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Social Responsibilities of Science

ONE of the most significant features of representative scientific gatherings in recent years, even of such widely differing types as the British Association, the World Power Conference, the Society of Chemical Industry, or the Association of Scientific Workers, as in the reports of Carnegie Institution of Washington or the Carnegie Endowment for International Peace, is the concern which has been expressed at the social consequences of the application of scientific discoveries. The necessity for concrete action in this field has been emphasized in recent months in different ways by the attention being given to the problems of the Special Areas, the rearmament programme and the growing *malaise* in Europe. We are witnessing a race between scientific progress and social instability.

It is accordingly appropriate and welcome that the International Council of Scientific Unions, meeting for the first time in London, should have before it a proposal submitted by the Royal Academy of Sciences at Amsterdam for the appointment of a committee to endeavour to co-ordinate views advanced in recent years regarding the social responsibilities of science and scientific workers (see p. 697).

At present, however, it is difficult for any scientific worker to get a sufficiently clear and ample picture of the problems confronting us and their implications. The proposal, therefore, aims at providing a means of collecting the various opinions which have been brought forward in this sphere and presenting them in a form which may help individual scientific workers and scientific organizations to obtain a better view of their work and of their position in relation to social problems. In support of the proposal a memorandum which

has been forwarded to the General Secretary of the International Union bears the signatures of seventy-four scientific workers from different countries, although in inviting support of its proposal the Amsterdam Academy did not address itself to men of science in Germany, in Italy or in the Union of Soviet Socialist Republics, on the ground that in these countries at present scientific workers are bound much more closely to their respective Governments than is the case elsewhere. Nor has support been sought from scientific workers who have emigrated from these countries ; in the first instance, an endeavour has merely been made to ascertain the attitude to the proposal of men of science in countries where there is more freedom to express individual opinions.

That such a discrimination should be necessary in the twentieth century is a striking reminder that science has a spiritual message as well as its material aspect, and that it demands a supreme loyalty to truth which must over-ride all other claims if error and delusion are not to result. The search for truth is not fulfilled by giving bare facts, numbers or abstract theories only ; there must be also some sense of values and of perspective.

The cherishing of such ideals is a primary function of professional associations whether on a national or an international plane, but to turn to such a programme of research as that set forth in Sir Josiah Stamp's "The Science of Social Adjustment" is to realize the imperative need for scientific organizations to draw together if the beginnings of an attack on these problems is to be contemplated. Equally it is clear that a bridge must be built from the general but indefinite consciousness of social responsibilities to a definite practical campaign in this field. Clear thinking about

the social implications of scientific work, of the uses that are being and could be made of science, of the abuse of scientific knowledge, and of the fuller use which could be made of it for promoting general social welfare, is the prelude to effective action.

For such thinking, data must be assembled as basis for judgment, and it will still remain to determine the means of making such judgments more effective in the struggle of opinions by which the world is ruled. In the memorandum which accompanies the proposal of the Amsterdam Academy, the possibility is reviewed of interesting existing organizations in this work, and reference is made in particular to the admirable work of co-operation which has already been fostered by the League of Nations in the field of international health and intellectual co-operation. It is suggested that fuller use might be made of the scientific point of view in the work which the League undertakes in adjusting political and social conditions.

The largest general scientific organization, however, is the International Council of Scientific Unions, and it was at first suggested by the Amsterdam Academy that the International Council might regard it as part of its task to consider opinions brought forward from various sides concerning the attitude which should be taken by scientific workers in relation to the dangers at present menacing the future of our civilization. On this basis consideration of the social responsibilities of science could be introduced into various aspects of the Council's work, particularly that carried out on behalf of the League of Nations.

A mere statement of this kind, however, is too wide to lead to the initiation of any concrete piece of work, and the resolution finally submitted to the Council accordingly proposes the appointment of a special committee in the following terms :

"The International Council of Scientific Unions, already at a former occasion having expressed its faith in the possibility and the necessity of peace between the world's peoples, and being convinced that the 'brotherhood of scientists' can be an important factor towards the establishment of a desire for mutual understanding and helpfulness, considers it to be a part of its task to give attention to the opinions brought forward from various sides concerning the attitude which should be taken by scientists in relation to the dangers which at present menace the future of our civilisation.

"The International Council therefore decides to appoint a Committee, which should attempt to

arrive at a co-ordination of what has been proposed in respect to the social responsibilities of science and of scientific workers."

It is intended that this work should be carried out in a way which will relate the points of view expressed so that the result may be a guide for those interested in these matters. Moreover, such a committee would no doubt attempt to formulate some general conclusions which might indicate where scientific thought or the personal influence of scientific workers could assist in analysing and attacking social problems, and which might also help individual scientific workers to choose their own point of view in co-operating to safeguard our cultural advance. At the same time, the committee should serve as a centre of contact for organizations and persons interested in this type of cultural work, and assist in creating between these organizations and persons a feeling of mutual sympathy and of solidarity.

It can scarcely be challenged that such a committee could render almost invaluable service, both in the education of public opinion as to the contribution of science in social matters, and in the stimulation of scientific investigation, as well as of effective co-operation between professional organizations, to provide not merely a definite professional code but also a permanent anchorage or shelter from which members of the profession of science would be free to render their special service and exert their full influence undeterred by political or any other type of prejudice. It is indeed only from some such vantage ground that scientific workers can assist humanity to link up science with ethical values, and derive the courage and the authority needed at times to denounce the abuse of scientific effort or results, and to point out positive means of promoting the well-being and co-operation of mankind.

It is unnecessary at this stage to go further into the programme of activity for the committee sketched by the memorandum. The opportunities which confront us in such matters as nutrition, the problems of the Special Areas and the location of industry, the prevention of accidents and industrial disease, are only a few examples of questions to which reference has recently been made in these columns, in respect of which scientific workers might make an important or decisive contribution. Surveys of these fields, of the possibilities of assuring a certain standard of life through a full use of scientific and technical means of production

and distribution of food and general commodities, and of the alleviation of poverty and misery; the prostitution of scientific knowledge for ignoble uses and in particular for purposes of war, and the development of a code of ethics and the question of a right attitude to preparations for war; the study of racial relations and feelings are all touched upon in some detail by the memorandum, and indicate the vast field in which fruitful work could be done. No scientific worker who realizes the benefits which science is able to give to society, or who desires to exert his full influence in social affairs, whether as a citizen or in his special capacity as a scientific worker, can be indifferent to the proposal or programme outlined by the Amsterdam Academy.

What matters above all, even in the collection and co-ordination of the existing material, is the spirit in which the work is carried out. Only as

that is dominated by the highest ideals and finest loyalty to that spirit of service inherent in science itself can we expect to arouse the devotion and to create the vision which will enable the many difficulties in the way of effective action to be overcome. Even if the committee starts with a comparatively restricted field, that need not hinder it from rekindling the finest ties of professional loyalties and a vision of the possibilities and benefits which the scientific spirit linked with a sense of human values might bring to mankind. Once that is kindled, the human spirit will not long delay to break the shackles with which craven and retrograde political creeds and nationalist systems have sought to restrain its advance into an age of freedom and plenty, where man's mind and spirit, released from the cramping influence of poverty, disease and war, may achieve a stature and creative fertility hitherto unknown.

Personalities in Natural History

Green Laurels :

the Lives and Achievements of the Great Naturalists. By Donald Culross Peattie. Pp. 38 + 429 plates. (London, Bombay and Sydney : George G. Harrap and Co., Ltd., 1937). 12s. 6d. net.

THE author enjoyed his book, coining happy and striking phrases and suggesting interpretations of great characters. Goethe is "the father of the German romantic movement in poetry and science" and the Nordic interprets himself as "everything upstanding, gifted, pure, great and superior". Darwin is a "kindly English gentleman known by his good works", whose twenty years' record of silence is unsurpassed. Wallace was the greatest of professional collectors, because "he thought as he collected", but he was an "humanitarian before he was a scientist . . . a virtue only in a Romantic"; "disgraceful wrangles . . . never between these two". The old ideas were ancestors of theirs; "they built upon the sunken piers of obsolete wisdom". It is to sketch these "piers of nature's unfolding in the mind of man" that pleases the author, not a history of biology and an orderly sequence of discovered facts. Plato, Aristotle, Theophrastus, Dioscorides, Galen and Pliny held the field until sixteenth-century Gesner published his "Historia Animalium" with Dürer's illustrations. In this man is seen the universality of science, for, from his Swiss home, he corresponded among others with Belon, whose picture of the

bones of man and bird founded comparative anatomy, Rondelet (fish-lover), Aldrovandi (traveler), and Turner.

We are rather pleased to escape Vesalius and Harvey and to think of Borelli and Redi as unruly members of the first "Accademia del Cimento", unknown adventurers "on the rim of a volcano". There is sympathy for, and understanding of, Malpighi, Swammerdam and Leeuwenhoek in the first great days of microscopy. Réaumur is a brilliant of purest water, meteorologist, metallurgist, biologist, creator of entomology. In contrast, Buffon, protégé of the Pompadour, re-creator of the Jardin des Plantes, prolific writer, courtier, in his jealousy and pride true forerunner of Cuvier, his fame crushed in our minds by his championship of spontaneous generation against the experiments of Spallanzani. Here were gleams of evolution, but the next volume affirms a belief in the scriptural creation "both as to order of time and matter of fact". Linnaeus appeals, a country "sport", great collector and systematizer without whose work further progress had become impossible. He had forerunners, of course, especially Ray, and they, too, had made approach to the idea of sexuality in plants and its analogue in animals.

It was a glorious age, the collecting of Nature from every clime and isle—and in the story there is no elimination of that personality, which never

gives enduring fame, but on which is founded human love. Thus is approached that great "chevalier" Lamarck, who founded the "concept that evolution is possible, is real, is more characteristic of life than motion or breathing". There was no success here, a penniless old age, no helping hand from Cuvier, the man and all his work ungratefully contemned by him, his bones consigned to the pauper's tomb. Happy it is that Owen was no Cuvier in Darwin's days, and that Lyell preceded and Huxley lived. Personal humility, genius and confidence are, indeed, three factors in science.

Later, a few chapters to tell us about the early collector-naturalists of North America. We all know of sour Wilson with his pictures of museum-stuffed birds, and flighty Audubon with his nature brush. Few know C. S. Rafinesque, of the University of Transylvania, literally built in the backwoods, its golden age synchronous with his professorship, 1819-26. Here was a picturesque and eccentric genius, dabbler in every field of biology with incursions into Indian archæology and language, member of a score of scientific societies, but yet a failure, since never a single idea or suggested thought was carried to fruition. Returning from an excursion, Rafinesque found his museum swept bare and was denied his classroom, the villain of the piece, President Holly himself, driven out next year by his fundamentalist

students. Here again a death in abject poverty, the body almost cased in the nine hundred books and pamphlets it had written.

Then there were the Bartrams, father and son and families, the father fresh from the plough to become the correspondent of Linnæus and the fashionable world of England, all collectors then. The gorgeous *Franklinia* was theirs, those living now descended from a single tree of Georgia never since found wild. Michaux, a French farmer, was sent over in 1785 to collect trees and plants for the forest of Rambouillet, but, although he shipped a vast abundance, Nature in Europe formed too close a "society" for them; he is better known for his later contributions from the East. Jefferson, third President of the United States, was a naturalist, but surely the strangest enterprise and settlement must have been that of New Harmony, the communistic State founded in 1825 by thirty-five ladies and gentlemen from the cultivated purlieu of Philadelphia. Kindly Robert Owen was the founder, an immigrant from Lanark, not appreciated there—the experiment a failure, but New Harmony a place of pilgrimage for fifty years. Here the great "American Conchology" of Say took shape, its author's name-seal to be ever associated with a large share of the animals of North America, his associate Lesueur responsible for its exquisite plates. A most pleasant book.

J. S. G.

Secret Languages of Ireland

The Secret Languages of Ireland: with Special Reference to the Origin and Nature of the Shelta Language, partly based upon Collections and Manuscripts of the late Dr. John Sampson. By Prof. R. A. Stewart Macalister. Pp. x+284. (Cambridge: At the University Press, 1937.) 16s. net.

SHELTA, or more correctly Sheldrū, a secret language found among a certain class of tramps in England and current among Irish tinkers, was discovered in 1876 by Charles Godfrey Leland, that enthusiastic, if somewhat erratic, student of everything appertaining to the customs and beliefs of peasantry, gypsies and vagabonds generally all the world over. The results of his investigations of Shelta were ultimately passed to the late John Sampson, the great authority on gypsy languages, and through him brought to the notice of Kuno Meyer, the Celtic scholar, by whom the language was at once hailed as a survival of the old Celtic used by the Druids. Unnoted until

the time of Leland, it has since been investigated by a number of Celtic and Romani scholars, with results which would now seem to have failed to justify early enthusiasms.

The book on the language, which was to be produced by Leland, Meyer and Sampson, was never completed; and on the death of the last named, the material which had been collected for it was passed to Prof. R. A. Stewart Macalister. Very wisely, while using this material, he has written his own book, enlarging the scope of the inquiry to include as a whole the intriguing problem of the occurrence of a number of 'secret' languages in early and medieval Ireland, and the evidence for their survival until recent times. It is a problem which not only has provided material of interest to the phonetician and the philologist, but also as a development which can be traced back to early historic times in Ireland, of no little significance for the student of the growth of social order and religious belief in that country.

Prof. Macalister discusses the whole problem with thoroughness. Beginning with the use of oghams as a method of alphabetic writing, which he believes, probably with justice, to be a deliberate archaism, intended to preserve, if not to create, an esoteric atmosphere, he goes on to discuss in considerable detail the various methods of cryptographic record which were adopted by the Irish scribe. This he follows with a discerning sketch of the social and religious conditions, which would have tended to preserve the Druidic custom of using at need a language understood only by the initiated; and from this traces the rise of those bastard dialects, Hisperic Latin and Hisperic Irish, as well as the jargon known as Bog Latin. In regard to Hisperic Latin, he might, perhaps, have pointed out that this development is not peculiar to Ireland, and have found a parallel in the language of the macaronic verse of "The

Battle of the Frogs and Mice", the Italian burlesque in imitation of the Aeneid. The vocabularies and analyses which Prof. Macalister gives of these secret languages, as well as of the modern Shelta and "Vernacular of the Masons" are of extreme interest.

The author completes his picture of the conditions which favoured the production and perpetuation of these languages by a brief sketch of the vagrants of Ireland. The accession of declassed clerics to these vagrant bands will explain, he holds, some anomalous evidence of learning which appears in the secret languages. As regards the central theme of inquiry, his conclusion is that Shelta does not represent an ancient language, though there are, not unnaturally, archaic elements in it, and that while its vocabulary is Irish, its syntactical construction is essentially English.

Bibliography of the Exact Sciences

Sotheran's *Bibliotheca Chemico-Mathematica*: Catalogue of Works in many Tongues on Exact and Applied Science. Second Supplement. Vol. 1. Pp. xi + 840. Vol. 2. Pp. iii + 841-1396. (London: Henry Sotheran, Ltd., 1937.) 21s. net.

THE second supplement to Sotheran's "*Bibliotheca Chemico-Mathematica*" lists no less than 22,895 items, thus exceeding in length not only the first supplement, but also the original two volumes. The arrangement of the contents is similar to that adopted in the first supplement. The individual items are arranged under a series of subject headings, instead of under a general alphabet, as is the case in the earlier volumes. This supplement has in fact been produced by binding together thirteen different special subject catalogues that have appeared separately during the last fourteen years. For this reason, presumably, the compiler has not thought it necessary to prepare a detailed subject index, a feature that rendered the original work especially valuable. However, the new arrangement may well prove more convenient to many users. The main subject headings in this great catalogue are as follows: aeronautics, astronomy and astrology, chemistry, chemical technology, engineering, geology and meteorology, horology and dialling, mathematics, microscopy, mineralogy, mining and metallurgy, navigation and physics. Some of these subjects are further subdivided, and there are also sections dealing with scientific works of general interest,

collected works and sets of scientific periodicals. In the new supplement, nautical, aeronautical, mining and engineering works are more fully represented than in preceding volumes of the "*Bibliotheca*".

Those familiar with the catalogues of scientific books issued from time to time by the old-established firm of Henry Sotheran, Ltd., will realize the value of this supplement. To others it may be pointed out that, as catalogues of second-hand books, they are among the select few that have permanent interest and value. Comparable catalogues are issued by only a very few antiquarian booksellers, either in Great Britain or elsewhere. Those issued by Henry Sotheran, Ltd., excel, in the first place, in sheer numbers of books listed, these including both modern and standard texts and old, historically interesting publications of the sixteenth, seventeenth and eighteenth centuries. Secondly, the catalogues are not restricted to the more important (and therefore more valuable) works, but include also the lesser known writings of well-known men of science, and many books by obscure and almost unknown authors. Moreover—and herein lies the especial value of these catalogues—a very large proportion of the entries are annotated with bibliographical, biographical and historical notes. These notes, sometimes of considerable length, are drawn from many different authorities, and are remarkable for their accuracy.

No comprehensive bibliography of the exact sciences exists, and indeed the preparation of

such a work would be a monumental task. Very few of the separate sciences have, in fact, formed the subject of special bibliographies. Such as exist are invariably incomplete, and are often either inaccurate, or lacking in bibliographical detail. It may fairly be claimed that this new supplement, together with the three preceding volumes of Sotheran's "Bibliotheca Chemico-Mathematica", comprising in all 47,480 entries, form the nucleus of a complete bibliography of the exact sciences, and an essential addendum to the few special bibliographies already existing. It is therefore a work of very definite value to librarians, bibliographers and historians of science.

The "Bibliotheca", being compiled from successive priced catalogues of an antiquarian bookseller, suffers from the unavoidable defect that a proportion of the entries are repeated. This repetition throws an interesting sidelight on the value of old scientific books. A comparison of the prices asked in earlier volumes of the "Bibliotheca" with those asked for the same work in Sotheran's latest catalogues indicates unmistakably that a marked increase in the value of at least the more important early scientific books has taken place during the

last fifteen to twenty years. An outstanding example is afforded by Newton's "Principia", the first edition of which might have been purchased in 1919 for £30; in 1934, £120 was asked for it. Other examples could be quoted in confirmation of this trend in prices, which must indicate not only an increased demand for this type of book, but also a growing scarcity. Librarians throughout the world are filling gaps in their collections, and it seems probable that before many years pass it will be extremely difficult, if not impossible, to obtain copies of the outstanding early works of science at any price.

