the protein of the animal with a corresponding excretion of tissue nitrogen. The exceptional property of lysine, among the amino acids, in resisting the introduction into its molecule of ^{15}N, after the ingestion by an animal of isotopic nitrogen, was demonstrated. Apparently lysine is not involved in the reversible shift of amino groups, which seems to be a prominent feature of nitrogen metabolism of the body.

It is clear that metabolism work involving the use of isotopes has just begun, and the significant results already obtained justify a great extension of the work. It is indeed a tragedy, and a most serious loss to biological science, that Schoenheimer should have been cut off at so early an age from those pioneer investigations the future of which is so full of promise. J. H. QUASTEL.

Dr. W. Steiner

DR. WERNER STEINER, born 1896 at Cologne, died after a brief illness on September 10 at Durham. From 1926 onwards he was Prof. M. Bodenstein's assistant in the Institute of Physical Chemistry at Berlin and in charge there of the teaching and research work in spectroscopy. He published some thirty valuable papers on this and related subjects, several of them in English journals. After leaving Germany in 1933 he worked for a while on similar lines at Cambridge in the laboratories of the late Prof. T. M. Lowry. In 1936 he accepted the position of a science master at the Gordonstoun School in Morayshire, and in January 1941 at the Durham School. Here, as well as in his University career, he gave of his best. Besides science his main interest was divinity, and his last contribution was to a theological journal. F. A. PANETH.

WE regret to announce the following deaths:

Mr. F. A. Leete, C.I.E., lately chief conservator of forests, Burma, on December 11.

Prof. J. Wilson, formerly professor of agriculture in the Royal College of Science, Dublin, on December 9, aged seventy-nine.

NEWS and VIEWS

Great Britain and the United States

THE Association of Scientific Workers has, through its Social Relations Committee, recently sent the following message to American men of science: "We British scientists, engineers and technicians organised in the Association of Scientific Workers send our greetings to our colleagues in the United States of America. . . . With the combined might and resources of the U.S.A., the U.S.S.R., China and the British Commonwealth of Nations, ultimate victory is certain. We are nevertheless faced by a powerful and desperate combination of powers. They too have large resources and the advantage of having planned for war many years before actual fighting started. Their scientists have been concerned with the specific problems of warfare and supply for many years longer than we have. We must make up this leeway. But we can do more than that. We, the scientists in the Allied countries, can by pooling our ideas, technical skill and cognate information, play in concert a most vital part in the common effort. . . . We are happy to recall the very close bonds which have united men of science of our two countries in the past. Many of us have personal friends among you. We have worked in your great laboratories; you have worked in ours. This interchange will prove to be most valuable in the present situation. We have as well the terrific advantage of a common language, and, to a large extent, of a common cultural heritage. But we still have a lot to learn from each other and from our Soviet colleagues. By helping each other without stint, we shall help ourselves and we shall be laying the foundations of a truly international scientific commonwealth. American, Soviet and British scientists have the responsibility of preserving the scientific heritage of the whole world against the barbarism and obscurantism of Fascist 'ideology'. We shall do it, and we shall enrich and strengthen it by so doing. Our most sincere and best wishes to you."

The Empire Bond

YET another sign, if such be needed, of the intangible bond which links together the several members of the British Commonwealth of Nations is provided by the letter printed on p. 21 of this issue, from the honorary secretary of the Australian National Research Council. In this letter, Dr. H. R. Carne offers hospitality in Australian laboratories to scientific workers in Great Britain who are unable to make any direct contribution to the war effort. Not only scientific workers in Great Britain, but also the many students from other parts of the Empire who would normally be proceeding to postgraduate courses or research work in this country but are prevented by present circumstances, are offered an invitation to utilize the universities and research institutes of Australia, to carry on their work. While it is unlikely that many in Great Britain will be able —or will indeed wish—to leave the country at the present time, scientific workers everywhere will appreciate the friendly spirit in which the invitation has been given, and will wish to thank their Australian colleagues for the very practical form which their concern about the influence of war-time conditions on research has taken. Although the outbreak of war in the Pacific may make it necessary for Australian institutions to modify their offer (Dr. Carne's letter was dated September 19), the fact that it was made by a country already deeply involved in the War is worthy of record.

Malayan Wild-Life

THE war in Malaya is no doubt interfering with the very interesting wild-life of that region, and the observations that have so long centred upon it. Robinson and Chasen's work on the birds of Malaya describes such interesting items as the breeding habits of the edible-nest swiftlets, the gorgeous sunbirds and the spider-hunters. Malaya has some seven hundred birds including about forty game birds and pigeons. An earlier official publication on the birds of Singapore gives a list of more than a hundred species, including eleven of the sixteen Malayan kingfishers and many interesting doves, hornbills, the vividly coloured little red and orange flower-peckers that haunt the tree-tops, the rollers, the bee-eaters and several swifts. Many species well known in Britain are winter visitors or migrants from northern Asia. including snipe, golden plover, redshank, turnstones, greenshank, and grey plover. The roseate and gull-billed terns are regular birds of Singapore island, the Kentish plover nests on the sandy shores and herons and white egrets fish the marshes. The fishing owl is a very common bird. The "Handbook to British Malaya" states that the fauna of British Malaya is excelled in number of species only in parts of South America. The one-horned Javan rhinoceros is almost extinct, and the common rhinoceros, like the Malayan elephant, has been much persecuted for ivory. The ancient Malayan tapir survives, but the Malayan bison or seladand is almost extinct in certain districts. There are several deer, and the curious serow or goat antelope is in the remoter country. The Malaya tiger is smaller than the Indian, while monkeys and apes include the curious nocturnal slow loris and also orangs, which have often been collected for European zoos. Malaya is the metropolis of the squirrels and there are more than sixty bats, including the great flying fox or keluan with a wing span of nearly five feet, which haunts the coastal mangroves.

As well as the big game hunting, the snipe-shooting and pigeon-shooting are among the best in the world, but collectors have also been attracted to Malaya for fauna and flora. Corbett and Pendlebury's 1934 work on the butterflies of Malaya records more than eight hundred species. There are probably a quarter of a million insects including more than a thousand butterflies in this region, with many of the swallowtail family. There are the famous bird-wing butterflies which often feed with their forewings fluttering and their hindwings kept fairly still. One of the most striking butterflies in the world is Rajah Brook's birdwing, *Papila brookiana*, with a wing span of 6¾ in., which was discovered by Dr. R. A. Wallace in Borneo. The sex ratio is such that the female is about one to every thousand males. The long-tailed blue butterfly of the English list also occurs here, and there are many skippers. There is also the giant atlas moth. Reptiles are not quite so evident as in India and Australia, but crocodiles are numerous, and Russell's viper and other deadly Indian snakes are found here too; also the largest living snake, the king cobra or hamadryad, with a recorded length of 18 ft. 6 in. There are many lizards, turtles and tortoises, including the flying lizard. There are some three hundred fishes in the rivers, including catfish and carp.

The flora of Malaya has been written up by H. N. Ridley, while from a horticultural point of view, the Western world has sent many collectors for its orchids. There are twenty-eight Vitis plants, sixteen Vacciniums and some seven hundred orchids and wild forms of many Western garden favourites like *Canna orientalis*. There are twenty-one Dracænes, thirteen Carex, five Scirpus, three Lemna and the tiny Waffia's microscopic flowers in the ditches and wells. Some plants familiar to British botanists include the common reed *Phragmites communis* on river banks, the chickweed, *Stellaria media*, as a weed of cultivation and the dandelion *Taraxacum Dens-Leonis*, an "escape' on the Penang Hill. The Malayan flora totals some nine thousand species, and of more than three hundred trees in which the tall Dipterocarpaceæ predominate, some half are peculiar to the Peninsula. Lianas, rhododendrons, epiphytes and small palms are characteristic.

Television in Colour and Stereoscopic Relief

HITHERTO, television has been confined to flat pictures. In a press demonstration on December 18, Mr. J. L. Baird demonstrated stereoscopic relief in combination with television in colour. Mr. Baird states that his first experiment in this direction was applied to his 600-line two-colour apparatus. The red image was made to 'view' the scene from a slightly different angle from the blue, so that the red and blue images constituted a stereoscopic pair, the receiving screen being viewed through glasses fitted with red and blue filters as in the anaglyph process. This, while simple, had the disadvantage that it was necessary to wear glasses and that, as the colour phenomenon was used to effect the change over from the right to the left eye, neither the colours nor the stereoscopy could ever be properly rendered. So far the object in mind had been to produce a system capable of being transmitted through the existing channels available to the B.B.C., but in an endeavour to produce as perfect a result as possible, it was decided to produce an entirely experimental apparatus regardless of existing practical limitations.

In the apparatus now demonstrated by Mr. Baird, the frame frequency has been increased from 50/sec. to 150/sec., the scanning altered to a field of 100 lines interlaced five times to give a 500-line picture, successive 100-line frames being coloured green, red and blue. At the transmitter a cathode ray tube is used in conjunction with photo-electric cells, the moving light spot being projected upon the scene transmitted. In front of the projecting lens a mirror device consisting of four mirrors at right angles splits the emerging light beam into two paths separated by a space equal to the separation of the human eye. By means of a revolving shutter the scene is scanned by each beam alternately, so that images corresponding to the right and left eye are transmitted in rapid sequence. Before passing through the shutter disk the light passes through a rotating disk with blue, red and green filters. Thus superimposed red, blue and green pictures blending to give a picture with full natural colours are transmitted for left and right eye alternately. At the receiver the coloured stereoscopic pairs of images are reproduced in sequence and projected upon a field lens, alternate halves of the projecting lens being exposed by means of a rotating shutter, the image of the shutter being projected upon the eye of the viewer so that his left and right eyes are presented alternately with the left and right images, the combined effect being a stereoscopic image in full natural colours.

