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Food Requirements in the Modern State

THE Health Committee of the League of Nations has given abundant evidence during the past few years of its interest in human nutrition. The health experts who were asked last year to formulate guiding principles for the construction of adequate human diets emphasized the importance of the provision of ample supplies of protective foods, especially dairy produce, fresh vegetables and fruit, for the purpose of securing an optimum state of nutrition. The problem of securing such supplies for the masses of the populations of modern States must involve in most instances far-reaching changes in economic and agricultural policies. A mixed committee was accordingly set up, composed of economic and agricultural experts, in addition to health experts, under the chairmanship of the Viscount Astor, to report on the whole position regarding the relation of nutrition to health, from the point of view of practical politics. The Committee has now issued the first volume of its report*, which provides a general survey of the problem.

In the light of the established principles of nutrition, it can be shown that in no country does the whole population attain the scientifically desirable standard of physical development or resistance to disease. To remedy this serious defect, the greatest emphasis ought to be laid on the proper feeding of pregnant women and of children, for many individuals bear throughout life the stigmata of defective feeding in childhood. This would involve a campaign of education in which public health officials, practitioners of medicine, health nurses, school teachers and social workers should co-

operate. Economic and agricultural policies would have to be framed by the Governments concerned, to enable the necessary food to be produced and distributed. The campaign for better nutrition should take its place as an integral part of national policy. Such a policy would require for its effective working the supervision of a central authority which would secure the co-operation of bodies engaged in nutritional research, of those engaged in popular instruction and of those responsible for directing economic and agricultural policies.

The main body of the report deals in simple language with the dietary requirements of human beings of different classes and age-groups, and gives illustrations of some of the observed effects of improper feeding on the physique and health of individuals and communities. This section is followed by chapters dealing with some of the economic and agricultural aspects of the problem of nutrition. These chapters are short, for the reason that later volumes of the report will deal more fully with these particular aspects.

In the last section of the present volume, the Committee formulates recommendations which it invites the Assembly of the League of Nations to approve, in the hope that they may be accepted by Governments and may make an immediate contribution towards the improvement of nutrition among the peoples concerned. These recommendations urge the policy of encouraging the scientific study of nutritional problems and of furthering the dissemination of knowledge so gained. International co-operation is invited to facilitate the exchange of relevant information. Governments are also urged to consider what steps might be taken to meet the nutritional requirements of those

* The Problem of Nutrition. Vol. 1. Interim Report of the Mixed Committee on the Problem of Nutrition. (London: Allen and Unwin (League of Nations Publications Dept.), 1936.) 2s.

sections of their communities with the lower ranges of income, and particularly to ensure an adequate supply of safe milk for expectant and nursing mothers, infants, children and adolescents. Further recommendations include the examination of schemes to make supplies of the protective foods

available at prices within the reach of all classes without prejudicing the interests of producers. If necessary; the question of the re-orientation of agricultural production, with the view of satisfying the requirements of sound nutrition, should be seriously considered.

Malaria and Nutrition

THE Royal Society, more than thirty-five years ago, followed up Ross's discovery of the mosquito-cycle of the malaria parasite by sending specially qualified research workers to Africa and India to study the endemiology and epidemiology of the disease and the life-history and habits of the mosquitoes which transmit it. Judged by the results of those investigations, which were published as Reports to the Malaria Committee of the Society between 1899 and 1903, the action was one of the most important steps ever taken for the advancement of knowledge of the subject. The Society has recently taken a second step which everyone will hope may have an equally important outcome. At a meeting held in July this year, the Council decided that the whole income, together with the invested income, of its Medical Research (Anonymous) Fund should be employed for a period of five years on a scheme of laboratory research on malaria to be conducted in England, and a field inquiry into malnutrition to be conducted in India. The two subjects are more closely related than may be apparent, for it has been shown repeatedly in Italy and elsewhere that measures designed to improve the nourishment and general welfare of the people have a great effect in lessening the mortality, disability, and other evils due to acute or chronic malarial infection.

The scheme as a whole is estimated to cost about £8,500 for the period mentioned, and has been worked out and arranged for in detail. The malaria programme is in two parts, of which the first is concerned with the parasites and their relationship with human, animal and insect hosts, the second with the ecology of one or more of the species of anopheline mosquitoes chiefly responsible for spreading malaria in the tropics. On both subjects an advanced type of scientific 'long-range' research by modern experimental methods is contemplated. It is believed that in the present state of knowledge

this highly specialized type of work offers the best hope of improving existing methods of dealing with malaria, and it is recognized that its pursuit has been facilitated during recent years by several outstanding events such as the application of the practice of malariatherapy to the study of malaria itself, as well as for its original purpose, and the discovery that monkeys, as well as canaries and other birds, can be utilized for studying immunological and other problems. It is intended, too, to give increased attention to the chemotherapy of malaria, which has become of paramount importance since the discovery of effective synthetic anti-malarial remedies, and is a subject on which, up to the present, little has been done in Great Britain (see NATURE, Nov. 9, 1935, p. 743).

The practical object of the proposed research into the ecology of a particular species of anopheline mosquito is to improve the antimalarial method called 'species sanitation', which aims at the elimination from an area of the species that has been found to be most concerned in transmitting the disease. Success in this task would be greatly facilitated if complete knowledge were available of the biology, habits and behaviour of the insect concerned, and particularly if the physical, chemical and other factors governing its choice of breeding places, food supply, shelter and other items of behaviour were precisely known. Thanks to new methods devised by insect physiologists, these problems can now be studied experimentally in the laboratory and applied to observations made in the field.

Lieut.-Col. J. A. Sinton, I.M.S., lately director of the Malaria Survey of India, has been appointed to conduct the first part of the malaria programme, and it has been arranged that he will work in the laboratories of the Malariatherapy Centre at Horton where, in addition to the intensive study of particular problems, he will have an opportunity of continuing and extending the observations on

induced malaria which it was feared might have to be given up when Colonel S. P. James retires this year.

The second part of the programme is to be commenced in the Entomological Department of the London School of Hygiene and Tropical Medicine by the appointment of a young worker with experience in modern experimental zoology. For a period of 12-18 months he will study the physiology and behaviour of the several species of anopheline mosquitoes which can be made available in England, and will then proceed to an appropriate centre in India for the special research proposed. It is understood that the London School has undertaken to meet part of the cost of this research.

Dr. Curjel Wilson has been appointed to conduct

the nutritional survey in India in collaboration with Dr. Aykroyd, director of nutrition research to the Indian Research Fund Association. The survey will be concerned chiefly with the incidence of malnutrition among school children, and the dietary habits of groups of families in the districts where the children live. An important object of the investigation will be to train workers who will continue and extend the survey.

It may confidently be expected that the expenditure from its trust funds by the Royal Society which this programme involves will be fully justified by the additions it will make to our knowledge of malaria, which, despite all that has been done during the last three decades, still remains the greatest single destroyer of the human race.

Nature and Purpose of Science

The Scientist in Action:

a Scientific Study of his Methods. By Dr. William H. George. Pp. 355. (London: Williams and Norgate, Ltd., 1936.) 10s. 6d. net.

THE reviewer's first task is to state the nature of the book and the purpose of its author. Here this task is very difficult. "Action" is the key-word of the title; and on his first page, Dr. George tells us that he takes it "as basic that scientific research is a form of human action". But he has just said that "by definition speaking, writing or manipulation . . . are forms of action but thinking, believing or feeling are not." Research then, for Dr. George, is an activity in which thought and belief play no part. This is sufficiently puzzling; but it becomes more puzzling when most of the book is found to be concerned with things that are indubitably thought or believed and not *done*—laws, theories, propositions in general, and so forth.

This inconsistency pervades the book. A possible (but of course speculative) explanation is suggested by hints in the final section. It is that Dr. George started to "clarify his mind on the relation between experiment and theory, and more especially on the relation between experimental and mathematical physics"—in other words, to solve the central problem of the philosophy of science. Reading the works of his forerunners, he was repelled (as many others have been) by the folly of those to seek to interpret science as a set of formal propositions out of any relation to the

scientists who produce them. He therefore rushed to the other extreme and, "to his own surprise", arrived at the conclusion that science, though "inseparable from scientists, is quite separate from philosophy". In order to understand science, all that is necessary is to study the scientist reacting, like any other organism, to its environment; his problem turned out to be purely biological.

Of course, Dr. George could not act consistently on such a belief. Mental activity is even more difficult than physical activity to describe without some preconceived scheme to which it is supposed to conform; and even if a perfectly neutral description of the mental activity of a scientist could be given, it would not explain that activity or clarify anyone's mind concerning it. For that task it is necessary to show that the activity does conform to some logical scheme that is equally valid for all kinds of thought; the ordering of different kinds of thought into a single coherent whole is not merely inseparable from philosophy; it actually is philosophy. Accordingly, Dr. George found himself alternating between his new desire to ignore all forms of activity that cannot be merely described, and his old desire to clarify his mind; his book is a queer medley of his two moods.

Dr. George's work in his old mood does not appear to me very valuable. He has made the common mistake of being so preoccupied with those at the opposite extreme of thought as to ignore altogether those who stand very near to his own point of view. Thus, he might have been expected to find Bridgman's "operational"

doctrines sympathetic; he makes no reference, explicit or implicit, to Bridgman, but expresses approval of Hobson, who really agrees with him in nothing but a common dislike of transcendental metaphysics.

The book is divided into three main sections: the scientific outlook, getting scientific facts, arranging scientific facts. What Dr. George has to say on the topics to be expected under these headings is neither very original nor very profound; it is difficult to summarize, because so much of it is merely negative. Science is *not* based upon measurement; the "coincidence observations", constituting the facts on which it is based, are *not* merely temporal or spatial; the observables of quantum theory are *not* what is actually observed; mathematical probability is *not* a measure of rational belief. But the positive assertions that might be expected to supplement these negations are lacking; after the last of them "the reader is left to decide" what, if any, is the connexion between probability and belief—surely a matter vital to any understanding of science!

In his new mood, however, Dr. George is a very different person. His description of scientific activities is always accurate and, though there are many commonplaces, often acute. He does not, of course, profess to instruct researchers in their art, but few of them could read the book without gaining some useful hints; at any rate they will be soothed and entertained by finding all their instinctive prejudices set forth so sympathetically.

However—this may possibly shock Dr. George—the persons who will gain most from his work are precisely the philosophers whom he treats with such contempt. For many of them accept fully Dr. George's main thesis that science is incomprehensible apart from scientists. But they find it difficult to discover how scientists really

think. Lack of technical knowledge forbids them to study the original literature of science; while those distinguished men who undertake to explain science to the unlearned are notoriously untypical; indeed their success as popularizers is largely due to their sympathy with views that most scientists reject emphatically. Their difficulty is now completely solved. Dr. George is a thoroughly typical scientist—typical, not of all scientists (that is impossible, because scientists differ), but of those to whose mental idiosyncrasy the distinctive character of science is due; and he has been marvellously successful in portraying their method of thought.

Accordingly, if anyone in the future writes about the nature and purpose of science, meaning thereby that which scientists produce, without careful study of Dr. George's book, he will be wasting his own and his reader's time. But of course he will find himself in a difficulty. For what distinguishes the true scientist is a hatred of abstract thought and of the shackles of logic. The discovery of an intellectual difficulty delights the philosopher; it makes Dr. George and the rest of us go all hot and bothered. If this dislike of logical precision is a necessary element of the scientific outlook, there can be no philosophy of science; if a scientist who was willing and able to untie the intellectual knots in which he is constantly entangling himself, would thereby cease to be a scientist, then there can be no place for science in any scheme of ordered thought. If, on the other hand, this attitude is unnecessary and inessential, if science is really subject to a logic which alone can make it intelligible, how do scientists manage to produce science? The great merit of Dr. George's book lies in its raising this problem so clearly; it is for others to solve it.

NORMAN R. CAMPBELL.

The People of Pitcairn Island

The Heritage of the Bounty:

the Story of Pitcairn through Six Generations. By Harry L. Shapiro. Pp. xv+330+8 plates. (New York: Simon and Schuster, Inc.; London: Victor Gollancz, Ltd., 1936.) 3 dollars; 10s. 6d. net.

PERENNIAL interest in the story of Bligh and the mutineers of the *Bounty* has been enhanced recently by the cinematograph; but Dr. Shapiro, though fully alive to the drama of the story, of which he recalls the main outlines, is more immediately concerned with the opportunity

afforded science by the consequences of this tragedy of the sea. While still *in statu pupillari*, he was inspired by Prof. E. A. Hooton of Harvard with an overwhelming urge to biological and sociological investigation among the descendants of the mutineers and Tahitian women living on Pitcairn Island. He had to wait twelve years before his desire was satisfied. Although he visited Norfolk Island in 1923, and spent five months examining the Pitcairn Islanders and their descendants who had been transported there in 1856—the results were published in 1929—it was not until 1934 that he was able to land on Pitcairn.

Pitcairn Island, it will be realized, offers exceptional opportunity for the study of miscegenation and the effects of culture contact. The islanders are the descendants of six mutineers and thirteen Tahitian women. The six Tahitian males left no offspring. Although the descendants of the migrants to Norfolk Island are the more numerous, conditions on Pitcairn are more favourable to scientific investigation, as the accessions of new blood there have been few and are known—eight Europeans and one Polynesian female. The records of birth, marriage and death have been kept with care, while genealogical data are remembered with pride—and no less well remembered when calling for a veil of reticence. Another advantage from the point of view of the observer is that the material is entirely unaffected by the social disabilities which usually depress the products of racial crossing elsewhere and vitiate observation.

It is a remarkable fact, perhaps the most striking fact in the vital statistics of the island, that the increase in population has been extraordinarily rapid. In one hundred and forty-five years from the original matings, the living descendants of the mutineers now pass the eight hundred mark. There are more than six hundred living on Norfolk Island and some two hundred on Pitcairn; and if absentees were taken into account, the figure might well fall not far short of a thousand. The early generations seem to have been extraordinarily prolific. A calculation by Dr. Shapiro gives in his second group of women, listed according to years of birth in the period 1815–39, an average family of 11.2. It was owing to this rapid increase in numbers, which threatened over-population, that the Pitcairn Islanders were transported to Norfolk Island in 1856. Of those transported, forty-two had returned to Pitcairn by 1864; and from them the present population is descended. The continued rapid increase in numbers during the last seventy years is thought by the islanders again to threaten over-population; but Dr. Shapiro is of the opinion that the danger is not imminent. His analysis shows that the rate of increase is falling with a falling birth-rate.

Although inbreeding naturally is intense, no ill effect is perceptible, except possibly deterioration in the teeth. It may be responsible for a degree of homogeneity in physical character unusual in such a population of mixed origin.

The evidence of cross strains in physical character is interesting. The two stocks were markedly differentiated, and the strains on both sides certainly not inferior. The English probably were picked men. While the men of the present day incline to favour their European ancestry, as, for example, in the tendency to a lighter coloured eye, the women favour the Tahitian. In them the

dominant in eye colour is brown. In skin colour there is an overlap with both English and Tahitian. While none is as dark as the darker Tahitian, few individuals are as fair as the fairest English. In stature the men are taller than either the Tahitian or their European ancestors, of whom the height is recorded at the Admiralty. The head-length is almost identical with that of the Tahitian, being less than that of the English head; but in breadth they follow the English measurement and are narrower than the Tahitian. The cephalic index is intermediate between the two. It is interesting to note that the characteristic disproportion between the frontal diameter and broad face found in the Tahitian appears also in Pitcairn, although the facial breadth is low as in the English. Consequently in the Pitcairn islander the frontal diameter is lower than in the Tahitian, and still more so than in the European.

Dr. Shapiro sums up his results as showing that in their heredity the Pitcairn Islanders bear testimony to both their English and their Tahitian ancestry; and while some are more influenced by the Tahitian strain, some by the English, others appear to be intermediate. Each one is a varying mixture of characters, of which some follow the Tahitian, others the English character. On the whole, the features of the islanders are definitely English. This preponderance is only natural, the author concludes, as all new additions to the colony have been of English stock. Fortunately, the researches in the Pitcairn records made by Dr. Shapiro, which are here embodied with material from outside sources in a history of the islanders from the time of the first settlement, enable all such additions to the original strains to be traced and checked.

It is interesting to note that the author is decidedly of the opinion that the results of his investigation support the view that an early result of miscegenation is an increase of vigour transcending that of either of the original stocks.

Dr. Shapiro has recorded a number of phrases of the Pitcairn language, which he regards as a hybrid dialect. His evidence scarcely bears this out; and a closer knowledge of colloquial English tradition might have convinced him that it does not attain even the dignity of a dialect. It seems to be a mispronounced and degenerate English with a few Tahitian words and mannerisms.

The present-day culture is a blend which shows evidences of development, when compared with that recorded by early visitors to the island. The absence of European materials and appliances in the beginning naturally has affected the balance between English and Tahitian.

Dr. Shapiro is to be congratulated on the opportunity for this first scientific study of unique material, and on the use of it which he has made.

Some British Cœlomycetes

British Stem- and Leaf-Fungi (Coelomycetes): a Contribution to our Knowledge of the Fungi Imperfecti belonging to the Sphaeropsidales and the Melanconiales. By W. B. Grove. Vol. 1: Sphaeropsidales, to the end of the Sphaerioidae which have Colourless or nearly Colourless Spores. Pp. xx+488. (Cambridge: At the University Press, 1935.) 21s. net.

IN this handbook, Mr. Grove monographs the recorded British species of this most obscure group of the fungi, a task that has not been attempted in Great Britain since 1871. His Cœlomycetes comprise the Sphaeropsidales and Melanconiales sections of the Fungi Imperfecti, most, if not nearly all, of which are no doubt Ascomycetes classified in their imperfect as opposed to their perfect condition.

The modern systematic mycology of this group really dates from vol. 3 of Saccardo's "Sylloge Fungorum", which appeared in 1884. It is perhaps impossible for us at this date to envisage the state of affairs before Saccardo collected together all the recorded nominal species and put them upon his mycological map, but we may properly recall the cheer with which Mr. Grove greeted the appearance of this volume. In the *Midland Naturalist*, 9, 127 (1886), he tells us how, as about to vault a fence, he observed myriads of black specks on the bark of the top pole; how he deduced in the field that the pole must be mountain ash; how at home the black specks resolved themselves into the pycnidia of *Rhabdospora* as judged by their spores and habitat; and how he turned "to that monument of Herculean labour, the Sylloge Fungorum omnium of Professor Saccardo . . . who stands head and shoulders above all the other mycologists of the age". *Rhabdospora inaequalis*, Sacc., it was, for it agreed in the characteristic pycnidia, the spores and the habitat, and as further evidence there was Saccardo's excellent representation. "Now my task is smoothly done. No link in the chain is wanting. We have determined our fungus with a degree of certainty that cannot always be attained, and are still further rewarded by finding that it is a species new to Britain".

Some forty-eight years have passed, and Mr. Grove presents us with the first half of his monograph of British Cœlomycetes; and—as a monograph must of course—it contains numerous species that cannot be determined with the same certainty that marked the recognition of *Rhabdo-*

spora inaequalis. In Cooke's "Handbook", two hundred species were recorded as British; in this and the second volume which is shortly to follow, more than two thousand nominal species are listed. All the included species have been examined microscopically unless the contrary is specified, the material, on which this work is based, being represented by the collections at Kew and the British Museum, and by more than three thousand collections in the author's private herbarium. At long last, we have a good general idea of what has been found in Great Britain, together with what a most experienced naturalist has made of it.

Mycology is a term that is now held to cover many pursuits, but, broadly speaking, fungi can be studied in the field, in herbaria, in laboratories and in books. The work under notice is the result of some fifty years' ardent collecting and examining at home, checking determinations with authentic material, and a wide knowledge of the systematic literature. The laboratory side of the science, which has developed so strongly of late—especially since the Great War—is left to others.

Saccardo's ground plan, laid down in vol. 3 of the "Sylloge", is accepted absolutely, the most important change following on the general recognition of the genus *Phomopsis*, to which a large number of nominal species have in recent years been transferred. It does not appear that any other course was open to anyone who intended to present an orderly account of British Cœlomycetes, and surely it is high time that such an account should be presented. This classification—and it is the only one yet devised—is largely a habitat classification; that is to say, Cœlomycetes which fruit on leaves are apt to find themselves in another genus from those that fruit on stems; pycnidia formed on the surface of wood are not normally classified in the same genus as those that develop just beneath the periderm. As is well known, fungi in pure culture are apt to present little resemblance to their appearance in their natural habitat—the appearance under which they have been discerned, collected, described, classified and preserved in herbaria. It is, therefore, much safer to attempt the identification of a Cœlomycete, in the first instance, before, rather than after, isolation. If this elementary precaution is not taken, there is no known method of ensuring that any systematic data that may be acquired will be comparable to the data preserved in the existing diagnoses of fungi. Such, at any rate, is Mr. Grove's message

to the culture men, whom, after a characteristic implement of their craft, he dubs the "petri-petallists".

Together with the ground plan, the author accepts Saccardo's usage of generic names, and will have no nomenclatorial grit thrown into the works, especially by the new type species method of fixing genera (he gives no type species for the genera). As examples, see his citation of the genus *Phoma*, and his inclusion of *Hendersonia elegans* Berk., the type species of *Hendersonia*, in the genus *Stagonospora*, with a footnote that it will probably prove to be neither a *Hendersonia* nor a *Stagonospora*.

As with genera, so with the view of specific values, current for so many years after the appearance of the "Sylloge", but in this case with a note of hesitation. "Generally, in these pages, the host will be made the supreme test" but "in the genera *Cytospora*, *Phomopsis*, *Septoria* and the like, the list of presumed species cannot be considered as anything but an interim catalogue of the known and described forms". It is probably on this question of specific distinction that systematically directed culture work could be of the most immediate use to a study of the Cœlomycetes. For example, a *Phomopsis* is usually, if not always, the pycnidial condition of a species of the ascomycete genus *Diaporthe*. Mr. Grove lists about 158 nominal British species of *Phomopsis*. In a recent world monograph of *Diaporthe*, Wehmeyer has suggested that the type species, *D. eres*, which was first described on *Ulmus*, really occurs upon nearly all woody plants, and has (ominously enough) acquired about 160 synonyms. The question as to the number of good British species of *Phomopsis* is obviously open for research by anyone who cares to collect, determine and isolate these common and easily grown fungi. Pending

any such study, Mr. Grove will probably agree that we are still very much in the position so graphically described by Saccardo, when he was roughing out the classification of the Fungi Imperfecti. "Et in Mycologia fere omnes tyrones sumus."