The compilation of the "Bibliotheca Chemico-Mathematica" is entirely the work of Mr. H. Zeitlinger, a member of the staff of Henry Sotheran, Ltd. Mr. Zeitlinger is obviously equipped, not merely with a critical sense of the value of the books he catalogues, but also with an exceptionally wide knowledge of the bibliography and history of science, qualifications which render valuable the notes with which he enriches his catalogues. Both he and the publishers are to be congratulated on the production of a work of such interest and lasting worth.

Marine Zoo-geography

Tiergeographie des Meeres

Von Prof. Sven Ekman. Pp. xii + 542. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1935.) 32 gold marks.

THE collection of specimens of marine animals by individual workers and on fully organized expeditions has been carried on for many years, and still continues. To the systematic zoologist, much of the interest in these collections lies in the discovery of new or rare species which may throw light on evolutionary trends and classification. But the gradual accumulation of publications giving the faunistic results of collections, and often comprising lists of already known species, serves another purpose. Each record marks a pin prick on the globe to add to our picture of the geographical distribution of that species. It is only after many years of such recording of already described and well-known species have passed that this second purpose can reach fruition in an outline of marine zoo-geography.

Already in 1896, Ortmann had produced his well-known "Tiergeographie der marinen Organismen", giving a preliminary outline of the different faunistic regions; but almost all the results of the collections of the great oceanographical

expeditions have been published since that date, and we have now a wealth of data out of all proportion to that available in Ortmann's time. Many of these reports contain summaries of the known distribution of separate groups or families, but there has been no comprehensive survey of all these results as a whole. Prof. Sven Ekman's book is therefore welcome and timely. He gives an outline of all the marine faunistic regions as they exist to-day and their relationships one with the other. In order that the relationships between the different faunas might be disclosed, their composition has had to be studied in the light of geological evidence, and this is one of the main aspects of the book, which is not only an outline of present-day marine zoo-geography but also a history of its past and of the causes that have produced its characters to-day. All types of faunas are dealt with, from the littoral to the abyssal, including the pelagic and planktonic animals, of all the oceans and seas as well as of the Caspian Sea and the Sea of Azov.

As might be expected, it is the tropical littoral fauna with its limited methods of dispersal that shows the least geographical uniformity at the present day. In the Cretaceous and early Tertiary, the tropical fauna of the Indo-Pacific and Atlantic

regions had much in common, being united by the shallow Tertiary sea of Tethys. Climatic change in the Atlantic and the gradual emergence of land destroyed much of the tropical Atlantic fauna, and initiated the present era with its strong contrast between Atlantic and Indo-Pacific faunas. Results have shown that the term Indo - West Pacific must replace the older expression Indo-Pacific, since the faunas of east and west Pacific are radically different, the former having affinities rather with the Atlantic region. The vast island-free area between Polynesia and America was presumably the barrier between the littoral faunas of east and west Pacific. Later climatic change in the North Atlantic with its warm conditions also impeded the evolution of an endemic boreal fauna, which is so much richer in the Pacific.

Such are the type of conclusions brought forward in this most interesting book. Although much of the theoretical picture has previously been constructed by workers in individual animal groups, the probable truth gains added strength by Ekman's work, which has shown how different groups of the animal kingdom follow the same

trends. The book is well illustrated, and contains a valuable literature list of some twenty-six pages. This list has an additional attraction in that all titles of papers are given in full, and it thus forms a most useful guide to many of the most important reports on all the marine animal groups.

Prof. Ekman's book is more than a text-book, and is one of the most important additions to marine biological literature since Murray and Hjort's "Depths of the Ocean". Perhaps one of the most striking features brought out is how very great has been the advance in knowledge of species of marine animals within the last century. We cannot be far wrong in saying that in many groups the identification and description of the component species is nearing completion in certain regions. It behoves us now to pay increasing attention to the biology of the species themselves and their interrelationships one with another. It is only with such knowledge that we shall reach a correct understanding of the factors which bind the species to the different ecological associations in the zoo-geographical regions which Prof. Ekman has so ably outlined.

F. S. R.

Catalytic Reactions

Catalytic Reactions at High Pressures and Temperatures

By V. N. Ipatieff. Pp. xxii + 786. (New York: The Macmillan Co., 1936.) 30s. net.

THIS is a chemical autobiography; it concerns the life researches of a great Russian chemist, now an exile and professionally active in the United States in the field of catalysis and its industrial application. The author seeks to have correct significance placed upon his investigations, which he claims has not always been done; he retaliates by making little reference to the work of others. As a result, the reader is presented with a mass of information often stimulating and suggestive, which however should be approached critically. It is most valuable to have a subject presented in this way instead of the judicial form necessary in the text-book; instead there is the zeal of the author convinced of the importance of his discoveries and the soundness of his hypotheses. Such are developed here for the reactions of dehydration, alkylation, polymerization and isomerization, in some instances for the first time.

The name of Ipatieff is in particular associated with his pioneer work on catalytic reactions at high pressures and temperatures, and his method is followed industrially in the preparation of such

products as cyclohexane, tetralin and decalin. A summary of the main lines of his researches is given in an introduction. He was the first to observe in 1900 that a catalyst could influence the course of decomposition of an organic substance and force the decomposition to go in a certain direction only, and also to recognize that the material of the vessel might play the part of a catalyst. He showed how, according to the nature of the catalyst, alcohol could break down almost quantitatively in three different ways, to aldehydes, to ethylene, to butadiene. To-day such principles are universally recognized and made use of in diverse branches of the chemical industry.

The book is divided into thirteen chapters in which under appropriate headings the various sections of the subject are collected: these are sometimes rendered more useful by a series of numbered conclusions at the end. It can serve no useful purpose, even if it were possible, briefly to summarize some of Ipatieff's hypotheses and results, nor are all of them generally accepted.

The book will be read eagerly by workers in the field, particularly by those in industrial laboratories, and few will do so without some gain either in ideas or knowledge. The author's work has not been in vain; his contribution to progress is a substantial one.

The Human Foot:

its Evolution, Physiology and Functional Disorders. By Prof. D. J. Morton. Pp. xiii+244+14 plates. (New York: Columbia University Press; London: Oxford University Press, 1935.) 15s. net.

THE author of this book, though he bears the name, is not responsible for the designation which we know as Morton's metatarsalgia. The most important statement in the book is that the disabilities of the foot start in the first instance from defects of the bones and ligaments. The evidence for this statement is assembled from diverse sources.

Approximately one third of the book is devoted to an account of the evolution of the foot. This is quite interestingly and well done, and is in accordance with the prevailing ideas at the moment. It is inevitable that its truth should be more general than particular. From gaps in our knowledge, detailed speculation as to the way individual muscles may have changed to meet new functional demands must remain speculative and have little value as proof. From his evolutionary studies, the author arrives at the conclusion that the foot has become a coherent elastic arched contrivance in which bone and ligament differ only in calcium impregnation, but otherwise are short or long trabeculae answering to the stresses and strains imposed upon them. The muscles have but to balance the legs and the body upon the foot.

The analysis of the postural and locomotory activities of the foot but bear out this contention, and the disabilities of the foot are of course interpreted in the same way. In the examination of nurses and students, the author estimated the power of the muscles in those who had static change of the foot and found this the same in those who had no such disabilities. The opposing view asserts that in the maintenance of the configuration of the foot the muscles stand in the first line of defence; the ligaments are resistances invoked against external forces only after the muscles have failed. The reflex postural activity of muscles maintains not only the equilibrium of the body but also the form of the foot. It is the penetration of this conception into the practice of orthopaedics that has elevated its teaching and enhanced its results. The work of British medicine in bringing this about has been very considerable, and it has become widely adopted elsewhere. The problem at issue is one of clinical investigation and cannot be settled by appeals to a more or less speculative evolutionary background.

A National Encyclopædia of Educational Films and 16 mm. Apparatus available in Great Britain, 1936
Edited by William L. Lally. Pp. 479+7 plates. (London: The Central Information Bureau for Educational Films, Ltd., 1937.) 15s.

THIS is a new, enlarged, and again improved edition of a work first published under its present name in 1935 but really dating back to 1933. The improvement—and it is an immense improvement—consists in the inclusion first of a film title index giving reference to both 35-mm. sound and silent and 16-mm.

sound and silent films, and secondly, of a new subject index to the main classification. The first meets a criticism which we made of the first edition that there was no possibility of direct reference to any specific film when the title was known, and the second enables us to find films that deal with any particular topic. The encyclopædia is now in fact usable without a great expenditure of energy and temper.

Although it is now possible to trace films, the process is not even yet quite so simple as it might be. If we wish to obtain a film on a particular subject, we first turn to the subject index and choose a name. Then we look up this name in the index to titles. Perhaps we were unlucky, but when we looked up 'Cacao-Trinidad' and 'Cocoa from Trinidad' we could find neither. If the name is given, we find whether it is 35-mm. sound or silent or 16-mm. sound or silent, and on what page further particulars are given. We turn to that page, identify the film and find the source of supply and its length. 'Identify' is the word to be used, for when we looked up "Hop Gardens of Kent" as given on the title index, we found "Hoplands" not on the page named but the next. Nor is this the sole example of transmutation of titles.

The lengths are still given in reels. This is not quite satisfactory; for it makes a great difference to the suitability of the film whether it runs for 7 or 15 minutes. But this, with some other matters, can be attended to in future editions. It is a great advance to have a catalogue that is usable.

Grundlagen, Methoden und Ziele der Hygiene:

eine Einführung für Mediziner und Naturwissenschaftler, Volkswirtschaftler und Techniker. Von Prof. Dr. Werner Kollath. Pp. xvii+508. (Leipzig: S. Hirzel, 1937.) 18 gold marks.

THE preface declares that this book is intended as an introduction to hygiene for the student of medicine and also as a stimulus for the interested layman to introduce hygienic methods wherever this may be possible. The plan of the book is good in that the first part is devoted to the scientific foundations of hygiene, the association of physics and chemistry with biology and of biology with medicine. Subsequent parts deal with environmental hygiene, with nutrition, with medical statistics and public health organization, and the last part with bacteriology and serology.

The book, however, is too ambitious in trying to cover too much in five hundred pages. Balance is not maintained, the writing being either too discursive or too laconic. Twenty-three pages are devoted to atomic physics, ten pages to oxidation-reduction potentials, but immunology is accorded only nine and medical statistics only thirteen pages. Epidemiology receives only passing mention, and even the problems of milk-borne infections are dismissed by giving an incomplete list of the diseases which may be spread by milk. The bibliography makes mention of a number of text-books and gives references to fifty-six papers on a large variety of subjects by the author himself. The book is not likely to appeal to the English reader.

The International Council of Scientific Unions

THE International Council of Scientific Unions, formerly the International Research Council, will meet at the rooms of the Royal Society, for the first time in Great Britain, on April 26. The original statutes laid down that the triennial meetings of the Council should be held at Brussels, but these were altered in 1931 to empower the General Assembly to accept invitations from other countries.

The present Council was established in 1919 after its predecessor, the International Association of Academies, had lapsed during the Great War after actively promoting international science for about sixteen years.

For some years before 1898, the Academies of Munich and Vienna, with the Royal Societies of Göttingen and Leipzig, had been in the habit of meeting annually at one or other of these places as an association to discuss matters of common interest, and in 1898 they were to meet at Göttingen. The Royal Society of Göttingen invited the Royal Society to send delegates to take part in the meeting and its discussions, and also intimated that the four institutions would be glad to learn the views of the Royal Society on the possibility and desirability of its joining them. The Council of the Royal Society accepted the invitation and instructed its delegates to say that the Society would be disposed to join the association provided that it were so extended as to assume a fully international character. The suggestion was accepted in principle, and the Royal Society was requested to take such steps as might be desirable to ascertain how far the formation of such an international association might commend itself to the leading scientific bodies of other countries. As a private institution, the Royal Society was very favourably situated for opening such negotiations.

In the following year the Académie des Sciences of Paris, the Academia dei Lincei of Rome, the Imperial Academy of Sciences at St. Petersburg, and the National Academy of Sciences at Washington, approved of the proposal and expressed their readiness to join such an international association. A preliminary conference was therefore held at Weisbaden in October 1899, at which a draft scheme for the organization was prepared providing for triennial meetings of the General Assembly, which would consist of delegates from each adhering Academy. The Assembly was to be formed of two sections, one for the natural sciences, and the other for literature and philo-

sophy. The Council of the Association held its first meeting at Paris in 1900.

By the organization of the association an academy might be admitted either to the literary section alone, or to the scientific section alone, but not to both unless its constitution showed that the sphere of its labours included both literary and scientific subjects; and as at that time there was no society in existence in England dealing with the subjects of the literary section in such a manner as to satisfy these conditions, the United Kingdom could only be represented in the scientific section by the Royal Society. The Council, therefore, consulted several distinguished men of letters, a number of whom afterwards submitted a memorandum in which it was suggested that the Royal Society might either enlarge its scope so as to include a section corresponding to the philosophical, historical and philological division of some foreign academies; or that it might address a memorial to the Government pointing out the exceptional position in which Great Britain was placed as compared with other European countries through the absence of any academy representing departments of study other than mathematics and natural sciences, and advocating the formation of such an academy.

In 1900 the Council of the Royal Society appointed a committee of fellows of the Society to consider this memorandum and to report. The committee went into the whole matter very thoroughly and, after conferring with a number of representatives of historical and philological studies, presented a report, which was laid before a special meeting of the fellows, at which a very full and interesting discussion of it took place on May 9, 1901. The report came before the Council again at its meeting in July, and after full consideration it was resolved "that the Council while sympathising with the desire to secure corporate organisation for the exact literary studies considered in the Report, is of the opinion that it is undesirable that the Royal Society should itself initiate the establishment of a British Academy".

At the end of 1901 a number of those who had taken part in these discussions formed a new body, the British Academy for the Promotion of Historical, Philosophical and Philological Studies. This body drew up a petition to His Majesty in Council for the grant of a Royal Charter, and in 1902 the British Academy for the Promotion of Historical, Philosophical and Philological Studies was constituted, and incorporated by Royal Charters.

During the Great War, the periodical meetings of the International Association of Academies and of many other international organizations could not be held, though some of them were continued in neutral countries. In 1918, therefore, the Royal Society, the Academy of Sciences, Paris, and the National Academy of Sciences, Washington, discussed informally the question of the future organization of the scientific undertakings which had been carried on before the War by international co-operation; and ultimately the academies of all the allied countries were invited to send representatives to a conference which took place at the rooms of the Royal Society in October 1918. This was followed by a meeting at Paris at the end of November, when it was agreed to form an International Research Council and a number of affiliated International Unions to deal with matters of international scientific interest, which was done at Brussels in the next year.

Besides the ordinary routine of the triennial meeting, which is being held in London on April 26–May 4, the Council will have for consideration the report of the standing committee on the Study of Solar and Terrestrial Phenomena, and also that of the committee which was appointed three years ago to report on the relations which should exist between the Council and the Committee of Intellectual Co-operation of the League of Nations concerning matters of international science.

The Royal Academy of Amsterdam is proposing that the International Council should appoint a committee to study what co-ordination can be achieved in the opinions which have been put forward regarding the social responsibilities of science and of scientific workers towards the dangers at present menacing the future of civilization.

Public lectures will be given on April 28 and April 30 at the Royal Institution; the former by Sir William Bragg, on "Classical Experiments made at the Royal Institution", and the latter by Prof. E. V. Appleton, on "International Co-operation in Radio Research". The Government is giving an evening reception to the delegates at Lancaster House on April 29.

Arrangements have been made for the delegates to visit a large number of scientific institutions in and near London, where they will receive assistance from members of the scientific staffs in the objects of their visits.

The General Assembly will hold its closing meeting on Monday, May 3, and the delegates will attend the soirée of the Royal Society on Tuesday, May 4.

On Tuesday, April 27, there will be a reception of the delegates at the University of London, when the Chancellor of the University, the Earl of Athlone, will confer the honorary doctorate of science on Dr. N. E. Nörlund, the president of the International Council.

The Total Solar Eclipse of June 1937

THE total eclipse which starts on June 9 next and, crossing the date line, ends on June 8, will be the longest visible for many years, the maximum duration of totality being 7 minutes 4 seconds. It is most unfortunate that the belt of totality lies almost entirely over the ocean and that the maximum duration available from land is reduced to 4 minutes 8 seconds. This is from Enderbury Island in the Phoenix Group (lat. $3^{\circ} 8.5' S.$, long. $171^{\circ} 10.0' W.$) which is described in the *Sailing Directions, Pacific Islands Pilot*, vol. 2, 1932, as "30 feet high, uninhabited and surrounded by a coral reef, which is steep to. There is no fresh water, no anchorage and landing is difficult". The island is about 2.5 miles long and 1 mile wide. Of the other islands in the Phoenix Group, which lie within the belt of totality—Gardner, McKean, Hall, Birnie, Canton and Phoenix, all uninhabited—the most suitable island for landing eclipse apparatus appears to be Canton Island (lat. $2^{\circ} 28.9' S.$, long. $171^{\circ} 42.6' W.$).

Here totality lasts 3 minutes 45 seconds. The island is a coral atoll 10–12 feet high, with a spacious lagoon: there is anchorage, in 10 fathoms, unsafe with westerly winds, close to an entrance to the lagoon on the west side. Coco-nuts have been planted on the island, which is nine miles long by four miles wide. The islands are leased by the Colonial Office to Messrs. Burns Philp (South Seas) Co. Ltd., and come under the jurisdiction of H.E. the High Commissioner for the Western Pacific at Suva, Fiji.

The belt of totality east of the Phoenix group never strikes land until at sunset it reaches the coast of Peru. The U.S. Navy reported an island, Sarah Anne Island, which would have lain in the track of the shadow, but the island must have sunk below the ocean as it is no longer to be found. In Peru the maximum altitude of the sun is 8° and the maximum duration of totality 3 minutes 20 seconds. The Faculty of Science of the University of San Marcos has formed a

committee to help visiting scientific expeditions in all matters of transport, meteorology, health conditions and camp installation. The Dean of the Faculty, Prof. Godofrich Garcia, is president of the Committee.