Poverty and Malnutrition in South Africa

EVIDENCE given to the Industrial and Agricultural Requirements Commission by Dr. T. W. B. Osborn on March 17, 1941, has now been published under the title "Remedies for Poverty and Malnutrition in South Africa". (Pp. iii+22. Johannesburg: Central News Agency, Ltd., 1941. 2*s*. 6*d*.). Dr. Osborn, pointing out that the mines managements of the Rand have already convinced themselves that it pays to put their native labour force on a well-balanced ration, emphasizes the significance of the prevention of malnutrition in regard to infantile mortality and general physique among the Bantu. The potential production of foodstuffs in South Africa is considered more than sufficient to give each member of the community an ample balanced diet. Distribution is the major problem—getting the right food to the people, by increasing their purchasing power, subsidizing consumption, or free distribution. He criticizes milling practice in the cereal industry and asserts that it is essential that the germ of the wheat should go back into refined flour and mealie meal. The conversion of more skim milk into food for human consumption, development of the margarine industry on the grounds of price, in spite of the butter surplus, encouragement of soya bean growing, of the consumption of meat, fish and peanuts by the poorer sections of the community, and of the use of vegetables and fruit rich in vitamin C, such as guavas and red peppers, are also advocated.

The consumption of these foods so as to eliminate malnutrition should be encouraged within the present economic framework by a system of subsidies, preferably a combination of free distribution, subsidy to the consumer and subsidy to commerce. Dr. Osborn cites for example a scheme to encourage the use of mealie meal containing 5 per cent of soya bean meal, and then discusses the long-term solution of the problem of removing poverty in the midst of plenty. This means raising the general standard of living and making the economic struggle for existence less intense and ruthless. The final aims are to induce the maximum of economic efficiency, economic equity and personal freedom. Raising wages and reducing costs are not general remedies. They must be supported by measures to stimulate investment and consumption, and Dr. Osborn stresses the value of more generous State provision for sickness, old age and child welfare, the endowment of research, public works, consumer subsidies and the encouragement of drama and the arts. Means to check inflation are essential as well as the control of land values, the share market and overseas influences. Economic self-sufficiency he considers is not necessarily retrograde, but he emphasizes the necessity of unorthodox methods and also of safeguards against bureaucracy in the economic planning required.

The Forests of India

It would perhaps be difficult to find stronger evidence of the changes which have taken place in the management of the forests of India and the almost complete manner in which the Secretary of State for India, and the Central Government of India itself, are dissociating themselves from their administration, than is provided by the Inspector-General of Forest's Quinquennial Review ending March 31, 1939. (Ann. Return of Statistics relating to Forest Administration in British India for 1938–39 and Quinquennial Review ending March 31, 1939. Govt. of India Press, Calcutta, 1941.) For well over half a century the forests of India, their protection and improvement (and incidentally the increasing revenue they yielded), had formed a personal pre-occupation of successive Secretaries of State for India and (with that spur) of successive Governors-General and Viceroys. With increasing efficiency in management it became no longer possible for an inspector-general to portray in an annual report, kept within official requirements of space, the work being carried out throughout India and Burma. The latter was therefore reduced to tabular statements of statistics only, whilst a quinquennial report gave an eye-picture of the progress in management and the position of the forest estate.

It can now be realized that these reports have the very highest value in the light of the new position brought about by the Government of India Act, 1935, under which the forests are transferred to the individual provinces. The India Forest Service at present numbers 219 officers, of whom 163 were recruited at home direct to the Service. Gradually, with the retirement of these officers, the forests and their management will become purely the affair of the various provincial Governments. Even the senior administrative appointments, conservators and chief conservators in provinces, will no longer, it is said, be made by the Central Government. The Government of India still maintains an Inspector-General of Forests, shorn of all power, who is at the same time president of the Forest Research Institute and College at Dehra Dun. At the College the officers for the new 'Superior Forest Services' of the individual provinces are to be trained. The Inspector-General is permitted to visit, on invitation, the various provinces, but his reports on such visits are purely advisory. In fact, as the Quinquennial Report for 1934–35 to 1938–39 indicates, the chief position in forestry administration of the Inspector-General at the present time is his occupancy of the presidentship of the Research Institute. Out of 24 pages in this report less than six are devoted to describing work of purely forest management, and the remainder to forestry research work. Yet this latter is dealt with very fully in the annual reports of the Research Institute.

The annual revenue from the great forest estate of India and Burma for the year 1936–37 (before the separation of the latter) amounted to Rs.4,38,07,019, or well over three million pounds sterling. In addition nearly half a million pounds sterling of forest produce is given away free or at reduced rates. Many senior men with long experience in the administration of this great forest estate, the correct management and maintenance of which is vital to India as a whole, view with concern and distrust the devolution of their powers and responsibility by the Secretary of State and Governor-General.

An Index to Horticultural Research

The availability of research results of a purely horticultural character has been greatly increased by the publication of *Horticultural Abstracts* by the Imperial Bureau of Horticulture and Plantation Crops, East Malling, Kent. Mr. D. Akenhead, deputy director of the Bureau, has now compiled an index to the first ten volumes, covering the period 1931–40 (Sept. 1941, 160 pp., 25*s*.). The volume contains a subject index and an alphabetical list of authors ; it is world-wide in scope, and demonstrates the prosecution of an enormous volume of horticultural research during the decade it reviews. Greatest use of the index demands its relation to the journal which it serves, but the research worker can see from the present volume whether any work in his particular line has been reported. Detail is quite adequate for modern needs, for a reference can be found to apple sauce as well as to *Rhizopus arrhizus* rot of that crop, and to the utilization of waste potatoes, in addition to rubidium absorption in potato disks. The subject index is compiled with the different crop plants as the chief points of interest. The volume certainly achieves its expressed object of making information as available to the English-speaking horticultural worker as possible.

Health of Palestine

According to the report for 1939 recently published by the Department of Health in Palestine, the country was so much disturbed by political strife in that year as to prevent development of health work. The health of the people, however, was remarkably good, and there were no important epidemics. The recorded incidence of infectious diseases was the lowest for many years, and the death-rate from them half that of 1931. The total population numbered 1,501,698, of which 60 per cent were Moslems, 30 per cent Jews and 10 per cent Christians and others. The birth-rate was twice as high among Moslems (46·4 per cent) as among the Jews (23·0 per cent). Both rates were falling, but that of the Jews more rapidly than that of the Moslems. The death-rate of the Moslems was much more than double that of the Jews. Infantile mortality was 121·5 per 1,000 live births among the Moslems and 54 among the Jews; for Christians the rate was 101. These rates were the lowest ever recorded and showed a sharp decline from previous years. Of the various diseases diarrhœa caused 1,336 deaths and pneumonia 1,258, then in order of frequency came heart disease 617, cancer 364, cerebral hæmorrhage 311, and nephritis 276. 3,394 cases of malaria were reported with 15 deaths, 1,235 cases of typhoid with 134 deaths, and 175 cases of paratyphoid with 2 deaths. There has been no increase in tuberculosis in the last ten years. Ophthalmias are a formidable problem.

Piezo-Electro Crystal Filters

A BRIEF outline of the history of the crystal filter has been published by J. E. Benson (*A.W.A. Tech. Rev.*, 5, 191; 1941). The earliest application of piezo-electric crystals to frequency-selective circuits appears to have been made in 1920 by W. G. Cady, whose patent describes the behaviour of piezo-electric elements near resonance and their consequent use in the selection and measurement of high frequencies. L. Ezpenschied (Jan. 3, 1927) described the quartz-crystal band-pass filter having recurrent sections. This was followed by W. A. Marrison's patent (June 7, 1927) for a balanced crystal-gate filter designed for sharp response at a single frequency. In the same year, C. W. Hansell developed a similar bridge-balanced system, in which the parallel capacity of the crystal was balanced out of an equal capacity supplied from the input circuit in opposite phase to the crystal. Single-frequency rejection filters of the *T*-section type having a piezo-electric element in the shunt arm were described at about the same time by I. F. Byrnes. J. Robinson's stenode radiostat using a balanced crystal-filter circuit appeared in 1929.

Recent Earthquakes

ACCORDING to a radio message from Tokyo, the largest earthquake since 1930 shook southern Formosa on December 17. The epicentre is likely to have been near the town of Kagi around which most of the damage was done. Seventy-seven people were seriously injured and eighty-seven slightly hurt when 612 houses were destroyed and 918 badly damaged. Railway and telephone communications were temporarily severed. On the same day a violent earthquake occurred in the Mughla district of south-western Anatolia in Turkey. Damage was done to about eight hundred houses and a hospital, but only a few persons were injured. On December 20 an earthquake of moderate intensity shook Quetta. The shock lasted, according to human perception, for about ten seconds and was accompanied by a low rumbling sound. No damage has been reported, probably due to the new town having been built according to earthquake-proof design.

Institute of Physics Planning Committee

THE Board of the Institute of Physics has appointed a planning committee with the following terms of reference: "To watch and to advise the Board on matters affecting Physics and Physicists, including their education and training, and on post-war planning." The constitution of the Committee, which has power to co-opt, is as follows: Sir Lawrence Bragg, Prof. J. A. Crowther, Mr. E. R. Davies, Dr. H. Lowery, Major C. E. S. Phillips, Dr. C. Sykes, Dr. F. C. Toy. At the request of the Board the Committee will proceed at once to consider certain matters concerning the education and training of physicists. Close contact will be maintained with the participating societies of the Institute, namely the British Institute of Radiology, the Faraday Society, the Physical Society, and the Royal Meteorological Society, as well as with other bodies concerned with the application of physics to industry.