The citation of literature is terse. The standard floras appear as "All.", "Died." and "Mig.". B. & Br. stands for Berkeley and Broome and B. & V. for Berlese and Voglino. The original place of publication is often not given, especially with Saccardo's own species which later became incorporated in the "Sylloge", vol. 3. The author has been misled into thinking that the dates on the title pages give the correct dates of many species that were founded by Allescher and Diedicke. These, however, are points of nomenclatorial compilation, and the interest of the book is wholly taxonomic; it has, in fact, quite clearly grown out of a lifetime's comparison of the British flora with the diagnoses in a well-thumbed and well-loved copy of vol. 3 of the "Sylloge".

In common with all the foundation mycological books of any country, the present volume has required of its author a knowledge of our local phanerogams in bud, in leaf, in flower, in fruit and in decay—especially in decay. It appears to me that it will be welcomed by all British botanists who believe that the plants themselves, and the fungi themselves, are the thing. It is a milestone in our slow—our very slow—advance in the study of the microfungi. It may happily help to dispossess the commonly copied figures of a few fungi of their predominating influence on the young idea. It may even serve to distract attention from hypothesis and speculation and direct it rather to the original source of mycology itself—the yearly pageant of our woods and fields.

E. W. MASON.

Crustacea :

Anomura, Macrura, Euphausiacea, Isopoda, Amphipoda and Echinodermata : Asteroidea and Echinoidea. By Lee Boone. (Bulletin of the Vanderbilt Marine Museum. Volume 6 : Scientific Results of the World Cruise of the Yacht *Alva*, 1931, William K. Vanderbilt commanding.) Pp. 264 + 96 plates. (Huntington, L.I., N.Y. : Vanderbilt Marine Museum, 1935.)

THE present volume relating to Crustacea and Echinodermata collected by Mr. Vanderbilt and deposited in his museum is full of interesting material. Careful descriptions and good figures are given of every form described. The larger crustaceans are already known, but much new matter is added, and among the Caridea there are many new species. These last were mostly taken in coral and include a *Leptochela*, an *Athanas*, *Alpheus* spp., a *Coralliocaris*,

a *Thor* and a *Pontophilus*, besides a pontoniid which the author has referred to a new genus which she has named *Vanderbiltia*. Besides all these new species, many little-known forms are redescribed. There are also two new species of *Euphausia*. Some isopods and amphipods are included.

Among the most striking of the Caridea is the pontoniid *Conchodytes biunguiculatus* Paulson, which was found inhabiting the pearl oyster *Meleagrina* sp. Its peculiarly modified hind legs (pereopods 3-5) end in large hook-like claws, presumably for clinging to its host, and the abdominal terga of the female are very broad, forming a brood pouch, which holds 75-100 young.

The echinoderms must be magnificent, judging from the exquisite photographs, especially the sea-urchins.

Molekülspektren und ihre Anwendung auf chemische Probleme

Von Prof. Dr. H. Sponer. 1: Tabellen. Pp. vi+154. 17.60 gold marks. Teil 2: Text. Pp. xii+506. 37.80 gold marks. (Struktur und Eigenschaften der Materie, Bd. 15, 16.) (Berlin: Julius Springer, 1935-36.)

THERE is a good deal to be said in favour of the manner in which Prof. Sponer has arranged the material which he discusses in these two books. The first is really an appendix or collection of results for use in conjunction with the description of the applications of band spectra to chemical problems in part 2, and consists of a series of tables of the terms of spectra emitted by polyatomic molecules. Similar tables were, of course, given in Jevons's "Report on Band Spectra" for diatomic molecules, but the Sponer collection for more complicated molecular systems is new, and the data for diatomic molecules have been brought up to date. While it appears unlikely that the descriptive matter in the five hundred page Part 2 will soon need serious revision, it should be a relatively easy matter to add fresh results in a new edition of the one hundred and fifty page Part 1.

Part 2 is intended to assist experimenters, and there is little attempt at serious mathematical treatment of the subject. It opens with a brief, but good, introduction to the older quantum theory of spectra and to the new quantum mechanics, and continues with an excellent survey of the several types of band spectra and their peculiarities. The main interest lies in the examination of the methods and results of band spectra measurement and the chemical and physical data which can be obtained from them, and in the discussion of their importance in problems of chemical combination and valency. Considerable attention is paid to the methods by which molecular spectra are excited and to photo-chemical reactions. The book is bound to appeal considerably to chemists and to physicists who are interested in the applications of band spectra.

Destiny and Disease in Mental Disorders:

with Special Reference to the Schizophrenic Psychoses. By Prof. C. Macfie Campbell. (Thomas W. Salmon Memorial Lectures.) Pp. 207. (London: Chapman and Hall, Ltd., 1935.) 10s. 6d. net.

PROF. MACFIE CAMPBELL, who is professor of psychiatry at Harvard University, gives us a very readable account of personalities struggling against the difficulties of their environment, particularly with reference to the schizophrenic psychoses, which are a particular type developing in early adult life. This comes as quite a relief when contrasted with lengthy dissertations on infected bowels and sinuses. We feel on reading all these books on mental disorder that the problem in many ways has not even yet been stated, far less grappled with. There are so many factors involved, and we know so little. The writer, however, points out the importance of the environment and its manifold reaction on personalities, many of which we feel were already psychopathic in build.

Insect Enemies of Shade-Trees

By Prof. Glenn W. Herrick. Pp. x+417. (Ithaca, N.Y.: Comstock Publishing Co., Inc., 1935.) 5 dollars.

THE name of Prof. G. W. Herrick, of Cornell University, as a guarantee for a sound, trustworthy textbook is fully substantiated in the present volume. It brings together much scattered information regarding the insect pests of shade trees east of the Rocky Mountains and most of those on the Pacific coast. The economic values of each species of tree are discussed and the most effective control measures against their chief enemies are dealt with. For the most part, each species of tree, with its insect invaders, forms the subject of a separate chapter while, at the end of the book, pests of the smaller trees and shrubs, and some miscellaneous enemies, are dealt with collectively. In so far as certain of the species of insects mentioned are of European origin, the book will interest English readers, while the control measures advised are often applicable on this side of the Atlantic Ocean. The book is admirably printed with 331 clear text figures, which are mostly original. Considering the excellence of its general 'get up', the book is reasonably priced at five dollars.

Hydrostatics:

a Text-Book for the use of First Year Students at the Universities and for the Higher Divisions in Schools. By A. S. Ramsey. Pp. viii+169. (Cambridge: At the University Press, 1936.) 7s. 6d.

THIS volume has been specially prepared for the use of first year students in universities and for pupils reading for scholarships in the higher divisions of schools. It is thus a companion volume to the author's books on dynamics and statics, which have been published in recent years. The course well covers the academic requirements in the subject, and includes some simple applications of the metacentre, together with a brief discussion on capillarity. A working knowledge of the calculus is assumed, and there are numerous exercises provided for the student, many of which are taken from Cambridge examination papers. Answers to these are given where necessary. The text is illustrated with clearly drawn diagrams and elegantly worked-out examples. The book is admirably suited to its purpose.

Outlines of General Psychopathology

By Prof. William Malamud. Pp. xiv+462. (London: Chapman and Hall, Ltd., 1935.) 21s. net.

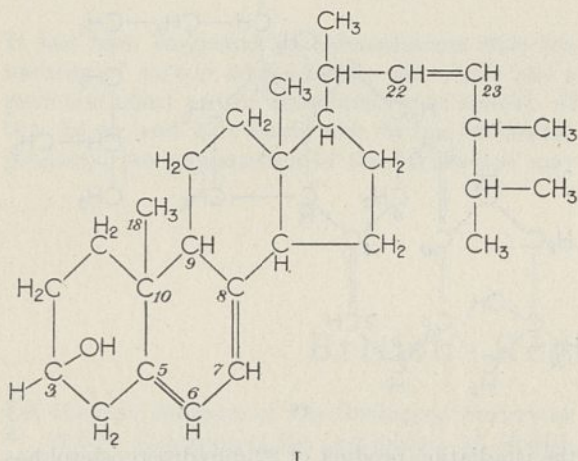
PROF. W. MALAMUD, who is professor of psychiatry in the State University of Iowa, gives a very readable and useful account of the principles of general psychopathology. We wish, however, that he had enlarged somewhat on the physiological concomitants: action currents, particularly the Berger rhythm, chronaxie, and the psychogalvanic reflex are all subjects about which the reader will want to know more than the author gives us—a mere page for the three.

The chapter on the psychopathological disturbances of sleep is very well done.

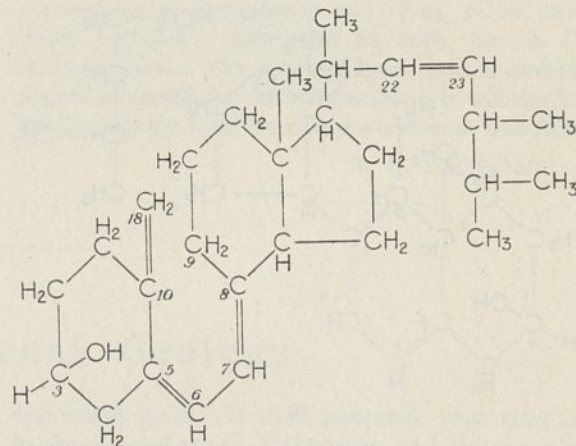
Chemistry of Calciferol and Vitamin D₃

CALCIFEROL (Windaus's vitamin D₂) and ergosterol have, according to the view accepted to-day, the formulæ shown in II and I below, respectively.

stances occur in fish-liver oils, in different proportions according to the species of fish.) Attempts to isolate this substance have so far been unsuccessful, though claims for a very high degree



I



II

The important common features of the two molecules are :

- The possession of two conjugated double bonds at C₅=C₆ and C₇=C₈.
- The possession of a hydrocarbon chain containing a double bond at C₂₂=C₂₃.

The two substances differ in one fundamental respect, namely, the fracture of ring *B* between carbon atoms 10 and 9 and the replacement of the methyl group containing carbon atom 18 by a methylene group, with the consequent introduction of a third conjugated double bond between carbon atoms 10 and 18. It is also possible, indeed probable, that the hydroxyl group at carbon atom 3, which is present in ergosterol—and in all other naturally occurring sterols—in the *trans* position (making the sterols members of the cholesterol series), occupies the *cis* (*epi*) position in calciferol. The point seems not yet to be settled.

A series of papers just published by Windaus and his Göttingen colleagues* is another landmark in vitamin chemistry. They report the logical conclusion, or almost the conclusion, of investigations that have been conducted at Göttingen during the past four or five years.

For some time it has been believed, on the basis of differential biological experiments with two species of animals, that the vitamin D of cod-liver oil is not calciferol. (Bills goes further and maintains that at least *two* separate antirachitic sub-

stances occur in fish-liver oils, in different proportions according to the species of fish.) Attempts to isolate this substance have so far been unsuccessful, though claims for a very high degree

of concentration have been made, notably by Rygh and by Ender.

A crystalline 3,5 dinitrobenzoate of this vitamin, and a colourless non-crystalline preparation of the hydrolytic product from the ester, have now been prepared by Brockmann. The source was tunny-liver oil. The activity of the liquid vitamin is stated to be 25×10^6 I.U. per gram, but it is not inconceivable that traces of impurity may be responsible for its failure to crystallize, and the pure compound may prove to be more active. The absorption spectrum is very similar to that of calciferol, thus disproving Ender's claims for concentration, since his product showed no bands in the ultra-violet. Brockmann argues that Ender's claims must have been overstated by 900 per cent ! In other words, that his preparation cannot have contained as much as 10 per cent of the vitamin and cannot have had more than one tenth of the biological activity claimed by him.

The constitution of this vitamin, for which Brockmann proposes the symbol D₃, would not be known but for the brilliant parallel investigations of Windaus, Schenck and Werder, whose results are published alongside Brockmann's. It is now rather more than a year since Windaus, Lettré and Schenck announced the preparation of 7-dehydro-cholesterol ($\Delta^{5,6,7,8}$ cholestadien-3-ol) and stated that it could be made antirachitic by irradiation. They have now isolated the crystalline 3,5 dinitrobenzoate of the active irradiation product, as well as its colourless

* Hoppe-Seyler's Zeitschrift für physiologische Chemie, 241, 100, 104, 116, 125, 129 (1936).

The facts relating the side-chain constitution to the antirachitic properties of their irradiation product can be summarized thus :

Sterol	Carbon atoms in side chain	Double bond in side chain	Antirachitic potency
Dehydrocholesterol	8	0	++++
Ergosterol	9	1	++++
Dihydroergosterol	9	0	++++
Dehydrostigmasterol	10	1	?
Dihydrodehydrostigmasterol (Dehydrositosterol)	10	0	+

It has been suggested by Schoenheimer that the number of carbon atoms in the side-chain has a profound effect on the absorbability of sterols. If this be so, and if it apply also to the irradiation products, the explanation of the facts cited may

be found along these lines. Difficulty in accepting such an explanation, however, arises from the fact that ergosterol shows, like sitosterol and other plant sterols, poor absorbability, while cholesterol is very well absorbed, yet the irradiation product of ergosterol is apparently absorbed as easily as that of dehydrocholesterol.

The various papers here summarized are supplemented in the same journal by a very interesting account, from Brockmann and Chen, of an anti-mony trichloride colour-test for both vitamin D₃ and calciferol. The authors claim a considerable degree of specificity for the test, and it will doubtless be eagerly tried by many workers in this field.

A. L. BACHARACH.

British Regional Geology

IN the new Museum of the Geological Survey at South Kensington the exhibition of British geology has been arranged on the basis of a division of the country into eighteen districts, each of which forms a geological and geographical province of distinctive type. To each region a separate division of the main floor or first gallery has been assigned, and in order to render the exhibits more intelligible descriptive handbooks have been prepared to serve as guides. These handbooks, issued under the general title of "British Regional Geology", also serve as compendious summaries of local geology. Eleven have already been published and these are briefly noticed below.

The Survey is to be warmly congratulated on the success of this important new enterprise. Each handbook is beautifully illustrated with maps, diagrams and plates, and the descriptive matter adequately provides all the necessary detail for a general comprehension of the area concerned. The complete series will constitute the most authoritative and attractive account of British geology as a whole which has ever appeared; one, indeed, that will be indispensable to students for purposes of general study. The individual numbers, issued at the remarkably low price of 1s. 6d. each, serve as welcome introductions to the more specialized sheet memoirs, and also as guides to tourists and others who wish to appreciate the interest and significance of the geological features of any British district.

"London and Thames Valley"¹ embraces a region from Oxfordshire and north Wilts to Essex

and north Kent. It thus comprises beds ranging in age from Lias to Pleistocene and Recent, the main features being the Chalk escarpment of the Chiltern Hills and its continuation west of the Goring Gap, and the middle of the London Basin. Palaeozoic formations are known from numerous borings, most of the rocks bearing a general resemblance to those of the Welsh Borders. As in most of the other handbooks of the series, an excellent list of maps and memoirs and a selected bibliography of other publications dealing with the district are appended.

The handbook on "The Wealden District"² covers the area to the south of the above and is probably one of the most familiar geological regions in the world. The Weald proper is continued across the Straits of Dover into the Bas Boulonnais. Beds of many ages are concealed beneath the covering of surface rocks, and at the eastern end of the Weald every system of older stratified rocks from the Silurian upwards is represented, although the complete sequence recognized has not been found in any one boring. A very clear diagrammatic section is given showing the active collieries and working seams of the Kent Coalfield. Water, however, is fundamentally the most important of the economic resources of the Wealden District, since practically all that is used is derived from underground sources.

"Bristol and Gloucester District"³ extends from the Forest of Dean across the Severn to the Cotteswold and Mendip Hills. Geologically speaking, it is one of the most varied districts of Britain, for, with the exception of the Ordovician

and possibly the Permian, there is exposed at the surface every geological formation from the Cambrian to the Cretaceous. Scenically, some of the most striking features, including caverns, gorges and bare rocky crags and uplands, are developed from the Carboniferous Limestone. On the west, limestones again dominate the scenery, the Inferior and Great Oolites forming the mural scarp of the Cotteswolds. These great limestone formations have attracted many famous geologists, the names of Arthur Vaughan and S. S. Buckman being pre-eminent as a result of their classic work on zoning. Tectonically, the synclinal areas of the Bristol, Somerset and Forest of Dean Coalfields and the echeloned periclinal areas of the Mendips are of special interest.

"South-West England"⁴ is a region of high moorlands, including the Devonian rocks of Exmoor and the Quantocks, and the granite masses from Dartmoor to Land's End and the Scilly Isles. At the base of the geological sequence lie the Pre-Cambrian rocks of the Lizard and Start Point. In 1834, De la Beche had already produced a geological map of Devon which led to his appointment as the first Director of the newly established Survey. Since then the region has been famous not only for the pioneer investigations of its mineral wealth, but also for the many contributions it has stimulated to our knowledge of petrology generally, culminating in the work of Teall, Flett, Dewey, and, still more recently, of Brammell and his school of co-workers. This handbook is itself a most valuable introduction to a great variety of petrological problems and there is, moreover, a most interesting section on mines and mining.

The handbook entitled "The Welsh Borderland"⁵ covers a region from Shrewsbury to south of Monmouth. It includes such geologically classic areas as the Wrekin, the Longmynd and the Malverns, where some of the most ancient rocks of England and Wales appear boldly at the surface; the Stiperstones and Shelve country and the Breidden Hills, where Ordovician rocks are magnificently displayed; and Wenlock Edge, famous in the sequence of the Silurian System which was first established by Murchison in 1835 as a result of his work in the Welsh Borderland. Much of the modern research in the region was initiated by Lapworth and Watts, whose stimulating example has been vigorously followed by a host of colleagues and former students. Indeed, many geologists have received their field-training in this area, which is unrivalled for the great variety and interest of its formations, many of which, moreover, are highly fossiliferous. The present handbook provides an invaluable guide to the classes who annually visit Shropshire and the

country about the Malverns for instruction in field-geology.

Another classical region in the history of geology is dealt with in "North Wales"⁶. Here Sedgwick set himself the task of disentangling the structure of the rugged mountain district of Snowdonia and Llyn, and here he founded the Cambrian System. Since then North Wales has attracted to its study an ever-growing band of stratigraphers, palaeontologists and petrologists. The region is essentially characterized by Lower Palaeozoic rocks, displaying one of the finest sequences of Cambrian, Ordovician and Silurian strata to be found in Europe; showing by deep-seated erosion the cores of ancient volcanoes; and revealing in its crumpled, folded, cleaved and fractured sediments the record of several periods of major earth-movements. Of the remaining systems, the underlying Pre-Cambrian is well represented in Anglesey, while the Carboniferous and New Red Sandstone cover fairly extensive tracts on the borders. Like the foregoing, this handbook will be in great demand by students attending geological field-courses.

"The Pennines and Adjacent Areas"⁷ include the Fell country from Stainmore Pass to the Craven district, consisting mainly of Carboniferous Limestone; the Central Pennines between Skipton and the Peak, largely formed of the Millstone Grits (and shales); the Derbyshire Hills of Carboniferous Limestone; the Lancashire and North Staffordshire Coalfield on the west; and, on the east, the coalfield of York, Derby and Nottingham which, in potential resources, is the most important in Britain. The great diversity of geological and physical features is accompanied by an even greater variety of economic interest and by a corresponding inequality in the distribution of population. The oldest rocks in the region—apart from the supposed Pre-Cambrian of Ingleton—are the Lower Palaeozoic formations exposed in the valleys below Ingleborough and in the Howgill Fells. The interest of the coalfields needs no stressing, but geologists will particularly appreciate the useful summary of the structure of the region and the excellent account of the Pleistocene glaciation.

Northumberland, Durham, the Lake District and the Isle of Man are dealt with in "Northern England"⁸. The Northern Pennines continue to the Border and separate a great coalfield on the east from the most attractive scenic area of England, an area which is itself fringed with coal and iron fields. The formations range from the Ordovician to the Jurassic and include a long history of igneous activity, the products of which are responsible for the rugged hills of Borrowdale; the worn-down volcano of the Cheviots; the

well-known granites and Carrock Fell complex of the Lake District; the Great Whin Sill, surmounted for a considerable length of its outcrop by the Roman Wall; and a swarm of dykes which has been traced across Scotland to the Tertiary volcano of Mull. Along the Durham coast, the Magnesian Limestone of the Permian System constitutes one of the most puzzling formations—lithologically and structurally—to be found anywhere in the world. The results of much recent work in the Lake District have been incorporated in the handbook, but in a future revision more attention might be given to the North Pennine ore-deposits and to the Tertiary dykes, or at least to the desirability of including bibliographical references to these subjects of recent research.

"The South of Scotland"⁹ is devoted to the region between the Cheviots and Solway Firth on one hand, and the faulted southern margin of the Midland Valley on the other. Here some of the fundamental principles of geology were established by Hutton and recorded in his "Theory of the Earth" (1795). It was in the Southern Uplands, too, that Lapworth began the far-reaching studies in which he demonstrated the value of graptolites as aids in working out the complicated succession and structure of a highly folded region. The area is mainly occupied by Ordovician and Silurian strata folded in part after the Arenig and, as a whole, at the close of the Silurian. The intrusions of serpentine and other plutonic rocks which have usually been regarded as pre-Glenkiln are considered by Dr. Pringle to be part of the Pre-Cambrian floor on which the Arenig strata were deposited. Small areas of Old Red Sandstone, Carboniferous and New Red Sandstone occur, with abundant illustrations of igneous activity in the great granite complexes of Galloway and the volcanic rocks and necks of Lower Carboniferous age. This handbook, like the one that follows, has a selected bibliography after each section, in some respects a preferable arrangement to placing the whole at the end. The map of the region, showing many localities of geological interest not easily found on detailed maps, is particularly clear.

"The Grampian Highlands"¹⁰ embraces the region between the Highland Boundary Fault and the Great Glen Fault. It excludes Arran, but is extended to take in Colonsay. The two fault lines represent great dislocations along which movements are still taking place, as witnessed by the earthquakes which occur about Inverness and Comrie. The district includes the highest ground in Britain and is geologically by far the most difficult on account of the inexplicable complexity of its structure. The most important formations

are those of the Moine and Dalradian divisions of the Highland Schists. A particularly valuable feature of the handbook is the clear summary which it contains of the different interpretations of succession and structure which have been proposed; this is the more useful because, as the author says, "it will doubtless appear to the reader that there are as many opinions as observers". The treatment of the igneous rocks earlier than, or associated with, the Dalradian metamorphism, and that of the Newer, or Caledonian, intrusions is also worthy of special praise. All students of tectonics and petrology will find this handbook a most helpful guide to a region of tantalizing perplexity.