So far, three expeditions have been announced as going to observe this eclipse. With the aid of a sloop of the New Zealand Navy, Mr. C. B. Michie, of Kaitaia, N.Z., is taking a party consisting of Dr. W. C. Burns and Mr. F. Gawith—all three being members of the 1930 expedition to Niaufou' or Tin-can Island—and Mr. Thomsen and some other member of the staff of the Dominion Observatory. The 19-foot coronagraph used at the eclipses of 1926, 1929, 1930, 1932, and 1936, has been sent to Mr. Michie from Japan and will be taken by him to Canton Island. By kind permission of the Royal Irish Academy, the 8-inch Grubb cœlostast will be used to feed the coronagraph. Photographs of the corona will, it is hoped, be secured through various colour-filters. Other details of the programme are not available here.

Another party will be organized by the U.S. Navy, the National Geographic Society and the National Bureau of Standards, and will proceed to Canton or Enderbury Island. Prof. S. A. Mitchell, director of the Leander McCormick Observatory, will be the scientific leader of the expedition, while Captain J. F. Hellweg, Superintendent of the U.S. Naval Observatory, Washington, will be responsible for the naval side of the work. Dr. H. D. Curtis, director of the Ann Arbor Observatory, Michigan, Dr. P. A. McNally, director of the Georgetown College Observatory, Dr. F. K. Richtmyer, of Cornell University, Dr. I. C. Gardner, National Bureau of Standards

and Mr. J. W. Willis, of the Naval Observatory, accompany the expedition and assure a wealth of valuable eclipse experience. The party will be completed by a naturalist (a naval surgeon), and a photographer from the National Geographic Society.

The spectrum of the chromosphere and corona will be photographed by Dr. Mitchell and Dr. Curtis respectively. Dr. McNally will photograph the corona through a variety of filters, while Dr. Richtmyer will measure the total light of the corona. Colour photographs of the corona will be attempted by Dr. Gardner, who will repeat some of the photographs secured by him in Siberia last June (see NATURE, March 13, p. 434). Time observations of contacts will be made by the observers from the Naval Observatory.

This party will be taken from Honolulu by the U.S. Navy mine-sweeper *Avocet* early in May. They may have a difficult time in preparing for the eclipse. We can only hope that the good weather, which has generally, though not invariably, attended Dr. Mitchell and Dr. Curtis, will hold for both parties on the morning of June 8 next.

A Japanese expedition, under the leadership of Prof. I. Yamamoto, of the Kwasan Observatory, Kyoto, will proceed to the coast of Peru to observe the eclipse of next June at sunset. The other members of the party are Prof. T. Araki and Messrs. Y. Sibata and M. Horii. The programme includes photography of the corona and of the spectra of the chromosphere and corona, photometry of the corona and some geodetic observations. The equipment will include some cinematograph cameras.

F. J. M. S.

Radium Treatment in Great Britain

RADIUM treatment is an established medical service in Great Britain, as may be gathered from the reports which are issued from year to year, especially by the four important organizations which have the responsibility of encouraging its practice and of helping research bearing upon its many problems. These organizations are the National Radium Commission, now in its eighth year of existence, and King Edward's Hospital Fund for London, both of which are primarily concerned with treatment; the British Empire Cancer Campaign and the Medical Research Council, whose interests in the subject are primarily research, their common matters of discussion in the first instance usually being referred to a joint

Radiology Committee. The allocation of radium by these four organizations at present exceeds 40 grams of radium element.

The seventh annual report of the Radium Commission* includes a statistical report of 47 pages which teems with interest. It being no longer a question whether radium is of *any* use in the treatment of cancer, one of the first questions which the Commission has tried to answer is how much use it is. To this end, an elaborate plan was laid, and the first fruits of this are now at hand. The present report gives the 3-year and 5-year results of radium treatment of five common

* Seventh Annual Reports of the National Radium Trust and Radium Commission 1935-1936 including a Statistical Report. (Cmd. 5342.) Pp. 91. (London: H.M. Stationery Office, 1937.) 1s. 6d. net.

sites of cancer, namely, breast, cervix uteri, lip, tongue and floor of mouth. From the data contained in thirty-nine tables it is now possible to obtain the answer to almost any question that can normally arise concerning the probable results of treatment, as practised throughout the country. The report is based upon an analysis of the records of more than 5,600 patients, and the hospitals from which the patients have been drawn are widely distributed throughout the whole of Great Britain.

Little is said throughout this statistical report of the efforts which the Radium Commission made in its preparation of suitable clinical record sheets and statistical cards so as to ensure that the right kind of information was eventually received from its National and Regional Centres, preferring to report upon the fact that the accuracy of this material has shown signs of steady improvement. How loyally these Centres have contributed in the work of the follow-up of patients is shown by the fact that only 3.9 per cent of the total patients has been lost sight of.

The spirit of co-operation is further shown by the arrangement made by the authorities of King Edward's Hospital Fund, that the data from hospitals receiving allocations of radium from the Fund should be put at the service of the Commission.

Though radium is used in the treatment of other diseases, its outstanding medical interest is its use in cancer, and one of the chief difficulties in the preparation of data is to agree upon some common and acceptable method of classifying the various stages of the disease. This had already been done in 1929 for uterine cancer by the Radiological Sub-Commission of the League of Nations Health Organization, but for no other sites. The Commission therefore undertook this for the other sites of cancer already mentioned.

The general scheme of the report follows the same lines for each site under investigation; the completeness of the information may be gathered from the following tabular headings: percentage net survival rates; patients who have died classified according to cause of death; percentage three-year net survival rate according to whether or not a histological examination was made; number of patients treated by different methods or combinations of methods; percentage net survival and symptom-free rates at three and five years after treatment according to method of treatment and stage of disease; age distribution of patients; three-year net survival rate according to age of patient and stage of treatment.

In only one of the five groups, namely, carcinoma of the cervix uteri, is there any appreciable difference in the three-year net survival rate

according to whether or not a histological examination was made. Table 13 is here reproduced; while no explanation is available, it may be suggested that the failure to have this valuable histological evidence was only one indication of inadequate treatment.

TABLE 13. CARCINOMA OF CERVIX.
Percentage three-year net survival rate according to whether or not a histological examination was made.

Stage of Disease	Histological examination made	No histological examination
I	63.4 (304)	50.8 (66)
II	51.2 (440)	35.7 (99)
III	32.4 (678)	15.5 (120)
IV	15.0 (266)	5.0 (85)
All stages	40.0 (1,688)	24.8 (370)

Numbers in brackets are the number of patients.

The dangers of malignant disease are twofold; primarily the growth with its local spread, secondarily its extension into other structures of the body. The extent to which the latter adds to the difficulty of radiological treatment is well shown in the section of the report devoted to carcinoma of the tongue. The patients were classified according to the stage of the disease as follows:

I. Primary growth limited to the tongue: (a) glands not involved; (b) glands involved.

II. Primary growth limited to the tongue and floor of mouth: (a) glands not involved; (b) glands involved.

III. Primary growth has spread from the tongue to other structures within the mouth: (a) glands not involved; (b) glands involved.

This should be read in conjunction with the following data contained in Table 27.

TABLE 27.—CARCINOMA OF THE TONGUE.
Percentage net survival rates from all methods of treatment in which radium was employed.

Stage of Disease	Net Survival Rate at:	
	3 years	5 years
Ia	49.7 (339)	26.2 (83)
Ib	12.6 (310)	5.1 (85)
IIa	39.6 (143)	18.5 (29)
IIb	11.5 (265)	11.1 (57)
IIIa	31.0 (47)	— (6)
IIIb	7.5 (136)	3.3 (30)
All stages	25.7 (1,240)	13.9 (290)

For those who prefer composite figures, the following data (p. 701) are available, giving net survival rates in percentages.

The impression should not be formed that these patients have been treated by means of radium only; this is far from the case. In breast cancer, for example, no less than 86 different combinations of methods of treatment come under analysis,

in uterine cancer 66, and so on. This arises from the fact that there are three main methods in radium treatment, each of which may be associated with varied surgical or X-ray treatment.

Site	Earliest Stage of Disease		All Stages of Disease	
	3 years	5 years	3 years	5 years
Breast	70.1	50.0	37.2	24.6
Cervix Uteri ..	61.1	49.4	37.3	31.1
Lip	77.5	77.8*	63.8	53.6
Tongue	49.7	26.2	25.7	13.9
Floor of Mouth ..	62.0	53.6	36.2	31.0

* Small group of patients.

Difficulties in treatment are many, but no sentence in this report brings these difficulties more acutely to mind than the following:

"The proportion of patients in whom the disease is still localised to its original site and in whom there are no signs of local or metastatic spread when the patient is first seen amount, for all sites investigated, to only 25 per cent. of the patients. The marked difference in the survival

rates shows that for these patients the chances of survival are much more favourable than when either local spread or metastasis has taken place."

Of necessity the results of individual centres cannot be gauged when merged into the larger groups, so invaluable for statistical work. From the reports entitled "Medical Uses of Radium" issued for the last fifteen years by the Medical Research Council, this can be done for the centres taking part in its scheme of research. These reports also from time to time show the important results of radium treatment in certain non-malignant gynaecological conditions.

Radium has proved of service in the treatment of cancer, especially when the direction of the medical services has been in competent and inspiring hands. The tendency in treatment is for less interstitial work to be done, giving way to surface and distant applications of radium, the latter involving the use of bigger units, 1.5 grams. There is little doubt that, as the warrant is shown for the use of these bigger units, the country will see to it that the necessary radium is provided.

S. RUSS.

Centenary of the University of Göttingen

From a Correspondent

GÖTTINGEN is celebrating its bicentenary on June 30 of this year. Perhaps no university has maintained so high a standard of learning over so long a period as Göttingen. Among its illustrious professors have been Albrecht von Haller, a man of most varied genius and the first modern physiologist, Gauss, supreme alike as mathematician, astronomer and experimenter, Blumenbach, the humane and wise father of anthropology, the brothers Grimm, begetters of modern scientific philology, whose name is known in every nursery, Wilhelm Weber, associated with the measurement of electrical quantities, with terrestrial magnetism, with the electric telegraph and, along with his brother Ernst, with a multitude of physiological researchers, Ewald, the Hebrew scholar, commonly regarded as the father of scientific biblical criticism, Wüstenfeld, who traced the debt that European science owes to the Arabic-speaking world, and Henle, one of the greatest of anatomists, founder of the science of histology, whose name is attached to more than one structure of the body. These men and their colleagues and successors taught and inspired innumerable English-speaking students.

During the first third of the twentieth century, Göttingen fully maintained its historic standards. Its mathematical disciplines, especially, were held in the highest esteem. The great mathematical-physical group at Göttingen was, beyond all cavil, the most important scientific school in post-War Germany. Members of this school were among the first to re-establish contact with English colleagues after the War, and Göttingen was the first German university to receive English students.

The University of Göttingen was founded by George II of England, and opened on October 31, 1734. Thus an appropriate occasion for a bicentenary would have been the early autumn of 1934. At that time, however, both Germany and her neighbours were still very conscious of the effects of the official massacre, known as the 'clean-up', of June 30 of that year. The number who perished on that day is still not exactly known—the German Government has published no list—but a list of persons of political importance who disappeared about that time contains no less than 1,184 names. Further, it was towards the end of June 1933 that students and "black guards" (S.S. men) secured a great number of books from

the University library at Göttingen and burnt them in public without protest from the Rector. Memories are short, but it has been found impossible to secure complete forgetfulness of these events. The German authorities have, therefore, taken the prudent line of associating the day with other events. Last year the Heidelberg centenary celebrations were arranged to culminate on June 30, and this year June 30 is chosen for Göttingen.

Though 1934 might have been more appropriate for the celebration, 1937 is certainly the centenary of important events in Göttingen history. On September 17, 1737, the University occupied new buildings. In 1837, the liberal constitution that had been granted to the Hanoverians a few years earlier, was revoked by their sovereign, Ernest Augustus, son of George III of England. Seven of the most distinguished professors of Göttingen—the famous *Göttinger Sieben*—protested. They were expelled. The displaced professors included some of the greatest scholars of the age. Among them were Wilhelm Weber, the brothers Grimm and Ewald. These three events, therefore, the massacre of June 30, 1934, the burning of the books about a year before, the abrogation of the liberal constitution of 1837 and the expulsion of the professors in the same year, will be in the minds of many on June 30, 1937, when the Rector of the University of Göttingen has bidden guests from universities and learned bodies throughout the world to rejoice with him.

Those who join in the celebrations at the University of Göttingen will ask in what spirit that body interprets learned anniversaries. The question has been answered by its professor of ancient history, Dr. Kahrstedt, in an address at Göttingen on German Empire Day. He explained that that day was :

“the day to take this vow :— We renounce international science. We renounce the international republic of learning. We renounce research for its own sake. We teach and learn medicine, not to increase the number of known microbes, but to keep the German people strong and healthy. We teach and learn history, not to say how things actually happened, but to instruct the German people from the past. We teach and learn the sciences, not to discover abstract laws, but to sharpen the implements of the German people in competition with other peoples. If the German universities make and keep this vow, then it will naturally come about again that they are the first to be consulted in all cultural and spiritual questions.”

These sentiments and this confidence were echoed by the Minister of Education, Herr Rust, at the centenary celebrations at Heidelberg on June 30, 1936. Herr Rust said that “the National Socialist Government has, since 1933, got rid by a series of institutional measures of what was outworn and superfluous in the Universities”. We

may now therefore glance at these “outworn and superfluous” elements at Göttingen.

In its institute for mathematics, in its institute for theoretical physics, in its two institutes for experimental physics and in its institute for mathematical statistics, there were gathered together at Göttingen in 1932 as active and brilliant a group of investigators as were to be found anywhere in the world. Wholesale dismissals began in 1933, earlier at Göttingen than at any other seat of learning, and they affected especially these institutes which were the chief glory of the University. At the mathematical institute there was only a single survivor, while the other great institutes were also ‘cleaned-up’. Of the 238 members of the staff, 52—twenty-two per cent—were displaced. The readers of NATURE may be interested to learn the names of a few of these.

(1) Prof. Felix Bernstein at the time of his dismissal had been on the staff at Göttingen for twenty-five years. He was director of the Institute for Mathematical Statistics which was developed under his supervision. He now holds a chair at Columbia University, New York.

(2) Prof. Max Born has become famous for his work on the quantum theory and on atomic structure and is generally recognized as one of the most distinguished living exponents of theoretical physics. He now holds a chair at Edinburgh.

(3) Prof. Richard Courant is a specially stimulating teacher. He was the chief organizer of mathematical research at Göttingen. He is now a professor at New York University.

(4) Prof. James Franck won the Nobel Prize for physics in 1925 for his experimental confirmation of the basis of the quantum theory. At the time of his resignation he had been an “ordentlicher” professor at Göttingen for eight years. On resigning he wrote that he could not remain silent while his colleagues were being dismissed. Thirty-three professors and lecturers at Göttingen signed and published a protest against his “impertinent resignation”, accusing him of “sabotage”! Prof. Franck now occupies a chair at Johns Hopkins University.

(5) Prof. Hermann Fraenkel is very well known as an Hellenic scholar. He is now professor of Greek at Leland Stanford University, California.

(6) Prof. V. M. Goldschmidt, a geologist and mineralogist of international reputation, was liable to dismissal as a foreigner. He is of Norwegian nationality, having been born at Oslo where his father was professor. Many professors of geology and mineralogy in Germany signed a memorial that he might be retained. He was allowed to stay for a time, but his life was rendered unendurable and work impossible. He was given no sort of protection by the Rector or by the other authorities. He resigned and accepted a chair at Oslo.

(7) Prof. Edmund Landau is generally regarded as one of the great pure mathematicians of our time. His name is specially associated with the theory of numbers and the theory of functions. At the time of his dismissal he was director of the Mathematical Institute and had been for twenty-four years an "ordentlicher" professor at Göttingen. He is sixty years of age.

(8) Prof. Otto Neugebauer is one of the most distinguished living exponents of the history of science and especially of Greek astronomy and mathematics. He is now professor of the history of mathematics at the University of Copenhagen.

(9) Miss Emmy Noether had an international reputation. She was widely regarded as the most distinguished woman mathematician of our time and perhaps of all time. Her name is especially associated with the theory of groups. She died in exile in the United States soon after her dismissal.

(10) Dr. Karl Saller, an anatomist who specialized on questions of 'race', was dismissed because he could not teach the official doctrines concerning an 'Aryan race'. Dr. Saller was himself once a Nazi, but he could not endure the limitations laid by the Party on scientific inquiry, and his anthropological knowledge prevented him from accepting its racial doctrines. He resigned and was treated with great severity.

(11) Prof. Hertha Sponer is a distinguished experimenter whose name is associated with the analysis of molecular spectra. She is now professor of physics at Duke University, North Carolina.

(12) Prof. Hermann Weyl was called to Göttingen from Zurich in 1930 to succeed the mathematician Prof. Hilbert for whom the famous Mathematical Institute had been built, partly from Rockefeller funds. Prof. Weyl had difficulties because of his wife's Jewish origin and therefore took the opportunity to leave Göttingen when invited to Princeton. Prof. Weyl is known as a philosopher as well as a mathematical physicist.

In estimating the influence of the new régime on German universities several factors have to be considered :

(1) The actual losses can now be estimated with fair accuracy. The number of teachers known to have been displaced from the universities and seats of higher learning is 1,684 ; that is about fifteen per cent of the scholars of Germany. To this must be added a number of quiet resignations and retirements. The true number of displacements is probably not far from 2,000. No institution has suffered more than the University of Göttingen by the loss of distinguished members of its staff ; and of the universities, only Berlin, Frankfurt and Heidelberg have lost as high a percentage.

(2) The intimidation of the staff has a profoundly unsettling effect on their work. Moreover, a stream of edicts—often of a contradictory nature—constantly pours from the Ministry of Education. Merely to master this mass of 'official German' is a considerable task. The excited and threatening political atmosphere in which all officials must live—and German university teachers are now more than ever officials—militates against careful scientific work. Estimates in all departments are unanimous in reporting a rapid and continuous fall in quality. This fall is somewhat masked, partly by the inclusion of foreign contributions, which are eagerly accepted by German scientific journals, and partly by the output of text-books.

(3) The most deadly enemy of German science is the method of recruitment of the junior teaching staff. There is now in operation a complex apparatus that effectively bars studious, scholarly and objectively minded young men from joining the junior staffs of German universities. Beginning in the elementary schools and ending with 'habilitation', there is a whole series of searching tests of the opinions, the political reliability and the military value of every academic aspirant. Two recent orders must suffice to illustrate these points.