Announcements

PROF. HENRY NORRIS RUSSELL, research professor of astronomy at the University of Princeton, has been elected to an honorary fellowship at King's College, Cambridge. Prof. Russell, who is the doyen of American astronomers, graduated as Ph.D. at Princeton, after which he entered King's College, Cambridge, as an advanced student in 1902, and was in residence at Cambridge for three years. During that time he carried out research in collaboration with Mr. A. R. Hinks, now secretary of the Royal Geographical Society, upon parallax, and the methods they developed have become standard. This no doubt was a first step on the way to some of Prof. Russell's most notable work.

THE Harrison Memorial Prize, which is awarded by a selection committee consisting of the presidents of the Chemical Society, the Institute of Chemistry, the Society of Chemical Industry and the Pharmaceutical Society, has been awarded for 1941 to Dr. Henry Norman Rydon. This prize is given to a chemist of either sex who is a natural-born British subject, not more than thirty years of age, who, in the opinion of the selection committee, shall during the previous five years have conducted the most meritorious and promising original investigations in chemistry. The Prize is to be regarded as an exceptional distinction to commemorate an exceptional man.

THE Town and Country Planning Association has arranged a series of fortnightly lunch-time meetings at 1.20 on "Post-War Reconstruction", beginning on January 8, at the Dome Lounge, Messrs. Dickins and Jones, 224 Regent Street, London, W.1. Admission is by ticket obtainable from the Association. The first meeting will be addressed by Mr. George Hicks, parliamentary secretary to the Ministry of Works and Buildings, who will discuss the part the Ministry can take in reconstruction.

REFERRING to the obituary notice of Mr. R. T. Baker in NATURE of December 13, p. 718, Prof. John Read writes that Mr. Baker died at Cheltenham, New South Wales, on July 14, aged eighty-six years.

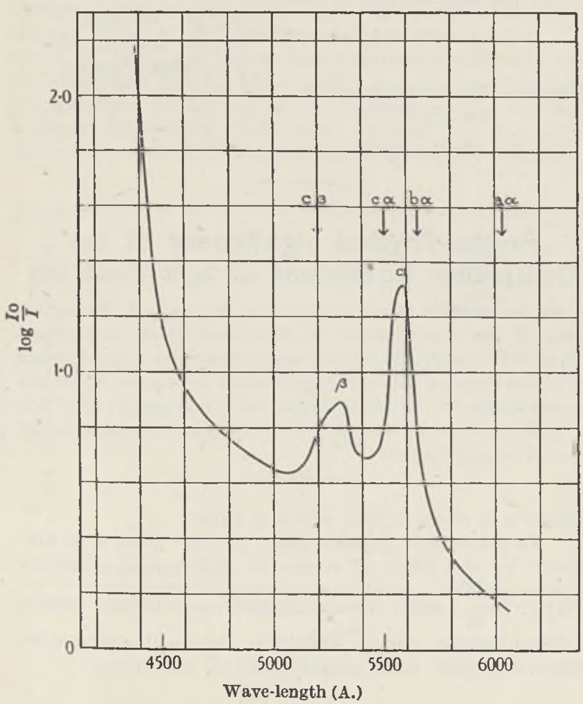
LETTERS TO THE EDITORS

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

A New Soluble Cytochrome Component from Yeast

HITHERTO cytochrome *c* is the only component of cytochrome which has been obtained in solution, the others being attached to the insoluble parts of the cell structure.

During the purification and concentration of the lactic dehydrogenase of yeast, as described in a future communication, we have obtained a new cytochrome which is extremely soluble in water. The positions of the bands of its absorption spectrum do not correspond with those of any cytochrome component known hitherto. The new component appears to be present in yeast in amounts too small for its detection by direct spectroscopic observation of the yeast cells; but its spectrum becomes visible on removal of other coloured substances and concentration. We have obtained it in strong solution, red in colour, and free from other cytochromes. Its absorption spectrum in the reduced state, as determined in a Hilger-Nutting spectrophotometer, is shown in the accompanying graph, in which the positions of the bands of cytochromes *a*, *b* and *c*, as ordinarily seen in yeast, are also indicated. Its α band is situated at 5570 A., between the α bands of cytochrome *c* (5500 A.) and cytochrome *b* (5650 A.); the β band, which is unsymmetrical, has its peak at 5300 A. If a trace of cytochrome *c* is added, a distinct space can be seen between the α bands of the two cytochromes. In liquid air the bands become much sharper; the α band then appears double. The new component, unlike cytochrome *c*, is somewhat autoxidizable, and its bands disappear on shaking with air.



The spectrum is clearly that of a hæmochromogen. This hæmochromogen does not combine with carbon monoxide in neutral solution, and in this respect it resembles cytochromes *a*, *b* and *c*. On denaturation with dilute sodium hydroxide and addition of pyridine and hyposulphite, it is converted into pyridine hæmochromogen, with absorption bands identical with those of pyridine protohæmochromogen. The pigment, therefore, has a protohæmatin prosthetic group, like cytochrome *b* and unlike cytochromes *a* and *c*. By converting the pigment into its pyridine hæmochromogen and comparison with standard hæmochromogen solutions, by the spectroscopic method described by Keilin[1], its concentration may be estimated with great accuracy. This makes it possible to calculate the absorption coefficient, which for the α band is found to be $\beta_{5570} = 0{\cdot}4 \times 10^8$ cm.^{2}/gm. atom Fe. The new cytochrome resembles cytochrome *b* not only in the nature of its prosthetic group, but also in being autoxidizable to some extent in neutral solutions. In order to avoid confusion with other hæmatin compounds, we suggest that it should be called cytochrome b_2.

Owing to the impossibility of obtaining Delft yeast, we have not been able to study the catalytic properties of cytochrome b_2 in detail. We have, however, found that it is not capable of replacing the substance[2] linking the succinic system with cytochrome *c* which is destroyed at *p*H 5, and which it has been suggested[3] might be cytochrome *b* or a hitherto unrecognized component. The identity of cytochrome b_2 with the yeast lactic dehydrogenase is discussed in a future communication.

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[1] Keilin, D., *Proc. Roy. Soc.*, B, **113**, 393 (1933); NATURE, **148**, 493 (1941).

[2] Keilin, D., and Hartree, E. F., *Proc. Roy. Soc.*, B, **129**, 277 (1940).

[3] Keilin, D., and Hartree, E. F., *Proc. Roy. Soc.*, B, **127**, 167 (1939).

X-Ray Study of the Elastic Constants of Metals

IN a recent letter[1] we showed that the diffuse X-ray reflections from single crystals of alkali metals are related to the elastic constants in just the way predicted by the Waller theory[2], as interpreted and applied by Jahn[3]. We are now able to give data for sodium which will illustrate this more conclusively.

The figures represent the intensity of diffuse reflecting power on the surface of a sphere surrounding the reciprocal lattice point (*hkl*), in the direction [*pqr*], as calculated from Jahn's formula. The observed intensities are derived from visual estimation on a series of Laue photographs taken at degree intervals, in various crystal orientations, the range of each set of photographs being sufficient to cover the entire observable reflecting region for each plane. Allowance has been made for the usual factors which affect the normal reflexions (structure factor, atomic scattering factor, factors involving the crystal and film positions relative to the incident beam), and which also, of course, affect the diffuse reflexions.

± [pqr] (hkl)	Calculated intensities: (002)	(110)	(112)	(222)	Observed intensities: (002)	(110)	(112)	(222)
[100]	24	22	24	23	—	—	—	—
[010]	24	22	24	23	—	—	—	—
[001]	19	24	21	23	—	—	—	—
[110]	24	11	20	16	—	—	—	—
$[1\bar{1}0]$	24	165	71	141	—	V.S.	M.	S.
[101]	88	56	30	16	M.S.	M.	W.	—
$[10\bar{1}]$	88	56	133	141	M.S.	M.	S.	S.
[011]	88	56	30	16	M.S.	M.	W.	—
$[01\bar{1}]$	88	56	133	141	M.S.	M.	S.	S.

Sodium single crystals are very soft and elastically anisotropic; they are body-centred cubic in structure. Lead single crystals are also soft and are anisotropic in the same sense ($c_{11} - c_{12} < 2c_{44}$), although the shear constant c_{44} is much smaller relative to the compressibility ($c_{11} + 2c_{12}$); but they are face-centred cubic in structure. Diffuse reflexion photographs (which are particularly good for large angles of incidence, on account of the slow decrease of the atomic scattering factor) show that the reflecting regions in reciprocal space are similar to those found for sodium, although the intensity 'spikes' are less pronounced. At low temperatures the diffuse reflexions almost disappear, but the Laue spots become much more numerous and the background clearer.

Tungsten crystallizes, like sodium, with a body-centred cubic structure, but it is elastically isotropic ($c_{11} - c_{12} = 2c_{44}$) and the elastic constants are large.

	c_{11}	c_{12}	c_{44}	$c_{11} - c_{12}$	$c_{11} + 2c_{12}$	($\times 10^{11}$ dynes/cm.^{2})
Na	0·52	0·40	0·41	0·12	1·32	(4)
Pb	4·77	4·03	1·44	0·74	12·83	(5)
W	51·3	20·6	15·3	30·7	92·5	(6)
	50·1	19·8	15·1	30·3	89·7	(7)

For tungsten, the Jahn formula predicts small, elliptical diffuse spots which should disappear at a very small angular distance from the Bragg position. This is exactly what we find. The diffuse spots are smaller than the Laue spots, and disappear at $\theta_B \pm 2°$; there are none of the detailed, persistent groups of spots and streaks (some of which extend right across the Brillouin zone boundaries) that are found for both sodium and lead. A rough calculation, which is in good qualitative agreement with our observation, indicates that the tungsten diffuse reflexion should be about $\frac{1}{50}$, and that of lead about $\frac{1}{2}$, as intense as the diffuse reflexion from sodium, for the first observed order from (110) planes.