Under the title "Scotland: The Tertiary Volcanic Districts"¹¹ the magnificent record now exposed in the west of Scotland, of the intense and prolonged igneous activity which broke out in Early Tertiary times, is discussed. The vast amount of denudation which has since taken place has revealed the extensive roots of mighty volcanoes and the deeper-seated plutonic rocks that crystallized beneath the covering of lavas. The complexity of the vents and intrusions and the orderliness of the ring-structures (ring-dykes and cone-sheets) are unsurpassed in any other part of the world. Only brief accounts of the pre-Mesozoic formations are given, the bulk of the handbook being devoted, as its title indicates, to (a) the plateau lavas; (b) the Central Intrusion complexes of Mull, Ardnarmurchan, Skye, Rum, St. Kilda and Arran; and (c) the dyke-swarms. This justly famous petrographic province has stimulated world-wide discussion of problems of petrogenesis. In this connexion it may be pointed out that the official interpretation of the upward passage of gabbro into granophyne in the ring-dykes of Mull as the result of gravitational differentiation *in situ* has not remained unchallenged. The handbook is lavishly illustrated and, at least for petrologists, it may be hailed as the most attractive example of a series that is a worthy commemoration of a hundred years of geological research in Britain.

¹ "London and Thames Valley." By R. L. Sherlock. Pp. 70+5 plates.

² "The Wealden District." By F. H. Edmunds. Pp. 85+13 plates.

³ "Bristol and Gloucester District." By F. B. A. Welch and R. Crookall. Pp. 86+12 plates.

⁴ "South-West England." By H. Dewey. Pp. 75+12 plates.

⁵ "The Welsh Borderland." By R. W. Pocock and T. H. Whitehead. Pp. 81+11 plates.

⁶ "North Wales." By B. Smith and T. N. George. Pp. 92+12 plates.

⁷ "The Pennines and Adjacent Areas." By D. A. Wray. Pp. 87+11 plates.

⁸ "Northern England." By T. Eastwood. Pp. 76+8 plates.

⁹ "The South of Scotland." By J. Pringle. Pp. 97+7 plates.

¹⁰ "The Grampian Highlands." By H. H. Read. Pp. 81+10 plates.

¹¹ "Scotland: The Tertiary Volcanic Districts." By J. E. Richey. Pp. 115+9 plates.

London: H.M. Stationery Office. 1s. 6d. net each.

Obituary

Lieutenant-General Sir Alfred Keogh, G.C.V.O.,
G.C.B., C.H.

IT can scarcely be doubted that, by coming generations, the Great War will be held to mark an epoch in the history of medicine. Taking medicine in its widest sense, as a calling centred on the preservation of life and the mitigation of human suffering, its historian will have to go back to the day of Lister for anything comparable to the rapid and marvellous advance that was made during the War. The two cases are certainly widely different. Lister, like Pasteur, stands in solitary grandeur on the plains of peace, conferring after laborious days the splendid and enduring gift which his rare genius had put into his hands to bestow. In the case of the War, many great names are involved—it was team-work on a titanic scale. No one man among them stands as Lister stood among his fellow labourers. But moving about among the soldier and civilian members of the medical profession who are most competent to judge, the impression is left that if a name were to be chosen for the seat of honour, none could come before that of Sir Alfred Keogh, whose death at the age of seventy-nine years occurred on July 30.

Of talent of almost every kind, the Briton, like the men of other nations, is apt to say we have no lack; but in the art of fostering talent, of affording it the best field for action, of bringing it into focus on the things that are of most vital concern to the nation, the Briton is much less inclined to boast. Of the master art of the harmonious control of gifted men, it is still less the case. Here indeed lies the loudest complaint to-day about the expiring generation, and here also arises the haste to organize, systematize, rationalize, and almost, if one may be permitted to say, to 'Germanize' our ways. According to the adage, "It is lawful to learn from the enemy; it is both wise and lawful to learn from a friend who may also be a potential enemy". This in the Great War meant that Lord Haldane, when Minister of War, had embodied in the administration of the army sufficient of the ways of the German General Staff to help him in securing that six divisions were ready for instant embarkation to the field of war in August 1914, going at once into action. This, according to Earl Haig, was the foundation of victory.

Sir Alfred Keogh's appointment as Director-General of the Army Medical Services was almost simultaneous with that of Lord Haldane as Minister of War. It would, perhaps, be adding too much in praise of Lord Haldane to say that he had at once taken the full measure of the man whose appointment was to mean so much. Suffice it to say, that in Sir Alfred Keogh there was embodied all that was best in the ways of the German General Staff and all that was best in the military traditions of our own country. He was, however, not an imitator, but a man in whom great powers of initiation were inborn.

It would be out of place here, and beyond the writer's power, to give in any detail the record of Sir Alfred Keogh's work in the army. Its essential character can only be briefly indicated. In the first place, the imagination of Keogh, like that of his illustrious fellow countryman Earl Roberts, had enabled him to foresee in wonderful degree the conditions which would obtain in Great Britain in the event of foreign war. He foresaw its magnitude, and the scale of preparation that was required. On the formation of the Territorial Army, under Haldane's regime, Keogh laid, along with it, the foundation of a vast voluntary civilian medical service, which at the outbreak of war sprang into action, appearing with its great military hospitals, staffed with men of the highest medical skill, and the countless number of voluntary aid detachments, with their minor hospitals and training centres. He blended the civilian medical profession and the Army medical service and effected a perfect liaison between the organizations in the field and the organizations at home. It is confidently stated that no other army had its like in the efficiency of its medical service. How many thousands are there to-day, alive; how many thousands are there repaired, who in the conditions of any preceding war would have perished, or been left with grave injuries of kinds which grew to be remediable during the Great War?

The Army Medical Services were not prepared for everything. Among the unforeseen conditions of war in the field, no more conspicuous case could be cited than that of the outbreak of gas warfare. If foreseen as a possibility by Keogh, he, like other soldiers, regarded its incidence as so unlikely that he had no measures of defensive protection designed or in readiness. The results of this, if ever revealed in detail, would serve like the exception that proves the rule to show how much danger must have been entailed by any gap in Keogh's prevision and provision. He did all he could on the spur of the moment amid the toils of hard labour, to meet the new peril, and happily the co-operation of another born leader of men, Sir Henry Thuillier, brought the protection of troops against gas in advance of the attack, and kept it so up to the end of the War.

Keogh was ever ready to listen to proposals that came from people whom he could trust. He assumed no pontifical air; he was rather the supreme and vigilant officer, under whose direction the collected legions of the profession, and the collected outcome of medical investigation at home, passed without delay to wherever lay the appointed place in the field of war.

Turning now to the other field in which Keogh worked, we might stop to say much on the position of medicine in relation to experimental science. It might well be contended that Keogh in his Great War work exhibited the scientific method. He certainly

had imagination, a real love of science, and far more of real science in him than most medical men. If he is not strictly to be regarded a man of science, at least he believed in science wholeheartedly, and knew its ways. This gave him one great qualification for an administrative scientific post, and when we add to this his administrative achievements, as D.G.A.M.S. before the War, we cannot wonder that Lord Haldane, best aware of them, urged in 1910 the appointment of Keogh to the rectorship of the Imperial College of Science, which at that time, above all things, needed a talented administrator at its head. This post Keogh held actively from 1910 until 1914, when he was recalled to his old position at the War Office.

After the War, Keogh returned to it eagerly, and retired reluctantly from it only when he reached the age of sixty-five years in 1922. How much he loved the work can be gauged from the fact that at the most critical period of the War he said, with a rueful smile to the writer, that he was longing "to get back to South Kensington". Many readers of *NATURE* will have personal recollections of Keogh at the Imperial College. They may, perhaps, be puzzled to pick out any conspicuous act of reorganization likely, outside the College, to be associated with his name. If those who had the happiness of holding teaching or other office at the College during his rectorship are asked what he did, they too cannot, or will scarcely stop to tell you. For all thoughts of what he did are overwhelmed by the thought of what he *was*.

Keogh was above all else a veritable knight, a Christian Irish Catholic gentleman, endowed with all the graces that these words imply, not forgetting the savouring salt of humour. No wonder he was so much beloved by those who were nearest to him, and honoured and respected by those further removed who came into contact with him. By his War work he earned his place among the greatest who have served mankind, and incidentally to the work, he stood a noble figure bent on the advancement and right use of natural science.

A. S.

Mr. R. R. Webb

ROBERT RUMSEY WEBB, the last of the famous coaches for the old Mathematical Tripos, died in Cambridge on July 29, at the age of eighty-six years. He was born at Monmouth on July 9, 1850 and went up to St. John's College, Cambridge, in 1868 as a sizar. In 1870 he was admitted a scholar of the College; in 1872 he was Senior Wrangler and first Smith's Prizeman. His election to a fellowship followed immediately; in 1878 he was appointed College lecturer in mathematics, holding this post until 1911; from 1878 until 1893 he was also lecturer at Emmanuel College. He retained his fellowship until his death, and he lived in rooms in College until a few years ago, when he moved to the house of his former 'gyp'.

From the date of his degree, Webb devoted his energies to training pupils for the competitive struggle of the Tripos. He was one of the famous

line of coaches which included Hopkins, Routh and Besant; he worked his men hard, but, as the letters which appeared in *The Times* after his death testify, he inspired and retained their affection, as well as their admiration for the masterly way in which he could manipulate such things as 'moving axes' in rigid dynamics and differential geometry. Naturally, in later days, after he had given up dining in Hall, for reasons variously reported, he became somewhat of a legendary figure. For example, the story was told that, in term time, after a strenuous morning's teaching, it was his invariable practice to go by train to Royston and walk the thirteen miles back to Cambridge, arriving so precisely at the same time each day that the College porters set their clock by him.

Webb did not take a great share in University business, though to the end of his life he was keenly interested in what was going on and, even in his seclusion, he always seemed to know the latest gossip. He examined four times for the Mathematical Tripos; the present Vice-Chancellor of the University recalls how hard he was made to work solving Webb's problems, and how much mathematics he learnt, when he was a co-examiner in 1905 and 1906.

Webb's published work is small in volume, but he was always interested in the progress of mathematics, and kept in touch with many of its developments, even after his retirement; his rooms were crowded with mathematical periodicals and treatises, as well as with paper-backed novels, in French and other languages. He had been a member of the London Mathematical Society since 1873 and he certainly attended one meeting, in January 1878, when the minutes record that "Prof. Cayley gave an expression for the surface of an ellipsoid which had been communicated to him by Prof. Tait", and "Mr. Webb made a few remarks upon the subject". On this occasion, Webb was persuaded to print his own version, and the result is "Some Applications of a Theorem in Solid Geometry" (*Messenger of Math.*, 9, 170; 1880), one of eight papers appearing under his name in the *Messenger*, vols. 9-11, the most considerable of which deal with dynamics and elasticity. He also published a paper on attractions in the *Quarterly Journal* (14, 98; 1877), and communicated in 1886 a short note "On the Problem of Three Moments" to the Cambridge Philosophical Society (*Proc.*, 6, 42; 1889). But he never could be persuaded to work up into a book any of his numerous manuscripts, which he was so generous in lending.

WE regret to announce the following deaths:

Prof. Henry Sewall, emeritus professor of medicine in the University of Colorado, an authority on human physiology and tuberculosis, on July 8, aged eighty-one years.

Mr. C. F. Talman, meteorologist in the U.S. Weather Bureau since 1922, on July 24, aged sixty-one years.

Prof. Frédéric Wallerant, formerly professor of mineralogy in the University of Paris, aged seventy-eight years.

News and Views

Television in the Home

ON the occasion of the opening of the Radio Exhibition, referred to on p. 410 of this issue, on August 26, an opportunity was provided by Messrs. Baird Television, Ltd., of witnessing the reception of the television programme broadcast from the B.B.C. station at Alexandra Palace. The demonstration was given on a standard Baird Televisor receiving set installed in the company's offices in Haymarket, under conditions which approximated to reception in the home. The receiving set was contained in a cabinet similar to the ordinary radio-gramophone, the picture on the screen of the cathode ray tube being viewed in a mirror in the raised lid of the cabinet. This picture was of such dimensions and height that it was comfortably visible by the viewer seated on a settee at a distance of about ten feet. The transmissions from the Alexandra Palace are, of course, only experimental; but the direct-vision pictures provided, including half or three-quarter length views of single persons, such as the announcer and a singer, were very satisfactory. The bulk of the programme, however, comprised the transmission of sound films, and while these were good on the whole, they emphasized the somewhat limited field of the vision picture by a loss of detail when this picture covered a large area or a crowd of persons. As an indication of the present-day possibilities of practical radio-television, however, this demonstration was most successful.

Dr. J. H. Hutton

IT is announced that Dr. John Henry Hutton has been appointed a lecturer in the Faculty of Archaeology and Anthropology in the University of Cambridge, for a period of three years as from October 1. When the intention to appoint a lecturer in this Faculty was notified in the course of last term, it was intimated that a special knowledge of the peoples of India would be a requirement. In this respect, Dr. Hutton's qualifications are beyond question. As a member of the Indian Civil Service, which he entered in 1909 after taking his degree at Worcester College, Oxford, Dr. Hutton has made a special study of the ethnography of the Nagas of Assam. Not only is he himself the author of two of the volumes in the series of monographs published under the auspices of the Government of Assam, one dealing with the Angami Nagas (1921) and the other with the Sema Nagas (1922), as well as a contributor of numerous papers on Naga culture to scientific periodicals, but he has also so stimulated and organized the researches of his colleagues that the hill tribes of Assam are now as well, or even better known to anthropological science than any other comparable population of India. When Dr. Hutton was seconded under the Government of India to take charge of the Census of India, 1931, it was generally felt that no more suitable

selection could have been made. His introduction to the Report marked him as no unworthy successor to the late Sir Herbert Risley. However much opinions may differ as to the validity of the conclusions on the racial history of India at which Dr. Hutton arrived in that remarkable document, it cannot be denied that he has shown a notable breadth of outlook in grasping the essentials of his problem in their archaeological and historical perspective, combined with a detailed knowledge of the multifarious facts, which is without rival in the Indian field.

Economic and Military Armaments

IN the eighth Richard Cobden Lecture entitled "The Common Menace of Economic and Military Armaments" delivered on May 25 and now published (Cobden-Sanderson, Ltd., 1s. net), Prof. W. E. Rappard, discussing the relations between economic and military armaments, points out that as military armaments have contributed to the development of economic armaments, so the latter in turn have promoted the extension of military armaments by emphasizing the claims of the national State as against the rights of the individual and of mankind, and thereby increasing the tension in international relations. Both economic and military armaments are largely the legacy of past wars or the fruit of anticipation of future wars. Their primary source, however, is the doctrine of political nationalism which leads nations to look upon their own State as a universe in itself and therefore to disregard the rights of all others. A further source is in the present depression and in the efforts to overcome it by thorough-going State intervention.

BOTH economic and military armaments are weapons forged to enhance the independence, security and power of the national State. While a burden to the individual and a menace to the international community, they are incapable even at this price of truly fulfilling their professed purposes, and the present international situation must inevitably be aggravated by a persistent adhesion to these methods. Discussing the difficulties due to the existence to-day of at least three Great Powers of professedly and defiantly nationalistic Governments, Prof. Rappard suggests that the problem of international peace resolves itself into one of national ideals and conversions. Unless these nations can be led to adopt a more humane and less exclusive creed, peace can only be maintained by the closest co-operation between all those States, which, while respecting their own as well as their neighbours' statehood, still believe in the legitimate rights of the individual and in the supreme rights of mankind. Without a federal organization of the international community, there can be no real liberty, no lasting peace and no true relief from economic and military armaments.

Maiden Castle, Dorchester

THE most striking point to emerge from this season's excavations at Maiden Castle, so far as they have gone, is the conclusive evidence confirming Dr. Mortimer Wheeler's inferences as to the importance of the pre-Roman fortress-settlement in Britain. Should further investigation confirm his views as to its prevalence as an organized system, this should have a profound effect on theory as to the origins and form of town life in early and medieval England. The importance of Maiden Castle itself may be gauged from the evidence now being found of the deliberate destruction of the walled system of defences when the inhabitants were removed in Roman times to the newly founded neighbouring city of Dorchester. As investigation proceeds, the character of the prehistoric stone walling, which has now been found incorporated in the ramparts, and of which the existence was previously unsuspected, becomes more and more impressive. These walls were built of limestone from Upwey, some of the blocks weighing as much as five hundredweight. At the eastern entrance a later wall of fine masonry now being uncovered still stands to a height of six courses. Not only is it evident that it overlies earlier prehistoric levels of occupation, but it is also clear that it was designed to form a blocking wall across the prehistoric gateway when the hill-top temple was being built in the century preceding the coming of the Romans. Within the fortress itself, the remains of a substantial structure of wood, standing at the highest point of the camp, is being excavated. This was evidently of considerable size, and was in part constructed of tree-trunks a foot in diameter. Nearby a skeleton was found buried at some depth, an unusual feature in a fortress. The excavations will be continued until the end of the present month, when the three years' investigation which was undertaken by the Society of Antiquaries of London with the co-operation of the Dorset Natural History and Archaeological Society will have been completed.

Meare Lake Village

EXCAVATIONS at Meare Lake Village have been resumed by the Somerset Archaeological Society under the direction of Dr. Arthur Bulleid, and will continue until at least the middle of September. According to a preliminary report in *The Times* of August 29, the stone walling overlying the timber structure, apparently the foundations of a crannog, found last year in the central part of the eastern half of the village, is being examined further. The eastern margin and the south-eastern and north-eastern portions are now in course of investigation. Work has also been begun on the southern border of the village outside a definite dwelling. Timber and oak piles are being revealed, and in a layer of black earth a number of small finds have been made, which include a La Tène III brooch, a few objects of bronze, an antler weaving comb, a 'pygmy' pottery vessel, and a small Romano-British pot of the type known as 'Cossington' ware.

im Thurn Memorial Lecture, 1936

IN the recent lecture for 1936 on the foundation in memory of the late Sir Everard im Thurn, delivered at Edinburgh, Prof. J. L. Myres directed attention to the effect of changing outlook and development in method of research on the broader philosophic principles, which underlay the work of im Thurn. To the study of primitive peoples he conjoined the application of its results to the practical problem of the approach to the primitive mind in administrative and other affairs. He realized that this problem was but the counterpart of any native's difficulty in understanding European ways. im Thurn, Prof. Myres pointed out, insisted on the significance of 'character' which, whatever the superficial changes in culture, continues to influence native reactions to 'civilization'. This 'civilization' was defined as that in which "the prime motive of human action was the good of others or of one's whole race". As regards 'character' and 'culture' and their interaction, all grades between the individual completely disciplined by 'culture' and the man of genius can be discerned.

SINCE im Thurn's day, advance in scientific method has shown that culture and character alike appear as a composite system, or complex of elements, combined in different peoples in infinitely varying degrees of intensity. In a society in which transitions from one phase of life and society are effected mainly by individuals in isolation, character and initiative stand high, and in that society institutions are relatively unstable. Where, however, the rites of transition are matters of public concern and are performed by whole groups of initiates, behaviour and social structure are stabilized, character is stereotyped, originality suppressed and stagnation ensues. Our knowledge of 'primitive' cultures is mainly derived from such societies. Out of such closed cultures what way of escape is there, Prof. Myres asked. How does what im Thurn defined as civilization emerge as an altruistic prime motive of human action? Prof. Myres illustrated from the history of ancient Egypt, early Greece and elsewhere how in fact such transformations do take place, though they do not preclude the apparition of a dominant individual character as first cause, and they presume elementary freedom to choose the well-being of others, once presented as the prime motive of human action.

Bibliography of Natural History

THE first general meeting of the Society for the Bibliography of Natural History was held in the rooms of the Royal Entomological Society on August 26. The provisional committee set up to establish the Society made a report and submitted draft by-laws which were accepted as the by-laws of the Society. The following officers were elected: President: Dr. C. Davies Sherborn; Treasurer: Mr. Francis Hemming; Secretary: Mr. Francis J. Griffin; and a committee of management set up consisting of Prof. F. Balfour-Browne, Mr. J. R. Norman, Mr. J. Ramsbottom, Dr. T. A. Sprague and Mr. A. Cockburn Townsend. It was announced that

the first part of the Society's *Journal* would appear in September, and that it would contain a catalogue of all known papers giving information relating to the dates of publication of books on natural history. No such catalogue at present exists, and the publication should be of value to all systematists. An item on the programme of the Society which it is hoped will be of great value to all naturalists is the publication of facsimiles of rare works of importance to natural history. The decision of the Society to maintain an information bureau for the use of its members is an indication of the present trend of societies to make available to the individual member the collective experience and knowledge of all. The annual general meeting of the Society will be held on the first Saturday in February.

International Botanical Congresses

A FEATURE of the sixth International Botanical Congress held at Amsterdam last September was the re-organization of the Botanical Section of the International Union of Biological Sciences and its recognition by the Congress as a liaison between successive International Congresses. Hitherto, each quinquennial congress has been independent of preceding congresses, and has been organized entirely by an *ad hoc* committee of the nation which was acting as host. Participation by other nationals in its various activities was by invitation. A drawback of this arrangement has been the absence of any body to ensure that resolutions passed by one congress were carried out and that committees appointed for definite objects were set to work. A circular has now been issued by the honorary secretary of the Botanical Section of the Union describing the aims of international collaboration in science in general, and in particular defining the work of the Botanical Section in relation to successive congresses. The circular emphasizes the independence of the quinquennial congresses, the organization of which remains entirely in the hands of a national committee; but the various commissions and committees appointed by successive congresses will be adopted by the Botanical Section of the Union and thus "be united into a permanent, active and well-subsidized organization". This should ensure that work initiated at any one congress will be effectively carried out. For the present a definite liaison is suggested between the two organizations as the president of the Botanical Section of the Union, Prof. N. E. Svedelius, is vice-president of the next International Congress to be held in Stockholm in 1940. The president of the Congress is Prof. R. E. Fries.