The official *Völkische Beobachter* issued a statement on April 5, 1937, that sword practice would shortly become compulsory in all the universities. The statement ends thus :

"Soon, when we hear again the words of command for the duel in the universities and seats of higher learning, and the arms clash again, we shall know that this bodily exercise that belongs equally to the whole nation, is no longer a class distinction as formerly. And everywhere, when a man challenges the offender of his honour, there will no longer be any such thing as academic privilege, but only the manly settling of an offence against honour for every Folk-Comrade trained to arms."

The following decree of the Minister of Education was issued last month in his official journal :

"Disciplinary Procedure against Student Leaders. I request the Rectors of the German Universities that in future, before initiating disciplinary procedure against students who hold office in the German Students' Federation or in the Nazi Students' Union, they report to me with the presentation of the evidence and await my decision."

Thus not only are students being selected at the universities for qualities irrelevant to their scholarship but also the universities themselves are being deprived of their disciplinary power. The whole organization of the German university from rector to student is on a new basis. Göttingen ceased in 1933 to be a scientific centre. On June 30, visitors to Göttingen will celebrate a unique series of losses of learning, liberty and life.

Obituary Notices

Brigadier-General Sir H. C. L. Holden,
K.C.B., F.R.S.

SIR HENRY CAPEL LOFFT HOLDEN died on March 30 at the age of eighty-one years. He was a man of great vision, a distinguished scientific investigator, mathematician and mechanic. His was a versatile and inventive mind which knew no bounds. No matter what the nature of the work or investigation he undertook, he would bring to it an active, keen brain, with freshness of outlook and freedom from the trammels of past practice. He sought to improve on what already existed, or to develop something fresh which would be more effective in its application.

It is now nearly forty years since I came into contact with Sir Capel Holden, when he was superintendent of the Royal Gun Factory, Woolwich Arsenal. He at once impressed me as a man of forceful character and of considerable scientific attainment.

At a time when electric transmission in connexion with machine tools was almost unknown, Holden was a pioneer and applied his talents to the development of an electric drive on machines for the manufacture of guns. He introduced an ingenious magnetic chuck which has had many applications and is still in use in the Royal Arsenal. These pioneer efforts were the forerunners of many of the electrical devices applied to up-to-date machinery of the present day.

Prior to my contact with him, Holden had already shown a flair for experimental work and electrical investigation. Nearly fifty-five years ago when in India, he was given permission to erect a special area line, and the knowledge gained by his tests led to his appointment in the Royal Arsenal, Woolwich, in 1885 as Captain Inspector in the Royal Gun Factory, and afterwards as Inspector of Warlike Stores in 1888. But his innate genius for experimental and electrical work did not find full scope for his abilities until his appointment in the experimental establishment in the Royal Arsenal. Here he built up a reputation as one of the foremost ballistic experts and authorities on gun construction. Among other scientific developments, he modernized and improved the Brouncker chronograph for measuring velocities of ammunition in flight.

At this time, Holden was continuously at work designing instruments and making experiments in internal ballistics and investigating the burning of explosives, which materially improved our knowledge of such matters and led to great savings in expenditure. The most important results of his experiments were embodied in the rules and methods for calculating explosive charges and ballistics in guns. These had formerly been a matter of guess-work, and were actually obtained by trial and error. Since his methods have been in use, it has been easy to predict what are the best proportions of the charge of projectile and what ballistics can be obtained as

a maximum from a given gun under different conditions. For his special work in connexion with the foregoing investigations he received a substantial reward from the Government.

In 1899, Holden was appointed superintendent of the Royal Gun Factory, Woolwich, and acted as Chief Superintendent of Ordnance Factories for a short period in 1903. When the Royal Gun Factory and the Royal Carriage Departments were amalgamated in 1907, he was selected for the joint post, which office he held until his retirement in 1912. During this period, he completely revolutionized safety devices for guns and introduced many ingenious mechanical and electrical devices. Standing to his credit are many inventions and improvements which evolved from the fertile brain of this scientific investigator and born engineer. He again received a substantial reward from the Government for these further services. For many years, Sir Capel served as an official member of various committees, where his wisdom and advice were greatly sought after.

Yet, amid all the activities directly connected with his official post, Holden's inventive powers sought other fields of investigation. His energies directed him to take up motor engineering, in which he sought to perfect an engine for use in a motor-car and motor-cycle, and a four cylinder 'Holden' motor-cycle of his design, which embodied many ideas in advance of the then current practice, was put on the market. In 1905 he became chairman of the Royal Automobile Club, and afterwards, in 1921, chairman of the Royal Aero Club.

Holden's scientific attainments brought him early to the fore-front as a clear-thinking investigator of a high order. This was recognized by his election to the Royal Society more than forty years ago. He was called from his retirement to be Director of Mechanical Transport at the War Office in 1914, and served at the Ministry of Munitions in 1917-18. For his further services to the Government he was honoured by His Majesty the King by being made a Knight Commander of the Order of the Bath.

Sir Capel's services to electrical science and its application to electrical and mechanical development were clearly recognized by his election to full membership of the Institution of Electrical Engineers, and afterwards he became a vice-president of the Institution. He was also a vice-president of the Royal Society of Arts and in 1927 president of the Radio Society of Great Britain.

It is difficult, if not impossible, to estimate with any degree of accuracy, the value of the service Sir Capel rendered to his country and to the armament and engineering industries; but it may be said of him, as of other great engineers, that he wrested from Nature some of her secrets and used them for the benefit and convenience of mankind.

FRANCIS CARNEGIE.

Prof. S. Young, F.R.S.

PROF. SYDNEY YOUNG, after a brief illness, died in a nursing home in Bristol on April 8 at the age of seventy-nine years. He received his training in chemistry at Owens College, Manchester, and the University of Strasbourg, and in 1882 was appointed lecturer under William Ramsay in University College, Bristol. From that date until Ramsay went to London in 1887, he and Young published a series of joint papers dealing with such subjects as evaporation and dissociation, the properties of water and steam, and the thermal properties of many liquids.

It was not, however, until Young was appointed to the chair of chemistry in Bristol in 1887 that the long series of investigations commenced which established his reputation as one of the leading physical chemists of his day. The earlier papers dealt with the generalization of van der Waals, the determination of critical volume and density, the law of Cailletet and Mathias, the thermal properties of iso-pentane, *n*-pentane and *n*-hexane, and the boiling points of different liquids at equal pressures.

The preparation of the substances Young investigated necessitated a new type of still head, and after much experimental work, those he devised and made himself were so remarkably efficient that he was able for the first time to obtain liquids of an exceptional degree of purity, and with them he was able to investigate in a way that had been previously impossible the nature of the lower boiling fractions of American petroleum. The determination of the vapour pressure and boiling points of mixed liquids, such as the lower alcohols and water, and the alcohols, benzene and water, led to the 'azeotropic' method for the preparation of absolute alcohol, which proved of considerable technical importance.

The whole of this fundamental work was characterized by a very high degree of accuracy, and demanded great experimental skill and extraordinary patience. Dr. Young gave an account of this work in "Fractional Distillation", published by Messrs. Macmillan and Co., Ltd., in 1903, and in a second enlarged edition called "Distillation Principles and Processes" in 1922.

It was whilst Young was in Bristol that he was elected to the Royal Society in 1893. In the laboratories there the numbers of students were small, and in consequence both administration and teaching left him ample time for experimental work. Although some of his communications were joint papers with Miss E. C. Fortey, Dr. G. L. Thomas, Dr. F. Francis and Prof. F. R. Barrell, by far the larger number were the result of his own individual work. When he accepted the invitation to the chair of chemistry at Trinity College, Dublin, in 1903, he found the conditions there entirely different, and the large amount of teaching and administration made such heavy demands on his time that his experimental work suffered, although he still made contributions to various societies.

Young was president of Section B (Chemistry) of the British Association at the Cambridge meeting in

1904. "Stoichiometry" was published by Messrs. Longmans, Green and Co., Ltd., in 1908, and a second edition in 1918. In 1917 he was elected one of the vice-presidents of the Chemical Society, and between 1920 and 1925 he served on the Advisory Council of the Department of Scientific and Industrial Research. His work for Trinity College, Dublin, was highly appreciated, and a leading article in the *Irish Times* when he retired stated that "he was a proof that Irish and English mentalities are not among the things which resist combination".

Young's connexion with the Royal Irish Academy, of which he was president in 1921-26, gave him an importance in Ireland's intellectual life, and his tact, kindness and known moderation, together with the able co-operation of his wife, did much to ease a difficult period of transition. On his retirement from Trinity College in 1928, he received a remarkable, and perhaps unique tribute, for on that occasion he was presented with an address containing 210 signatures of old students and eminent men of science from all over the world. They expressed their high appreciation of his work, and wished him many years of leisure. In the last year of his life he was greatly pleased at being elected president of the Manchester University Old Students' Association.

Prof. Young married Grace Martha Kimmins in 1896, and she survives him. They had twin sons, of whom Sydney Vernon was killed in the Great War and Charles Edgar is headmaster of Lincoln School and headmaster designate of Rossall.

JUST at a time when preparations are being made to celebrate the hundred and fiftieth anniversary of the birth of the Czech biologist, Jan Evangelista Purkyně (Purkinje) comes the news that his grandson, Prof. Cyril Purkyně, died in Prague on April 5 after a long illness at the age of seventy-four years. Prof. Cyril Purkyně had been professor of geology and mineralogy at Prague Technical University since 1907, after having taught geology and palæontology at Pilsen from 1895 until 1907. Whilst there, he began his work on local geological cartography and this was extended after his appointment as the first director of the Czechoslovak State Geological Institute in 1919.

WE regret to announce the following deaths :

Prof. A. W. Borthwick, O.B.E., first professor of forestry in the University of Aberdeen, and formerly chief research and education officer to the Forestry Commission, on April 19, aged sixty-four years.

Lord Conway, known for his explorations in the Himalayas, Spitsbergen, the Andes, etc., author of many well-known works on exploration and travel, on April 18, aged eighty-one years.

Prof. A. Gravis, emeritus professor of botany in the University of Liège, on January 1.

Sir George Hart, K.B.E., C.I.E., formerly Inspector-General of Forests in India, on April 16, aged seventy-one years.

News and Views

Prof. G. G. Henderson, F.R.S.

THE medal of the Society of Chemical Industry has been awarded to Prof. G. G. Henderson, regius professor of chemistry in the University of Glasgow. The Medal is presented every alternate year for conspicuous service to applied chemistry. Prof. Henderson began a life-long association with teaching in 1884, when he became assistant to the professor of chemistry in the University of Glasgow. He also possesses the unique distinction of having been president of the Chemical Society, the Institute of Chemistry and the Society of Chemical Industry. For a number of years, he was one of the secretaries of Section B (Chemistry) of the British Association, in 1905 he became recorder, and in 1916 he was president. Much time and energy has been devoted by Prof. Henderson to the prosecution of original research—mostly in the organic field and particularly the chemistry of terpenes—and to the supervision of the research work of students.

Destruction of the Bed Bug

A PROMISING advance in solving the problem of the destruction of bed bugs is reported in the *British Medical Journal* of February 27, p. 459, by Messrs. S. A. Ashmore, of the Government Laboratory, and A. W. McKenny Hughes, of the Natural History Museum, acting for the Committee of the Medical Research Council. That the evil is a grievous one, although often passed by on account of the unsavoury nature of the subject, can be gathered from conversations with medical officers of health, who have been known to declare that they can identify streets with infested houses from the paleness of the children due to sleeplessness produced by bites. It has been said that in hot weather children are driven from their beds to play in the streets in some quarters during the light night hours. Disadvantages attach to most of the treatments previously tried. Thus hydrocyanic acid in the gaseous form is lethal to the insects and also to their eggs, but the use of this highly toxic substance obviously requires great precautions, especially, for example, in treating a room situated in the midst of tenements. Certain chlorinated aromatic derivatives appeared promising, but were found to act as liver poisons on the animal organism, and presumably on man, if traces were left unevaporated.

THE authors put forward a simpler method with which they have had promising results both in the laboratory and in about two hundred infested houses. It consists in spraying the room at a temperature not below 60° F. with a quantity of fairly high boiling coal-tar naphtha for which a specification is given, the room being thereafter sealed for eighteen to twenty-four hours. It is claimed that this sub-

stance is not only lethal to the insects, but is also an ovicide, and that it is not harmful to other animals. The concentration of vapour necessary is well below that of the flash-point of its mixture with air. Research is going on at the Field Biological Station of the Imperial College of Science to determine which of the many constituents of this coal-tar naphtha is specially efficacious, but the above-quoted report points to a remedy, by the careful use of a cheap and easily obtained product. It is greatly to be hoped that this method proves successful, for this social evil is a very great and widespread one.

The Boulder Dam

A LECTURE on the remarkable engineering achievement, known as the Boulder Dam, across the Colorado River about thirty miles south-east of Las Vegas, Nevada, where the river forms the boundary between the States of Nevada and Arizona, was delivered to the Institution of Civil Engineers on April 15 by Mr. John Lucian Savage, chief designing engineer, Bureau of Reclamation, United States Department of the Interior. The Dam has already been referred to in *NATURE* (Feb. 9, 1935) and the leading particulars will be given in one of a series of articles on "Water Power Developments in the United States", already prepared and awaiting publication. Mr. Savage's lecture was a very detailed account of the engineering features of the undertaking and of the constructional methods employed. It is interesting to note that the four diversion tunnels for the river (which were a necessary provision at the outset of operations) each 56 ft. diameter bore and 4,000 ft. long, were driven through unusually sound monolithic rock, with the result that 1,500,000 cubic yards of excavation in the three miles of tunnel were removed without the use of timbering or roof supports of any sort. "The ideal character of the andesite breccia rock for tunnelling purposes, as evidenced by this record, is one of the marvels of Boulder Dam." The reservoir behind the dam, called "Mead Lake" in honour of the late Dr. Elwood Mead, has a capacity of 30,500,000 acre-feet, of which 9,500,000 acre-feet has been reserved for flood control. This volume of flood storage, combined with the 520,000 cusecs (cubic feet per second) of flood discharge capacity, provides for an estimated inflow into the reservoir of nearly a million cusecs without overtopping the dam. This extraordinary provision for inflow is made in view of the remote contingency of the failure of an upstream dam.

A Film of the Royal Botanic Gardens, Kew

A PRIVATE view of a new 'documentary' film of the Royal Botanic Gardens, Kew, was given to a number of men of science in London on April 14. The film, which was made by Short Film Productions,

Ltd., and produced by Mr. Harold Lowenstein with the co-operation of Sir Arthur Hill and his staff, gives a 'cross-section' of the activities of Kew as a public garden and as the centre of economic botany and horticulture in the Empire. The opening views give a picture of the Gardens as seen by the ordinary visitor, followed by sequences showing some of the work that goes on behind the scenes, both out of doors and under glass, in order to keep the Gardens in good condition and to provide a constant succession of bloom throughout the year. The most interesting section of the film from the scientific point of view is that illustrating the work that is carried out in the Herbarium, Jodrell Laboratory and Museums. The process of drying, pressing, mounting and storing botanical specimens is shown in the film in detail, and the method of examining and describing new species is also dealt with. The work of the Jodrell Laboratory consists largely of identifying fragments of plants (roots, stems, leaves, etc.) by microscopical examination, and one of the best sequences in the film illustrates the technique of examining a portion of stalk found in the stomach of a poisoned cow. The film ends with an impressionistic treatment of the part that Kew has played in the foundation and improvement of many of the important agricultural enterprises throughout the Empire. The introduction of Para rubber and cinchona (quinine) from South America via Kew to the East in the middle of last century is illustrated, and more recent instances show that this type of work is still being undertaken. This film will undoubtedly be of value in spreading a knowledge of the great importance of the Royal Botanic Gardens in the botanical and horticultural work of the Empire, and it is hoped that it will obtain a wide circulation, especially among schools and other educational institutions.

Palestine Folk Museum

AN appeal for financial assistance towards the needs of the Palestine Folk Museum, appearing in *The Times* of April 19, should meet with a sympathetic reception from the widespread public in Great Britain and America, which is interested in the history and culture of Bible lands. The museum, which is situated in Jerusalem, was opened in 1936 under a committee formed in the preceding year and composed of representatives of the resident English, Arab and Jewish communities. Unfortunately it has no funds, and its work is carried on by voluntary helpers—no inconsiderable burden, even with a tolerant standard of efficiency. No Government grant has been made towards the expenses of the Museum, nor is it eligible to receive assistance from the funds provided by the Carnegie Corporation to aid the museums of the Empire through the Museums Association, Palestine being a mandated territory. Until something in the nature of an assured income is provided, it will not be possible to appoint a curator, an obvious necessity, or to carry on research. Folk museums now have a recognized and an increasingly important part to play in the record and study of cultural history; but the value to the student,

whether archæologist or historian, of a folk museum in a country in the near East, such as Palestine, is exceptional. A prolonged period of little cultural change has preserved peasant arts and industries, with their characteristic implements and appliances, domestic and other, virtually unchanged for many centuries, so that objects can be seen in daily use in the villages, which are identical in form and purpose with finds from Palestinian sites of the Bronze and Iron Ages. This period of comparative immobility is rapidly drawing to a close under the impact of an expansion of population and industry under Western influence.

Science and the Conservation of Food

IN his Friday evening discourse at the Royal Institution on April 16, Mr. T. Macara described some special problems of "Science and the Conservation of Food". While the term 'conservation of food' may be applied to many aspects of the production and handling of foods, he confined himself to problems connected with some common types of manufactured food. The first problems discussed were mould growth and fermentation, crystallization, and absence of jelly property in jam. As regards mould growth and fermentation, Mr. Macara put forward the theory that their prevention depends on the production of a jam having a higher osmotic pressure than that of mould spores or yeast cells, and he showed how this result could be achieved. The jelly property of jams is due to the fruit pectin, and it was shown how the jellifying property of this pectin may be lost or destroyed through lack of knowledge of its properties. Problems connected with the preservation of fruits, vegetables and meat products were then discussed. The British Food Manufacturers' Research Association has found certain bacteria the spores of which show an extraordinary high resistance to heat. Boiling for 8 hours or heating to 230° F. for an hour fails to destroy them. It was pointed out that these times apply to small quantities of materials, and that when larger quantities have to be sterilized it is necessary to know the rate at which heat penetrates the product. The question of food storage in cans is surrounded with difficulties on account of defects in the coating of tin on the cans. A number of cases have been met with where the cans became perforated after three or four months' storage.