The thermal theory predicts that the relation of diffuse to normal (Bragg) reflecting power for any set of planes should be governed by the actual values of the elastic constants and not primarily by the crystal structure. In our opinion, this is proved by the above experiments on single crystals of metals.

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[1] Lonsdale and Smith, NATURE, 148, 628 (1941).
[2] Waller, "Theoretische Studien zur Interferenz- und Dispersionstheorie der Röntgenstrahlen" (Uppsala: Universitets Årsskrift, 1925).
[3] Jahn, NATURE, 147, 511 (1941); *Proc. Roy. Soc.*, A (in the press).
[4] Quimby and Siegel, *Phys. Rev.*, 54, 299 (1938); data extrapolated to room temperature.
[5] Goens, *Phys. Z.*, 37, 321 (1936); data corrected for an arithmetical error.
[6] Bridgman, *Proc. Amer. Acad.*, 60, 305 (1925).
[7] Wright, *Proc. Roy. Soc.*, A, 126, 613 (1930).

A Reversible Discharge Tube

R. W. WOOD[1] has described an interesting discharge tube which could be made to exhibit "either the spectrum of atomic hydrogen or molecular oxygen at will" on excitation by a high-frequency discharge. In the course of investigations on the spectra of gases excited by high-frequency discharge, we have prepared a discharge tube which has an analogous behaviour and can be made to show either the air spectrum or hydrogen spectrum as desired. The fundamental difference between the two tubes, however, is that under the discharge hydrogen is suppressed by oxygen in Wood's tube, whereas here, hydrogen suppresses air.

The discharge tube, which has a quartz window and aluminium electrodes, was sealed off the evacuation apparatus after being repeatedly washed by hydrogen. The spectrogram taken soon afterwards showed only the spectra of hydrogen, in particular a very intense development of the well-known continuous spectrum of hydrogen. The tube was excited by high-frequency discharge. On standing for a few days the tube, on similar excitation, showed only nitrogen bands in the visible, clearly due to traces of residual air, and there was no trace of hydrogen. On continued excitation, however, hydrogen gradually appeared, nitrogen got weaker and in a couple of hours the tube showed nothing but hydrogen, nitrogen being suppressed under the discharge. The continuous spectrum of hydrogen was found to be considerably weakened in intensity while the atomic spectrum was very prominent, due, no doubt, to the absorption of hydrogen by the walls of the tube resulting in a gradual 'clean up'.

On cutting off the discharge and allowing the tube to rest for some period, the same series of phenomena can be repeated. Most of the hydrogen appears to be confined to the electrodes, for it has been possible so to excite the tube with external electrodes that, by omitting the internal electrodes from the path of discharge, the tube shows only the spectrum of air for any length of time.

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NAND LAL SINGH.
JAG DEO SINGH.

Benares Hindu University,
Oct. 25.

[1] *Phys. Rev.*, 35, 658 (1930).

Psycho-Physical Significance of the Dissipation Coefficient of Soft Materials

IN an earlier communication[1] we raised the question of the significance of the dissipation coefficient (k) of soft materials, which we measure by compressing cylinders under loads compensated to ensure constant shear stress (S). For materials the firmness (ψ) of which is independent of stress, k is defined by an equation of the Nutting type[2]

$$\psi = S\sigma^{-1} t^k,$$

where σ is shear strain and t is time.

Broome and Bilmes have shown[3] that k is also given by the ratio of mean to differential viscosity ($S/\frac{\sigma}{t} \div S/\frac{\partial\sigma}{\partial t}$) and, for relaxation at constant strain, differentiation shows that the Maxwell relaxation time will vary as a power ($1/k$) of the stress.

In order to establish the psycho-physical significance of k, we have given pairs of cylinders to groups of ten subjects who, squeezing the cylinders under controlled conditions, were asked to decide which was the firmer of each pair, the squeezing being timed to take ½, 1, 2 and 4 sec. respectively. When a standard bitumen (viscosity $= \eta$; $k = 1$) is compared with a series of rubbers ($k = 0$) of varying shear moduli (n), a unique curve is obtained when p (percentage "bitumen softer" answers) is plotted against nt. The time required to give an equality point corresponding to the case where η is numerically equal to n, is not equal to the time-unit from which η is calculated (1 sec.) but to a fraction ($\alpha = 1/3$) of this value.[4]

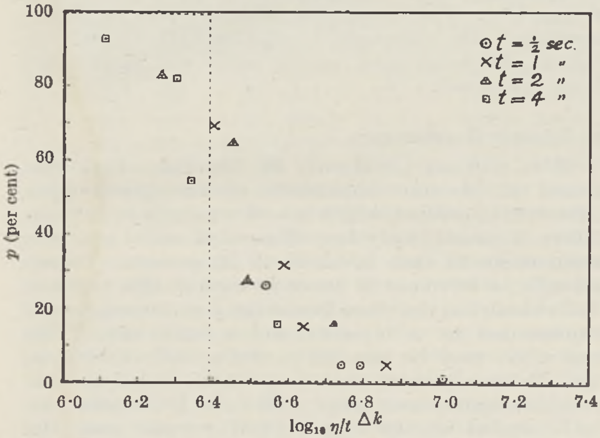

Fig. 1.

The dotted lines represent the curves obtained from the data from the compression machine.

In order to study further the relationship between α and the difference between the k-values of the materials (Δk), we have done two further experiments (I and II) with ten subjects, giving three sessions per experiment and 32 judgments per session, that is, 960 judgments per experiment. A series of fluid bitumens was compared with (I) an unvulcanized rubber ($k = 0 \cdot 50$; $\psi = 2 \cdot 5 \times 10^6$) (we are indebted to Dr. L. R. G. Treloar, of the British Rubber Producers' Research Association, for this material) ; and (II), a synthetic rubber-clay-Vaseline mixture ($k = 0 \cdot 22$; $\psi = 4 \cdot 0 \times 10^6$). The Δk-values were, therefore, 0·50 and 0·78.

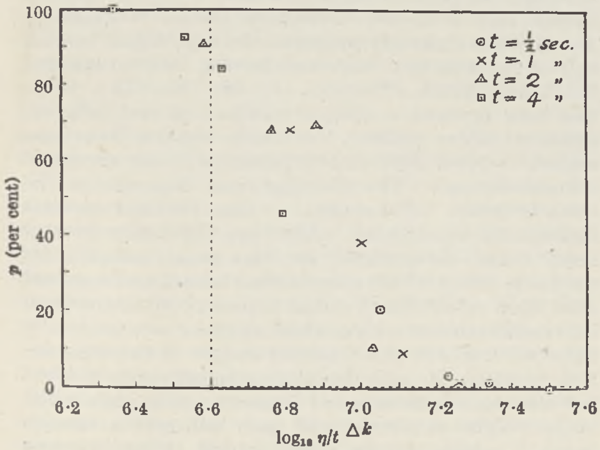

Fig. 2.

The accompanying graphs show that unique curves are obtained by plotting p against log ($\eta/t^{\Delta k}$). Thus, from subjective comparisons of the firmness of a material with that of a true fluid, we can derive the dissipation coefficient, although no conscious judgment of this property is given by the subjects. This is a strong point in favour of the use of the Nutting type of equation, especially where subjective judgments are of industrial importance.

In experiment I, α is 0·98 and in II, 0·45, subject to a fair margin of error. The relationship between α and k should be further investigated.

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[1] Scott Blair, G. W., and Coppen, F. M. V., NATURE, 146, 840 (1940).
[2] Nutting, P. G., *Proc. Amer. Soc. Test. Mat.*, 21, 1162 (1921); *J. Franklin Inst.*, 191, 679 (1921).
[3] Broome, D. C., and Bilmes, L., *J. Soc. Chem. Ind.*, 60, 184 (1941).
[4] Scott Blair, G. W., and Coppen, F. M. V. (in process of publication in the United States).

Hospitality in Australia for Scientific Workers

AMONG the ranks of scientific workers in Great Britain there must be a considerable number who are unable to make any direct contribution towards the nation's war effort and whose researches have been seriously interfered with or stopped by various circumstances arising from the War.

Australian men of science have widely expressed their wish to extend the hospitality of their laboratories to such scientific colleagues in Great Britain, so that they may continue with their work.

The Australian National Research Council has made inquiries to ascertain what facilities the universities and research institutes of Australia can offer, not only to colleagues in Great Britain, but also to those men of science in other parts of the Empire who normally would proceed to the United Kingdom for study leave or postgraduate courses but are now debarred from doing so.

The response to this inquiry indicates that scientific laboratories throughout Australia are anxious to offer such hospitality, and that facilities are available for workers in almost all branches of science.

In view of certain limitations of the facilities available in certain laboratories, my Council would be glad to advise any scientific colleagues who may wish to come and work in Australia as to which institutions can offer them the facilities required for their particular investigations.

L. H. R. CARNE
(Hon. Secretary).

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RESEARCH ITEMS

Biological Productivity of Lakes

IN studying the biological productivity of lakes, quantitative determinations of the standing crop of plants (producers) and of animals (consumers) have been made on several Wisconsin lakes by C. Juday, who described his results at the Autumn Meeting of the U.S. National Academy of Sciences held during October 13–15. The ratio of plants to animals is not a static, but a dynamic, factor, which shows seasonal and annual fluctuations, as well as variations in shorter periods of time, especially with respect to the phytoplankton. The annual variations range from 10 : 1 to 15 : 1 when stated in terms of live weight. In soft-water lakes the ratio can be readily modified by the use of organic fertilizers, such as soy bean meal and cotton seed meal. The effect of these fertilizer fluctuations on the growth-rate of fishes is now being investigated. Manning and R. E. Juday (1941) found that the biological productivity of the upper stratum (epilimnion) of a lake is correlated, within certain limits, with the chlorophyll content of the phytoplankton. In terms of glucose, the computed productivity ranged from 14 to 44 kgm. per hectare a day in August in seven lakes.