Forestry Research in Canada

As a result of recommendations made at a Conference on Forestry Research held in Ottawa in November 1935, the National Research Council of Canada has appointed a committee to study the requirements in respect to research in all branches of forestry, including measures for the better utilization of forest products. This committee is to function as an associate committee of the National Research

Council, and includes in its membership representatives of the Dominion Departments of the Interior and Agriculture, in addition to the National Research Council; the forestry departments of each province; members of the forestry faculties of universities in which there are departments of forestry; the lumber, pulp and paper and allied industries throughout the Dominion; the forest engineering societies; the forest protective associations and the Canadian Forestry Association. It is understood that the committee will base its preliminary programme on the findings of the Conference on Forestry Research held in November 1935 already alluded to. The importance of forestry and her forests to Canada needs no emphasizing. Much valuable work is being done already in the direction of research by federal and provincial agencies, individual companies and other organizations. The new committee will bring together data on the work at present in progress, correlate the information thus obtained, investigate the need for further research, and so forth. It is evidence of broad and statesman-like views among those responsible for the formation of the committee that representatives of all sides of forestry interests are included. In Great Britain, the position is far otherwise—research work is too often relegated to water-tight compartments, energies being thus dissipated; forestry committees are not fully representative of all sides of forestry; whilst representatives of the individual forestry staffs of the universities as a whole do not automatically find places on forestry research committees.

Control of Rabbit Infestation by the Use of a Virus

OF all the pests from which the pastoral industry in Australia has suffered, rabbit infestation is probably the most serious economically, and little permanent success seems to follow the methods of control in use at present, such as trapping and poisoning. One hope would appear to lie in the discovery of some infectious disease, deadly to the rabbit but innocuous to man and other animals, and easily communicable to, and spreading widely by natural means among, the rabbits. Sir Charles Martin, as a result of an experimental inquiry, suggests that a disease 'rabbit myxomatosis' may fulfil these requirements (Commonwealth of Australia. Council for Scientific and Industrial Research, *Bull.* No. 96. Melbourne, 1936). This is an infectious, highly fatal, febrile disease caused by an ultra-microscopic virus, causing mucinous discharges, swellings and tumours in affected animals, fatal within twelve days or so, transmitted sufficiently by contact, and with a fatality of almost a hundred per cent. It attacks animals of the genus *Oryctolagus*, to which wild rabbits in Europe and Australia, and domesticated rabbits in Europe and America, belong; but it does not affect the indigenous rabbits of America, or man and other animals and birds. Experiments were conducted by Sir Charles Martin in a pen measuring 50 yards \times 10 yards, with both tame and wild rabbits. A colony having been established for three weeks or thereabouts, one or two rabbits inoculated

with the disease were introduced. With colonies of 27 and 30 tame, and 55 and 44 wild, rabbits, the fatality was 99.6 per cent among the tame, and 100 per cent among the wild. The disease originally came from epizootics among tame rabbits in South America.

Research at Millport

THE Annual Report of the Executive to the Council of the Scottish Marine Biological Association for 1934-35 includes the director's report on research. Drs. Orr, Marshall and Nicholls are concentrating on the development and food of the herring from hatching onward. In this connexion, it is found that copepods are by far the most important food organisms, the larval and post-larval herring eating chiefly the small species. In view of this fact, it was decided to investigate seasonal distribution and breeding periods of these small copepods, in the same way as has already been done for *Calanus finmarchicus*. Results so far show that in the early months *Microcalanus pusillus* and *Oithona helgolandica* were the most abundant species, with *Pseudocalanus elongatus*, *Centropages hamatus*, *Temora longicornis* and *Acartia clausi* occurring in smaller numbers. Most of the important planktonic organisms have been weighed, and in some cases the chemical composition determined. During the winter, when zooplanktonic organisms are scarce, a beginning was made on the analysis of non-planktonic animals important as fish food. Investigations on shore ecology, especially in Kames Bay, by Dr. A. C. Stephen and Mr. Elmhirst, have been continued. The work already done has shown a very rich fauna important for fish food. Various fishes from the seine net have been examined and shown to feed on the dominant invertebrates. A very interesting feature in these investigations is the work by Dr. Nicholls on sand-dwelling copepods, especially minute species living in the interstices between the sand grains on the beach. Several new species of these and three new genera have been found. Other researches include algal ecology and preserving colour in green seaweeds, experiments on timber preservation in the sea and the growth of the dog-fish *Acanthias*.

Seismology in New Zealand

THE report of Dr. C. E. Adams, Dominion Astronomer and Seismologist, for the year 1934 (*Dept. Sci. Indus. Res. Bull.*, No. 105) shows that the seismic activity of New Zealand was much greater during that year than in 1933, the number of earthquakes felt being 230, instead of 108. Of these, 158 were felt in the North Island only, 60 in the South Island only, and 12 in both islands. The most important shock was that of March 5 at 11.16 p.m. N.Z. time (11.46 a.m., G.M.T.). Its intensity in several parts of northern Wairarapa reached the degree 9 of the Rossi-Forel scale and chimneys fell over a wide area in the southern part of the North Island. The map that accompanies the paper shows that most of the epicentres lay in the extreme north of South Island and the southern half of North Island. Owing to the increased activity off the east

coast of the latter island and to other changes that have been reported along the coast, it is strongly recommended that a detailed marine survey should be carried out of the whole east coast, including soundings in the seas to the east of New Zealand.

Solar Activity and Terrestrial Phenomena

IN 1924 the International Research Council (now transformed into the International Council of Scientific Unions) formed a Commission for the Study of Solar and Terrestrial Relationships, a field of science which extends over the domains of at least three of the International Scientific Unions. This Commission, among other activities, has published triennial reports, reviewing the state and progress of knowledge on solar and terrestrial relationships, and, where necessary, making recommendations regarding action that may conduce to further progress. These reports are distributed to certain libraries and to institutions and individuals occupied in work relating to the subject. The fourth report has recently been issued (*Conseil International des Unions Scientifiques: Quatrième Rapport de la Commission pour l'Etude des Relations entre les Phénomènes Solaires et Terrestres*; pp. 159. Firenze, 1936) under the editorship of the president of the Commission, Prof. G. Abetti, Astrophysical Observatory, Arcetri, Italy. It differs from its predecessors in being better and more attractively produced, and in having a valuable 28-page introduction by the editor, giving a general survey of the subject for the past three years. The remainder of the volume consists of twenty-one brief articles on different aspects of the subject, by various authors.

Electric Supply in the Irish Free State

THE annual report of the Electricity Supply Board of the Irish Free State for the year ending March 31, 1936 shows that a further increase in the sale of electricity has been effected, and results in a surplus of income over expenditure of about £310,000. The total capital expenditure is now about 10½ million pounds, of which 5 per cent is paid to the State. The total sale of electric units during the year amounted to 187 millions, and the average receipts per unit dropped from 1.92d. to 1.84d. The figures show a very satisfactory acceleration in the development of the consumption of electricity for domestic purposes. In the environs of Dublin the consumption increased by 63 per cent. The total units generated during the year were 243 millions, of which 211 millions were supplied by the hydro-electric power station on the Shannon. Details are given of the extension of plant, and the building of new works on the Shannon and at the Pigeon House in Dublin. Two Swiss experts have reported on the development of the River Liffey for hydro-electric purposes. As it is the intention of the Corporation of the City of Dublin to use the water-storage reservoir on the Liffey to augment the ordinary water supply to the city, it was found inadvisable to take full advantage of the Liffey water-power project for six or seven years. As soon as the necessary legislative provision has been obtained, the work on the reservoir will be

begun. The average yearly production of the Liffey hydro-electric development is computed to be 30 million units.

Scientific and Technical Literature

SEVERAL suggestions for the improvement of scientific and technical literature are made by Commander T. W. Macalpine in the *Publishers' Circular and the Publisher and Bookseller* of July 18. Criticizing the present procedure followed by a specialist or a publishing company in regard to a projected scientific book, he suggests that the exposition of the subjects treated in scientific and technical works, etc., would be improved, their utility for easy and quick reference increased, the cost of production decreased, and their filing and storage on shelves, etc., facilitated, if there existed an independent body of recognized standing in the world of science which could furnish authors and publishers with general information and guidance. At present an author is rarely able to give much information of assistance to the publishers on such matters as form of treatment, size of volume, number of words, type or types, number and kind of illustrations, diagrams, paper, binding. Accordingly, the utility of a book is liable to be limited by the publisher's experience. An independent advisory body of recognized standing which could supply information on such matters, assist in the standardization of nomenclature and symbolism, as well as of formats and sizes of printed area on pages, and advice on subdivision, synopsis, contents list and index, etc., would make an important contribution to efficient publication.

Composition of Cereal Straw

THE seemingly facetious title, "The Two Ends of Straw", appears over an article by Dr. H. Nicol in *Agricultural History* (10, No. 1, Jan. 1936), reviewing some early, but fundamental, research upon the composition of cereal straw. The work of Prof. J. F. W. Johnston in 1842, of J. P. Norton and P. F. H. Fromberg in 1845, and of J. I. Pierre in 1863 and 1866 is collected to show that straw has a great diversity of composition between the root end, and the parts towards the flower. The work of Pierre is particularly detailed, and supplies a great deal of material not widely known at the present day. Dr. Nicol discusses some of the results in relation to the recent hypothesis of 'negative migration' of plant constituents, where nitrogen and mineral elements are returned to the soil. Several additional papers upon the partitional analysis of straw have come to light since the publication of the article under review, but the most recent is dated 1879. There is considerable gratification, but also cause for humble reflection, that modern ideas are being confirmed by work which has remained in oblivion for nearly sixty years.

Greenkeeping Research

THE spring number of the *Journal of the Board of Greenkeeping Research* (4, No. 14, from the Board's

Research Station, St. Ives, Bingley, Yorks, 2s. 6d. net) contains the annual report of the organization, which shows, *inter alia*, a very gratifying volume of advisory work. Many suggestions for future work of a practical kind have been made by the Greenkeepers' Advisory Committee, and the report of last year's annual conference is embellished by the full text of Prof. N. M. Comber's address on "The Constitution of Soil". Mr. R. B. Dawson, director of the Research Station, contributes a short but highly informative article on camomile lawns, and the previous accounts of lawn grasses, of weeds, and of fertilizers, are continued. The difficulties of accurate botanical description are being met by the publication of a glossary of botanical terms. Mr. R. B. Ferro discusses some of the difficulties of field experimentation on the golf course. Two short articles on water installations, a description of the management of a golf course on heavy clay soil, and a plea for special investigation of bowling green problems, are included in the issue.

A Journal of Marriage Hygiene and Birth Control

WITH the May issue (2, No. 4), *Marriage Hygiene* completes its second year. The objects of this quarterly journal are to secure for conjugal hygiene a proper place in preventive medicine, to publish scientific contributions treating marriage as a social and biological institution, and to promote and co-ordinate contraceptive clinics and marriage consultation centres in various parts of the globe. Each number contains notes and comments, original articles, reviews and abstracts of current literature. "The Positive Side of Birth Control" (E. B. Reuter), "Birth Prevention in France" (J. J. Spengler), and "Artificial Insemination" (H. Brewer) are some of the original articles in the present number. The yearly subscription for the volume of about five hundred pages is 18s. It is published from Kodak House, Bombay 1, India, the editor being A. P. Pillay. The London agents are Messrs. H. K. Lewis and Co., 136 Gower Street, W.C.1.

Anti-Noise Regulations

THE City Council of Philadelphia has adopted a noise abatement ordinance prepared by a Special Committee of the Philadelphia County Medical Society. The ordinance prohibits sounding of motor-horns except when absolutely necessary for the prevention of accidents, building operations at night except by special permit, the use of sound devices by pedlars, unnecessary noise in handling rubbish cans, and the use of gongs, sirens or exhaust whistles on any vehicles except those of the police and fire bureaux, and hospitals. Loud playing of radios in homes or in front of stores is also among the specific noises forbidden in the ordinance.

Costing Returns of Hospitals and Sanatoria

IN recent years, the value of costing methods in securing business efficiency has become increasingly recognized, not only in industry but also in local government. The Ministry of Health has issued Part 1

and Part 2 of the costing returns of hospitals for the year ending March 31, 1935 (H.M. Stationery Office, 1936. Price 1s. and 1s. 3d. net). Part 1 contains particulars of Poor Law hospitals, general hospitals administered by local authorities under the Public Health Acts or the Local Government Acts, sanatoria and other institutions for the residential treatment of tuberculosis, and maternity homes and hospitals. Part 2 contains the similar particulars for Poor Law institutions and separate casual wards.

Research at the London Hospital

THE annual volume of "Researches Published from the Wards and Laboratories of the London Hospital during 1935" has recently been issued (London: H. K. Lewis and Co., Ltd., 136 Gower Street, W.C.1. Price 7s. 6d. net). The matter has been selected and issued by the Publications Committee for Researches from the London Hospital, of which Prof. Bedson is honorary secretary. The volume includes twenty-seven papers, all published in various current journals, which cover a wide range of subjects included in the science and art of medicine.

A Large Sunspot

THE rising solar activity continues to yield, amongst other phenomena, a fairly high frequency of sunspots—about six groups a day being visible. These groups are usually of moderate extent, but about a dozen seen since the beginning of 1936 may be discriminated as naked-eye spots. These spots or groups of spots have areas of not less than 500 millionths of the sun's hemisphere or about 585 million square miles. The latest of these large spots is now crossing the sun's disk, from August 25 until September 6, with central meridian passage on August 30.7 U.T. Its growth to a large spot with multiple umbrae was considerable between August 27, when its area measured 400 millionths, and August 29, when it had increased to 900 millionths. The spot was surrounded by extensive faculae, as seen in integrated light, and by flocculi as seen in hydrogen light ($H\alpha$) or in that of ionized calcium (H and K). There was marked activity recorded with the spectrohelioscope at the Royal Observatory, Greenwich, on August 27 and 28—in particular a bright eruption, visible in $H\beta$ as well as in $H\alpha$, on August 28 between 10^h and 11^h.

Announcements

FOLLOWING her record-breaking westbound passage across the Atlantic from Bishop Rock to the Ambrose Lightship, the *Queen Mary* has recently beaten the eastbound record. She passed Bishop Rock at 7.12 hr. G.M.T. on August 30, having taken 3 days 23 hr. 57 min. for the crossing. The average speed for the voyage of 2,939 miles was 30.63 knots, as compared with the average of 30.31 knots for the 3,015 miles which gave the *Normandie* the blue riband of the North Atlantic in June, 1935.

A WORLD Peace Conference is being held at Brussels on September 3-6. It has been organized by the International Peace Campaign; the Viscount

Cecil and Pierre Cot are joint presidents; Miss Rose Manus, 48 Boulevard Botanique, Brussels, is the international secretary; Dame Adelaide Livingstone is vice-chairman of the British National Committee, which has its office at 27 Chester Terrace, Eaton Square, S.W.1. The Congress has special committees on medicine, science and education, and will raise general points, too, likely to be of interest to scientific workers.

DR. FRIEDRICH KÜSTNER, of Mehlem a. Rh., professor of astronomy and formerly director of the observatory of Bonn University, celebrated his eightieth birthday on August 28.

AN Institute for Industrial Medicine has recently been inaugurated in Milan.

THE twenty-fifth Congress of the German Society of Legal and Social Medicine will be held at Dresden on September 17-19. Further information can be obtained from Dr. Schrader, Lahnstrasse 9, Marburg a.d. Lahn.

THE Association for Photographic and Cinematographic Documentation in Science will hold a Congress in Paris on October 9-15. Further information can be obtained from Dr. Claoué, rue Scheffer 39, Paris, 16^e.

ERRATUM.—In the letter entitled "Measurements of Cosmic Rays in a Deep Mine" by Drs. J. Barnóthy and M. Forró in NATURE of August 22, p. 325, lines 9 and 15, for "2,500 m." read "1,500 m."; line 15, for "0.09" read "0.18".

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

A lecturer in electrical engineering in the Borough Polytechnic, London, S.E.1—The Principal (September 9).

A lecturer in mechanical engineering in the Handsworth Technical College, Golds Hill Road, Handsworth, Birmingham—The Principal (September 12).

A junior bacteriologist in the University of Bristol—The Registrar (September 12).

A vice-principal (industrial and/or mining engineering) of the Wakefield Technical College—The Director of Education, Education Department, 27 King Street, Wakefield (September 14).

An assistant lecturer in mathematics in the University of Sheffield—The Registrar (September 15).

An investigator for research in problems of falls of ground and haulage in coal mines to the Safety in Mines Research Board—The Under Secretary for Mines, Establishment Branch, Mines Department, Dean Stanley Street, London, S.W.1 (September 19).

A demonstrator in mechanical engineering in the University of Leeds—The Registrar (September 21).

A regius professor of natural history in the University of Aberdeen—The Private Secretary, Scottish Office, Whitehall, London, S.W.1 (October 31).

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 407.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Radio-Helium

THE following experiment concerning the nature of the radioactive element produced in beryllium when bombarded by fast neutrons¹ was made on the suggestion of Dr. O. R. Frisch.

Beryllium was precipitated as a hydroxide in a very fine-grained form (this was kindly done for us by Prof. G. v. Hevesy), so that it might be able to give off any helium produced in the process. The $\text{Be}(\text{OH})_2$ powder was bombarded by neutrons from a beryllium-radon source of about 200 mc. strength, and a stream of hydrogen was at the same time passed through the tube containing the $\text{Be}(\text{OH})_2$ and then through a capillary tube to a thin-walled jacket around a thin-walled Geiger counter. The distance between the neutron source and the counter was 60 cm., and the latter was properly shielded by lead.

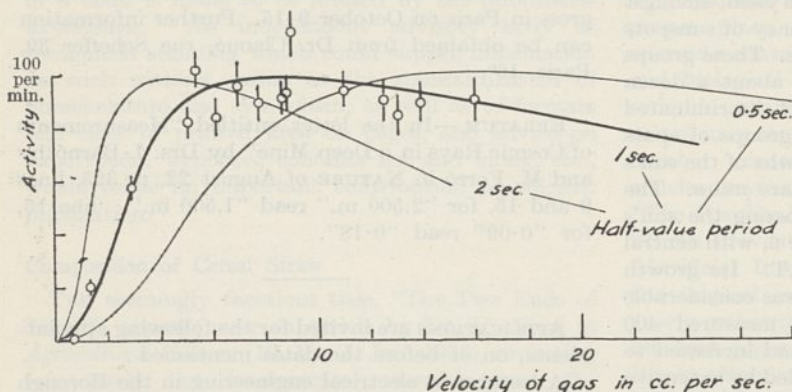


FIG. 1.

When the velocity of the gas was zero, the rate of counting was 20 per minute: when the velocity of the gas was increased, the counting rate increased as shown in Fig. 1, where the counting rate (less the γ -ray effect of 20 per min.) is plotted against the velocity of the hydrogen. This shows that a radioactive body in a gaseous state is produced in the $\text{Be}(\text{OH})_2$. From the volumes of the $\text{Be}(\text{OH})_2$ tube, the capillary and the jacket around the counter, one can calculate roughly the shape of the curve for the cases of the activity having a half-value period of 0.5 sec., 1 sec. or 2 sec. These curves are drawn in Fig. 1, and it is seen that the activity has a half-value period of about 1 sec., thus being identified as the one previously reported¹.

A radioactive gas produced by bombarding ^9Be by neutrons could scarcely be anything but ^3He or possibly ^4He .

T. BJERGE.

Physical Laboratory,
Technical Highschool of Denmark,
Copenhagen.
July 29.

¹ T. Bjerger, *NATURE*, **137**, 865 (1936).

β -Ray Spectrum of Radio-Helium

IN order to investigate the energy distribution of the β -rays from radio-helium¹, we have employed an expansion chamber constructed by Dr. J. C. Jacobsen and kindly lent to us. In the middle of the top plate, a thin-walled brass cylinder (0.05 gm. per cm.², 1.5 cm. diameter) was inserted, into which an activated beryllium cylinder could be dipped. The latter was made of beryllium powder (0.12 gm. per cm.²) stuck on to a brass tube (0.1 gm. per cm.²) and could be moved automatically from a position around a neutron source (beryllium-radon) to the position in the Wilson chamber in 0.4 sec., this movement also starting the timing arrangement for expansion and light. A suitable lead shielding was arranged which cut down the electrons due to the γ -rays to a number small compared with the number of β -rays. The radioactivity induced in the brass tube carrying the beryllium is negligible as the latter is exposed to the neutrons only for a few seconds at most every minute.

The β -rays were bent by a magnetic field of 1,500 oersteds. The gas in the chamber was air at about half an atmosphere pressure, the condensing vapour a mixture of ether and alcohol.

Radio-helium emits negative electrons. 120 tracks have been measured and corrected for the stopping power of the brass cylinder and half of the beryllium layer. The uncertainty in the individual values of H_p is estimated to be about 10 per cent. The

energy spectrum obtained is shown in Fig. 1. As usual, it is somewhat difficult to determine the

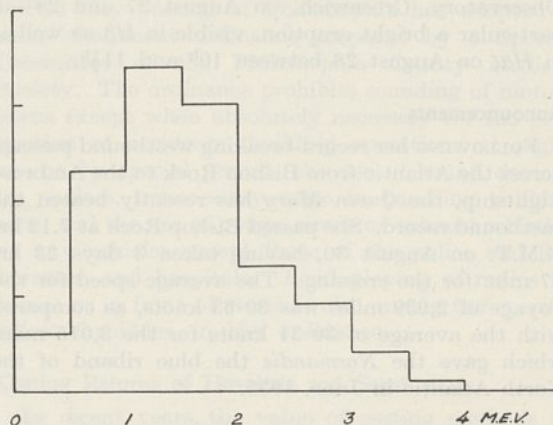
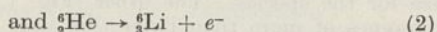
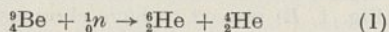


FIG. 1. Energy spectrum of β -rays from radio-helium.

upper limit: the scarcity of tracks in this region tends to give a value which is too low, whereas the

uncertainty of the individual tracks tends to give a value which is too high. We consider 3.7 ± 0.5 m.e.v. as the most probable value from our measurements.