Joint Committee on Materials and their Testing

A COMMITTEE having the above title has now been set up by leading technical institutions and societies in Great Britain to act as the British national organization in matters relating to materials and their testing. The need in Great Britain of some means to provide for more adequate co-ordination of the study of materials and their testing has, during the past year, received the earnest consideration of the principal technical institutions and societies which are concerned directly and indirectly with these important subjects. Twenty-two institutions and societies are represented on the Joint

Committee. Essentially, the work of the Joint Committee will be divided into two fields of activity, national and international, of which the former will no doubt be of major importance. As a commencement in this field, the Committee is now engaged in making arrangements for a general discussion on the subject of the notched bar test to be held in Manchester in the early autumn of the present year. The activities of the International Association for Testing Materials in Great Britain are at present entrusted to the keeping of a British Committee, and the latter has agreed that, at the conclusion of the London Congress of the International Association for Testing Materials now being held (April 19-24), the Joint Committee shall take over the representation in Great Britain of all matters connected with the International Association. The first chairman of the Committee is Dr. H. J. Gough, largely through whose initiative the Joint Committee has come into being; the secretary is Mr. C. W. J. Taffs, of the staff of the Institution of Mechanical Engineers, the Council of which has kindly offered the necessary facilities for office work at Storey's Gate, St. James's Park, London, S.W.1.

New Commonwealth Society

THE fourth annual report of the New Commonwealth Society and Institute for the year ended September 30, 1936, refers to the way in which the events of the year have emphasized the soundness of the thesis of an equity tribunal and an international police force which the Society was created to advocate, and the report indicates that the New Commonwealth Society is rapidly gaining ground. Forty-four countries are now represented in the membership, which including the international members shows an effective increase of 252 on the year. The position of the group associate membership is less satisfactory. In addition to the publication of the journal and numerous pamphlets during the year, the British Section has initiated a scheme for a "Writers Panel" to develop publicity in the Press. Brief reviews of the activities of other national sections are included in the report. The section dealing with the New Commonwealth Institute outlines the progress of collective research on procedure for peaceful change, a basis for which has been provided by a report prepared by Prof. K. Strupp dealing with the possibility of an international peace convention and peace charter. A department for collective research on the organization of some form of international force has been initiated under Capt. E. Abraham, and similar activity has also been initiated on the reform of the League of Nations. Detailed proposals have already been forwarded to the members of the Advisory Research Committee and to the Foreign Offices of all States members of the League. A further development in the year is the organization of an information department.

Additional Food for the Special Areas

A MEMORANDUM on the Special Areas Bill dealing with the provision for additional food, etc., for

mothers and children in distressed areas has been submitted to the Prime Minister by the Children's Minimum Council. The memorandum submits evidence of the inadequacy of incomes in distressed areas based, in respect of food, on figures given in "A Revised Estimate of the Poverty Line" by R. F. George (*J. Roy. Statistical Soc.*). The figures indicate broadly the increasing extent to which the incomes of the unemployed fall below the requirements for health as the size of the family increases. Other evidence of the lack of nourishment of mothers and children in these areas is presented, and the limitations of the present provision by local authorities in England and Wales in consequence of the inability of local rates to support it are also reviewed and discussed. The memorandum urges that the Government should provide in the forthcoming Bill for grants from the national exchequer to local authorities in the Special Areas to cover the whole cost of the supply of free milk to all children in public elementary schools and to scholarship children in secondary schools; the supply of free school meals to all children belonging to families where the amount available for food falls below a scale to be determined by the Ministry of Health; the supply of free boots to school children in such families; and the supply of free milk to expectant and nursing mothers and to children under school age in such families.

Lancashire and Cheshire Fauna

THE twenty-second report of the Lancashire and Cheshire Fauna Committee, just issued, which covers 1935, is probably the most useful publication of the Committee apart from its Check List. It deals chiefly with vertebrates, and in addition to the records of the occurrence of rare species, includes detailed tables of the distribution of the woodcock, grey squirrel and great crested grebe in Cheshire, and the pochard, great spotted woodpecker and redstart in both counties. The committee which announces it is also to include the recording of the marine fauna within the three mile-limit in its work, makes an addition of 101 species new to both counties and 25 new to one county, the former consisting of 28 Coleoptera, 20 Diptera, 20 Hymenoptera, 12 sawflies, 8 Acari, 5 Hemiptera, 2 Mallophaga and Neuroptera and 1 each of Mollusca, Lepidoptera, Anoplura and Siphonaptera. The more interesting specific records are: a new colony of Natterjack toads at Storeton, Cheshire; a November golden oriole at Macclesfield; numerous reports of the invasion of crossbills; a meadow-pipit at Heywood, Lancashire, with an abnormal clutch of five sky blue eggs spotted with red, and a magpie that has developed the habit of nesting on the ledge of a steep moorland cliff there; a chiffchaff wintering there, although it does not nest in the district; a December immigration of blackbirds; an investigation of swallow broods showing that 35 broods in Lancashire averaged 4.05 young and 97 broods in Cheshire averaged 4 young; a kestrel taken in Manchester and found to have its plumage and its nostrils so heavily laden with soot that none of the usual parasites inhabited it.

Horticultural Science in France

M. Georges Truffaut lectured to the Royal Horticultural Society in October of last year, on the experiments on manuring, pest control and microbiology of the soil, which have been carried out under his direction at Versailles. The text of this lecture appears in the Society's *Journal* (62, Pt. 3, March) and portrays results which are in sufficient accord with the findings of research institutes in Great Britain to warrant thankfulness, and yet are original enough to provide great stimulation. M. Truffaut and his colleagues have shown that only when the nitrogen, phosphoric acid and potash are combined upon a basis of their atomic weights will the soil yield its fullest increase in response to artificial manures. The insistence of the earlier agricultural chemists on the necessity of lime for the growth of most crops is countered vigorously by the workers at Versailles, who find that the presence of calcium ions is often undesirable in garden soil. The most welcome contribution of the lecture to the science of pest control is perhaps the description of a new spray fluid known as 'Elgetol'. This is a mixture of a synthetic yellow dye with wetting agents. It has a milder action upon the tree than lime sulphur or tar oil winter wash, but it is quite effective against the overwintering eggs of various insect pests. Workers at the Versailles laboratories have established the fact that soil bacteria can obtain their energy exclusively from carbohydrates and organic salts excreted by the root-hairs of plants. "Living green plants are thus the main source of energy for soil micro-organisms." The lecture also reviewed a wider field of work than the results here mentioned; the sections on calcium metabolism and the control of pests during winter are most informative.

The Post Office and Broadcasting

IN the *Journal of the Institution of Civil Engineers* of March, a report is given of the interesting discussion of a recent paper by Sir Noel Ashbridge on broadcasting. Sir George Lee pointed out that the Post Office acts in several ways as an auxiliary to broadcasting. An important function which it fulfils is reducing the interference which many listeners experience on their wireless sets from electrical machinery. Last year, it investigated 40,000 cases of interference. The total circuit mileage used by the B.B.C. in the P.O. network last year was about 6,000. A large number is also in use for Continental broadcasts. Every country in Europe has now these special circuits, and they are often used for the broadcasting of special events. It is estimated that if 80 per cent of the mains-operated receivers were in use during some important event, such as the coronation, when most people switched on their receivers, the load on the grid system due to this cause alone would be 250,000 kilowatts. The annual consumption of receivers is about 270 million units, quite an appreciable fraction of the load on the grid. Another interesting statistical fact which Sir George Lee gave was in connexion with the three short-wave and one long-wave station

which work to America every day. Several hundred kilowatts are radiated from Great Britain towards America but all the power picked up in America would be only sufficient to raise a fly seven inches high in one year. On land-lines, amplifiers are put in at about every fifty miles and there is therefore a large number of amplifying stations between Great Britain and San Francisco. Each amplifier receives such feeble signals that they are just distinguishable from the inherent noise in the circuit, and it amplifies them only sufficiently for the signals to be received at the next station; yet the total amplification received in that repeated process is 10^{256} , a number inconceivably great!

Electric Locomotives for the Natal Railways

FROM the Metropolitan-Vickers Electrical Company's *Gazette* of March 1937, we learn that during the year 1935 it had received orders for twenty-five new 1,200 h.p. electric locomotives for the railways of Natal from the South African Government. The new locomotives had become necessary because of the increased traffic and the doubling of the route mileage. The company had already supplied ninety-five locomotives which had been in constant service in Natal for terms varying from nine to twelve and a half years. The line from Glencoe to Pietermaritzburg is very hilly. Glencoe is situated near the centre of the Natal coal-field, and the transport of coal to Durban constitutes a large part of the traffic on the line. Power is supplied from Colenso through a three-phase 88,000 volt transmission system. The new locomotives differ from the original ninety-five in many details, but they are suitable for multiple unit working in combination with any of the ninety-five original locomotives. Each locomotive is of 1,200 h.p. capacity with four axles each driven by a 300 h.p. traction motor. The auxiliary machines in each locomotive consist of an air compressor, an exhauster and two motor generators of 16 kW. and 28 kW. capacity respectively. The compressor supplies compressed air for the operation of the locomotive brakes. The exhauster produces the vacuum for the train brakes. Of the many improvements embodied in the new locomotives the most important are in the control gear and the pantographs for collecting the current. The latter work with a line pressure of 16 lb. as against the original 26 lb. and weigh about 400 lb. less. They can now be raised to the collecting wire without mechanical shock, and similarly there is no shock when lowered to the roof.

Recent Solar Activity and Auroras

A NOTE received from MM. Eigenson and Gnevishev of the Pulkovo Observatory directs attention to the high degree of sunspot activity on and about January 31 last (when the Tashkent Observatory recorded a total spotted area of 4000 millionths of the sun's hemisphere) and a series of auroras which were extensively observed from the U.S.S.R. between January 31 and February 3. The solar activity and associated terrestrial phenomena (including the

aurora observed in England on February 3) have been described in NATURE (Feb. 6, p. 228; Feb. 13, p. 277; Feb. 27, p. 375; and April 17, p. 680).

The Royal Veterinary College and Hospital

THE new governing body of the Royal Veterinary College has now been set up according to the constitution granted by the new Royal Charter of 1936, by which its name has been changed to the Royal Veterinary College and Hospital. The government of the college is now vested in a court of governors and an executive council. The Duke of Gloucester is president of the court, which consists of eighteen members nominated by the Royal College of Veterinary Surgeons, the Royal Agricultural Society of England, the National Veterinary Medical Association, the County Councils Association, the Medical Research Council and the Corporation of London.

Colonial Officers and Scientific Research

A FURTHER series of grants have been made by the Trustees of the Carnegie Corporation of New York to the Secretary of State for the Colonies to enable selected officers of the Colonial Service to spend a period of absence from their official duties in study, research and travel. Those who have received grants include the following: H. L. Collett, agricultural and soil erosion officer, Basutoland, for the purpose of investigating methods for the prevention of soil erosion in the United States; H. R. Phillpotts, assistant superintendent of public works, Jamaica, for a course of study in water purification and chlorination in the United Kingdom, and in sanitary engineering; W. Fotheringham, veterinary research officer, Kenya, for a course of study in pathology and bacteriology at the University of Edinburgh, and at the Royal Veterinary College, Camden Town, particularly in relation to the respiratory diseases of sheep; W. C. Gee, assistant engineer, Wireless, Posts and Telegraphs Department, Malaya, for the study of short-wave telephony transmission and ultra-short wave transmission and reception at various institutions in the United Kingdom, in the United States, and elsewhere; A. G. Beattie, agricultural officer, Nigeria, for a visit to India for the purpose of studying peasant husbandry, dairying and cattle breeding, and irrigation from wells; H. M. O. Lester, deputy director of Sleeping Sickness Service, Nigeria, for visits to the Congo, Tanganyika, the southern Sudan, and other parts of Africa, to study methods of sleeping sickness control; J. D. Martin, assistant conservator of forests, Northern Rhodesia, for a course in silviculture and ecology at the Imperial Forestry Institute, Oxford; J. G. M. King, district agricultural officer, Tanganyika, for a visit to Nigeria to study methods of mixed farming introduced in that colony; R. A. M. Mackay, assistant inspector of mines, Tanganyika, for a course of study connected with the ore bodies of the Lupa Gold Field at the Royal School of Mines, London; A. C. G. Palmer, science master, Grenada Boys' Secondary School, Windward Islands, for a course in education with particular reference to agriculture.

Announcements

LIEUT.-COLONEL J. H. M. GREENLY has been elected chairman of the British Non-Ferrous Metals Research Association in succession to the late Mr. Thomas Bolton.

PROF. L. A. ORBELI of Leningrad, who is in charge of the late Prof. Pavlov's laboratories, has been appointed a member of the Permanent International Committee of Physiological Congresses in succession to Prof. Pavlov.

SIR HUMPHRY ROLLESTON has been appointed chairman in succession to the late Lord Moynihan of the Medical Board of the Eichholz Clinic, 204 Great Portland Street, W.1, which employs a staff of blind chartered masseurs, and is administered by the National Institute for the Blind.

THE February issue of *Forschungen zur Alkoholfrage* is dedicated to Dr. Emil Abderhalden, professor of physiology in the University of Halle, on the occasion of his sixtieth birthday.

THE Health Section of the League of Nations has nominated Prof. Giuseppe Bastianelli, director of the Institute of Malariortherapy at Rome, as president of the Special Committee for Malaria.

THE second Rumanian Congress of Radiology and Medical Electricity will be held at Cluj on May 21-23 under the presidency of Prof. Negru. Further information can be obtained from the secretary, M. Hananut, Calea Motitol 7a, Cluj, Roumania.

THE first International Congress of Infantile Psychiatry will be held at La Maison de la Chimie, 28 rue Saint-Dominique, Paris 7^e on July 27-August 1. Further information can be obtained from the treasurer, M. Gimbert, 11 rue Duroc, Paris 7^e.

THE twenty-sixth Congress of the German Society for Historical and Social Medicine will be held at Breslau on May 12-14, the subject for discussion being the present state of our knowledge of electropathology. Further information can be obtained from Prof. Gerhard Schrader, Lahnstrasse 9, Marburg.

AN International Congress for a discussion on short waves in physics, biology and medicine will be held in Vienna under the honorary presidency of Dr. Arsonval, Marconi and Zennek on July 12-17. Further information can be obtained from the Secretariat, Alserstrasse 4, Wien IX.

THE Paris laboratory known as "La Biothérapie" has founded a Besredka prize of 15,000 francs for an essay on the therapeutic applications of local immunity. The first award will be made in June 1938. Further information can be obtained from La Biothérapie, 5 rue Paul-Barruel, Paris XV^e, before December 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. 720.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Atmospheric Disturbances due to Thundercloud Discharges

It is generally recognized that the phenomenon of lightning is extremely complicated, and many attempts, notably by Schonland¹, using a special camera, have been made to analyse and classify lightning flashes.

The problem has been attacked in another way by the study of the variations in the earth's electric field due to the lightning discharges. I have already described in NATURE² an automatic cathode ray oscillograph photographic method of recording these variations. In that work, as in similar observations on field changes made by others, it was recognized that the inherent limitations imposed by the particular time-scale employed resulted in the observer's interest being centred on a part rather than on the whole phenomenon. A convenient cathode ray oscillograph photographic method has now been developed to make a continuous record of all the electric disturbances resulting from thundercloud discharges over a period of seconds, yet providing sufficient resolution to separate pulses of only a few micro-seconds duration.

A linear time-base is employed to produce a horizontal deflection of the cathode ray fluorescent spot; the field changes produce a vertical deflection, while the photographic film is moved at right-angles to the time-base deflection at a speed of 16 cm./sec. In this way a trace of saw-tooth form is obtained with the wave form of the field changes superimposed in time order of arrival, and the records give the total duration of the whole discharge as well as that of the separate lightning strokes. The advantage of this method is apparent, for, to obtain the same resolution by a continuous film time base alone, the film speed would have to be 1.6 metres per second.

An example of a complete record of the atmospheric disturbance occurring during a thundercloud discharge is shown in Fig 1. Portion A extends over 0.2 sec. and after an interval of 1.45 sec. is followed by the further phenomenon of the type shown in Fig. 1 B. The advantages of this continuous recording are again illustrated since in Fig. 1 A, we see the extraordinary phenomenon of a volley of discharges, followed in Fig. 1 B after a quiescent interval of 1.625 sec. by the main lightning discharge. This is seen to be analysed into a series of pulses essentially different from the previous ones, but presumably to be correlated with the intermittent lightning phenomenon photographed by Schonland. In Fig. 2 is illustrated part of a volley of discharges of the type already noted in Fig. 1 A. The whole disturbance

had a duration of 2.3 sec. and in this case there was no indication of any succeeding intermittent lightning discharge. These examples of the results were obtained on Friday, June 19, 1936, between 11 p.m. and 1 a.m., when an extremely active storm crossed London from the south.

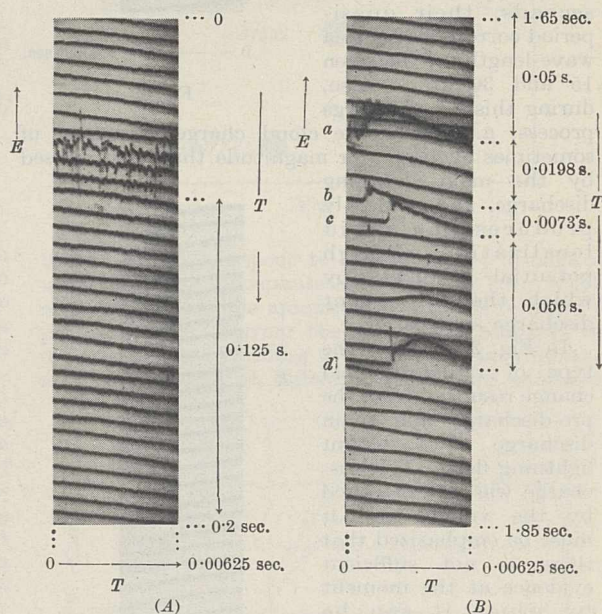


Fig. 1.