Modification of Injury Produced by Röntgen Radiation

ATTEMPTS to modify the amount of injury produced by Röntgen radiation are of interest from theoretical and practical points of view. They indicate the importance of indirect effects of the radiation in the final injury to cells under certain conditions, and offer some hope of improving the tumour injury—tissue injury ratio in cancer therapy. Two types of experiments in which the radio-sensitivity of cells have been modified were described by T. C. Evans at the Autumn Meeting of the U.S. National Academy of Sciences held during October 13–15. It has been found that the effect of Röntgen radiation of decreasing the fertilizing power of Arbacia sperm is, within certain limits, proportionately increased as the concentration of the sperm in sea water (during irradiation) is decreased. The resistance of the sperm to this action of the radiation is greatly increased upon the addition of sufficient amounts of (1) dead sperm, (2) living sperm of Nereis, (3) egg albumen, (4) gelatin and (5) Arbacia egg jelly. Another line of evidence for the effect of the 'medium' on the radio-sensitivity of cells is derived from experiments on the skin of certain mammals. In these experiments it has been found that the resistance of the skin is increased when the circulation of the blood is blocked during the irradiation.

Heavy Carbon Isotope in Plant Metabolism

THE use of the heavy carbon isotope in studies of plant metabolism was discussed by R. Belkengren, A. O. Nier and G. O. Burr, of the University of Minnesota, at the Autumn Meeting of the U.S. National Academy of Sciences held during October 13–15. The normal carbon dioxide of the air contains about 1·1 per cent of the carbon isotope ^{13}C. Using methane in a thermal diffusion column, the heavy carbon was increased to 5–10 per cent. This methane was burned to carbon dioxide and fed to green plants by photosynthesis. The accuracy of the mass spectrograph is such that the percentage of heavy carbon dioxide $\left(\frac{\text{mass } 45}{\text{mass } 44} \times 100\right)$ can be found to the second decimal place. Hence the amount of heavy carbon that has gone into any chemical fraction of the plant can be determined with fair accuracy even after considerable dilution. Young bean and radish plants were used for the experiments reported. When exposed to heavy carbon dioxide in darkness, the leaves of the bean seedling do not form a measurable amount of any diffusible compound that is transported and respired in other parts of the plant. However, in light the newly formed photosynthate is rapidly transported to all parts of the plant and incorporated at varying rates into every chemical fraction thus far examined. Within three hours root tips 30 cm. from the leaf are respiring heavy carbon dioxide, and after 24 hours the terminal centimetre of growing roots contains 30 per cent of the newly fed carbon. The conversion of newly formed photosynthate into chlorophyll, xanthophyll, lipids, cellulose, starch, protein, amino acids and amides has been measured.

A Trisomic Grasshopper

H. G. CALLON (*J. Hered.*, 32, 296–298 ; 1941) has found a trisomic individual of the grasshopper *Mecostethus grossus*, which is a rare species in Britain. There is usually only one chiasma situated near the centromere in each bivalent of *M. grossus*. Consequently, a trivalent is never formed in this trisomic individual, but the three homologous chromosomes are represented by a bivalent and a univalent. This univalent may be passive in the spindle similar to the *X*-chromosome, and may be included in one telophase group or it may, unlike the *X*-chromosome, be included in the spindle and remain near the equator until after the disjunction of the bivalents. As a result of this latter process, a diploid restitution nucleus is formed. The external appearance of the trisomic individual was similar to a normal male *M. grossus*.

Heparin

THE unit of early crude preparations of heparin, the blood anti-coagulant, originally found in liver and afterwards in most tissues, was defined as the minimum quantity necessary to keep 1 ml. of cat blood fluid for 24 hours at 0°. Units so defined in terms of some potentially variable animal reaction have not the advantage of units stated to be the specific activity contained in a fixed weight of standard preparation and measurable by any quantitative and standard biological test. Workers in Toronto have already proposed the crystalline barium salt of heparin as a standard having 100 units/mgm. F. C. MacIntosh (*Biochem. J.*, 35, 770, 776 ; 1941) has now devised a simple method of test wherein oxalated horse plasma, to which heparin has been added, is recalcified in the presence of an excess of thrombokinase. The clotting time depends on the concentration of heparin. The method reveals differences in activity which are definitely greater than those determined for the same samples by methods using whole mammalian blood, and suggests that even crystalline barium heparin contains several individuals the activity of which appears to be unequally directed towards the different stages of the coagulation process. He also describes a colorimetric method for the standardization of heparin. Any high molecular weight sulphuric acid ester will give a characteristic colour change when added to an aqueous solution of a metachromatic dye such as toluidine blue. The effectiveness of any substance in producing this colour change appears to be roughly proportional to its anticoagulant potency as obtained by the plasma-kinase method. A number of synthetic anticoagulants have thus been compared with heparin; for example, chlorazol fast pink and Bayer 205 (Germanin) have anticoagulant activities of the same order as heparin by the biological and colour tests, although their action may not be identical with that of heparin.

The Hindu Kush Earthquake of November 21, 1939

THIS earthquake has been studied especially by S. M. Mukherjee and A. R. Pillai, of the Colaba Observatory, Bombay ("The Hindu Kush Earthquake of November 21, 1939", by S. M. Mukherjee and A. R. Pillai, India Meteorological Department, Sci. Notes, 8, No. 91, pp. 85–90 + 2 pages of reproductions of seismograms). By Geiger's method of least squares, the epicentre of the earthquake was obtained at 36° 11′ N. and 70° 53′ E. The depth of focus was found to be 210 ± 14 km., which makes the earthquake a deep-focus shock. The hypocentral time is obtained as 11h. 01m. 43s. U.T. The authors note that there is a tendency for the Hindu Kush shocks to originate from very near the same focus, and also that this earthquake was recorded with initial compression at Bombay and the European stations, similar to most of the preceding shocks from the same epicentral region. It is remarked that the Hindu Kush earthquakes of a strong nature tend to occur in winter, while the weaker ones occur at all seasons. All these facts point to the possibility that all shocks from this region may originate from the same causes and by the same mechanism. The authors recognized the pulse *sP* at about 8°, the smallest epicentral distance for which seismograms were available. It is suggested that for the Hindu Kush earthquakes, a study of the *sP* phase may afford very reliable information concerning the epicentre and depth of focus of the shocks from the seismograms of a single Indian station. The desirability of more open time-scales on the seismograms is suggested.

The Microcoulomb Experiment

UNDER this title, Prof. F. Ehrenhaft has published (*Philosophy of Science*, 8, 3; 1941) a résumé of his work, extending over thirty years, on the charges carried by minute solid particles in gases. It is recalled that, so long ago as 1909, using a method similar to that of the well-known Millikan experiment, Ehrenhaft obtained a value $4 \cdot 6 \times 10^{-10}$ E.S.U. for the mean charge on particles of colloidal silver. Certain particles, however, gave values for the charge considerably smaller, in some cases only one tenth of the electronic charge. The present article summarizes the very extensive and protracted researches carried out by the author, first at his Institute in Vienna, and later, after his expulsion from the Institute, abroad, into the genuineness of this effect. The charges have been studied in various forms of apparatus, both at normal and at high pressures. Particles of wax and selenium of perfect sphericity as viewed under the microscope have been prepared and studied. In order to avoid the uncertainties associated with the use of Stokes's law as a means of determining the masses of these minute spheres, Ehrenhaft has worked out a microscopical technique for the direct determination of their diameters, and produces evidence that the density of the particles is identical with that of the same substance in bulk. The mass is thus determined directly, without reference to the laws of motion through a viscous medium. The very ingenious microscopic technique is fully described in the paper. Prof. Ehrenhaft believes that the anomalous effects are genuine, and that in many cases the particles studied carry charges which differ from the fundamental electronic charge, or integral multiples of this charge, by amounts well beyond the limits of experimental error.

Sodium Arsenites

THE composition of the alkali arsenites is not very well established, in spite of the fact that very large quantities of sodium arsenite have been used in the past few years for the control of harmful insects; more than 7¼ million pounds were used in the United States in 1938–40 for three kinds of insects alone. O. A. Nelson (*J. Amer. Chem. Soc.*, 63, 1870; 1941) has made a phase rule analysis of the system containing Na_2O, As_2O_3 and H_2O, and the results show that solid phases of the following compositions separate: (1) Na_2O, $3As_2O_3$, (2) Na_2O, As_2O_3, (3) $2Na_2O$, As_2O_3, $7H_2O$ and (4) $2Na_2O$, As_2O_3. Of these, (1) and (3) were not previously known. The system was examined by Schreinemakers and De Baat in 1917 and some of their results could not be confirmed by Nelson, who gives reasons for supposing that these results a e improbable.