The most reasonable assumption as to the formation and disintegration of radio-helium are the processes:



If the energy release in (2) is 3.7 m.e.v., the mass of ${}^8_2\text{He}$ would be 6.0207, using the masses given by Oliphant². Recently Oliphant has reported³ that (1) takes place even if the bombarding neutrons have only 1.5 m.e.v. kinetic energy. If these figures are applied in (1), it follows that the energy available for the breaking up of the intermediate ${}^9_4\text{Be}$ nucleus into He and ${}^2_2\text{He}$ is 0.8 m.e.v., which does not seem unreasonable.

We wish to thank Prof. N. Bohr for his interest in the work, and the Radium Institute of Copenhagen for the gift of the emanation.

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K. J. BROSTRÖM.

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July 31.

¹ See preceding letter.

² M. L. Oliphant, NATURE, 137, 396 (1936).

³ M. L. Oliphant, Copenhagen Conf. 1936 (unpublished).

Passage of Fast Electrons through Matter

WHEN a fast electron passes through matter, it loses its energy mainly by emission of a few large quanta of radiation (*Bremsstrahlung*). The radiation quanta are absorbed again, the absorption being due mainly to the creation of pairs. Thus, in a *thick sheet of matter*, a fast primary electron produces quite a number of secondary positive and negative electrons, which appear as a *small shower* giving rise to triple coincidences, etc.

Using the cross-sections for the above processes as obtained from relativistic quantum mechanics¹, we have calculated the probability for the production of secondary electrons with an energy greater than E , say, when a primary electron of energy E_0 passes through a sheet of matter of thickness L . The result can be expressed in the same form for all materials if the thickness L is expressed in certain units characteristic for the material. The unit thickness ($L = 1$) corresponds to:

0.40 cm. Pb; 7.4 cm. Al; 33 cm. H_2O ; 280 m. air.

The average number of positive or negative electrons emerging from the sheet depends only on L and the ratio E_0/E . It is given in the accompanying table (the total number of positive + negative electrons being twice the corresponding figure given in the table):

E_0/E	20	100	400	1000	10,000
$L = 2$	0.5	1.3	2	2.5	3.7
3	0.7	1.8	3.4	4.4	7
4	0.7	2	3.8	5.2	8.6
5	0.5	1.8	3.8	5.4	9.3
7	0.2	1.2	3	4.7	10.3
10	0	0.5	1.8	3	8.4

The results are only valid for $E \gg mc^2$.

The table shows that the maximum number of secondaries is produced at a thickness L_m of about

3.5–5, increasing slowly with E_0/E . $L = 4$ corresponds to 1.6 cm. lead. For this thickness a primary electron of 2×10^9 e.v. produces, for example, on the average 2 positive and 2 negative electrons with energies greater than 20×10^6 e.v.

There can be no doubt that the process discussed above is responsible at least for a large part of the triple-coincidences obtained by Rossi and others. The thickness $L_m = 4$ (1.6 cm. lead) at which the number of secondaries is a maximum agrees well with the maximum of Rossi's well-known curves².

Showers of this sort can also be produced by hard light quanta. After having travelled an average distance $L = 1.7$, the light quantum creates a pair, each electron of which produces secondaries in the way described above.

A more detailed discussion of these processes and in particular of the higher stages (tertiary, quaternary . . . electrons) will be given elsewhere. The latter have to be taken into account for large values of L and E_0/E .

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July 29.

¹ Bethe and Heitler, *Proc. Roy. Soc., A*, 146, 83 (1934).

² Int. Conf. Nuclear Physics, London, 1934.

Intrinsic Uncertainty of Reference Frames

PHYSICAL ideas which seem at first sight somewhat arbitrary become, as Eddington has stressed, almost inevitable when the relativity principle is taken to its proper conclusion. As examples may be quoted the law of gravitation, in which the radius of curvature anywhere in the universe is proportional to the corresponding amount of matter there, and the principle of unit weights (equal *a priori* probabilities) in statistical mechanics.

Eddington has pointed out further, following earlier ideas of Mach, that the *ad hoc* introduction in quantum theory of a term m to represent mass is theoretically unsatisfactory, in view of the necessary dependence of such a term on the remaining unspecified matter. It seems logical to realize not only that relativity has denied the absolute independence of mass, space and time; but also that these concepts should rigorously be regarded merely as aspects of the configuration and changes of configuration of matter. On any kind of atomic theory it follows that these three associated concepts of mass, space and time are all statistical in character.

Any mechanical properties of a system will be implicitly affected by fluctuations in our frame of reference. If in particular we use the rest of the world as our reference frame, there will be an uncertainty of order R/\sqrt{N} , where R is the radius of the universe, and N the number of particles it contains. From this uncertainty, Eddington has considered what term should represent the 'reference mass' of the universe. If this statistical view of the origin of mass is accepted, it does not seem unreasonable that we should assume a corresponding uncertainty of the conjugate co-ordinate, proper time, of order h/mc^2 or $R/c\sqrt{N}$.

The above argument could thus be regarded as one approach to Flint's assumption that in addition to the usual limitations imposed by Heisenberg's uncertainty principle, there is a limit to the subdivision of proper time, from which postulate he

shows that a paradox of negative energy levels disappears¹. It seems in any case significant that the order of these uncertainties is that at which it is known that wave mechanics begins to break down.

A further conceivable development of the argument is its connexion with changes associated with a direction of time. If recognizable changes of configuration could be imagined referred to an ideal time defined in terms of the number of interactions that take place, then as entropy increases, the approach of equilibrium will imply that more interactions will take place before a recognizable change occurs. If our observable time is regarded as dependent on recognizable change, then, being a statistical average, it will as a macroscopic phenomenon eventually disappear. Before this stage is reached, however, it will in terms of our ideal time go more and more slowly; and it could appear to follow, if we adopt conventionally a fixed relation between measurements in space and time (denoted by the constant c), that space will correspondingly expand. Equivalently, the velocity of light could be said to decrease, though it should be noted, in view of past suggestions (on rather insufficient evidence), that this velocity is apparently decreasing, that even the present observed expansion of space, whatever its cause, would, on the assumption of an absolute constant for the velocity, only give rise to an apparent decrease of about 16 cm./sec./year, which would be undetectable².

In spite of possible fallacies in the above arguments, they may serve to stress properties of an observable time that are now perhaps becoming appreciated. Thus it should be remembered that a clock is not merely an oscillating system that is observed at a particular instant—this would define in terms of space a periodic sort of time; if it has also to record its *number* of oscillations without disturbance, it begins to be a more complicated mechanism.

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¹ NATURE, 137, 313 (1936).

² cf. Edmondson, NATURE, 133, 759 (1934).

Genotypic Control of Chromosome Size

THE differences in size between the chromosomes of related species are usually differences that can be attributed to structural changes such as fusion, fragmentation, etc. In many groups, however, enormous differences of size are found, which may be of the order of 1:100 or even 1:1,000. Such differences, uniformly affecting as they often do the whole complement, must be due to a unitary genotypic control of chromosome size. In other words, the size of chromosomes, like other properties of the organism, must be subordinate to the action of the genes they carry¹.

Experimental examples of this principle are very rare, the only clear case being that of a bud sport in a triploid plant presumed to be a hybrid between diploid and tetraploid *Tradescantia* species with different chromosome sizes. The mutant had chromosomes 1/5 the size of the stock².

In experimental material of grasses³, kindly supplied by Dr. T. J. Jenkin, of the Welsh Plant Breeding Station, Aberystwyth, I have been able to

find evidence of the inheritance of this genotypic property governing chromosome size. A male sterile plant of *Lolium perenne* (Fig. 1, A), with chromosomes of about a quarter the size of the normal, was crossed with a normal plant and gave 8 male sterile seedlings, two of which were examined. One of them (Fig. 1, B) proved to have chromosomes of normal size for the species. The other (Fig. 1, C) has chromosomes of more than twice this size.

I have found similar differences in crosses between *Festuca arundinacea* and *F. pratensis*⁴.

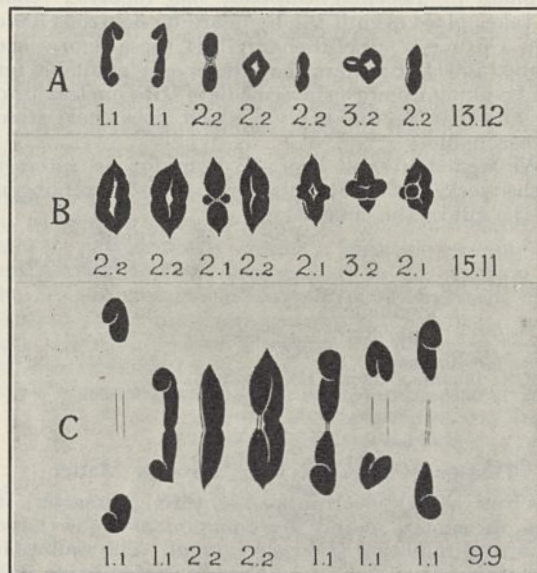


FIG. 1. Metaphase and early anaphase bivalents in three *Lolium perenne* plants. A is the female parent of both B and C. Total and terminal chiasmata are given under each bivalent. Acetocarmine preparations. \times about 1,700.

Further study will be necessary to determine the mode of inheritance of this character, but the present observations prove that it is subject to Mendelian segregation. They therefore throw doubt on statements that characteristic chromosome size differences between species are maintained in their hybrids. Some of these statements have already been disproved⁵.

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¹ Darlington, *Amer. Nat.*, 66, 25 (1932).

² Darlington, *J. Genet.*, 21, 207 (1929).

³ Jenkin, Welsh Plant Breeding Station Bull., H.12 (1931).

⁴ Jenkin, *J. Genet.*, 28, 205 (1934).

⁵ Upcott, *J. Genet.*, (in the press).

Behaviour of Local *Drosophila melanogaster* during Late Larval Stage

DURING March 1935 a few local *Drosophila* flies which emerged from the soil and leaves of a millipede culture of Dr. N. F. Paterson were collected, and a culture was started. The stock proved to be of good viability; the flies were identified as *Drosophila melanogaster*. After the cultures had been kept for a few generations it was observed that the larvae of this 'Witwatersrand' stock displayed an interesting difference in behaviour compared with the standard *D. melanogaster* cultures. During their late larval

stage, the larvæ of the latter, in order to pupate, creep up against the side of the culture bottle, whereas those of the 'Witwatersrand' stock only very occasionally behave in this manner, the great majority pupating on or even in the culture medium. We tentatively labelled this behaviour as 'positive hydrotropism' in contrast to the general 'negative hydrotropism' of *D. melanogaster*.

This positive behaviour apparently is the cause of the high percentage of wing abnormalities observed in our 'Witwatersrand' cultures, for when the flies emerge from the moist culture medium their wings often fail to unfold normally.

On April 14 this year, a random culture of our Witwatersrand stock was used for two series of selection experiments, a negative and a positive series. This culture had eight pupæ on the side of the bottle and between 150 and 200 on the culture medium. The negative series started with the eight pupæ removed from the side of the bottle, and the positive series with the pupæ on and in the culture medium. This method of selection was effected for each generation obtained. It follows that the number of parents each time for the negative series was very small in comparison with that of the positive series. This notwithstanding, the eight generations so far obtained for the negative series show an average of 38 negative pupæ per generation, and an average of only 10 negative pupæ for the six generations so far obtained for the positive series. The negative pupæ in the latter, after being counted, were always destroyed, and only the positive pupæ used; in the former only the negative pupæ were used.

It seems justified to conclude that this negative behaviour differs innately from the general positive behaviour of our Witwatersrand stock. Probably multiple factors are involved. This general positive behaviour again differs innately from the general negative behaviour of the standard stocks of *Drosophila melanogaster*.

Furthermore, several experiments have been made to cross our Witwatersrand stock with the standard *D. melanogaster* stocks, but without success.

It seems reasonable to conclude that our local Witwatersrand stock must belong to a geographic race of *D. melanogaster*.

We are indebted to Dr. Smart of the British Museum and to Dr. Paterson of the University of the Witwatersrand for the trouble taken to identify the flies, and also to Messrs. Paff and Bosazza for the photographs taken.

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July 8.

Creeping Movements of *Spirogyra*

THERE are several references in the literature to the movement and behaviour of masses of the alga *Spirogyra* when kept under water in a vessel. Hofmeister¹ described the unravelling of the filaments into wave-like hanks; this he believed to be due to the action of light. The same author, Oltmanns² and Langer³ have also described the way in which the algal threads creep considerable distances up the sides of a containing vessel. Oltmanns suggested that the latter movement might be related to a secretion of mucilage from the cells. Langer showed that it was not a growth movement, and that it took

place more rapidly and vigorously in the dark than in the light.

We have carried out a series of experiments to discover the effect of non-plasmolyzing solutions of various electrolytes and non-electrolytes upon the extent of these creeping movements in a species of *Spirogyra* tentatively named as *S. longata* Vauch. The method employed was the same for all experiments. A fixed quantity by weight of the alga was placed in a series of different solutions of electrolytes

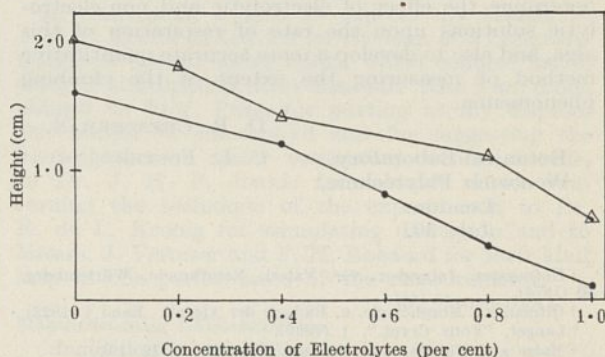


FIG. 1. Graph to show the relation between the extent of climbing and the concentration of electrolytes; —△—△—, potassium nitrate; —●—●—, sodium chloride.

and non-electrolytes in tap water, of concentrations ranging from 0.0 per cent to 1.0 per cent contained in similar test-tubes. The volume of the solution was constant for all the experiments. Since it was found that light had an inhibiting effect upon the creeping movements, the experiments were carried out in the dark. Measurements of the heights climbed above the meniscus of the solution were made after a period of twenty-four hours.

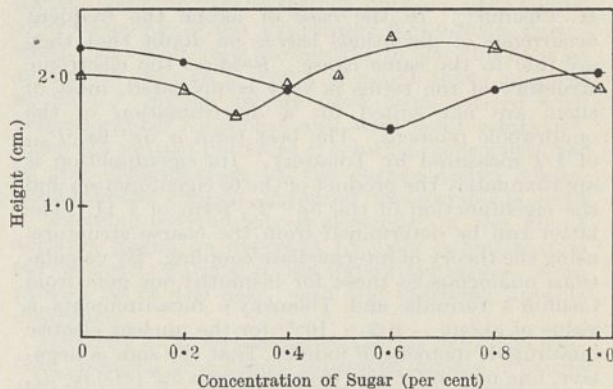


FIG. 2. Graph to show the relation between the extent of climbing and the concentration of non-electrolytes; —●—●—, dextrose; —△—△—, sucrose.

Using electrolytes such as sodium chloride and potassium nitrate, it was found that with increasing concentration of the electrolyte there was a corresponding decrease in the climbing effect. This is illustrated by Fig. 1.

Using non-electrolytes such as dextrose and sucrose, it was found that up to a certain definite concentration the behaviour was very similar to that obtained using electrolytes. Beyond this point, however, the effect was reversed and a further increase in concentration caused an increase in the extent of climbing (Fig. 2).

There seems to be a parallel between our observations on the effect of sugars upon the extent of climbing of these algal filaments and those of Maige and Nicolas⁴ upon the effect of sugar solutions on the respiratory activity of various plant tissues. The latter showed that, during the first period of immersion in a sugar solution, a plant tissue showed a period of decreasing respiratory activity followed by one of increasing activity during the period of sugar penetration.

It is hoped to carry out further experiments to determine the effect of electrolytic and non-electrolytic solutions upon the rate of respiration of this alga, and also to develop a more accurate quantitative method of measuring the extent of the climbing phenomenon.

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July 30.

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C. L. FOSTER.

¹ Hofmeister, Jahresber. ver. Vaterl. Naturkunde, Württemberg, 30 (1874).

² Oltmanns, "Morphologie. u. Biologie der Algen". Band 1 (1922).

³ Langer, "Folia Crypt.", 1 (1930).

⁴ Maige and Nicolas, *Ann. sci. nat. Bot.*, Sér. 9, 12 (1910).

The Electric Quadrupole Moment of the Nucleus ¹²⁷I₅₃

THE hyperfine structures of many terms in the arc, as well as in the first spark, spectrum of iodine show deviations from Landé's rule¹. As Murakawa has pointed out, the cause of this may be an electric quadrupole moment of the nucleus. The existence of such nuclear quadrupole moments was shown for the first time by Prof. H. Schüler and me in europium and cassiopeium². The exact theory was given by H. Casimir³. In the case of iodine the frequent occurrence of deviations leaves no doubt that they are due to the same cause. Because the electronic structure of the terms is very complicated, most of them are not suited for a determination of the quadrupole moment. The best term is $5p^4 6s \ ^4P_{5/2}$ of I I measured by Tolansky. Its eigenfunction is approximately the product of the $6s$ eigenfunction and the eigenfunction of the $5p^4 \ ^3P_2$ term of I II. The latter can be determined from the coarse structure, using the theory of intermediate coupling. By calculations analogous to those for bismuth⁴ one gets from Casimir's formula and Tolansky's measurements a value of about -0.2×10^{-24} for the nuclear electric quadrupole moment of iodine. That the sign is negative, one may infer also from the term $5p^3 \ (^2D) 6s \ ^3D_2$ measured by Murakawa.

Two remarks should be added: first, Murakawa and Tolansky have determined the spin of iodine only by means of the interval rule. As we know it fails in most terms, the value of $7/2$ cannot be excluded at present. Secondly, the structure of $^4P_{5/2}$ of I I was deduced by Tolansky under the assumption that the combining higher levels have no perturbation. His measurements on several lines seem to show that $^4P_{3/2}$ and most of the higher levels have deviations in the same direction as $^4P_{5/2}$. This would make the deviation in $^4P_{5/2}$ somewhat greater.

All one can say at present is, that the sign of the quadrupole moment is negative and that its value is smaller than -0.5×10^{-24} . The negative sign

indicates that the charge distribution is flattened in the direction of the spin axis. It may be noted that the positive quadrupole moments now determined (^{75}As , $^{151}, ^{153}\text{Eu}$, ^{175}Yb , ^{201}Hg) have values ranging up to 5×10^{-24} , whereas the negative quadrupole moments ($^{63}, ^{65}\text{Cu}$, ^{127}I , ^{209}Bi) all have values⁵ smaller than -0.5×10^{-24} .

Note added in proof: Recently, L. A. Strait and F. A. Jenkins⁶ have shown by means of intensity measurements in the band spectrum that the spin of iodine is $5/2$.

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¹ S. Tolansky, *Proc. Roy. Soc.*, **152**, 663 (1935); *Proc. Phys. Soc.*, **48**, 49 (1936); K. Murakawa, *NATURE*, **137**, 1030 (1936).

² H. Schüler und Th. Schmidt, *Z. Phys.*, **94**, 457 (1935); **95**, 265 (1935).

³ H. Casimir, *Physica*, **7**, 719 (1935).

⁴ H. Schüler und Th. Schmidt, *Z. Phys.*, **99**, 717 (1936).

⁵ H. Schüler und Th. Schmidt, *Z. Phys.*, **98**, 430 (1936).

⁶ L. A. Strait and F. A. Jenkins, *Phys. Rev.*, **49**, 635 (1936).

In the preceding note, which the Editor of *NATURE* has been good enough to let me see in advance of publication, Schmidt, following Murakawa¹, suggests that the frequent occurrence of perturbations in terms of both the arc and spark spectra of iodine indicate a nuclear quadrupole moment. This may be correct, but as I have shown that at least in the spark spectrum² term interaction perturbation occurs, and in view of the complex electronic structures involved, it is very likely that the perturbations may be due to either of the above causes or possibly both, depending upon individual terms (that is, if a quadrupole moment is assumed to exist). This fact makes caution desirable and any calculation of the quadrupole moment can only be very approximate. Schmidt has been obliged to employ my measurements for the arc spectrum, and as I have previously pointed out, the structures in this spectrum are not so well resolved as in the spark spectrum. His calculation is therefore based upon a small deviation from the interval rule in which I was not able to prove whether more than one level was affected, so that the type of perturbation is uncertain.

Regarding Schmidt's suggestion that the spin may be $7/2$, it may be pointed out that Murakawa³ (spark spectrum), Tolansky⁴ (arc spectrum, spark spectrum) and Lacroute⁵ (Zeeman effect) all give $5/2$. This value may be considered as certain, therefore, particularly in view of the Zeeman effect support.

The approximate quadrupole moment suggested by Schmidt is of course only tentative. I am engaged now in investigating the fine structures in the ultra-violet lines of the iodine spectra with the view of obtaining further data.

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University of Manchester.
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¹ K. Murakawa, *NATURE*, **137**, 1030 (1936).

² S. Tolansky, *Proc. Phys. Soc.*, **48**, 49 (1936).

³ K. Murakawa, *Sci. Pap. Inst. phys. chem. Res. Tokyo*, **20**, 285 (1933).

⁴ S. Tolansky, *Proc. Roy. Soc.*, **A**, **149**, 269 (1935); *Proc. Roy. Soc. A*, **152**, 663 (1935); *Proc. Phys. Soc.*, **48**, 49 (1936).

⁵ P. Lacroute, Thesis (Faculty of Science, University of Paris, Nov. 1934).

Monomolecular Layers of Chlorophyll

IN order to study the properties of monomolecular layers of chlorophyll, a mixture of the modifications *a* and *b* in the proportion 3:1 (the proportion encountered in living plants), furnished by Prof. Stoll of Basle, was dissolved in ether or acetone. The solution was first added to pure water, to 0.01 normal and to 0.1 normal sulphuric acid. The relation obtained between area and pressure showed that a monomolecular layer actually is formed. No noticeable difference was found between the case of pure water and that of the acid, so that all the results can be incorporated in Curve I (Fig. 1). The spreading with a solution in acetone is recommended because on account of the greater volatility of the ether, traces of solid chlorophyll frequently remain at the opening of the pipette, making it more difficult to obtain reproducible values. Curve I corresponds to a film of the liquid type. The limiting area per molecule at zero compression is 124 \AA^2 , a value in satisfactory agreement with the value of about 133 \AA^2 , recently given by Hughes¹. The small difference probably is due to impurities. At a pressure of about 26 dynes per cm. the film becomes polymolecular, the curve becoming a horizontal line.