Now it is to be presumed that the extended phenomenon shown in Figs. 1 A and 2 is the type of brush discharge so often observed in an active cloud as a prolonged flicker or glow. Although this does not produce the large and rapid change in the electric moment of the cloud charge that the lightning flash does, it is, nevertheless, effective in radiating a long series of electromagnetic waves of peak value and duration sufficient to cause considerable interference in radio receivers. It is interesting to note in this connexion the aural observations of Ashmore³ and Howard⁴, who reported that noise was heard by them in a wireless receiver an appreciable time before the lightning was visible, and also the similar observations of Fyson⁵ and Coursey⁶ recently mentioned in NATURE.

Turning now to the main lightning discharge illustrated in Fig. 1 B, the successive pulses *a*, *b*, *c*, *d*, represent partial discharges. It will be noted that

the main change of field in *a* is accompanied by a characteristic series of perturbations of decreasing intensity which is usually followed immediately by a rapid intense discharge. No case has so far been recorded of this particular process *a* preceding any of the subsequent discharges *b*, *c*, *d* of the group. The perturbations are evidently due to radiation from the successive 'steps' of the 'stepped leader' pre-discharge mechanism always found by Schonland to initiate such a series of lightning flashes. A detailed analysis shows that the 'steps' are separated by an interval of between 30 and 100 micro-seconds, their quasi-period corresponding to a wave-length of between 15 and 30 km. Also, during this pre-discharge process, a considerable cloud charge is moved of sometimes even greater magnitude than that caused by the main lightning discharge, and evidently produces the rapid localization of high potential gradients by which the subsequent discharge is initiated.

In Fig. 3 is shown the type of radiation field change resulting from the pre-discharge and main discharge of a distant lightning flash. This discharge was not preceded by the volley, and it must be emphasized that there is not sufficient evidence at the moment by which it can be asserted whether the volley of discharges is the usual or rare precursor of the lightning flash.

A careful study of many such records brings to light a number of interesting features concerning thunder-cloud phenomena which will be discussed in a subsequent paper.

Wheatstone Laboratory,
King's College,
London.
March 8.

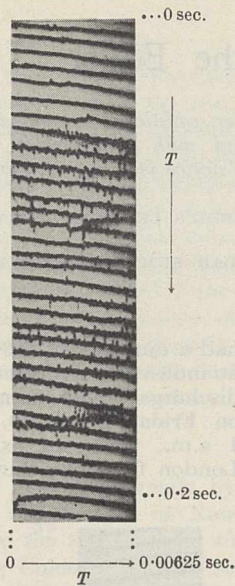


Fig. 2.

Fig. 3 is shown the type of radiation field change resulting from the pre-discharge and main discharge of a distant lightning flash.

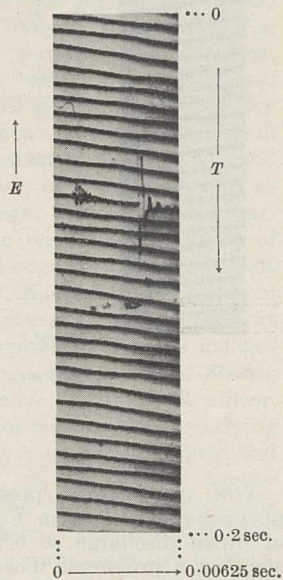
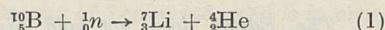


Fig. 3.

F. W. CHAPMAN.

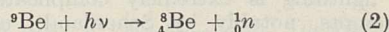
Chemical Detection of Helium formed in Beryllium by Gamma Rays

SOME time ago, we showed¹ that micro-analytical methods are sensitive enough to identify spectroscopically and to measure the helium artificially produced by slow neutrons in boron. This reaction

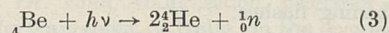


has been fully investigated by physical methods², so that chemistry can merely help in its quantitative study; but there are other processes of artificial disintegration where apparently at present only microchemical methods can decide between different possibilities.

Since the discovery of the 'nuclear photo-electric effect' by Chadwick and Goldhaber, it is known that gamma rays produce neutrons from deuterium and beryllium³; in the latter case the formation either of ⁸Be or of ⁴He is to be expected according to the equations



or



It is equally possible that both reactions take place. Now if reaction (3) occurs to any considerable extent, then we should be able to detect the helium by gas-analytical methods, while in the case of formation of a stable, or slowly disintegrating, ⁸Be, no helium should be found.

In a first, semi-quantitative, experiment, lasting one month, we placed tiny radon sources in holes bored into a lump of 6.6 gm. of beryllium metal. After the decay of 0.6 curie of radon, we dissolved the beryllium in sulphuric acid and, by our micro-method, analysed for helium the 17 litres of hydrogen evolved; we found therein about 2×10^{-8} c.c. In another 8 gm. of beryllium, cut from the same piece but not irradiated, no helium could be detected; this means that less than 5×10^{-10} c.c. was present. The amount of helium which must thus be ascribed to the γ -irradiation is so considerable that it would appear to be formed by the main reaction; for if we assume the γ -rays of radium C' of 1.8 and 2.2 million volts to be equally efficient, and the cross-section of the beryllium nucleus to be 5×10^{-28} cm.², we should expect a quantity of helium corresponding to the order found. Because of the uncertainties in these assumptions, however, we tried to decide by a more exact method whether helium is the main product of the reaction. Should this be so, then the number of helium atoms produced in beryllium would be twice that of the photo-neutrons; this latter figure can be determined from the equal number of helium atoms produced in boron according to reaction (1). With this aim in mind, we repeated the experiment, with larger quantities of radon, arranged as follows.

Into a sphere of metallic beryllium (radius 0.84 cm., weight 4.5 gm.) we drilled small holes towards the centre; in these we inserted glass capillaries (length on the average 6 mm., width 1 mm.) filled with radon. The sphere was placed during the whole irradiation in the pocket of the methyl borate vessel of 7.5 cm. radius, described in our previous paper¹. Owing to their slowness, about 90 per cent of the photo-neutrons are caught inside this vessel. When, after 8½ months, 4.7 curie of radon had decayed near the centre of the beryllium sphere and the surrounding methyl borate, we analysed both the

¹ Schonland, Malan and Collens, *Proc. Roy. Soc., A*, 152, 595 (1935).

² NATURE, 131, 620 (1933).

³ *Met. Mag.*, 68, 114 (1933).

⁴ *Met. Mag.*, 68, 139 (1933).

⁵ NATURE, 138, 278 (1936).

⁶ NATURE, 138, 509 (1936).

beryllium metal and the borate for helium; in the first we found $1.8 \pm 0.3 \times 10^{-7}$ c.c., in the latter $1.1 \pm 0.3 \times 10^{-7}$ c.c. of this gas. The theoretical ratio 2:1 is, therefore, approached closely enough to make it highly probable that the main product of the γ -irradiation of beryllium is ^4He , and not a stable ^8Be ; thus, if reaction (2), and not (3), is the primary step, then the ^8Be nucleus disintegrates into two helium atoms with a half-value period of not more than a month.

Our grateful thanks are due to Prof. S. Russ, director of the Radon Department, Middlesex Hospital, London, for kindly supplying the radon tubes; and also to Dr. M. Goldhaber, Cavendish Laboratory, Cambridge, for suggesting the experiment and for helpful discussions.

F. A. PANETH.

E. GLÜCKAUF.

Imperial College of
Science and Technology,
London, S.W.7.

April 5.

¹ Paneth and Loleit, NATURE, 136, 950 (1935). Paneth, Glückauf and Loleit, Proc. Roy. Soc., A, 157, 412 (1936).

² Chadwick and Goldhaber, NATURE, 135, 65 (1935). Proc. Camb. Phil. Soc., 31, 612 (1935). Taylor and Goldhaber, NATURE, 135, 341 (1936). Amaldi, D'Agostino, Fermi, Pontecorvo, Rasetti and Segrè, Proc. Roy. Soc., A, 149, 522 (1935).

³ Chadwick and Goldhaber, NATURE, 134, 237 (1934). Proc. Roy. Soc., A, 151, 479 (1935). Szilard and Chalmers, NATURE, 134, 494 (1934).

Dilatometric Ultra-Micro-Estimation of Peptidase Activity

As appears from recent publications of Indian workers (Sreenivasaya and Bhagvat¹, compare also Rona and Fischgold²), a considerable volume change is observed in systems in which enzymatic cleavages take place. This volume change may be applied to the estimation of enzyme activity, and the dilatometric methods thus developed possess certain advantages, among which may be mentioned the continuous observation of the undisturbed enzymatic process. While looking around for possible means of refining the histochemical methods previously described (Linderstrøm-Lang and Holter³), I came across the falling drop method for the measurement of specific gravity (Barbour and Hamilton⁴), a method which recently was re-investigated and improved by Fenger-Eriksen, Krogh and Ussing⁵. Experience with this method led to the development of a static principle of measurement especially suited for estimation of volume changes in small drops and therefore for micro-estimation of enzyme activity. The following description is concerned only with the application of the method for this latter purpose, but the method may prove useful for the estimation of specific gravity also in other cases.

In a vertical glass tube, 30 cm. long, placed in a water-bath at $30^\circ \pm 0.005^\circ$, a practically constant specific gravity gradient was produced by mixing kerosene and bromobenzene in varying ratios. The gradient was measured by means of 0.1 c.mm. test drops of known specific gravities. Fig. 1 illustrates a characteristic experiment. The test drops were introduced at the top of the glass tube, a suitable micropipette being used, and fell in the course of ten minutes to the level given on the figure, where they remained practically constant for more than eight hours if the medium was well saturated with an aqueous solution of a suitable water vapour pressure.

Their positions were observed in a horizontal microscope with ocular micrometer. The drops of enzymatic reaction mixtures were introduced in the same way and their positions were observed after about ten minutes.

In Fig. 1 the drop A (0.1 c.mm.) had the composition: 0.1 M with respect to *dl*-alanyl-glycine;

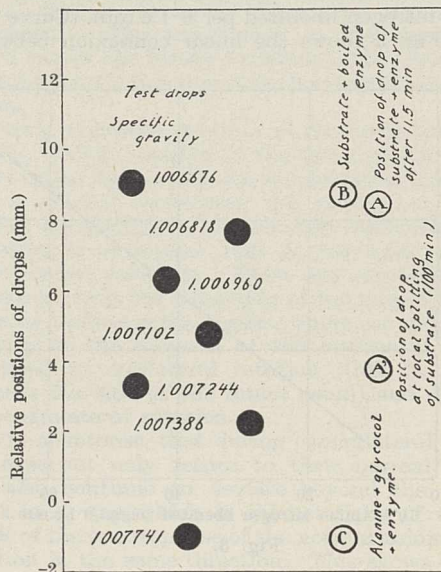


Fig. 1.

0.0173 M with respect to caustic soda; 0.0333 M with respect to phosphate buffer of pH 7.4; and it contained a suitable amount of peptidase (extract of pig stomach). During the enzymatic reaction the drop fell—corresponding to a decrease in volume—and its positions at different times were compared

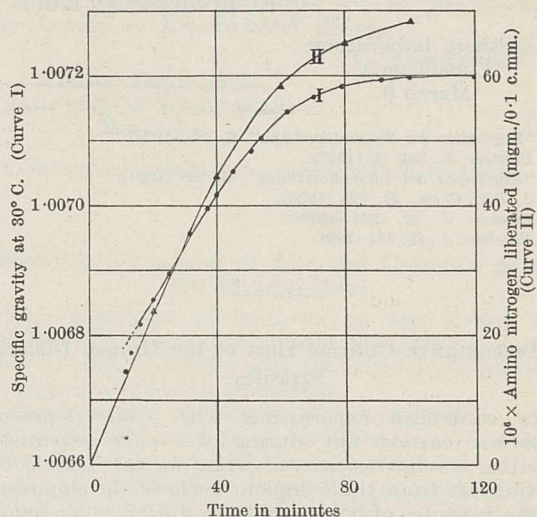


Fig. 2.

to those of the test drops. It reached a final position A' when the reaction was completed. Drop B contained boiled enzyme but was otherwise identical with A. In drop C the *dl*-alanyl-glycine was replaced by *dl*-alanine (0.1 M) plus glycol (0.1 M). Both these drops remained constant at their respective

levels. The final position of *A* (*A'*) is nearly halfway between *B* and *C*, in agreement with the fact that *d*-alanylglycine alone is split by the enzyme.

Fig. 2 (Curve I) shows graphically the results of this experiment. The chemical change (appearance of amino groups) during the enzymatic reaction was measured simultaneously in larger samples of the same reaction mixture and calculated as milligrams of amino nitrogen liberated per 0.1 c.mm. (Curve II). Finally, Fig. 3 shows the linear connexion between

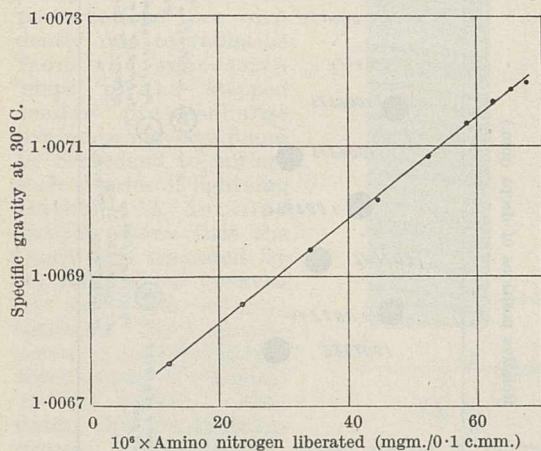


Fig. 3.

volume change and liberation of amino-nitrogen, 0.74 c.mm. disappearing per mgm. amino nitrogen formed. This agrees as regards order of magnitude with the volume changes found by Sreenivasaya, Sastri and Sreerangachar⁶ for other proteolytic processes.

The method is being further developed and extended to include other enzymatic processes.

K. LINDERSTRØM-LANG.

Carlsberg Laboratory,
Copenhagen.
March 9.

¹ "Ergebnisse der Enzymforschung", 6, 234 (1937).

² *Biochem. Z.*, 261, 66 (1933).

³ "Ergebnisse der Enzymforschung", 3, 309 (1934).

⁴ *J. Biol. Chem.*, 69, 625 (1926).

⁵ *Biochem. J.*, 30, 1264 (1936).

⁶ *Biochem. J.*, 28, 351 (1934).

A Presumptive Culicine Host of the Human Malaria Parasites

In controlled experiments with *Culex biteniorhynchus* carried out during the past seventeen months, we have observed what we are unable to distinguish from the complete cycle of development of the parasites of benign and sub-tertian (malignant) malaria in laboratory-bred females fed on gametocytes of *Plasmodium falciparum* and *P. vivax* respectively. Presumptive sporozoites accompanied by a stomach cyst were also observed in an insect which was fed on gametocytes of *P. malariae*, the parasites of quartan fever, those of sub-tertian being also present in much smaller numbers. Ross's black spores were found associated with sporozoites and cysts in several

sub-tertian infected, and in one benign tertian infected, insect. These appearances were absent in laboratory-bred controls which had had no blood meals.

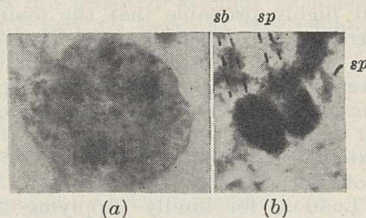


FIG. 1.

PRESUMPTIVE PLASMODIAL FORMS IN LABORATORY INFECTED *C. biteniorhynchus*

- (a). UNSTAINED SEMI-CHITINIZED-BLACK PIGMENTED CYST: S.T. INFECTION.
(b). BLACK SPORES: B.T. INFECTION, UNSTAINED.

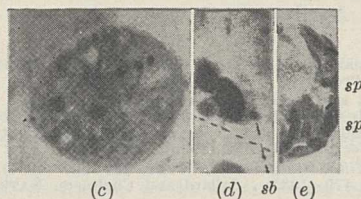


Fig. 2.

CORRESPONDING PHASES IN PLASMODIALLY INFECTED ANOPHELE

- (c). STAINED CYST (Q. OR S.T.). AFTER WALCH.
(d). UNSTAINED CHITINIZED SPOROZOITES AND 'SPOROBLAST'. AFTER WALCH.
(e). BLACK SPORES. AFTER WALCH.

sp = CHITINIZED SPOROZOITES. *sb* = CHITINIZED 'SPOROBLASTS'.

Apart from the fact that culicine mosquitoes have up to the present been held to be inhospitable to human malaria parasites, the interest of these observations is biochemical. Some years ago, one of us pre-indicated *C. biteniorhynchus* as a possible malaria carrier¹ because it breeds in pure water among *Spirogyra*² (on which it also feeds), it being pointed out¹ that some of the most virulent anopheline vectors are likewise found in uncontaminated sources, a fact later confirmed by Covell's tables³. The practical, as well as the theoretical, implications of significant correlation between larval environment and power to transmit malaria are of great interest, but since they call for further discussion than is here possible, this together with details of our observations must await publication elsewhere.

We wish to express our obligations to successive Senior Health Officers, Penang, for opportunity to carry out our work, and further, especially to Dr. J. W. Scharff for his critical interest in it.

K. B. WILLIAMSON.
MAHOMED ZAIN.

Government Antimalarial Laboratory,
Penang,
Straits Settlements.
Feb. 20.

¹ Williamson, K. B., *Malay Med. J.*, 2, 53 (1927).

² Senior White, R., *Bull. Ent. Res.*, 16, 187 (1926).

³ Covell, G., *Ind. Med. Res. Mem.*, 7 (July 1927); also *Rec. Mal. Surv. Ind.*, 2, 1 (March 1931).

Biological of a Littoral Mite

DURING my work on the biology of the sea-shore in East Greenland¹ I made some biological observations of the large, bright red littoral mite (*Moligus littoralis* L.); its distribution is almost circumpolar, especially on the shores of the more northern regions. In East Greenland it was commonly met with on the shore, but extending its domain beyond the shore, being found (also the eggs) up to an altitude of 120 m., most often in sandy and gravelly places. Trägårdh (p. 419²) has recorded this and explains it by the non-occurrence of big competing mites. In southern Spitsbergen, it seems to be a strictly littoral form; but in northern Spitsbergen (Low Island, c. lat. 80° N.; Hinlopen Strait) it also extends to the "fjældmark", which is beyond the shore (Summerhayes and Elton, p. 250)³.