XZ Aurigæ: An N-Type Variable

G. Alter and D. L. Edwards have issued a paper with this title (*Mon. Not. Roy. Astro. Soc.*, 101, 5; 1941), which shows that this star is not a β-Lyræ type as recorded by Prager and Schneller. This discovery was made by an accidental comparison of a photovisual plate of a star field with the corresponding Franklin-Adams chart, when it was found that XZ Aurigæ was not present on the chart (limiting mag. 15), while it appeared on the Sidmouth photovisual plate as a star of magnitude 10. Further exposures showed that the star had a colour index of about $+4^m$, for which reason it was necessary to make fairly long exposure-times for photographic magnitudes to obtain a star image with the Mond Astrograph. Thirty-four comparison stars were chosen in the surrounding region, their magnitude range being large enough to exceed that of XZ Aurigæ in the photovisual scale, though not sufficiently large to secure the extension of the fainter photographic magnitudes, as the available apertures are too small. On three occasions only was it possible to secure both photographic and photovisual magnitudes, and the colour index was found to be $+3 \cdot 8$ to $+5 \cdot 0$. In view of this large colour index the 12-inch McClean objective prism was used to obtain the spectrum, but good photographs could not be taken owing to poor weather conditions and also to the fact that the star was close to the limiting magnitude obtainable with the instrument. The best photograph taken on March 30, although of poor definition, showed that the spectrum is almost certainly of late *N*-type—a view supported by the large colour index obtained. Wolf's observations, which were published in 1917, showed that the photographic magnitude was 14·5, and this is corroborated by the present investigation. It is remarkable that the colour index was found to change by about one magnitude in 10 days.

ASPECTS OF MODERN GEOLOGY

By PROF. EDSON S. BASTIN
University of Chicago

FOUR notable geological symposia were held on September 25 and 26 during the celebration of the fiftieth anniversary of the University of Chicago and with the co-operation of the Geological Society of America and the American Association for the Advancement of Science. All four symposia dealt with the frontiers of geological research.

The climax of the geological programme was undoubtedly the address of Reginald A. Daly, of Harvard University, on glaciation and submarine valleys. This was a remarkably lucid exposition of his hypothesis of the origin of submarine valleys by silty bottom currents or underflows operating under the general control of Pleistocene glaciation and its attendant effects on sea-levels.

Clay Materials

The first symposium, on the structure, properties and occurrence of clay materials and their practical application, was opened by Dr. Ralph E. Grim, of the Illinois Geological Survey, long a leader in clay research. Dr. Grim reviewed the old ideas of the composition of clay materials and the researches of the past fifteen years using modern research tools, that have led to the present generally accepted concept that clays are composed essentially of minute crystalline particles of one or more members of a few groups known as the clay minerals. The composition, structure and properties of these components were discussed and some new interpretations suggested.

Following this paper Dr. Sterling B. Hendricks, of the U.S. Bureau of Plant Industry, described in detail the lattice structure of many of the clay minerals.

Prof. W. P. Kelley, of the College of Agriculture of the University of California, discriminatingly reviewed the importance of clay researches to modern agriculture and emphasized the close relationship between soil science and geology.

Prof. F. H. Norton, of the Massachusetts Institute of Technology, pointed out that in addition to the clay minerals there are various mineral impurities, and that clays also contain soluble salts from the ground water which have a strong influence on their physical properties. Clay, having such a large surface, is very sensitive to adsorbed ions, and many of the variations observed in clays are traceable to this adsorbed material.

The symposium concluded with a discussion by Dr. Hans F. Winterkorn, of the College of Engineering, University of Missouri, of the importance of clay research in engineering construction, particularly of highways and dams, and the use of base-exchange and other methods for stabilizing such constructions.

Coals

The second symposium dealt with the physical constitution of coals and their practical significance and was under the leadership of Dr. Gilbert H. Cady, long in charge of the important coal studies of the Illinois Geological Survey. Dr. Cady pointed out that a satisfactory classification of coals into types must rest upon an understanding of the physical and chemical properties of the primary components of coal—vitrain, clarain, durain and fusain. Increased knowledge of these components has led to the important practical result that it is now possible to synthesize coals or modify them to conform to petrographical specifications.

Dr. H. H. Lowry, of the Carnegie Institute of Technology, reviewed the data on the chemical nature of the banded constituents of coals and emphasized the fact that essentially distinct types of chemical compounds peculiar to each of the banded components have not been found. Recent progress in Britain in the study of coals was reviewed by Prof. C. E. Marshall, of the University of Birmingham, who further emphasized the increasing importance of microscopic study of both the plant and the mineral components of coals to efficient utilization. That in the United States improved marketing and utilization practice based upon the newer knowledge of coal constituents is well under way was emphasized by Capt. Louis C. McCabe, of the U.S. Quartermaster Corps. In the coking of coals and in hydrogenization, knowledge of the coal components are also of great import as emphasized by George C. Sprunk, of the U.S. Bureau of Mines, who pointed out, for example, that the portions of coal that are translucent under the microscope are readily hydrogenized and give high yields of liquid fuels, whereas components that are opaque are difficult to liquefy.

The influence of metamorphism on the coal constituents was stressed by Dr. C. E. Dapples, of Northwestern University, who pointed out that some constituents such as cannel and durain tend to resist physical change, whereas fusain, clarain, vitrain and resinous bodies alter their physical properties with increase in rank.

Glacial Geology

The third symposium was concerned with the newer developments in the field of glacial geology, principally in North America, and was opened by Prof. Richard F. Flint, of Yale University. Several problems of very fundamental importance were discussed by him, one of these being the cause of the locations of the great ice caps. It has long been held that these ice caps grew *in situ*, but that hypothesis seems to encounter insuperable meteorological difficulties. It was pointed out that each central area of ice accumulation stands in definite relation to a high range of mountains—the Torngat Range of Labrador, the great mountains of Baffin Island, and the Swedish-Norwegian mountains, respectively. It seems likely that it was on these mountains that the snow fell, forming Alpine glaciers, and that these glaciers coalesced, growing outward away from the mountains and thickening to such an extent that they became high enough and cold enough to catch snowfall themselves, thereby shifting the locus of maximum snowfall away from the mountains, and eventually allowing the ice caps to bury the mountains.

Space does not permit the mentioning of all the contributions to this symposium, but the northern extent of glaciation in North America is certainly a matter of very general interest, and according to Dr. A. L. Washburn, of Yale University, this is still an unsolved problem the solution of which is handicapped by the fact that sea ice may produce some features which simulate the work of glacier ice. Recent field investigation indicates that Victoria Island, with an area of about 79,000 square miles, and the very much smaller Royal Geographical

Society Islands, were definitely glaciated during the Ice Age, and that glaciation of at least the southern portion of Banks Island is probable. Evidence obtained by a Canadian Government Expedition in 1908–9 suggests glaciation of Melville Island. No geological evidence seems to be on record indicating lack of glaciation on other islands in this region. It appears that glaciation was of considerable areal importance in Canada's Western Arctic, but information concerning the complete areal extent must await further expeditions.

It was emphasized by Dr. D. A. Nichols, of the Canadian Bureau of Geology and Topography, that most of the present knowledge of the glacial geology of Canada has been gleaned incidentally to studies of other aspects of geology, notably the economic, and that great opportunities for specialized glacial studies exist. Correlation of glacial and marine features of the Atlantic Coast was considered by Prof. Paul MacClintock, of Princeton University, and the contributions of botanical studies to knowledge of post-glacial climates were presented by Prof. W. S. Cooper, of the University of Minnesota, who concluded that the record from pollen studies and the facts of plant geography apparently agree in indicating a mid-post-Pleistocene warm-dry period followed by a return towards cool-moist conditions during the last few thousand years.

Petroleum

The fourth symposium related to geological frontiers in the search for oil and was opened by A. I. Levorsen, chairman of the Research Committee of the American Association of Petroleum Geologists. Among the many interesting points brought out by Mr. Levorsen in his discussion of trends in petroleum geology was a point often overlooked by those interested in mineral resources, namely, that petroleum reserves contrast with reserves of other mineral resources in that it is impossible to estimate them in advance of discovery by drilling. Thus, whatever may be the *true* reserves, *estimated* reserves have always been small, and continued discovery is essential to continued development.

The role of modern surface methods in the search for oil was described by E. W. Owen, president of the American Association of Petroleum Geologists, and the role of micro-palæontology by Prof. Carey Croneis, of the University of Chicago. Dr. W. C. Krumbein, also of the University of Chicago, spoke of the importance of a fuller knowledge of the principles of sedimentation in the search for stratigraphic oil traps in contrast to structural traps.

In speaking of the role of ground water in petroleum accumulation, Prof. F. B. Plummer, of the University of Texas, concluded that recent extensive investigations of pore sizes, of the forces required to move liquid and gas hydrocarbons through them, of the variation in subsurface pressures, and of the forces due to interfacial tension, indicate that crude oil droplets cannot move through a porous sand from synclinal positions to anticlinal positions by gravity alone. The conclusion is reached that hydrocarbons migrate largely as gas particles and partly as liquid films enveloping gas bubbles, along with the slow downward movement of the ground water towards the lower part of the region, and that as the tiny gas bubbles come within the influence of decidedly low pressures they accumulate in the trap.

FOOD INVESTIGATIONS IN CANADA

FOOD studies constitute a very important field of research. In the National Research Laboratories at Ottawa nearly one half of the work in the Division of Biology and Agriculture now relates to food. Preparation, processing, packaging and preservation during transport are all subjects of research.

Since the autumn of 1939 the investigations in the food laboratories of the National Research Council have been directed almost wholly to new problems arising from the War. Among these is improved preservation of perishable products such as bacon and eggs shipped to Great Britain, the object being to overcome the effects of the longer shipping period and the lack of refrigerated space. The utilization of market poultry and other perishable products for which the export market has been reduced, and improvements in the nutritional value of canned goods and other processed foods have been studied. Special problems such as the storage of blood for transfusion, which the storage laboratories are well equipped to study, have also been given attention.

Poultry

One of the first problems undertaken in the food storage laboratories dealt with the preservation of dressed poultry in the frozen state. The results of this study led to definite recommendations as to pre-cooling, freezing, packaging and storage practices that should be followed to avoid impairment in appearance or eating quality. A new package was designed to facilitate moisture-proof sealing of the product in order to prevent deterioration from surface-drying during storage.