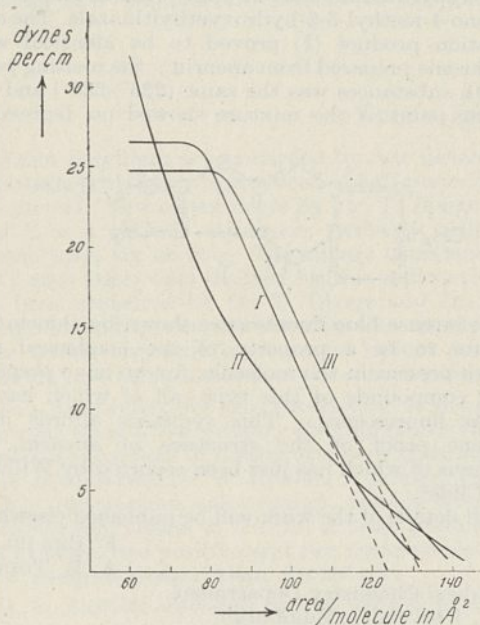


FIG. 1.

As the chlorophyll molecule possesses several double bonds, another curve was expected when spreading on an acid solution of potassium permanganate. This expectation proved to be justified. Curve II was obtained on a 1 per cent solution of potassium permanganate in 0.1 normal sulphuric acid. Over the whole range, but more particularly at small pressures, the film is more compressible than the films previously studied. It was impossible for us to measure the pressure where the film becomes polymolecular, this pressure being too high for registration by the instrument used.

Finally, the behaviour of chlorophyll on water containing carbon dioxide was studied. Great care had to be taken not to have the water over-saturated with carbon dioxide. Ultimately the experiments were carried out on water in equilibrium with

carbon dioxide at one atmosphere. The results are contained in Curve III. The molecule appears to require a greater space under the influence of carbon dioxide, having a limiting area of 132 \AA^2 . That this is not due to the acid character of the solution is indicated by the experiments on sulphuric acid. The pressure required to make the film polymolecular is slightly less than in the case of pure water. Experiments with nitric oxide showed that this gas, which in its physical properties (solubility, etc.) strongly resembles carbon dioxide, has no effect.

In conclusion, I wish to express my thanks to Prof. E. Gorter in Leyden for the loan of a Langmuir trough of special construction, which enabled me to work in atmospheres other than air. Also I am much obliged to Prof. Prins for putting at my disposal the sample of chlorophyll and for suggesting the investigation on water containing carbon dioxide, to Dr. J. H. P. Jonxis for valuable advice concerning the technique of the experiments, to Dr. R. de L. Kronig for stimulating discussion and to Messrs. J. Vermeer and F. H. Robaard for their kind help in the performance of the measurements.

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¹ A. Hughes, *Proc. Roy. Soc., A*, **155**, 710 (1936).

Contact Potentials of Reversible Soluble Films of Lauric Acid

WHEN a nearly saturated solution of lauric acid in distilled water is placed in an Adam-Jessop film-pressure trough, the soluble adsorbed film may be compressed or swept in the same manner as an insoluble film of a higher fatty acid. However, the surface is rapidly replenished by diffusion from below, after sweeping, or the compressed film diffuses downward. In either case the reading of the film-balance returns to zero, in a period of about thirty minutes at 25°C . Similar effects have been noticed with benzopurpurin solutions¹ and with soap solutions². Since the contact potential of solutions is proportional to the concentration of the surface-active solute, simultaneous contact potential measurements with a polonium-covered silver electrode on the above surfaces might be expected to yield potential-time curves nearly parallel to the force-time curves. Such proved to be the case, with the following notable differences.

Referred to a pure water surface as zero, the contact potential of a nearly saturated surface of lauric acid solution is -120 mv . Upon sweeping rapidly, the surface tension of the swept surface rises about five dynes and returns to its original value slowly. The surface potential immediately after sweeping rises to 0 mv , and falls rapidly to -100 mv in twelve minutes, whilst the surface tension has changed but a dyne per centimetre. This result is to be expected, since the first film to be formed by diffusion from below is necessarily dilute, and contributes but a small surface pressure, but a large change in surface potential. After twelve minutes the film becomes more close-packed, and the surface tension falls more rapidly, while the potential changes but slightly, in complete accordance with the results of Harkins and Fischer³ on lauric acid films spread by the aid of a solvent.

Upon compression, the pressure may rise to so high as 25 dynes per centimetre, while the potential drops to -200 mv. Both surface potential and surface pressure return to their equilibrium values in half an hour, the surface pressure falling very rapidly, due to solution of the compressed film, to a value of 6 dynes per cm., in two minutes. This is again in accordance with expectations, since Harkins and Fischer found that a highly compressed film of lauric acid lowers the surface potential about 80 mv. more than that of a dilute film.

These results indicate that (1) the time element is very important in the determination of surface tension of solutions of surface-active materials, (2) determinations of surface potentials by dynamic methods (such as Kenrick's jet method) are unsuited for examination of solutions of materials such as these which require considerable time for equilibrium in the surface.

The work is being continued on solutions of undecylic acid.

The results obtained by Bouhet⁴ by an optical method may be mentioned as further evidence that sweeping a solution of a higher fatty acid removes the adsorbed film, the swept surface then having the physical properties of a pure water surface.

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July 31.

¹ Doss, *Current Sci.*, **4**, 405 (1935).
² McBain and Wilson, private communication, and *J. Amer. Chem. Soc.*, **58**, 379 (1936).
³ *J. Chem. Phys.*, **1**, 852 (1933).
⁴ *Ann. Phys.*, **x**, 15, 5 (1931).

Dissociation Pressure of Copper Sulphate Pentadeuterate

J. R. PARTINGTON and K. Stratton¹ have found by a tensimetric method the dissociation pressure of copper sulphate pentadeuterate to be 6.655 mm. Hg at 25° C., and 9.285 mm. Hg at 30° C. One of us, in collaboration with H. Perpéro², has constructed a tensimeter by means of which he ascertained in a preliminary experiment that the dissociation pressure of copper sulphate pentadeuterate is lower than that of the pentahydrate. Continuing this research, we have modified the original tensimeter so that the pressures are now measured by means of an ordinary shortened manometer instead of a differential one, the new results being as follows:

° C.	20	30	40	50	60
mm. Hg	4.4	9.9	21.0	42.1	80.9

For 25° the value of 6.5 mm. Hg is found by interpolation.

The pressures obtained are in good accord with those measured by Partington and Stratton, giving in addition a wider range of temperature. The value published in collaboration with H. Perpéro², which is mentioned by F. T. Miles, R. W. Shearman and Alan W. C. Menzies³, was not intended to be exact, as is seen from the fact that it was rounded off to whole units and mentioned only in passing in a paper describing the apparatus, and is decidedly a little too low, whereas the measurements of Miles, Shearman and Menzies lead, on the contrary, to dissociation pressures a little too high, if we understand these authors rightly.

The aim of the communication published with H. Perpéro was not to give a precise value of the dissociation pressure of copper sulphate pentadeuterate, but to show only that this pressure is lower than that of the pentahydrate, which is corroborated by experiments of the authors quoted.

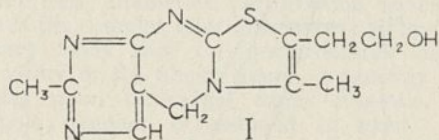
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¹ *NATURE*, **137**, 1075 (1936).
² *J. Phys. et le Rad.*, vii, 6, 439 (1935).
³ *NATURE*, **138**, 121 (1936).

Synthesis of Thiochrome

THE formation of thiochrome by oxidation of aneurin (vitamin B₁) with alkaline potassium ferricyanide was first reported in these columns¹. Continuation of our synthetic work² has resulted in the synthesis of thiochrome. 2-Methyl-4-chloro-5-chloromethylpyrimidine, synthesized from 2-methyl-4-hydroxypyrimidine-5-acetic ester, was condensed with 2-amino-4-methyl-5-β-hydroxyethylthiazole. The condensation product (I) proved to be identical with thiochrome prepared from aneurin; the melting point of both substances was the same (225°-226°) and the melting point of the mixture showed no depression.



The intense blue fluorescence shown by thiochrome appears to be a property of the condensed ring system present in the molecule, for we have prepared other compounds of this type, all of which have a similar fluorescence. This synthesis affords independent proof of the structure of aneurin, the synthesis of which has just been reported by Williams and Cline³.

Full details of the work will be published elsewhere.

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¹ Barger, Bergel and Todd, *NATURE*, **136**, 259 (1935).
² Bergel and Todd, *ibid.*, **138**, 76 (1936).
³ *J. Amer. Chem. Soc.*, **58**, 1504 (1936).

The Amylase System of Rice Grain during Ripening and Germination

THE formation and properties of α- and β-amylases in germinating grains have been frequently studied by many investigators. Some workers¹ believe that dormant grains contain only β-amylase which increases during germination, while α-amylase appears only during sprouting. Others² consider that the increase in amylolytic activity during germination is not a fresh enzyme formation, but is due to an activation by an activator of organic nature,

'amylokinase', which arises during the process of germination, or to an increase in the soluble part of the amylase, especially in the case of the β -component, which increase is based on proteolytic decomposition. Our researches on the amylolytic changes during ripening and germination of rice grains have thrown fresh light on this important question. The results thus far obtained may be briefly summarized as follows.

The rice grain contains both α - and β -amylases, which are differentiated by their hydrolysis of amyloamylose, according to the method introduced by Samec and Waldschmidt-Leitz³. These two amylases are further differentiated by their differences in pH optima, the α - and β -amylases having their optima at pH 7.0 and 4.6 respectively. At their optimum pH, they behave like pure α - and β -amylases in their hydrolysis of amyloamylose. In the case of the amylase the optimum pH of which lies at pH 7.0, the iodine colour end-point (violet) was reached without any measurable maltose formation. This observation demonstrates for the first time the occurrence in plants of an amylase of pH optimum 7.0, which in the early stages of starch digestion yields no reducing groups.

These two enzymes are present in the dormant

seed, and exist largely in the insoluble condition, so that they cannot be extracted with water, but they can be obtained in an active state by extraction with phosphate buffer (M/15) at pH 7.0. The α -amylase becomes inactive (in the sense that it cannot be extracted with water) as ripening advances, and again becomes active during germination. In the light of these findings, it can be said that the view put forward by Ohlsson and co-workers, that the amylase arises only during the germination of grains, is untenable. Further work on the behaviour and nature of these enzymes during germination and storing, their distribution in the seed and their relation to the cooking quality of rice is in progress.

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¹ G. Nordh and E. Ohlsson, *Z. physiol. Chem.*, **204**, 89 (1931-32); E. Ohlsson and C. E. Uddenberg, *ibid.*, **221**, 165 (1933); E. Ohlsson and O. Edfeldt, *ibid.*, **221**, 174 (1933).

² E. Waldschmidt-Leitz, M. Reichel and A. Purr, *Naturwiss.*, **20**, 254 (1932); K. Myrback and S. Myrback, *Biochem. Z.*, **258**, 158 (1933).

³ M. Samec and E. Waldschmidt-Leitz, *Z. physiol. Chem.*, **203**, 16 (1931).

Points from Foregoing Letters

WHEN beryllium is bombarded by fast neutrons, a radioactive substance is produced of half-period about one second. New experiments by Dr. T. Bjerger show that it is a gaseous substance, probably helium of atomic mass six or five. The energy distribution of the β -rays (electrons) emitted by this radioactive gas has been measured by Dr. T. Bjerger and Dr. K. J. Broström, and agrees with the view that the electrons arise during the transformation of helium atoms of mass six into lithium atoms of the same atomic mass.

The probability for the production of secondary electrons when a fast primary electron passes through various thicknesses of matter has been calculated by H. J. Bhabha and Dr. W. Heitler. A primary electron of 2×10^9 electron volts energy, passing through a thickness equivalent to 1.6 cm. of lead, produces, on the average, two positive and two negative electrons, with energies greater than 2×10^7 e.v.

M. S. Bartlett discusses further aspects of the uncertainty principle applied to time, and conceives that, in relation to an ideal time defined in terms of the number of interactions that take place, our observable time may slow down, as the universe approaches equilibrium. Such a 'slowing down' of observable time would be equivalent to an expanding universe or a decrease in the velocity of light.

The occurrence of chromosomes of double normal size in a male sterile specimen of the perennial ryegrass, *Lolium perenne*, is described by P. T. Thomas. The mode of inheritance indicates that chromosome size is subject to Mendelian segregation.

Drosophila cultures derived from flies collected on the Witwatersrand and bred by Dr. G. Eloff, although identified as *D. melanogaster*, nevertheless show a remarkable innate difference in behaviour in that during late larval stage, contrary to the general behaviour of the standard *D. melanogaster* cultures, the larvæ stay on or even in the culture medium in

order to pupate; also, crosses between the two types of stocks are sterile.

Spirogyra, in the dark, climbs up the sides of the containing vessels. Solutions of electrolytes such as sodium chloride or potassium nitrate up to one per cent in concentrations—which do not produce collapse due to loss of water (plasmolysis)—are found by D. R. Chesterman and C. L. Foster to reduce the creeping. With non-electrolytes the behaviour up to a definite point is similar; beyond this point it is reversed. The authors suggest that these results may be related to effects upon the respiratory activity of the algal cells.

From measurements of the iodine hyperfine structure Dr. Th. Schmidt concludes that the iodine nucleus has a negative electric quadrupole moment smaller than -0.5×10^{-24} . The negative sign means that the charge distribution is flattened in the direction of the spin axis. Dr. S. Tolansky points out that the perturbations upon which Dr. Schmidt's calculations are based may have a different origin, and therefore the approximate quadrupole moment suggested can only be considered tentative.

From experiments with monomolecular surface films of chlorophyll, W. Sjoerdsma finds an area per molecule of 124 square Angstrom units. Under the influence of carbon dioxide, the chlorophyll molecules appear to require a greater space (132 \AA^2).

The rate of change in surface pressure and in the contact electrical potential when the surface of a solution of lauric acid is swept clean of its adsorbed film and the lauric acid allowed to re-accumulate at the surface, by diffusion from the interior of the solution, have been determined by R. T. Florence, R. J. Myers and Prof. W. D. Harkins. They point out that possible variations due to the time factor must be taken into account when measuring the surface tension or surface potential of such solutions.

Research Items

Social Origins in India

Two things in the social organization of India immediately strike the observer, it is pointed out by K. P. Chattopadhyay (*J. Asiat. Soc. Bengal. Letters*, 1, 1935) in discussing peculiarities of caste in relation to early racial movement. One is the peculiar system of endogamy combined with exogamy running through the whole system, the other is that the giving of food and drink, or acceptance thereof, between different social groups depends on certain ideas of purity associated with the groups. In the course of further discussion, it is also noted that theories of caste, which have been put forward, tend to ignore local differences. Applying to conditions in India the results of an analysis of culture and the effects, issuing in rivalry and group isolation, presumably produced by racial migrations, it would appear that there were not two, but three cultured peoples who contended for mastery in India and built up the caste organization. Of two early streams of culture bringers one was a fisher folk, who were acquainted with, or later acquired, knowledge of iron and practised a rude form of agriculture, comparable to jhuming, but not terracing or systematic irrigation. Another people worked copper, silver and gold and practised terraced irrigation with hoe cultivation. Cattle were valued for meat only. A third stream of later date is associated with cattle for dairy work, but not for plough cultivation. This last-named employment of cattle is associated with another people, who sometimes preceded and sometimes followed the dairy folk. With this people and the people of the hoe cultivation is a tradition of origin from, or occurrence of, incestuous unions of brothers and sisters. The fisherfolk practised burial, at first in the house, but the hoe culture people practised cremation. In some instances the burial people, after being submerged, again recovered and then a formal, but not actual, cremation was made to precede burial. Alliances between different groups and bitter struggles appear to have taken place before equilibrium was reached and the caste system evolved.

Hormones and Evolution

IN a communication recently presented to the Royal Anthropological Institute, Dr. S. Zuckerman discusses the evidence bearing upon the relation of hormones to the evolutionary problem (*Man*, 1936, August). How far, it is asked, is the endocrine system responsible for physical and psychological characteristics; what value is to be attached to Bolk's view of the endocrine mechanism as one through which man has become a fetalized primate? Does the so-called hormone theory of evolution in fact reveal some novel evolutionary mechanism? Recent research has largely justified the *a priori* view that all the characteristics of the organism are moulded by an endocrine mechanism to subserve the developmental integration of the various bodily systems, in order that the correlated action of an organism as a whole should be possible. At the same time, physical and psychological characters are dependent on an enormous number of factors besides hormones. There is not the slightest direct experimental evidence in support of the view that different individuals and

different racial types possess distinctive types of endocrine balance. We do not yet possess the data for making definite interpretations of racial types in terms of hormones. There is a correspondingly unfortunate lack of evidence in Bolk's view of the fetalization of man, and within the order of primates an orderly process of fetalization cannot be recognized. Yet it is not unlikely that human evolution may have proceeded by a series of changes in the endocrine complex; but we are defeated in any attempt to find in this conclusion some novel understanding of the evolutionary process. The endocrine complex, like any other character, is genetically determined, and we have no knowledge that the effect of its response to environmental influence is transmitted to a succeeding generation. The available facts of endocrinology provide no measuring rod by which to estimate the divergence between different racial types.

Sickness Absence and Labour Wastage in Industry

AN attempt has been made by the Industrial Health Research Board of the Medical Research Council, by an investigation of data furnished by several organizations, to obtain some sort of datum line by which absenteeism due to sickness and wastage by lapsing from employment may be evaluated (Report No. 75. London: H.M. Stationery Office. 1s. 3d. net). This Report is divided into two parts, sickness being dealt with by May Smith and Margaret Leiper in Part i, and labour wastage by Major Greenwood and May Smith in Part ii. The measurement and incidence of sickness absence in clerical work and light organizations are considered, and in two large groups examined the rates for men are 3 days and 4½ days respectively, and for women 4 days and a little more than 6 days, per year. The crude rates obtained are subject to various fallacies, for example, long periods of absence due to serious illness of two or three workers may upset any simple arithmetical ratios obtained. Respecting labour wastage, the problem to be solved is discussed, the crude wastage rate is considered, and an 'industrial life table' is constructed. The actual labour wastage in two organizations is then studied, and various interesting features emerge from the analysis. Finally, suggestions are made for recording and analysing sickness absenteeism and labour wastage.

False-killer Whale in Scotland

Two papers dealing with the recent stranding of false-killer whales (*Pseudorca crassidens*) in Britain record an exceptionally interesting occurrence (*Scottish Naturalist*, 1936, p. 93). The greatest stranding, of forty-one individuals, took place in the Tay Estuary on November 27, 1935; but odd occurrences of single individuals or of small groups up to eleven in number which took place between November 16 and December 10, and ranged along the east coast from Norfolk to Montrose, show that a considerable movement must have been taking place in the North Sea. Prof. A. D. Peacock and his collaborators have recorded minutely the measurements and other striking characters, of the Carnoustie school of whales, reserving more detailed studies for later publication.

Hydroids from the West Indies

DR. EUGÈNE LELOUP in his monograph "Hydraises Calyptoblastiques des Indes Occidentales" (Mémoires du Musée Royal d'Histoire Naturelle de Belgique, Deuxième Série, Fasc. 2, 1935) describes collections made by P. Wagenaar Hummelinck on his voyage in 1930 to the West Indies, especially to the Islands Bonaire, Curaçao and Aruba. With these are specimens taken from floating Sargasso weed in the Atlantic and a series of calyptoblastic hydroids dredged at Dry Tortugas (Florida), the last sent by Dr. Waldo L. Schmitt, Smithsonian Institution, U.S. National Museum. Among these hydroids, four are found for the first time in the Atlantic: *Halecium dyssymetrum* from Florida, hitherto only known from the East Indies, and for the first time recorded since the type specimens were described; *Synthecium cylindricum* var. *pusilla* on Sargassum weed, previously known only from the Pacific; *Laomedea kincardi* and *Sertularella minuscula* from Bonaire, previously known only from the Pacific and from the Indian Ocean respectively. Several other forms are reported for the first time since the discovery of the type specimens, and many are new records for certain localities. Among the fifty species and varieties described there are three new to science.

Principal Rots of English Oak

A SMALL volume on this subject by Messrs. Cartwright and Findlay of the Forest Products Research Laboratory has been issued by the Department of Scientific and Industrial Research (London: H.M. Stationery Office, 1936). Existing knowledge and recent work carried out at the Laboratory on the principal fungi causing decay in English oak are detailed and illustrated. One of the fungi attacking the tree is known as the beef-steak fungus, and the attack increases the value of the timber, producing the so-called 'brown oak' which fetches a higher price and is much valued in France. The report states that the general measures for controlling the attack of heart-wood of trees by fungi are the prevention, by silvicultural methods, of the formation of large branches which may die by becoming infected with fungi. Attacks of this nature are serious in parts of England; but in some of the best managed oak forests in France are unknown. Probably one of the best preventives is to keep the young plantations dense and thin lightly in the earlier stages of growth; and to grow oak in mixture, preferably when possible with its natural companion beech. The economic aspects of the various rots of felled timber are dealt with; and a final section treats of the stains and discolorations of oak wood such as 'golden oak', yellow, grey stains and chemical stain.

Composts for Mushroom Growing

THE food requirements of the common mushroom have not yet been determined with accuracy, though a considerable amount of success has been obtained with composts of a more or less synthetic nature. Mr. G. Paterson-Hart has described a number of such mixtures (*Gard. Chron.*, Aug. 1, 1936). Soya bean compost, a mixture of bean straw with tree leaves, and sphagnum moss impregnated with stable drainage, have proved fairly successful. Straw, covered with soil, and impregnated with salt solution, has grown mushrooms, whilst grass cuttings, ditch clearings, tree leaves and straw, when mixed and covered with mould, make quite a successful bed.

The problem would seem to be to identify the common factor in all these different mixtures, and also in such varying habitats as stable sand dunes and heathy woods, where the fungus grows naturally.