According to the statements of Sig Thor (p. 97)⁴, in southern Spitsbergen (Hornsund), more than one generation seems to develop in the year. This does not hold good for the species in East Greenland. June 25 (at Eskimonæs, lat. 74° 05' N.), the snow having recently melted, I found eggs in abundance (in good agreement with the figures given by Trägårdh (p. 10, tab. I, figs. 1-2)⁵). They were found especially on the dry sandy shore, in dense cakes under almost every flat stone. Some of the eggs had not hatched, and others were just hatching, the larvæ swarming over the shore. They only had three pairs of legs. Adult individuals were definitely not found. Later in the summer, also in the other localities I visited, only empty egg-clusters and adult individuals were found. So there can be no doubt that the species in East Greenland only winter in the egg. The difference in behaviour from that in Spitsbergen is possibly due to the more severe climatic conditions.

Moligus littoralis is probably feeding especially upon *Collembola*; though I have seen it suck out the shore fly, *Fucellia arcticiformis*, also gnats and even individuals of the same species.

HOLGER MADSEN.

State Veterinary Serum Laboratory,
Copenhagen.

¹ Madsen, Holger, *Medd. om Grönl.*, 100, Nr. 8 (1936).

² Trägårdh, J., *Medd. om Grönl.*, 43 (1917).

³ Summerhayes and Elton, *J. Ecology*, 16 (1928).

⁴ Thor, Sig, *Skrifter om Seabard og Ishavet*, No. 27 (1930).

⁵ Trägårdh, *Bih. K. Svenska Vet. Akad. Hand.*, 26, Afd. IV, No. 7 (Stockholm, 1900).

Effect of Unilateral Elimination of the Horizontal Semicircular Canal in the Pike

IN a recent publication¹ it was shown that in the dogfish the sense organ situated in the ampulla of the horizontal semicircular canal is in a constant state of excitation. This activity is maintained in the resting animal in the absence of any obvious external stimulus. The result raises the question as to whether the inflow to the centre of the spontaneous discharge from the ampullary sense ending has any noticeable effect on muscle tone.

In order to investigate this, the horizontal semicircular canal of the pike (*Esox lucius*) was eliminated by severance of the nerve branch supplying the ampulla. The operative technique used in the experiments permitted the elimination of a single canal without any damage to the rest of the labyrinth.

A fish in which the left horizontal canal has been eliminated shows a persistent tonic deviation of the eyes towards the side of the eliminated canal, that is, the left eye is deviated backwards and the right eye forwards. This deviation is obviously due to the inflow to the centre of the spontaneous afferent discharge from the remaining right horizontal canal, which is no longer counterbalanced by a similar discharge from the corresponding left canal. The asymmetry in eye muscle tone which causes the forced deviation of the eyes clearly indicates a tonic function of the horizontal semicircular canals.

During clockwise rotation in the horizontal plane, that is, during rotation of the fish towards the side of the intact right canal, the eye deviation is increased and a normal horizontal eye nystagmus follows. During anticlockwise rotation the spontaneous eye deviation is abolished, that is, the eyes return to their normal positions. These eye responses are in full accord with the behaviour of the ampullary sense organ as studied in the dogfish, where the spontaneous activity of the ampulla of the horizontal canal is increased by ipsilateral rotation (that is, rotation towards the side of the intact canal) and decreased by contralateral rotation.

It is of interest that during contralateral rotation the eyes not only return to their normal position but also continue to deviate beyond the 'neutral' point in a way which is characteristic of the slow phase of the eye response of the normal animal during rotation in the same direction. This shows that the centre is capable of responding to a decrease in afferent discharge with the production of a compensatory eye reflex.

The conclusion is therefore justified that a single horizontal semicircular canal in fishes is sufficient to call forth muscular responses to both clockwise and anticlockwise rotation in a horizontal plane. It should be noted that the reflex tests were carried out with exclusion of visual orientation.

A full account of this work will be published in the *Journal of Experimental Biology*.

O. LÖWENSTEIN.

Zoology Department,
University of Birmingham.
March 18.

¹ Löwenstein, O., and Sand, A., *J. Exp. Biol.*, 13, 416 (1936).

Anomalous Expansion of Zinc and Cadmium near the Melting Point

THE expansion of bismuth, as was shown by Roberts¹ decreases rapidly near the melting point. This anomaly coincides with the anomalous decrease of volume of bismuth on melting.

The expansion coefficients of monocrystals of zinc and cadmium have been measured in order to ascertain whether the anomaly found by Roberts for bismuth occurs with these metals also, and whether the sign of the anomaly coincides with that of the normal change of volume in melting.

In directions nearly parallel or perpendicular to the hexagonal axis, the expansion of zinc crystals increases rapidly between c. 415° C. and the melting point (419.5° C.). In the neighbourhood of 418°-419° C. (near the limit set by the plastic deformation under its own weight) values of the expansion coefficients reaching 50-100 × 10⁻⁵ (Fig. 1a) were observed.

The same was observed in the case of cadmium for directions nearly perpendicular to the axis (Fig. 1b).

with a total current of about 1mA., which was discontinued and the counter set in work. Thus we could measure the activity produced by the neutrons in silver alone.

As regards the half-value periods, the results of our preliminary measurements agree with those of earlier work in other laboratories. We have obtained two active components with periods of 22 ± 3 sec. and 100 ± 15 sec. respectively. The ratio of their intensities is about 1. However, the relatively considerable number of decay electrons is very remarkable. We have obtained, for example, in the first and second minute, 5.1, 1.8 counts as a mean value from 100 measurements, the background counts being deducted. We can state, therefore, that it is indeed not hopeless to search for nuclear reactions of this kind with such a low voltage. By comparison with a preparation of radium-beryllium with known content of radium, we can say that the artificial activity produced by our process is equivalent to that of the unslowed neutrons

of such a preparation containing about 6.8 mgm. of radium element. Of course, that does not mean that the number of the neutrons emitted will be the same in both processes; we cannot yet state anything on this point because of the difference of the velocities of the neutrons in the two cases, and we know nothing about the velocities of our neutrons.

The experiments are being continued and will be completed from this point of view.

E. BERTEL.
R. FÜRTH.
F. OBOŘIL.
K. SITTE.

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March 11.

A Photo-electric Method for the Measurement of the Optical Constants of Metals

THE optical constants of a metal are measured by allowing a beam of parallel light, plane-polarized at an azimuth of 45° , to fall on the plane polished surface of the metallic specimen, and then analysing the reflected elliptically polarized light. From the constants of the ellipse, and the angle of incidence of the light, the optical constants may be calculated.

The methods hitherto adopted for the analysis of the elliptically polarized light fall into three groups: (i) photographic methods for the ultra-violet; (ii) visual methods for the visible region; (iii) bolometric methods for the infra-red. Of these the most accurate are the visual methods.

In essentials the present method is similar to the visual methods, but since the eye is replaced by a photo-electric cell, the range of application is extended to include the ultra-violet and infra-red portions of the spectrum. The method in principle is as follows: The elliptically polarized light is analysed by transmission through a Soleil-Babinet compensator and a Nicol prism. The photo-electric cell in conjunction with a Lindemann electrometer becomes the objective indicator for the determination of the correct settings of compensator and analyser to produce extinction of the light.

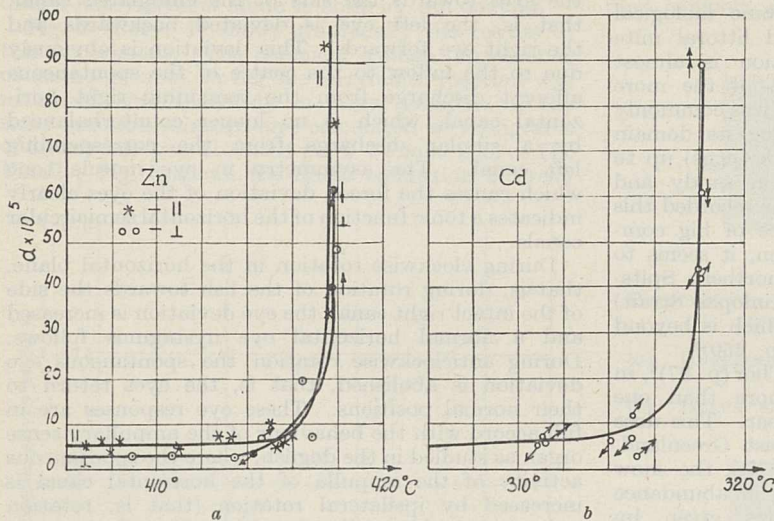


Fig. 1

CHANGE OF COEFFICIENT OF EXPANSION WITH TEMPERATURE FOR ZINC AND CADMIUM. \uparrow , FIRST HEATING AND COOLING; \leftarrow , SECOND HEATING AND COOLING.

It is clear therefore that zinc and cadmium exhibit anomalous expansion near the melting point and that the sign of the anomaly coincides with that of the change of volume in melting.

W. F. HACHKOVSKY.
P. G. STRELKOV.

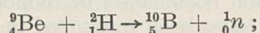
Physico-Technical Institute of Ural,
Leningrad.

¹ Roberts, J. K., *Proc. Roy. Soc., A*, 106, 385 (1924).

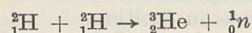
Induced Radioactivity with Neutrons from Slow Deuterons

It is of interest, not least from the point of view of possible practical applications, to search for the lower limit of voltages, with which artificial radioactivity can still be produced of intensity sufficient for utilization. We have begun an investigation, in which the induced activity is produced by neutrons, which are produced by slow deuterons. This procedure has the advantage that the small number of neutrons that can be expected will be compensated, at least partly, by the greater efficiency of slow neutrons, due to the slow primary particles.

In our experiments, a beam of positive rays of deuterons was directed on to a mica foil covered with a thin layer of beryllium. The origin of the neutrons is probably the process:



but the reaction



cannot yet be excluded as a possible source of the neutrons. Outside the tube a Geiger-Müller counter of silver was placed at about 10 cm. from the source. It was screened by lead, in order to reduce the number of counts due to the background to 2-3 per minute. The mica foil was irradiated for five minutes

In practice, for a variety of reasons, complete extinction cannot be obtained. There is always a certain amount of background light (of the order of 0.5 per cent of the maximum illumination). Hence instead of adjusting for zero intensity, one adjusts for minimum intensity. This, however, does not reduce the accuracy of the settings, provided the light source is steady. When the light source is unsteady, as for example in a carbon arc, large irregular fluctuations of the electrometer needle are produced. This effect is eliminated by using a compensating beam of light, derived from the same source, and a second photo-electric cell. The accuracy of the results obtainable compares favourably with the accuracy obtainable by visual methods.

Although not expressly designed for the purpose, the same method may be used for determining optical rotatory power.

Full details will be published elsewhere.

J. BOR.

Physics Department,
College of Technology,
Manchester.
March 17.

Determination of Vitamin C in the Living Organism

WHILE determining the vitamin C content of urine taken from healthy individuals or patients suffering from various diseases by titration with 2,6-dichlorophenolindophenol, we tried to perform this test in the living organism itself. First we injected small quantities of a 1/1,000 normal sterile solution of the dye into the sole of healthy and scorbutic guinea pigs. We observed that decoloration of the dye takes place much more rapidly in healthy animals than in guinea pigs suffering from scurvy. When methyl blue was injected simultaneously, its colour remained unchanged, which shows that decoloration of dichlorophenolindophenol was not due to resorption but to reduction.

Next we tried to show that this reduction is caused by ascorbic acid, and performed similar experiments on human beings. Patients were kept on a vitamin C deficient diet for 10 days and then 1/400 normal dye solution was injected into the forearm. Using a 1.0 ml. tuberculin syringe, it is not difficult to produce a bubble of about 2 mm. diameter. After observing the time of decoloration, various amounts of ascorbic acid were given intravenously. The colour of the newly injected dye disappeared in a much shorter time than before.

Detailed experiments have shown that the time of decoloration depends on the amount of ascorbic acid present in or administered to the organism. We concluded from our numerous experiments that a decoloration time of about 5 minutes indicates *saturation*, that of more than 10 minutes *deficiency* of vitamin C, while decoloration times of 5-10 minutes show *normal* content of vitamin C of the body.

We believe that this simple reaction may prove useful for many purposes.

H. ROTTER.

Gynaecological and Obstetrical Section,
Jewish Hospital,
Budapest.
Jan. 15.

Churning for Butter

THE familiar process of churning cream to yield butter has led to two different theories of the mechanism involved. The Fischer-Hooker¹ theory is that churning is due to the reversal of an *O/W* emulsion (cream) to a *W/O* emulsion (butter), a view accepted by Palmer². Rahn³ believes that churning involves aeration or frothing with consequent accumulation of milk proteins adsorbed at the newly-created air/liquid interface.

We accept Rahn's theory and hold that emulsion *inversion* is not concerned; rather is it emulsion *breaking*, due to the preference of the proteins for an air/liquid interface rather than a fat/water interface. The subsequent kneading together of butter granules results in an accidental resemblance to a *W/O* system.

If the milk proteins be restrained from accumulating in the froth (where surface denaturation occurs) churning could progress indefinitely without butter granules forming. We tested this idea by adding very surface-active materials to fresh cream of 50 per cent butterfat content (*pH* 7), so that these materials would undergo preferential adsorption in the froth. Saponin and bile salts have proved excellent anti-churning agents. Thus, 1 in 1,000 of saponin in the aqueous phase, added to cream which normally churned in 60 minutes, totally inhibited butter formation for hours. Its effect was still apparent even when the cream contained 50 per cent of sucrose to load the water phase and assist emulsion breaking; without saponin, such cream churned dramatically in 15 minutes. Egg albumen delayed butter formation until surface denaturation of this colloid allowed the accumulation of the milk proteins at the air/liquid interface.

Colloids which are not particularly surface-active have, as anticipated, no influence on the progress of churning; for example, 1 per cent of gum arabic in the cream.

Our complete results are being prepared for publication elsewhere.

WILLIAM CLAYTON.

JAMES FREDERICK MORSE.

Research Laboratory,
36 Crimscoot Street,
London, S.E.1.

¹ "Fats and Fatty Degeneration", 93 (New York, 1917).

² "Colloid Symposium Monograph", 1, 410 (1928).

³ cf. Rahn and Sharp, "Physik der Milchwirtschaft", 111 (Berlin, 1928).

Reactions Caused by 'Activated' Alumina

WE have observed that passage of a chloroform solution of diacetyltoxicarol through alumina activated for chromatographic adsorption causes 'hydrolysis'; in one experiment, 1.1 gm. of pure toxicarol was isolated from 2 gm. of ester. Of the two acetoxy groups attacked, one was derived from a phenolic, the other from an enolic hydroxyl group; both are very readily hydrolysed by alcoholic alkali. This hydrolysis, which is the more remarkable in that it occurred in a non-polar solvent, was traced to the alkalinity of the alumina used. Commercial 'activated' alumina in water reacts alkaline to phenolphthalein and the alkalinity can be titrated with sulphuric acid; the colour returns if the mixture is kept after neutralization; further quantities of acid are consumed after six and again after eighteen hours; thereafter the supernatant solution remains

colourless. The following figures are for 5 gm. of (1) Merck's alumina for adsorption, activated according to Brockmann, (2) B.D.H. aluminium oxide for adsorption purposes, (3) B.D.H. aluminium oxide, calcined, and (4) B.D.H. aluminium oxide (calcined) 'AnalaR', shaken in 50 c.c. of distilled water.

	c.c. of 0.1 N H ₂ SO ₄ consumed				% Alkalinity calc. as NaOH
	At once	After 6 hr.	After 18 hr.	Total	
1	2.0	1.2	0.8	4.1	0.33
2	3.5	1.1	0.6	5.2	0.41
3	0.3	0.1	0.1	0.5	0.04
4	0.2	0.1	0.1	0.4	0.03

The amounts of adsorbed alkali, as shown in the last column, for the 'activated' aluminas are surprisingly high. The low figures for the ordinary aluminas are a satisfactory 'control'.

Hydrolysis of diacetyltoxicarol is prevented by previously washing the alumina with acetic acid or a solution of phenol in a neutral solvent (we are indebted to Prof. Heilbron for suggesting the use of phenol), but the activity of the adsorbent is largely destroyed by acetic acid and to a less, but still considerable, extent by phenol.

Other reactions of rotenone and its derivatives normally associated with the use of alkali in a hydroxylic solvent can also be effected by passage through activated alumina in chloroform or benzene, and we hope to report these experiments in detail elsewhere. Great caution is advisable when adsorbing alkali-labile compounds. It seems probable that the alkalinity of activated alumina may be responsible for some of the abnormal results recorded by other workers, for example, the isomerization of carotene¹, and the partial inactivation of vitamins A² and K³.

R. S. CAHN.

R. F. PHIPERS.

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W.C.1.

but relates to all megamolecules. In connexion with Dr. Huggins's letter, I would direct attention to the diagram given by Jordan Lloyd on p. 267 of her 1932 paper of the structure involving hydrogen bonds associated with . . . HNCOHNCO . . . strings which is now proposed by Dr. Huggins. Further, I may perhaps be permitted to point out that "pictures of this sort" which Dr. Huggins finds "preferable to those proposed by Wrinch", have in fact already been given by Wrinch and Jordan Lloyd², and that in any event (as there explained) they are not inconsistent with the cyclol structures which (presumably) Dr. Huggins had in mind. It may well be the case that all three types of link are relevant to the question of the structure of proteins in its various aspects, and possibly others so far unformulated. Thus the prudent course is to seek for support for each and every type of link which is geometrically feasible.

If, however, at this early stage in the history of the protein molecule, it is important to decide between alternatives which are not mutually exclusive, I suggest that it would be of interest to consider how far hydrogen bonds alone can (1) yield structures for protein films and (2) yield structures for the globular proteins which explain the non-random distribution of the molecular weights of proteins established by Svedberg³ and (3) explain the relation between α - and β -keratin. It appears from a recent series of experiments by Langmuir, Schaefer and Wrinch⁴ that the mechanical characteristics of protein films are in good accord with the cyclol hypothesis and its predictions: it is now clear that this hypothesis implies the existence of globular proteins and explains why they fall into discretely arranged molecular weight classes¹⁰: further, the cyclol link appears to fit elegantly⁶ into Astbury's keratin structures. Alternative structures depending upon hydrogen bonds alone would, however, be of great interest.