The use of the improved package for dressed poultry for export has been restricted owing to the shortage of refrigerated space on ocean-going vessels. This emphasized the importance of canning. A canning laboratory was established towards the end of 1939 and has now been almost completely equipped.

Following a preliminary survey of the canned poultry on the domestic market, improved methods of processing have been developed and their suitability to plant conditions demonstrated. The recommended processes include pressure pre-cooking, retort pre-cooking, improved methods of handling the raw and finished product and broth, and the use of side-opening cans, lacquered with a gold storing-type enamel which adds to the attractiveness without materially affecting the total cost. Attention has also been given to the development of a grading system, and apparatus has been devised for quantitative separation of the meat and jelly and for measuring the strength of the meat broth and jelly.

Another set of experiments was concerned with the development of rancidity in poultry fat during storage. Prompt pre-cooling and freezing were found essential to the preservation of quality.

Eggs

Eggs shipped to Great Britain in ordinary storage are subject to deterioration from the growth of micro-organisms on the exterior or interior of the eggs, desiccation through loss of moisture, and thinning of the 'thick' white through loss of carbon dioxide. Preservative treatments have been tested and methods of handling investigated. Oil dipping appears to be the most practicable commercial treatment. Canadian spray-dried whole eggs have been examined for export to Great Britain.

Pork

The frozen storage of pork is of considerable importance since the seasonal production of pigs in Canada demands that a considerable amount of pork must be placed in storage during peak seasons in order to maintain reasonably uniform export of bacon throughout the year. Studies have been made on colour changes and on development of rancidity in pork during storage.

Bacon

Investigations into the curing and transport of Wiltshire bacon, begun in 1938, have been continued as the major project in the food laboratories of the National Research Council. Before the War this work was extended to include comparative tests of Canadian and Danish bacon as received in Great Britain.

Wiltshire bacon is the most important perishable product which Canada exports to Great Britain during peace or war. Bacon studies undertaken before the War included a survey of the curing processes used in Canada. This disclosed variations in the method of producing Wiltshire sides in different plants. An extensive study of the bacon produced by these factories followed. The companies concerned co-operated actively with the National Research Council in these studies.

The results showed that the principal variation in Canadian bacon with respect to bacteriological, chemical and physical composition and such attributes of quality as colour, colour stability and tenderness was in the product manufactured in different factories. This indicated that differences in the curing process, rather than the differential response of individual carcasses to curing, were the primary cause of variable quality. The market value, of course, is also affected by the preference of consumers for sides of a certain conformation.

In recent months more emphasis has been laid on methods for converting the extremely perishable unsmoked bacon normally shipped to England into a form that will withstand the delays in transport while maintaining the highest possible quality. It has been found that smoked bacon is less perishable than the unsmoked material. The possibility of smoking the product in Canada, and the use of cures that render the product less perishable are being investigated.

Smoking is almost universally used in the processing of bacon but Canadian Wiltshire sides have hitherto been exported to Great Britain in the 'green' or unsmoked condition and smoked there. It is generally accepted that smoking has a preservative action but little information of a quantitative nature is available. Extensive studies have therefore been undertaken on the relative perishability of smoked and unsmoked bacon as judged by colour measurement, peroxide oxygen content of fat, and surface bacterial counts. In the storage studies unsmoked bacon was found to be rancid after forty-two days, whereas the smoked product was usually satisfactory after seventy days.

Wiltshire bacon is usually matured for two or three weeks before smoking and then consumed immediately. This procedure is believed to produce the most desirable flavour. If smoking were employed as a method of preservation during transit, the material would have to be smoked shortly after cure and then be carried through a relatively extended transport period before reaching the consumer.

As regards the research on Wiltshire bacon, it may be noted that twenty-three papers on this subject have been published in the *Canadian Journal of Research*. These papers have dealt with such subjects as: a survey of Canadian plant and curing processes; distribution of chloride; effect of heat treatment on nitrite content, colour and toughness; measurement of the colour of meat; seasonal variations in colour; bacteriological and chemical changes during cure; the effect of temperature and bacterial growth on nitrite content, etc. Further work on these topics has had to be curtailed in favour of work on the improvement of methods of preservation of bacon for export to Great Britain.

Influence of Conditioning Factors

Precise control of temperature, humidity and other factors are frequently necessary for the storage and freezing of foodstuffs. Earlier investigations into the humidification and the reduction of temperature variations in cold stores have been continued. Apparatus has been developed for the measurement and control of humidity in cold stores.

Blood Storage

Shortly after the outbreak of war, certain problems relating to storage of whole blood were referred to the Division of Biology and Agriculture by the Sub-committee on Blood Storage of the Associate Committee on Medical Research. The object of these studies was to determine the conditions under which human blood could be stored for the longest possible period. This work has been completed.

Vitamin Fortification

Current attempts to raise the nutritional level of the population, including the vitamin fortification of certain foods, have emphasized the need for information on the effect of processing and storage treatments on the vitamins, several of which are destroyed by exposure to air or by high temperature. Methods and equipment for studying these problems by chemical means are being developed.

The vitamin B complex contains at least two components that can be determined chemically by means of a fluorimeter. Such an instrument has been designed and constructed. It is cheap, simple, self-contained, stable in operation and is capable of measuring thiochrome (produced from thiamin or vitamin B_1) in concentrations as low as one part per hundred million.

Many other investigations relating to foods are under way in the laboratories of the National Research Council or in other laboratories under the programme of work decided upon by the Canadian Committee on Storage and Transport of Food.

Special mention may be made of the development and testing of improved methods of controlling temperature in refrigerated cars. In this work the Division of Physics and Electrical Engineering co-operated by designing the necessary apparatus, and the Fisheries Research Board successfully carried out test shipments of frozen fish from Prince Rupert to Montreal.

Detailed accounts of investigations in food storage and transport are contained in papers published in the *Canadian Journal of Research* and in the annual review of activities issued by the National Research Council of Canada.

RESPIRATION AND THE ASSIMILATION OF CARBON DIOXIDE

AN account of work by C. H. Werkman, L. O. Krampitz and R. G. Wood of Iowa State College on the assimilation of carbon dioxide during respiration was given on October 13 during the Autumn Meeting of the U.S. National Academy of Sciences.

The concept of heterotrophic assimilation of carbon dioxide was first established in 1935 by Wood and Werkman, while investigating the dissimilation of glycerol with the propionic acid bacteria. They observed the molar correlation between carbon dioxide disappearance and succinic acid formation and proposed the reaction: pyruvate + CO_2 → oxaloacetate, to account for this fixation of carbon dioxide. The latter four-carbon dicarboxylic acid serves as the oxidizing agent for the glycerol, resulting in the formation of succinic acid.

The concept of carbon dioxide assimilation has recently been applied to many other heterotrophic forms, including the liver tissue of mammals. It is in this tissue that the role of carbon dioxide fixation has been shown to be of fundamental importance with regard to respiration. Oxaloacetate is the cardinal compound in the main respiratory mechanism of the tissue. Consequently elucidation of the mechanism of its formation is of fundamental importance. Direct evidence for the fixation reaction has been obtained with a bacterial enzyme preparation from *M. lysodeikticus*, which is capable of bringing about the decarboxylation of oxaloacetate, that is, the reverse of fixation reaction. Thus far attempts to carboxylate pyruvate have failed. This may be due to an unfavourable equilibrium, that is, the breakdown of oxaloacetate is greatly favoured. On the other hand, pyruvate as such may not be the compound with which carbon dioxide unites but rather a derivation of pyruvate. With ^{13}C as a tracer it was possible, however, to demonstrate the fixation reaction using oxaloacetate. Decarboxylation of oxaloacetate was carried out in the presence of the enzyme and $NaHCO_3$ with an enriched ^{13}C content. The reaction was allowed to continue until the original oxaloacetate concentration was halved. The residual carbon dioxide was removed and the remaining oxaloacetate was decarboxylated to pyruvate and carbon dioxide and the latter thus obtained determined for ^{13}C. The concentration of ^{13}C was substantially above normal.

The criticism that a chemical exchange of carbon dioxide with carboxyl group, analogous to the exchange of deuterium with ionizable hydrogen, may take place was investigated. Oxaloacetate spontaneously decarboxylates slowly. An experiment similar to the above one was performed omitting the enzyme, and the residual oxaloacetate decarboxylated. The ^{13}C content of this carbon dioxide was normal.

The possibility of the enzymatic exchange of carbon dioxide with carboxyl groups of other keto acids was investigated, with an enzyme capable of oxidizing pyruvate to acetate and carbon dioxide. An experiment was conducted in which the oxidation was permitted until one half of the pyruvate remained. The residual pyruvate was decarboxylated and the ^{13}C content of the carbon dioxide was found normal. Similarly, the oxidation of α-keto glutarate to succinate was carried out, and likewise the normal ^{13}C content of carbon dioxide obtained.

Thus it has been demonstrated that the exchange reaction is specific for oxaloacetate, and apparently does not occur in other keto acids. The exchange reaction in oxaloacetate is essentially 3- and 1-carbon addition or a fixation reaction.

GAME PRESERVATION IN BURMA

THE annual report on game preservation in Burma for the year ending March 31, 1940 (Rangoon, Supt. Govt. Printing, Burma, 1941) shows that this matter is treated in Burma with the serious spirit it demands. The present policy aims at providing a sufficient number of sanctuaries to ensure that no species of Burman bird or animal becomes extinct. The following list of sanctuaries will indicate how this laudable effort is carried out under the able game warden, a member of the Burma Forest Service. It is a pity that India as a whole and the British Colonies have not made similar attempts at game preservation. There are seven sanctuaries situated in North and South Burma: Pidaung (Myitkyina), 278 sq. miles; Shwe-u-daung (E. Katha), 81 sq. miles, with another 45 sq. miles situated in the neighbouring Federated Shan States; Maymyo (summer headquarters of Government of Burma), 49 sq. miles; Moscos Islands (Tavoy), 19 sq. miles; Kahilu (Thatôn), 62 sq. miles; Mulayit (Thaungyin), 53 sq. miles; Wetthigan (Minbu), 1¾ sq. miles.