Air Conditioning in Living Rooms

A SIMPLE device for humidifying air to a degree best suited for breathing has been developed by the A.E.G. Co. of Berlin and is described in *A.E.G. Progress*, No. 2, 1936. The water to be evaporated is contained in a tank in which rests a frame with capillary pads consisting of absorbent blotting paper overlapped and sewn together. These pads are completely saturated with water and can be readily replaced. The evaporation of the water is accelerated by an electric fan built into the back wall of the protective case. With a relative air humidity of 50 per cent and a temperature of 68° F., the apparatus evaporates about 7 oz. of water per hour. It is found that one filling of water is sufficient for eight hours operation. The quantity of water evaporated varies to a certain extent with the condition of the air, the rate increasing with the heat and the degree of dryness. The apparatus has been found useful in living rooms where the atmosphere gets close, in nurseries, in offices where smoking is allowed, as well as in hotels, hospitals, etc. In countries where a dry and warm summer climate has already rendered the electric fan indispensable, the apparatus is particularly useful, producing a refreshing and vitalizing effect.

The Nitrous Oxide Molecule

ALTHOUGH the molecules of carbon dioxide and nitrous oxide are both linear, it is known that one is symmetrical and the other unsymmetrical:



Cheng E. Sun and Ta-Yu Wu (*J. Chinese Chem. Soc.*, 4, 340; 1936) show that this difference may be explained by the energy contents of the two molecules. They used the semi-empirical method of Eyring and found that the unsymmetrical form of nitrous oxide has a lower energy content than the symmetrical form, whilst the reverse is the case with carbon dioxide. Although the method is only approximate, the differences between the energies of the two forms are sufficiently large to be significant.

Recent Advances in Enzyme Chemistry

IN a summary of recent work on enzymes, Prof. E. Waldschmidt-Leitz (*Chemistry and Industry*, 55, 620; 1936) points out that crystalline enzymes (urease, pepsin, trypsin, etc.) are all proteins, yet the reactions show that an enzyme cannot merely be a protein, the existence of a specific active grouping being necessary for enzyme differentiation. An iron porphyrin complex is the active group of liver and pumpkin catalases as well as of the peroxylase of horse-radish. A low molecular weight flavine compound, vitamin B₂, when connected with a protein carrier, becomes a true enzyme, the yellow respiratory ferment. The 'two-affinities' theory of von Euler, according to which an enzyme must be capable of reacting with its substrate at two distinct points in the molecule, is shown to be most defensible. The action of activators (for example, trypsin by enterokinase) is probably due to intermediate compound formation. Many other interesting features of enzyme chemistry are considered in the article.

Plankton Research

A SPECIAL plankton meeting was held by the International Council for the Exploration of the Sea in May 1935. The reports are published in vol. 95 of the *Proceedings* recently published. The papers by F. S. Russell and A. C. Hardy give an excellent picture of some aspects and methods of plankton research. H. Höglund and S. Landberg report on investigations upon photosynthesis of phytoplankton by constant illumination, and B. Schulz on hydrographical problems.

In Russell's paper, all those studies of zooplankton are reviewed which are concerned with: (1) the distribution and abundance of the plankton in the open ocean and (2) in the coastal waters; (3) the relation of the animals with animate and inanimate environments and the causes of their fluctuation in abundance. A table based on data of various workers brings out facts of great interest, such as the greater number of cold-water species in the south as opposed to the north, the phenomenon of bipolarity of some planktonic species, the small number of purely subantarctic species of copepods, and differences between the faunas of the different oceans. The bearing of the plankton distribution upon the interpretation of hydrographical data is stressed. The author himself, in a notable study of the *Sagitta* population at Plymouth, has found that *S. elegans* is an indicator of Atlantic water and *S. setosa* of Channel water. Another important aspect dealt with is the relations between the plankton and the fish. "If correlations can be shown to hold consistently for a number of years it should be possible to predict certain conditions in the fisheries." Several other problems are discussed and attention directed to the need for further studies of life-histories and habits, food supply, and for more experimental work.

Hardy gives a preliminary account of experiments made by him and the research staff of the Oceanographic Department in Hull in the charting of the North Sea plankton. A new instrument has been used for the survey, the 'continuous plankton

recorder'. This is an ingenious torpedo-shaped machine provided with a system of planes and a shock absorber, and inside with two bandings of filtering gauze arranged to wind off two rollers and to pass together into a tank of formalin. By means of a winding mechanism, for every mile of sea through which the instrument is towed a fresh section of gauze samples the plankton. Taken out of the preservative chamber, the number of organisms per division of silk can be estimated. With the co-operation of different steamship lines a programme of surveying was started in 1932. "The main objects of the survey are to chart the broad monthly changes in the density of the plankton along a series of lines across the North Sea . . . to correlate as far as possible the seasonal and yearly variations observed with changing hydrological and meteorological conditions on the one hand, and with fluctuations in the fisheries on the other, and in addition to provide extensive material for the study of ecological relationships between different members of the phyto- and zooplankton." Some promising examples of the results are given showing changes in the production of the phytoplankton and zooplankton in different seasons on the same line, and differences on different lines at the same periods.

B. Schulz reviews the results of hydrographical observations in the Kattegat in August 1931. Very numerous and detailed records were taken simultaneously during a week from five ships (one Danish, one Swedish, one Finnish and two German) lying within a relatively small area. The author summarizes the results as showing that "unperiodical changes of the hydrographical conditions (currents, temperature, salinity) at the points of observation were quite considerably bigger than one would have expected according to our previous knowledge and views. The mixing processes resulting in the Kattegat from the outflow from the Baltic Sea and the inflow from the North Sea are far more intensive and turbulent than was formerly supposed."

The Radio Exhibition at Olympia

THIS year's National Radio Exhibition at Olympia is the eleventh annual event of its kind, and the Radio Manufacturers' Association is to be congratulated on its successful organization of the show, which offered more comfort for the visitor than in the past, and also maintained the spirit of novelty which is so characteristic of this event. For the most part, the exhibition was a display of the vast variety of wireless receiving sets, which are now available to meet practically all the many and differing demands of the broadcast listening public. On a much smaller scale, the needs of the specialist and technically-minded enthusiast and experimenter are catered for, in the way of special components and of receiving sets for use abroad or for general experimental work. The impression was definitely conveyed that this vast industry of some twelve years standing is now firmly planted on its feet; with only a few excep-

tions, the names of the exhibitors are now almost common household words among the general public.

The general broadcast receiving set of to-day is similar in all essential features to its predecessor, various improvements in detail having been effected where in the past the control of the set has been difficult or inconvenient, or the performance has left something to be desired. It has undoubtedly improved in reliability due to the advanced testing methods adopted by the industry, and this is a feature that many members of the public will greatly appreciate.

The receivers now fall broadly into the two classes, comprising the straight amplifier and detector combination and the supersonic heterodyne type, and in each form separate models are generally available for either battery operation or for connexion to the electric supply mains. In one or two cases a spectacular

method of visual tuning has been incorporated in the receiver. The great advance that has taken place in this year's sets, however, is the extension of the tuning arrangements to cover the short wave broadcasting bands. The title 'all-wave' tuning is generally applied to such receivers, but in only one or two cases can the set be tuned continuously from a wave-length in the region of 10-15 metres up to nearly 600 metres. The majority of the 'all-wave' receivers cover the short wave broadcasting bands only, there being gaps in the wave-length scale, where, at present, there are no transmissions of interest to the broadcast listener. Even with this restriction, however, it is necessary to provide the receiver with four separate wave-length bands, selected by an extension of the usual wave-change switch.

The production on a manufacturing scale of such a set in which the tuning on each band is controlled by the same knob, with a pointer reading on scales calibrated directly in wave-lengths, is a technical achievement of considerable merit. It is evident that, following upon the use of short-waves for Empire and other long-distance broadcasting, the reception of such short-wave programmes has now successfully passed beyond the experimental stage.

The other great feature of the exhibition was the demonstration of the present stage of television with the aid of the special test transmissions from the B.B.C. experimental station at Alexandra Palace. At this station separate television transmitters have been installed by the Baird Television Co. Ltd. and the Marconi E.M.I. Television Co. Ltd., and during the course of the radio exhibition these installations were used on alternate days for broadcasting a television programme. The accompanying sound was radiated from a separate transmitter installed by the B.B.C. The wave-lengths in use are 6.67 metres (frequency 45 megacycles per second) for the vision and 7.23 metres (41.5 megacycles per second) for the sound.

The daily programmes were received at the exhibition and demonstrated to the public on a number of receiving sets, the makers of which were not stated. Although naturally the interest displayed by large numbers of visitors precluded the study of the results for more than a short period, the demonstration was sufficient to indicate that the successful reproduction of a television programme broadcast from a station ten miles away is a present-day achievement. For the first time, the public has been enabled to see, as well as hear, the announcer in the studio and a well-known broadcasting singer. The majority of the programme comprised the transmission of sound-films, either constructed specially for this demonstration or extracted from standard news and entertainment films.

In the exhibition hall itself several firms displayed sets suitable for receiving these transmissions, although these were unpriced and were not in operation. The output on the vision side of these sets operates a cathode ray tube of unusually generous dimensions, the largest having a bulb of 22 inches diameter, the luminescent screen providing a picture area of $17\frac{1}{2}$ in. \times $13\frac{1}{2}$ in. In most cases it is claimed that these receivers will give satisfactory results on the transmissions from the Alexandra Palace at distances up to 40 miles. In accordance with the recommendations of the Television Advisory Committee, all such receivers are arranged to reproduce the vision programme whether this be emitted on the Marconi E.M.I., or the Baird system.

It would thus appear that the time is ripe for the carrying out of practical and widespread tests of the possibilities of radio-television in Great Britain, although it is natural that some time must elapse before the technique has been simplified and the manufacturing costs reduced to such a point as to make television reception in the home available to the majority of the general public. R. L. S.-R.

Valency and Molecular Structure

By Prof. R. F. Hunter and Prof. R. Samuel

THE connexion between the numerical valency exhibited by an atom and the number of its outside electrons, which prevailed in certain pre-wave mechanical theories of valency and in the theory of Heitler and London, appears to us of fundamental importance to the problem. It cannot be fortuitous that iodine, for example, which possesses two *s*- and five *p*-electrons, exhibits odd covalencies of 1, 3, 5 and 7. Nevertheless, this relationship appears to have been lost sight of in the chemical theories of Lowry, Sidgwick, and others on account of the conception of co-ordinate covalency, in which only electrons belonging to one of the atoms concerned are made responsible for chemical combination. This conception appears to connect these theories with the theory of molecular orbitals (Herzberg, Lennard-Jones, Mulliken) in that chemical linkage is ascribed to the bonding power of single independent electrons, while the formation of pairs is an essential feature of the theory of Heitler and London.

Since valency is an ambiguous term, it is necessary

to distinguish clearly between energetical questions and numerical chemical valency. While bond energy may vary from molecule to molecule, the valency number indicates the possibilities for chemical reaction and is a property of the free atom or radical. The maximal valency of the halogens is 7, but since this necessitates the fission of the s^2 group, considerable energy, which decreases with rise in atomic number, is required, so that heptavalency obtains with oxygen in Cl_2O_7 , and with fluorine in IF_7 . Although we are here mainly concerned with experimental facts, it is necessary to make brief reference to the wave mechanical interpretation of bonding power.

*Wave Mechanical Considerations*¹.—It is true that in the exchange integral (in formula 11 of Heitler and London's original paper),

$$E_{12} = \int \left(\frac{2e^2}{r_{12}} + \frac{2e^2}{R} - \frac{e^2}{r_{a1}} - \frac{e^2}{r_{a2}} - \frac{e^2}{r_{b1}} - \frac{e^2}{r_{b2}} \right) \frac{\psi_1\psi_2}{2} d\tau_1 d\tau_2,$$

the attraction (negative sign) is produced by those terms which are caused by the terms of the potential representing interaction between one nucleus and one electron. The pure interaction between the electrons themselves (e^2/r_{12}) gives an effect of opposite sign, and is antibonding. This, however, cannot be interpreted as proof of the bonding power of the single electron. That the whole expression E_{12} is called the exchange integral is not due to this term containing r_{12} representing the interaction of the electrons between themselves, but to the fact that the mere existence of the quantity E_{12} is connected with the use not of the wave function $\psi_1\psi_2$, but of the wave function $\psi_1\psi_2 \pm \psi_2\psi_1$. This, in its turn, is the direct consequence of the degeneracy produced by the identity of the electrons.

Thus, the relation of the electron pair bond theory to the single electron bond theory in the method of molecular orbitals becomes quite clear. In the latter, the same terms appear even without the repulsion term with r_{12} , but the appearance of the double product $\psi_1\psi_1$ is produced here not by the use of the function ψ_1 but of the function $\psi_1 \pm \psi_1$. In other words, it is introduced by the identity of the nuclear fields.

From the point of view of a theory of valency, this is of course purely incidental. Chemical linkage is not confined to atoms of the same element, and attempts have therefore been made to explain this by means of a pseudo degeneracy of unequal nuclei, if the interaction is of the order $E_p - E_\phi$, meaning that the valency of an atom not only as regards bond energy, but also in the numerical sense, should depend on the partner, and the greater the difference in the nuclear fields the smaller must be the distance between them to bring about this bonding effect.

The latter point is certainly empirically untrue as seen, for example, from the known diameters of oxides of the first short period. Regarding the first point, since we are not concerned here with the development of a perturbation method of calculation but with a theory of valency, it seems obvious that the valency number of an atom cannot depend on the partner with which it combines, other than in the energetic sense. Indeed the method of molecular orbitals gives incorrect results with regard to the products of dissociation of a molecule, due to neglect of the wave mechanical interaction of the electrons.

Since dissociation is the converse of molecule formation, this confirms our view that the method of molecular orbitals describes the electronic configuration and term system of the completed molecule but is not a theory of valency. Actually, it is unable to distinguish in itself between terms of attraction (molecule formation) and terms of repulsion (elastic collisions), and only becomes a theory of valency by the introduction of a postulate which identifies non-promoted with bonding electrons and promoted ones with anti-bonding. From new spectroscopical data it becomes increasingly evident, however, that this postulate can no longer be maintained.

*Spectroscopical Evidence*².—The number of molecules in which it is possible to correlate the molecular terms with those of the separated atoms has increased considerably of late. Particular interest is attached to the halides and oxides of the second group, in which it has been shown that the ground level of the molecule is correlated, not to an unexcited halogen

or oxygen atom plus an unexcited metallic atom with the configuration $s^2 {}^1S$, but to an excited metal atom with the configuration $sp {}^3P$. This now receives confirmation from some ten examples, the most striking of which are those in which the metal possesses high excitation energy. Whenever an excited molecular term appears in which the bond energy is higher than in the ground level, it is correlated to the so-called anomalous terms of the metal atom, in which both the original s -electrons have been simultaneously excited, showing that whenever a second linkage is formed (as in BeO and MgO), it occurs only in the presence of two p -electrons. Whenever an odd-electron molecule is formed (BeF and CaF), the partial removal of the odd electron increases the bond energy, showing that the unpaired electron is always disturbing.

Both these points receive confirmation from molecules of other types. NO, PO, and AsO, and also SiF and SnCl, all show the disturbing influence of the unpaired electron. On the other hand, molecules such as AlO and GaO are formed by the combination of oxygen with unexcited metal atoms of the configuration $s^2p {}^2P$, but the molecular term, of which the bond energy is much higher than in the ground level, is formed by the combination of oxygen with metal atoms of the configuration $sp^2 {}^4P$; the second linkage again occurring only after fission of the s^2 group. These results are incompatible with the theory of the co-ordinate link and show the anti-bonding character of the closed helium-like s^2 group, which constitutes the 'lone pair' in the majority of cases. While the pair bond conception of valency gives a straightforward and consistent interpretation of these results, the theory of molecular orbitals, on account of its promotion postulate, would predict that molecules such as BeO and BeF would be formed by unexcited metal atoms because they possess an excess of non-promoted (and therefore bonding) electrons.

The difference between an electron pair bond theory of valency and that of molecular orbitals finally finds its expression between localized and non-localized electrons in polyatomic molecules. The first experimental evidence in this connexion has been obtained from a complete vibrational analysis of the band spectra of SO₂ and SeO₂. These results show that the harmonic vibrations, for example, of SeO in its unexcited and excited states, agree closely with two symmetrical valence vibrations of unexcited and excited SeO₂; the energy of electronic excitation being almost identical in the two molecules and the factor of anharmonicity of the ground states, which could not be accurately determined for SeO₂, appears at least to be of the same order. Furthermore, the heat of dissociation of SeO₂ into gaseous atoms is about twice that of SeO. The molecular constants of SO₂ bear the same relationship to those of SO, and the continuous absorption spectra of halides and oxyhalides of sulphur show that the bond energies of the S-Cl, S=O, and S=S bonds are approximately of the same order in widely differing molecules such as SO, SCl₂, SOCl₂, S₂Cl₂, and SO₂.

Each of the bonds in polyatomic molecules of this type appears to be localized between two atoms, in accordance with the older structural formulæ of chemistry. It is characteristic that there is one atom which may be regarded as the central atom, and for such cases the Heitler-London theory indicates strong localization of bonds.

*Chemical Evidence*³.—It has been shown that the conception of the lone pair of electrons as an agent for true chemical linkage is in direct contradiction to the results of band spectroscopy. In our opinion, the spectroscopical evidence is of the greatest importance for the following reasons. The difference between two non-electrostatic links (normal and co-ordinate covalency) involves a difference of the role played by individual electrons. Physico-chemical measurements such as the parachor, dipole moment, etc., are concerned with the whole electronic cloud of valency electrons, and *a priori* cannot give information as to the part played by a particular electron. This can only be obtained from spectroscopical experiments. It is therefore always possible to interpret the mechanism of chemical linkage from the results of physico-chemical experiments in alternative ways, as has already been indicated in cases of the parachor, optical activity (for example, toluene-sulphonic esters and beryllium benzoylpyruvate), and crystal structure (SiF_6^{--}).

Similarly, the increase in dipole moment accompanying the formation of certain molecular associations in solution observed by Earp and Glasstone⁴ is no proof of the presence of a co-ordinate link. The dipole moments of such associations sometimes decrease and sometimes increase, depending on the geometrical position of the constituent molecules as to whether there is a cancelling out, or an increase through induction⁵. The energies of dissociation of such complexes, determined by these and other authors, vary between 1 and 10 k.cal./mol., which is about 1/100 to 1/10 of that associated with a true chemical bond. This, in our opinion, proves conclusively that the complexes are loose associations held together by van der Waals forces.

With regard to the resonance linkage suggested, for example, for the NO_2 group, it is possible that a co-ordinate link would oscillate between the oxygen atoms if it existed, but no experimental proof has so far been advanced for its existence. These arguments therefore in no way invalidate our earlier conclusion that chemical and physico-chemical evidence fail to provide any proof for the existence of a second form of non-electrostatic linkage in molecules of the first order.

It is true that an atom possessing a lone pair of electrons is frequently associated with chemical reactivity in carbon chains and the formation of complex associations in inorganic chemistry. Since band spectroscopy excludes a mechanism of the 'donor' and 'acceptor' type, something else must be responsible for such phenomena. As a tentative suggestion, it may be pointed out that the molecular refractivity indicates that the polarizability is always high in such atoms so long as the electrons of the lone pair are not involved in chemical linkage, and that the large dipole moment induced on approach of a reagent molecule might be responsible for such phenomena.

We wish to express our gratitude to Prof. F. London for his help in connexion with the wave mechanical section of this article.

¹ See Hunter and Samuel, *J. Chem. Soc.*, 1180 (1934); Lessheim and Samuel, *Proc. Ind. Acad. Sci. (Bangalore)*, 1, 623 (1935), and the literature mentioned in these papers.

² Lessheim and Samuel, *Phil. Mag.*, 21, 41 (1936); Asundi and Samuel, *Proc. Phys. Soc.*, 48, 27 (1936); *Proc. Ind. Acad. Sci. (Bangalore)*, 2, 30 (1935); 3, 466 (1936); Asundi, Jan Khan, and Samuel, *Proc. Roy. Soc.*, in press, and literature mentioned there.

³ Hunter and Samuel, *Chem. and Ind.*, 54, 31, 467, 635 (1935); *Rec. trav. chim.*, 54, 114 (1935), and literature mentioned there.

⁴ *J. Chem. Soc.*, 1709 (1935).

⁵ cf. Stuart, "Molekülstruktur," p. 114 (1934).

Science News a Century Ago

Death of John Pond, F.R.S.

ON September 7, 1836, John Pond, the sixth Astronomer Royal, died at Blackheath at the age of sixty-nine years, and a few days later was buried in the tomb of Halley in Lee churchyard. Pond was born in London in 1767. After attending schools at Hadleigh and Maidstone, at the age of sixteen years he entered Trinity College, Cambridge, and attended the mathematical lectures of Vince. Ill-health led him to travel, and during visits to Portugal, Malta, Turkey and Egypt he made many astronomical observations. From 1798 until 1807 he lived at Westbury, near Bristol, where by his observations on the declination of some of the principal stars he showed conclusively that Bird's quadrant at Greenwich had altered its form.

Pond was elected a fellow of the Royal Society in 1807. He married and removing to London in 1811 was chosen to succeed Maskelyne at the Royal Observatory. In 1812 he mounted a six-foot mural circle by Troughton, in 1816 a transit instrument of 5-in. aperture, in 1821 substituted the mercury horizon for the plumb-line and spirit-level, and in 1825 introduced the system of observing the same object by direct and reflected vision. A sound practical astronomer, he published catalogues of stars, translated Laplace's "Système du Monde" and wrote many articles for Rees' "Encyclopædia". In 1817 he was awarded the Lalande Medal and in 1823 the Copley Medal. He was succeeded at Greenwich by Airy, who, writing to Henry Warburton, M.P., to support an application for a pension for Mrs. Pond, said that Pond's claims to the gratitude of astronomers were due first to the accuracy which he introduced into all the principal observations, secondly, to the attention he bestowed on those points (chiefly of sidereal astronomy) which he regarded as fundamental, and thirdly his regularity of observation. "Since the commencement of Mr. Pond's residence at Greenwich," said Airy, "Astronomy considered as an accurate representation of the heavens in the most material points has acquired a certainty and an extent which it never had before."

Discovery of Fossils on the Continent

In its column of Miscellanea, the *Athenæum* for September 10, 1836, said: "Dr. Klippstein, a German savant, who has been long devoted to geology, and who directs the researches in the environs of Alzei (a little town of the Rhine Hesse) has lately made a discovery. On digging twenty-eight feet under the soil, near Eppelsheim, and a league from Alzei, his workmen found a head of a *Dinotherium giganteum*, in perfect preservation. This is probably the most colossal of all antediluvian animals, and the existence of which was first pointed out by the learned zoologist, Dr. Caup. This head is six feet long and three feet and a half broad. Near the head was also found a shoulder bone of which remains have not been met with elsewhere. Also at one thousand feet below the surface, in the mines of Anzin, an entire fossil palm tree has been found in an upright position. Its roots pierced the soil to a depth of several feet, and it is to be brought to the Museum of Natural History in the Jardin des Plants."