The Pidaung sanctuary is primarily constituted to protect elephants, bison, saing, sambhur, hog deer, pig, tiger, leopard, bear, pea-fowl, pheasant, jungle fowl, partridge and quail. Of these it is reported that elephant, bison and saing continue to increase, though elephants only spend part of their time in the sanctuary. On the other hand, there is a marked reduction in sambhur and hog deer found in the open plains; this is attributed to tigers and wild dogs. Four tigers are to be shot by the keepers of the sanctuary and as many wild dogs as possible, as also crows which are a serious pest to bird life in the sanctuary. Those acquainted with big-game shooting in India must have noted at times the results of the wild dog pest—whole jungles deserted by game once the animals are aware of the advent of parties of wild dogs.

The Shwe-u-daung sanctuary contains the above mentioned fauna, with the addition of *Rhinoceros sumatrensis* and the serow. There is reason to believe, says the warden, that the small band of Sumatran rhinoceros living in this sanctuary has become well established, and the evergreen hill forests covering the upper slopes of the sanctuary provide an undisturbed area where these animals can live in peace. The increase in wild dogs is giving trouble here. In the Kahilu sanctuary the animals are *Rhinoceros sumatrensis*, serow, sambhur, barking deer, mouse deer, hog deer and jungle fowl. It has been proved that the rhinoceros in this sanctuary is *R. sumatrensis* and not *R. sondaicus*, as identified some years ago from skulls by the Bombay Natural History Society. The Sumatran rhinoceros is an extremely rare animal in Burma.

Of the other sanctuaries the Maymyo contains barking deer, jungle fowl, partridge and pea-fowl; Moscos Islands, sambhur, barking deer and pig; Mulayit, barking deer, pig, tiger, and leopard; and the latest made sanctuary, the Wetthigan, which includes the lake of that name for the preservation of numerous indigenous and migratory waterfowl, of which thirty-three resident species and thirty-one migratory species have been identified.

It is of interest to hear that the reservation of other sanctuaries is under consideration. The only cause for alarm is the warden's statement that "there is at present no co-ordination between the civil authorities who are responsible for the issue of fire-arms and ammunition, and the Forest Department which is mainly responsible for the protection of wild animals and birds". It is to be hoped that this defect in a far-sighted policy may be removed.

IRISH FISHERIES

THE quantity of sea fish landed in Eire during 1939 was larger than that landed in any year since 1931, and its value reached the highest figure since 1929 (Department of Agriculture (Fisheries Branch). Report on the Sea and Inland Fisheries for the Year 1939. Dublin, Published by the Stationery Office). The increased landings in 1939 were due to heavier catches of demersal fish by the stream trawlers operating from Dublin, and of mackerel by inshore fishermen on the County of Kerry coast-line. The total catch of whiting in 1939 seems to be the highest recorded for the country, and landings of prime fish, cod and hake, were the heaviest for several years. The quantitative yield of the herring fisheries was less in 1939 than in 1938, but its total value was greater by £5,000. The decrease in quantity was due to the failure of the summer fishery of the north-west coast. The substantial increase in the mackerel landings was due to heavier catches in the autumn mackerel fishing off the south-west coast.

The S.S. *Muirchu* took part during the year in scientific cruises off the north and south-west coasts of Ireland. The cruise off the south-west coast was undertaken in April 1939 for the purpose of continuing the mackerel investigations begun in 1938 in collaboration with the English and French research vessels. As in the previous year mackerel eggs were found in large numbers in an area thirty to seventy miles south to south-south-west of the Fastnet Light. Hydrographic and plankton observations were the main purposes of the cruise off the north coast.

In the inland fisheries the salmon fisheries in 1939 improved but slightly in quantity compared with the years 1937 and 1938, both of which were bad years also for other countries in Western Europe. There was a lack of small and large spring fish such as have spent two or three years respectively in the sea. This was partly compensated for in some parts of the country and particularly in the west by a very good run of grilse.

Artificial propagation of salmon and trout continues, but owing to weather conditions the quantity of ova available was below normal. At the brown trout hatchery at Lough Owel, in spite of weather, there was a record output of 560,000, some of which were returned to the Lough in the fry stage and others distributed among other stations throughout the country.

Scientific investigations into the age and growth of salmon and other salmon researches are in progress. Seventeen appendixes, mainly statistical, are included in the report.

FORTHCOMING EVENTS

Saturday, January 3

JOINT MEETING OF TECHNICAL INSTITUTIONS arranged at the request of the Mines Department (in the H. H. Wills Laboratory, Royal Fort, Bristol), at 2.30 p.m.—Discussion on the Best Ways and Means of Improving the Efficient Use of Fuel and Power in Existing Industrial Plants, under Present Conditions, and to Invite Constructive Suggestions. (To be opened by Mr. J. G. Bennett.)

Monday, January 5

SOCIETY OF CHEMICAL INDUSTRY (FOOD GROUP) (at the Chemical Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m. —Dr. C. A. Freak: "Insecticides".

ROYAL GEOGRAPHICAL SOCIETY (at Kensington Gore, London, S.W.7), at 3 p.m.—Mr. Patrick FitzGerald: "The Lake Basin of Tali, Yunnan".

Thursday, January 8

TOWN AND COUNTRY PLANNING ASSOCIATION (in the Dome Lounge, Dickins and Jones, 224 Regent Street, London, W.1), at 1.20 p.m.—Mr. George Hicks, M.P.: "The Part of the Ministry of Works in Post-War Reconstruction".

Saturday, January 10

BRITISH INSTITUTION OF RADIO ENGINEERS (at the Federation of British Industries, 21 Tothill Street, London, S.W.1). Dr. W. Wilson: "Recent Developments in the Design and Application of the Cathode Ray Oscillograph".

APPOINTMENTS VACANT

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

EDUCATIONAL PSYCHOLOGIST in connexion with the Child Guidance Clinic—The Director of Education, Education Offices, 15 John Street, Sunderland (January 9).

LIBRARIAN (WOMAN)—The Principal's Secretary, Royal Holloway College, Englefield Green, Surrey (January 10).

ELECTRICAL ENGINEER under the Engineer-in-Chief—The Secretary, Tyne Improvement Commission, Newcastle-upon-Tyne 1 (endorsed 'Electrical Engineer') (January 12).

RESEARCH ASSISTANT TO UNDERTAKE WORK ON HOT-TINNING—The Secretary, Tin Research Institute, Fraser Road, Greenford, Middlesex (January 17).

HEAD OF THE PHYSICS DEPARTMENT—The Principal and Clerk to the Governing Body, Wigan and District Mining and Technical College, Wigan (January 17).

EDUCATIONAL PSYCHOLOGIST, a MEDICAL DIRECTOR and PSYCHIATRIST, and a PSYCHIATRIC SOCIAL WORKER, in connexion with a Child Guidance Clinic—The Director of Education, Municipal Building, Preston (January 17).

GARDINER CHAIR OF CHEMISTRY—The Acting Secretary, University Court, The University, Glasgow (February 8).

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Tin Research Institute. Publication No. 106: The Longitudinal Ridged Structure in the Tin Coating of Tinplate. By Dr. B. Chalmers and W. E. Hoare. Pp. 8+1 plate. (Greenford: Tin Research Institute.) [1012

Other Countries

Smithsonian Miscellaneous Collections. Vol. 99, No. 22: The Ice Age Problem. By Walter Knoche. (Publication 3633.) Pp. ii+5. (Washington, D.C.: Smithsonian Institution.) [2511

Transactions of the San Diego Society of Natural History. Vol. 9, No. 27: The Distribution of Pocket Gophers in Southeastern California. By John E. Chattin. Pp. 265–284. (San Diego, Calif.: San Diego Society of Natural History.) [312

University of California Publications in Zoology. Vol. 44, No. 2: A Field Study of the Growth and Behaviour of the Fence Lizard. By Henry S. Fitch. Pp. 151–172. 25 cents. Vol. 44, No. 3: Speciation in the Avian Genus Junco. By Alden H. Miller. Pp. 173–434. 3 dollars. (Berkeley, Calif.: University of California Press; London: Cambridge University Press.) [312

Smithsonian Miscellaneous Collections. Vol. 99, No. 23: Evidences of Early Occupation in Sandia Cave, New Mexico, and other Sites in the Sandia-Manzano Region. By Frank C. Hibben. With Appendix on Correlation of the Deposits of Sandia Cave, New Mexico, with the Glacial Chronology, by Kirk Bryan. (Publication 3636.) Pp. vi+64+15 plates. (Washington, D.C.: Smithsonian Institution.) [312

Records of the Botanical Survey of India. Vol. 14, No. 2: A Revision of the Indo-Malayan Species of *Glycosmis correa*. By V. Narayanaswami. Pp. v+72+ii. (Delhi: Manager of Publications.) 4.6 rupees; 7*s*. [412

Indian Forest Records (New Series.) Botany, Vol. 2, No. 2: *Thyrsostachys oliveri* Gamble. By Dr. N. L. Bor. Pp. 217–226+2 plates. 10 annas; 1*s*. Entomology, Vol. 6, No. 9: Immature Stages of Indian Lepidoptera (3). By J. C. M. Gardner. Pp. 297–314+1 plate. 12 annas; 1*s*. (Delhi: Manager of Publications.) [412