The neighbourhood of Mainz and Alzey early attracted the attention of geologists on account of its wealth of fossils. Von Zittel said: "The discovery

of the famous *Dinotherium* skull at Eppelsheim by Klipstein and Loup induced Klipstein to contribute a more careful stratigraphical account of the strata in the Mainz basin, and he paralleled the bone-bearing sands of Eppelsheim with the gypsum of Montmartre, and the limestone strata under the bone-bearing sands with the coarse limestone beds of Paris."

Yarrell's History of British Fishes

AMONG the books on natural history published in 1836 was the "History of Fishes" by William Yarrell (1784-1856), an original member of the Zoological Society and at one time treasurer to the Linnean Society. In a review of his work in the *Athenæum* of September 10, 1836, it was said the book was "intended to form a continuation of Bewick, whose beautiful woodcuts, occasional vignettes and *naïve* descriptions will ever be ranked among our standard works . . . and we can safely say, to all those who possess Bewick's works, that their collection is not complete without adding Mr. Yarrell's fishes to the birds and beasts.

"The description of species are 226 in number, but as several of them are figured in various stages of growth, the representations amount to 240—all made under the superintendence of the author; besides which there are more than 140 vignettes of modes of fishing, boats, nets, etc., foreign and English."

Societies and Academies

Paris

Academy of Sciences, July 15 (*C.R.*, 203, 137-216).

GABRIEL BERTRAND and LOUIS DE SAINT-RAT: A new colour reaction of copper with urobilin. This reaction is more sensitive and more specific than other reactions in use for the detection of traces of copper. 0.0001 mgm. of copper in 1 ml. of solution can be detected with certainty.

GABRIEL BERTRAND: Pentacetylxylite. Details of the preparation and purification of the acetate.

ROBERT LESPIEAU: The synthesis of *r*-arabite.

SERGE BERNSTEIN: Some extremal properties of successive integrals (correction).

CHARLES PISOT: Certain characteristic properties of algebraic numbers.

FARID BOULAD BEY: The canonical forms of equations of nomographic order 6 and 5 representable by nomograms with symmetrical scales.

CHRISTIAN PAUC: Directions, contingent and paratangent in *distanciés* spaces.

V. A. KOSTITZIN: The differential equations of the problem of Mendelian selection.

GINO ARRIGHI: The expression of the energy of acceleration.

JEAN JACQUES TRILLAT and Mlle. RENÉE VAILLÉ: The unctuousity of mineral lubricating oils.

MME. H. EMMANUEL-ZAVIZZIANO and M. HAÏS-SINSKY: The electrolysis of solutions of titanium salts. By varying the conditions of the electrolysis, compounds of Ti^{II} , Ti^{III} , Ti^{IV} and of pertitanic acid can be prepared.

MICHEL KANTZER: The optical absorption of the vapours of tellurium dichloride and oxychloride.

PIERRE LAMBERT and JEAN LECOMTE: Description of a recording spectrometer with a grating and its use for the determination of the absorption spectra of benzene derivatives in the 3000 cm^{-1} region.

AUGUSTIN BOUTARIC and JEAN BOUCHARD: Study of the fluorescent power of some fluorescent solutions excited by ultra-violet rays.

Mlle. YVETTE CAUCHOIS: Study of the *L* spectra of emission and absorption of rhenium (75) I.

MARCEL LECOIN: The form of the continuous β -spectrum of radium E. The method was based on the use of a Wilson chamber placed in a magnetic field. The results are given as a curve, and differ considerably from the values found by the method of coincidences.

CHARLES HAENNY: The secondary radiation emitted under the action of neutrons.

MAURICE E. NAHMIA and ROBERT J. WALLEN: Some short periods in artificial radioactivity.

HENRI MURAOUR and GABRIEL AUNIS: The laws of combustion of colloidal [explosive] powders.

Mlle. NIUTA KLEIN: The transformation in glass.

Mlle. VALERIE DEUTSCH: The absorption of proteins. Crystallized haemoglobin from the horse.

EDOUARD RENCKER and PIERRE DUBOIS: The hydrates of manganous sulphate. The only definite hydrates are those containing 7, 5, 4, 3 and 1 molecules of water.

ALFRED MAILLARD: The system monomethylamine-calcium chloride.

MAXENCE MEYER: A new method of preparation of the diethoxysuccinic esters.

LÉON ENDERLIN: Contribution to the study of the reversible oxidizability of organic compounds. Iso-oxybis-*p*-bromophenyldiphenylnaphthacene.

LÉON DENIVELLE: The sulphate of *o*-phenylene or sulphurypyrocatechol.

CHARLES COURTOT and MOHAMMED GHOLI BASTANI: Introduction to the study of the chemistry of diphenylene telluride.

Mlle. BERTHE DELAPORTE: Cytological researches on the group Coccaceæ.

WILLIAM HENRI SCHOFFER: Researches on the nitrogen metabolism of a micro-organism.

CHARLES CHABROLIN: The germination of the seeds of the orobanche bean (*Orobanche speciosa*). The substance which induces the germination of the seeds of the orobanche bean diffuses round the roots of certain plants and can be washed out with water.

PAUL BERTRAND: The embryos of angiosperms, ferns and lycopods.

FRANCIS RATHERY, ANDRÉ CHOAY and PIERRE DE TRAVERSE: The comparative action of insulin and of the hypoglycæmic principle of the jejunum in the depancreated dog.

RAYMOND-HAMET: A new method of showing sympatheticolytic power.

GUSTAVE GUITTONNEAU and RENÉ CHEVALIER: The utilization of salicylic acid as an energy producing food by *Azobacter* in the soil.

ANTHELME ROCHAIX and PIERRE RIVOLLIÉ: A dissociation of the staphylococcus.

Washington, D.C.

National Academy of Sciences (*Proc.*, 22, 327-434, June 15).*

DAVID I. MACHT and RAYMOND E. GARDNER: Phytopharmacological reactions of normal, toxic and atoxic sera. The phytotoxic index is defined as the ratio of the rate of growth in the dark for 24 hours at 12°C. of roots of seedlings of *Lupinus albus* immersed in a solution to be examined to the rate

* Continued from p. 378.

of growth of controls in a nutrient solution under the same conditions. Normal human blood and blood sera from a number of animals gave an index averaging 75 per cent. Reptilian blood was very toxic, as was also that of sera from cases of pernicious anaemia, pemphigus and leprosy. Virus diseases gave sera less toxic for plant growth than normal blood sera.

ALBERT W. HULL: Changing direct current to alternating current by means of thyatrons. Constant voltage 3-phase A.C. was changed to constant current by a 'monocyclic network' of capacitors and reactors. This current was converted by a conventional circuit of radio type into a constant direct current. The direct current is changed back into alternating current by an exactly similar circuit, with thyatrons in place of rectifiers. Special tubes were developed for the purpose, and in a circuit described, 15,000 volts at 200 amp. peak is rectified to 200 amp. at 30,000 volts D.C., and the latter 'inverted' to alternating current.

FRANCIS G. BENEDICT and JOHN M. BRUHN: Chimpanzee metabolism. Twenty-two animals ranging in age from two months to fifteen years were used. Respiratory exchange was measured with an open-circuit respiration chamber, the out-coming air being sampled. The average heat production of a chimpanzee per $10 \times w^{2/3}$ (where w is weight), ranges around 1,000 calories. Unlike man, it is not unusually high in infant and pre-adolescent years.

C. P. HASKINS and E. V. ENZMANN: A determination of the magnitude of cell "sensitive volume" associated with the white-eye mutation in X-rayed *Drosophila* (2).

C. P. WINSOR and ANNA-BETTY CLARK: Dark adaptation after varying degrees of light adaptation. The shape of human dark adaptation curves changes with the degree of initial light adaptation. The results are consistent with Wald's view that three substances are involved in the visual purple cycle.

FRANCIS G. BENEDICT and ROBERT C. LEE: Studies on the body temperatures of elephants. The temperature of urine taken immediately it was voided averaged 35.9° C.; that of the faeces was 0.7° C. higher, due to fermentation. The elephant thus has the lowest body temperature of any of the large animals (man 37° C., birds 42° C.).

MORGAN UPTON: Differential sensitivity in sound localization. When the two ears are stimulated by equal energies at 800 cycles, the apparent sound is localized in the median plane of the head. The ratio of energy increment required to produce a noticeable shift of localization to original energy is large for low levels of energy, small for intermediate levels and increases again for very high levels. The results cannot be described in terms of the Weber-Fechner law.

W. J. CROZIER: On the sensory discrimination of intensities. The increment of light intensity which is just detectable is variable and should be treated statistically. The relation of sensory intensity (effect) to stimulating intensity should be discussed as a 'band' which measures the probability of occurrence of the index response.

MORGAN UPTON and W. J. CROZIER: On auditory intensity discrimination. A theoretical discussion of Upton's results (above). The energy increment involved can only be regarded as related to the mechanism of excitation so long as its statistical character is recognized.

J. VAN OVERBEEK: Light growth response and auxin curvatures of *Avena*.

JAMES BONNER: Plant tissue cultures from a hormone point of view. Parenchyma tissue from the lining of the 'cups' left when immature seeds are removed from bean pods has shown cell elongation and cell division *in vitro* in a culture medium to which an alcohol extract of fresh beans was added. The cell mass continued to grow as parenchyma, and a limited number of sub-cultures could be made, but from the central tissue only. Some chemical properties are given of the factor which seems to make growth possible.

CARL IVER HOVLAND: 'Inhibition of reinforcement' and phenomena of experimental extinction.

KENNETH W. COOPER: Demonstration of a hatching secretion in *Rana pipiens* Schreber. The jellies and vitelline membranes of early tail-bud larvae were removed, and the freed embryos were kept in water until normal embryos of similar age had hatched. The contents of dishes containing free embryos were filtered and the filtrate centrifuged and decanted. This liquid was able to remove the jellies from fertilized eggs, etc., the vitelline membrane swelling away from the egg or rupturing, at stages when manipulative removal is very difficult.

Vienna

Academy of Sciences, June 12.

JOVAN JURISIC: Morphology and biology of *Bryophyllum Daigremontianum* (Hamet and Perrier de la Bathie).

HEINZ HORNINGER: Geometrical theory of reflection at curved surfaces.

WALTHER RUZICZKA: Accumulation of iodine by cumarin derivatives.

LEOPOLD SCHMID and HUGO KÖRPERTH: (1) The colouring matter of the poppy. (2) Extracts of petals.

F. WESSELY, A. MÜNSTER, and K. SCHÖNOL: The bitter principle of Columbo wood. (4). Hydration of columbin and isocolumbin.

RICHARD SCHUMANN: The moon, sun and variation of latitude (2).

OTTO REDLICH, TRUDE KURZ and WALTER STRICKS: Raman spectra and constitution of hexabromostannic ion and hypophosphite ion. The occurrence of five fundamental frequencies in its Raman spectrum shows that the hexabromostannic ion has D_{4h} symmetry.

O. FRIEDRICH: Geology of the gravel bed of the Gross-Arl valley.

ELFRIEDE EYSANK: Coloration of fluorite and rock salt. Fluorite has an absorption band between 575 and 650 m μ and another between 380 and 405 m μ . The properties of these two bands are studied.

IRMBERTA LEITNER: Quantum yield in the coloration of rock salt by X-, γ -, and β -rays. X-rays produce 10^4 - 10^5 and β - or γ -rays 10^2 - 10^3 colour centres per quantum. High energy quanta probably act through the secondary radiation they produce.

E. GUTH and S. ROGOWIN: Mechanical properties of threads and films of cellulose derivatives.

KARL SCHWARZ and FRANZ EBSTER: The possibility of producing multiply ionized atoms of very high energy.

O. BRUNNER and W. KLEINAU: Visual purple (2). Mechanism of the bleaching process.

FRIEDRICH HARTMANN: The most general case of breaking of rods of structural steel.

Forthcoming Events

Official Publications Received

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
(BLACKPOOL MEETING).

Wednesday, September 9

At 8.30 p.m.—Sir Josiah Stamp, G.C.B., G.B.E.: "The Impact of Science upon Society" (Presidential Address in the Empress Ballroom, Winter Gardens).

Thursday, September 10

At 10 a.m.—Prof. J. C. Philip, F.R.S.: "The Training of the Chemist for the Service of the Community" (Presidential Address to Section B, followed by a discussion).

Dr. J. S. Huxley: "Natural Selection and Evolutionary Progress" (Presidential Address to Section D).

Brigadier H. S. L. Winterbotham: "The Mapping of the Colonial Empire" (Presidential Address to Section E).

Prof. W. Cramp: "The Engineer and the Nation" (Presidential Address to Section G).

Miss D. A. E. Garrod: "The Upper Palaeolithic in the Light of Recent Discovery" (Presidential Address to Section H).

Mr. J. Ramsbottom: "The Uses of Fungi" (Presidential Address to Section K).

Sir Richard Gregory, Bt., F.R.S., Prof. L. Hogben, F.R.S., S. R. Humby, S. V. Brown, Sir Daniel Hall, F.R.S.: "Cultural and Social Values of Science" (Discussion: Section L).

Sir John Orr, F.R.S., Sir Daniel Hall, F.R.S., Prof. J. A. S. Watson, Prof. H. D. Kay: "National Nutrition and British Agriculture" (Discussion: Section M).

At 2 p.m.—Conference of Delegates of Corresponding Societies. Dr. A. B. Rendle, F.R.S.: "Preservation of Native Floras" (Presidential Address).

At 4.30 p.m.—Exhibition of new Biological Films.

At 7.30 p.m.—Dr. Olaf Bloch: "The Scope of Photography" (Public Lecture at Lytham St. Annes).

Friday, September 11

At 10 a.m.—Prof. A. Ferguson: "Trends in Modern Physics" (Presidential Address to Section A).

Dr. C. R. Fay: "Plantation Economy" (Presidential Address to Section F).

Prof. R. J. S. McDowall: "The Control of the Circulation of the Blood" (Presidential Address to Section I).

A. W. Wolters: "Patterns of Experience" (Presidential Address to Section J).

Sir Richard Livingstone: "The Future of Education" (Presidential Address to Section L).

Denys W. Harding, F. C. Thomas, Rev. F. A. Farley: "The Psychology of Mass Entertainment" (Discussion: Section J).

At 2.15 p.m.—Prof. H. J. Fleure, F.R.S., Dr. J. S. Huxley, Dr. G. M. Morant, Prof. A. M. Carr-Saunders, Prof. R. Ruggles Gates, F.R.S., Prof. F. A. E. Crew: "Genetics and Race" (Discussion: Sections D and H).

At 7.30 p.m.—Dr. W. F. Bewley: "Science and the Glass-house Industry" (Public Lecture at Blackpool South).

At 8 p.m.—Prof. J. L. Myres: "Who were the Greeks?" (Public Lecture at Preston).

Sir James Jeans, F.R.S.: "Some Recent Advances in Astronomy" (Public Lecture at Southport).

At 8.15 p.m.—C. C. Paterson: "Science and Electric Lighting" (Evening Discourse).

Great Britain and Ireland

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1685 (2038a): Effect of Variation of Aileron Inertia and Damping on Flexural-Aileron Flutter of a Typical Cantilever Wing. By V. M. Falkner. Pp. 12+6 plates. 1s. net. No. 1693 (2237): Air and Vapour Locks in Fuel Systems. By M. A. A. Allfrey. Pp. 14+9 plates. 1s. 3d. net. (London: H.M. Stationery Office.) [108]
Imperial Economic Committee. An Index of the Minor Forest Products of the British Empire. Pp. 116. (London: H.M. Stationery Office.) 5s. net. [118]

Proceedings of the Royal Society of Edinburgh, Session 1935-1936. Vol. 56, Part 2, No. 7: Fossil Pollen in Scottish Tertiary Coals. By Dr. J. B. Simpson. Pp. 90-108+3 plates. 2s. 6d. Vol. 56, Part 2, No. 8: On the Suppression of Tangled in *Drosophila pseudo-obscura*. By H. P. Donald. Pp. 109-127+2 plates. 2s. (Edinburgh: Robert Grant and Son, Ltd.: London: Williams and Norgate, Ltd.) [128]
The North of Scotland College of Agriculture. Calendar, Session 1936-1937. Pp. viii+131. (Aberdeen: North of Scotland College of Agriculture.) [128]

Other Countries

Conseil Permanent International pour l'Exploration de la Mer. Rapports et procès-verbaux des réunions. Vol. 100. 1ère partie: Procès-verbaux (mai 1936). Pp. 62. 3.00 kr. 2ème partie: Rapport administratif (1935-1936): 3ème partie: Appendices. Pp. 111+25. 4.00 kr. (Copenhague: Andr. Fred. Høst et fils.) [118]

Cornell University: Agricultural Experiment Station. Bulletin 640: An Economic Study of Land Utilization in Chemung County, New York. By T. E. LaMont. Pp. 84. Bulletin 641: Seasonal Costs and Returns in producing Milk in Orange County, New York. By L. C. Cunningham. Pp. 41. Memoir 183: Measurements of Family Relationships in Farm Families of Central New York. By Howard W. Beers. Pp. 38. Memoir 184: Pollination and Life-History Studies of the Tomato (*Lycopersicon esculentum* Mill). By Ora Smith. Pp. 16+23 plates. Memoir 185: Effect of Narrow Ranges of Wave-Lengths of Radiant Energy and other Factors on the Reproductive Growth of Long-Day and Short-Day Plants. By N. A. Schappelle. Pp. 33. Memoir 186: Effects of some Environmental Factors on Growth and Color of Carrots. By W. C. Barnes. Pp. 36. (Ithaca, N.Y.: Cornell University.) [178]

Annual Report on the Departments of Agriculture, Malaya, for the Year 1935. By Dr. H. A. Tempany. Pp. iv+84. (Kuala Lumpur: Government Printer.) 50 cents; 1s. 2d. [178]

Smithsonian Institution: Bureau of American Ethnology. Bulletin 113: The Troyville Mounds, Catahoula Parish, La. By Winslow M. Walker. Pp. vii+73+16 plates. (Washington, D.C.: Government Printing Office.) 20 cents. [178]

U.S. Department of the Interior: Office of Education. Vocational Education Bulletin No. 106 (Trade and Industrial Series, No. 30): Stone Setting; the Setting of Cut-Stone Trim in Brick Buildings. Revised 1935. Pp. ix+226. (Washington, D.C.: Government Printing Office.) 20 cents. [178]

Indian Forest Records (New Series). Vol. 1, No. 13: Entomological Investigations on the Spike Disease of Sandal. (27) Chrysomelidae (Col.). By N. C. Chatterjee and G. D. Bhasin. Pp. iv+243-318. 1.14 rupees; 3s. 3d. Vol. 2, No. 5: New Indian Tingitidae (Hemiptera). By C. J. Drake and M. E. Poor. Pp. 141-149. 5 annas; 6d. (Delhi: Manager of Publications.) [178]

Tokyo University of Literature and Science. Divisional Reports on Present Tendencies in the Development of Mathematical Teaching in Japan. Prepared by the Japanese National Commission on the Teaching of Mathematics. Pp. 174. 3.50 yen. Summary Report on Present Tendencies in the Development of Mathematical Teaching in Japan. By M. Kuniyeda. Pp. 50. 1.00 yen. (Tokyo: Maruzen Co., Ltd.) [178]

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 101 (Radio Research Board, Report No. 11): The Temperatures and Constituents of the Upper Atmosphere. By Dr. D. F. Martyn and Dr. O. O. Pulley. Pp. 31. (Melbourne: Government Printer.) [178]

Royal Agricultural Society. Summarised translation of Bulletin No. 19, Chemical Section: The Importance of Phosphoric Acid Supply for Egyptian Crops as illustrated by the Results of the Bahtim Permanent Experiments and Others. By Ahmed Mahmoud. Pp. 86. Bulletin No. 23: The Influence of Size and Weight of Seed upon the Course of Subsequent Growth and upon Yield of Wheat. By Dr. M. A. Fikry. Pp. 54+27 plates. (Cairo: Royal Agricultural Society.) [178]

Sveriges Geologiska Undersökning. Ser. C, No. 393: Den marina skalbärande faunan och de seneglaciala nivåförändringarna, med särskild hänsyn till den gotiglaciala avsmältningssonen i Halland. Av Bror Asklund. Pp. 103+2 plates. 2.50 kr. Ser. C, No. 394: Paradoxis celandicus Beds of Öland, with the Account of a Diamond Boring through the Cambrian at Mossberga. By A. H. Westergård. Pp. 66+12 plates. 3.00 kr. Ser. C, No. 395: Zur Kenntnis der Jämtländischen Ögysicarischiefer-Fauna. Von Bror Asklund. Pp. 12+2 plates. 1.00 kr. Ser. C, No. 396: Foraminiferen aus dem schwedischen untersten Senon von Eriksdal in Schonen. Von Fritz Brotzen. Pp. 206+14 plates. 4.00 kr. Ser. C, No. 397: Sjöarnas Transparenser, färg och areal. Av G. Lundquist. Pp. 28. 0.50 kr. Ser. C, No. 398: Siljansområdet brännkalkstenar och kalkindustri. Av Per Thorslund. Pp. 64+3 plates. 3.00 kr. Ser. C, No. 399: Die Entstehungsbedingungen der hydratischen Verbindungen im System CaO-Al₂O₃-H₂O (Flüssig) und die Hydratisierung der Anhydridkalkziumaluminat. Von Gunnar Assarsson. Pp. 202. 4.00 kr. Ser. C, No. 400: Die Fauna in einem Geschiebe aus der Trinucleusstufe in Jämtland. Von Bror Asklund. Pp. 6+2 plates. 1.00 kr. Ser. C, No. 402: Frösöns submoräna avlagringar; Preliminär meddelande. Av Bror Asklund. Pp. 8. 0.50 kr. (Stockholm: P. A. Norstedt och Söner.) [178]

Ministry of Public Works, Egypt: Physical Department. Helwan Observatory Bulletin No. 39: Arabic Names of Stars. By A. H. M. Samaha. Pp. 37. (Cairo: Government Press.) 5 P.T. [195]