D. M. WRINCH.

Mathematical Institute,
Oxford.
March 31.

¹ Gillam, A. E., and El Ridi, M. S., *Biochem. J.*, **30**, 1735 (1936).

² Castle, D. C., Gillam, E. E., Heilbron, I. M., and Thompson, H. W., *Biochem. J.*, **28**, 1702 (1934).

³ Dam, H., and Lewis, L., *Biochem. J.*, **31**, 17 (1937); cf. Dam, H., and Schenheyder, F., *Biochem. J.*, **30**, 897 (1936).

¹ Astbury and Woods, *NATURE*, **127**, 663 (1931). Astbury, *NATURE*, **132**, 593 (1933); *Koll. Z.*, **69**, 350 (1934).

² Jordan Lloyd, *Biol. Rev.*, **7**, 254 (1932) and later papers. Mirsky and Pauling, *Proc. Nat. Acad. Sci.*, **22**, 439 (1936).

³ Wrinch and Jordan Lloyd, *NATURE*, **138**, 758 (1936).

⁴ Wrinch, *Proc. Roy. Soc., A*, in the press.

⁵ Wrinch, *NATURE*, **137**, 411 (1936). **138**, 741 (1936).

⁶ Astbury, *J. Text. Inst.*, **27**, P 282 (1936). *Chem. Weekbl.*, **33**, 778 (1936).

⁷ Huggins, *NATURE*, **139**, 550 (1937).

⁸ Svedberg *et al.*, a series of papers in *J. Amer. Chem. Soc.* since 1929.

⁹ *Science*, **85**, 76 (1937). See also, *NATURE*, **139**, 516 (1937).

¹⁰ As explained in a communication to the Editor of *NATURE* dated March 10, 1937.

Nature of the Linkages in Proteins

THERE is now a considerable amount of agreement that the polypeptides in the protein molecule are held together by cross-linkages¹, but so far crucial experiments, from which the exact nature of these linkages may be deduced, are lacking. The only logical procedure is therefore to consider in turn all possible types of link and to investigate experimentally the deductions to be made from those which pass the qualifying test of being geometrically feasible. Among the links so far proposed are: (a) hydrogen bonds^{2,3,4}, (b) cyclol links^{4,5,6} and (c), as a deduction from (b), hydroxyl bonds^{4,5}.

The hypothesis of hydrogen bonds has recently gained further support from the suggestion, contained in the interesting communication from Dr. Huggins in *NATURE* of March 25, of synchronized oscillations in hydrogen bridges⁷. The importance of these synchronized oscillations is not confined to proteins

Isomerism of Derivatives of Cyclohexane

BOTH 4-methylcyclohexane-1-carboxy-1-succinic acid and 3-methylcyclohexane-1-carboxy-1-succinic acid, synthesized by condensation of ethyl bromoacetate with the sodio derivatives of the dicyano esters prepared by Higson and Thorpe's method¹, have been isolated in two forms; there being no indication of isomerism connected with multiplanar forms². This method provides a satisfactory synthesis of the tricarballic acids derived from cyclic ketones, and the low yield of $\alpha\alpha$ -dimethyltricarballic acid

obtained from acetone³ can be raised to nearly 30 per cent by suitable modification of the method. The conversion of the tricarballic derivatives into the corresponding aconitic acids is being investigated.

R. D. DESAI.
R. F. HUNTER.
G. S. SAHARIA.

Muslim University,
Aligarh.

¹ Higson and Thorpe, *J. Chem. Soc.*, 89, 1455 (1906).
² Desai, Hunter, Ghulam Khan and Saharia, *J. Chem. Soc.*, 416 (1936); Waheed Bukhsh, Desai, Hunter and Mehdi Hussain, *J. Chem. Soc.*, 1159 (1936); Desai, Farooq and Hunter, *J. Chem. Soc.*, 1162 (1936).

³ Clemo and Welch, *J. Chem. Soc.*, 2621 (1928).

The Retinal Centre as an Amplifier of Potential Differences

FROM the histological point of view the retina may be regarded as a nervous centre, a piece of the brain, projected on the surface of the body. With other centres it shares the property of responding to stimulation with slow potential changes. Thus, when light falls on the eye, the corneal electrode becomes positive with respect to an electrode behind the eye (vertebrate eye with inverted retina). This change coincides with the appearance of impulses in the optic nerve. Negativity of the corneal electrode coincides with inhibition of the discharge in the nerve¹. Below we are only interested in the initial positive phase of the retinal response, called the *b*-wave (see Fig. 1), known to be a measure of excitation.

Assume that at regular intervals a *b*-wave is elicited by a constant stimulus, and that on top of this *b*-wave is thrown another stimulus. The latter, the 'test light', exceeds the former 'adapting light' in strength and therefore succeeds in eliciting a second small *b*-wave on the falling part of the *b*-wave, caused by the adapting light (Fig. 1).

As 'test lights' are now chosen two stimuli which taken by themselves differ in size by about 8 per cent. They are then in turn superimposed upon the *b*-wave set up by the regularly recurring 'adapting light'. Do the small *b*-waves to which the test lights now give rise still differ by 8 per cent? An experimental answer is easily obtained. The superimposed *b*-waves are found to differ by, say, 34 per cent, to quote figures actually obtained in an individual experiment. Thus the difference between the test lights has been amplified owing to the fact that the retina has been charged by an earlier stimulus. This 'amplifier principle' has been studied in several ways, mostly with fairly strong stimuli, differently introduced with respect to the various phases of the electro-retinogram.

The fact that amplification may occur in a centre is obviously of general interest for all those who in different fields are trying to understand the working of the central nervous system in terms of simple principles. It illustrates a way of attacking the complicated functions involving differentiation. From the point of view of vision, the amplifier principle gives a clue to an understanding of processes of discrimination such as 'visual acuity', 'brightness discrimination', etc., all of which within limits are favoured by bright stimuli and an illuminated background. Together with many other recent results

obtained with the electro-retinogram, it points to the significance as well as to the necessity of considering small eye-movements in connexion with visual discrimination.

RAGNAR GRANIT.

Physiology Institute,
University, Helsingfors.

March 4.

¹ Granit, "Die Elektrophysiologie der Netzhaut und des Sehnerven . . .", *Acta ophth., Kbh.*, Supp. 8 (Levin and Munksgaard, 1936).

Perception of Weight and Elasticity

IN experiments on the perception of elasticity, we have found that individuals equate a pull on an expanding elastic spring with a much *lighter* lifted weight impression. Lifting a weight of 2.50 kilograms (for which the psycho-physical limen is of the order 0.10 kilogram) was matched by one person with a pull as large as 6.50 kilograms (probable error 0.20 kilogram). On the average, from results with some fifty persons, a lift of 2.50 kilograms is matched for weight with a pull on a spring of 4.00 kilograms approximately (probable error 0.25 kilogram). The under-estimation of the spring or elastic pull in terms of weight perception is of the same order irrespective of whether the subject begins with a zero pull in the spring, gradually increasing this until a match with the lifted weight impression is obtained, or whether he begins with a pull of the order 8.00 kilograms, gradually decreasing this until a match is obtained. The effects are just as marked, also, when a pull is used as standard for comparison with a series of lifted weights.

This difference between the effects of a pull and a lift points to phenomenological differences in the impressions of weight and elasticity, and has interesting practical bearings on the general psychology of physical training. An account of our experiments will be published, it is hoped, in the *British Journal of Psychology*.

D. KATZ.

Högskola, Stockholm.

W. STEPHENSON.

University College, London.

March 29

Scientific Research in Spain

GRATIFYING evidence that scientific investigation and literary research are by no means at a standstill in Spain has been received by the Society for the Protection of Science and Learning, the permanent successor to the Academic Assistance Council.

With their letter dated February 24, 1937, Prof. Manuel Marquez Rodriguez (dean of the Faculty of Medicine in Madrid), Prof. P. Carrasco (dean of the Faculty of Science in Madrid) and Dr. T. Navarro Tomas (director of the National Library)—all well-known authorities—have sent two copies of recent numbers of the *Anales de Fisica y Quimica*, a copy of *Revista de Filologia Espanola* and a copy of the *Anuario del Observatorio de Madrid* for 1937, which last has recently been referred to in *NATURE* (April 10, p. 624).

The continuation of such original work as is described in the above publications—and others are to follow—has been made possible by the founding by the Ministry of Education of the *Casa de la Cultura* of Valencia, the objects of which appear to be similar to those of this Society. The *Casa de la*

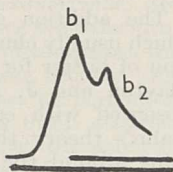


Fig. 1.

RETINAL RESPONSE ;
*b*₁ DUE TO 'ADAPTING
LIGHT', *b*₂ TO 'TEST
LIGHT'.

Cultura houses members of various professions from whom, the Society is informed, the Ministry has not asked for any declaration or guarantee of a political character. Further, the Ministry has not compelled those, who for special reasons, prefer to remain in Madrid, or to live in other places, to go to Valencia. While teaching has had to be interrupted in the universities, the Ministry has not ceased to pay salaries to professors and others who have remained in the provinces under the authority of the Government. The Ministry is also trying to apportion help to Spanish professors and scholars abroad who have not rebelled against the Government.

Complete detachment from prevailing social and political conditions is usually impossible for the

scientific and literary worker and, during the last few years, the work of many well-known scientists and scholars has been adversely affected by conditions against which they have been powerless. A census of outstanding advances in knowledge achieved during this period by those so adversely affected and helped by their colleagues and sympathisers would provide a unique and important historical record.

CHARLES S. GIBSON.
(Honorary Secretary.)

Society for the Protection of
Science and Learning,
6 Gordon Square,
London, W.C.1.
April 14.

Points from Foregoing Letters

PHOTOGRAPHIC records of electrical disturbances occurring during a thundercloud discharge, obtained with a cathode ray oscillograph, are submitted by Dr. F. W. Chapman. By means of a device in which the photographic film moves at right angles to the time-base deflection, electrical pulses only a few micro-seconds apart can be resolved. The records show a volley of discharges, presumably to be identified with the 'brush' discharge often observed in an active cloud as a prolonged flicker or flow, followed after a brief quiescent interval by the main lightning discharge. The volley radiates a long series of electromagnetic waves producing interference in radio receivers, while the main discharge consists of series of steps separated by 30-100 micro-seconds, their quasi-period corresponding to a wave-length of 15-30 km.

It is known that the beryllium nucleus, irradiated by γ -rays, emits neutrons, but it has not been decided by physical methods whether the nucleus is thereby transformed into an isotope of beryllium of mass eight, or into two helium atoms. By a micro-chemical method, Prof. F. A. Paneth and Dr. E. Glükauf have detected, in irradiated beryllium, helium in such quantity that the helium-forming process seems to be the main, if not the only, reaction.

A method for the estimation of enzyme activity by following the change in the density of the medium is described by Dr. K. Linderstrøm-Lang. Small drops of the enzymatic reaction mixture, at different stages, are introduced into a vertical glass tube containing kerosene and bromobenzene in suitable proportions to give a practically constant specific gravity gradient, and their density is determined by comparison with similar droplets of known composition which float at given levels, according to their density. Curves are shown giving the change in specific gravity with time and the amount of amino-nitrogen liberated in the case of mixtures containing *dl*-alanyl-glycine and peptidase.

What appears to be a complete cycle of development of malaria parasites has been observed by Prof. K. B. Williamson and M. Zain in controlled experiments with *Culex biteniorhynchus*, a mosquito hitherto not considered a malaria carrier. The authors suggest that its ability to carry the malaria germs may be related to the fact that it breeds in pure, uncontaminated water.

In East Greenland and northern Spitsbergen the littoral mite *Molpus littoralis* extends its range beyond the shore, probably due to the non-occurrence

of big competing mites. In southern Spitsbergen it seems to develop more than one generation in the year. In East Greenland, according to H. Madsen, only one generation is developed, the species wintering in the egg.

In experiments on the semicircular canals of the pike, Dr. O. Löwenstein shows that the sense organ in the ampulla of the horizontal canal has a tonic function, and that a single horizontal canal is capable of evoking muscular responses to both clockwise and anticlockwise rotation of the fish in a horizontal plane.

In an investigation on the lower limit of voltages with which artificial radioactivity can be produced, E. Bertl, Prof. R. Fürth, F. Obofil and Dr. K. Sitte have obtained two active components, of period 22 and 100 seconds, by irradiating silver with slow neutrons produced by the action of slow deuterons (positively charged heavy hydrogen nuclei) upon beryllium-coated mica.

The addition of saponin (1 in 1,000) to cream, which usually churns in 60 minutes, delays the formation of butter for several hours, according to Dr. W. Clayton and J. F. Morse. Similar inhibition was observed with egg albumin. The authors accept Rahn's theory that during churning the milk proteins around the fat particles are removed by the aeration and frothing, and this leads to the coalescence of the fat globules.

Drs. R. S. Cahn and R. F. Phipers report that commercial 'activated' aluminas contain relatively large amounts of adsorbed alkali and can bring about, in neutral solvents, reactions normally associated with alkaline reagents in hydroxylic solvents. They suggest that the alkalinity may be responsible for abnormal results recorded by other workers.

Commenting on Dr. Huggins's communication on "Synchronized Oscillations in Hydrogen Bridges", Dr. D. M. Wrinch points out that similar speculations have been put forward by Wrinch and Jordan. The author claims that the mechanical characteristics of protein films are in good agreement with her 'cyclol' hypothesis and its predictions.

An experiment is described by Prof. R. Granit showing that the difference in the initial positive electrical response from two test stimuli applied to a retina is increased (from 8 per cent to 34 per cent) when the retina is 'charged' by an earlier stimulus. This may explain why visual acuity, brightness discrimination, etc., are favoured by bright stimuli and an illuminated background.

Research Items

Pithecanthropus—Man or Gibbon ?

THE arguments put forward by Dr. E. Dubois in support of his view that *Pithecanthropus erectus* is to be regarded not as a man, but as a genus allied to the gibbon (see NATURE, Feb. 13, p. 291) have been examined and met by Prof. W. E. Le Gros Clark (*Man*, April 1937). The evidence of the volume of the endocranial cast provides no ground for inferring kinship between two animals because their cerebral development is different. Dubois' startling conception that the brain in its phylogenetic development grows discontinuously by doubling its size at each stage rests on quite inadequate observation. The endocranial capacity of *Pithecanthropus* may be assumed to be somewhere between 900 c.c. and 1000 c.c., and of *Sinanthropus* I at 915 c.c. Yet Dubois, while insisting that *Pithecanthropus* is gibbon, accepts Peking man as human. *Pithecanthropus* even comes within the range of modern man, of whom examples have been noted with a cranial capacity of about 833 c.c. A number of features in the endocranial cast of *Pithecanthropus* indicate a human status. Such are the convolutional pattern of the frontal lobes, which are more complex than in the apes, and the extremely simple fissuration of the brain, while the 'association areas' must have been incomparably more extensive than in the anthropomorphous apes, and the expansion of these areas can only be related to the development of mental attainments distinctive of the Hominidæ. The characters of the femur, which Dubois takes to indicate the gibbon status of *Pithecanthropus*, are open to serious question. Not only does the palæontological evidence not support his prejudice against the view that the Trinil femur is human because this implies that the frame of man reached its perfection for pedal progression long before his brain attained its present complex structure, but also the arboreal habits believed to be related to other characters of the femur are not proved conclusively. The evidence of the lower jaw fragment from Kedung Brubus is so questionable that it scarcely deserves serious consideration.

Arctic Birds in New Zealand

A SHORT but extremely interesting list of arctic birds which spend the northern winter in New Zealand has been compiled by R. A. Falla, covering fresh records since Oliver's paper in 1930 (*Rec. Auckland Inst. Mus.*, 2, 1; 1936). They include fourteen species, of which the two most common forms in New Zealand are bar-tailed godwits (*Limosa lapponica baneri*) and knots (*Calidris canutus*). Others are two species of skuas, turnstones, Asiatic golden plover, three species of sandpiper, Asiatic whimbrel, two species of phalarope. Considering the small number of expert observers in New Zealand and the wide expanses which must go unnoticed, the list promises that further work is likely to add many names to this wandering fauna. As a rule, the migrants arrive about October in winter plumage, and set out on the return journey in April, when the adults have completed a pre-nuptial moult. Mr. Falla considers

that birds of the year, which have not completed their post-juvinal moult in April, do not migrate, but spend the southern winter in New Zealand. The northern movement of the adults in April, however, bears upon Prof. Rowan's suggestion that increasing daylight is the stimulus which sets the migratory movement in motion, for on the contrary these New Zealand wintering birds undergo the physiological changes associated with migration, and commence migration while the days are shortening.

Studies of Species of *Silene*

E. M. MARSDEN-JONES and W. B. Turrill have continued their investigations on the genetics, life-histories and ecology of *Silene vulgaris* (*S. Cucubalus*) and *S. maritima* in the seventeenth paper of the series "Researches on *Silene maritima* and *S. vulgaris*" (*Bull. Misc. Inform., Kew*, 45-53, 1937). In this paper, the genetical relationships of a Welsh mountain plant are discussed on the basis of controlled selfings and crossing with typical *S. maritima* and *S. vulgaris*. The Welsh plant is classified taxonomically as a variety of *S. maritima*, but shows a number of aberrant characters which suggest either previous contamination with *S. vulgaris* or the retention of more ancient phenotypic character combinations than now usually found in coastal populations. Analyses are given of the genetical behaviour of a large number of crosses, and some are compared with results obtained in earlier researches. The importance of this series of papers is that a very full knowledge of two species of plants is being obtained from many points of view: cytological, ecological, genetical, phyto-geographical and taxonomic. When the work that has been planned is completed—and it is well in hand—the real make-up and history of these two species will probably be better known than for any other species of wild plants.

New Species of Alga

ON the Templeton Crocker Expedition of the California Academy of Sciences 1932, a number of algae were collected from thirty-two stations, principally among the Galapagos Islands. W. A. Setchell and N. L. Gardner of the University of California are working out this collection. They have published a preliminary account of the new species, varieties and combinations that have been identified up to the present (*Proc. California Acad. Sci.*, 22; 1937). The new species already amount to 45 (18 Myxophyceæ, 1 Chlorophyceæ, 3 Melanophyceæ and 23 Rhodophyceæ). Collections along the coast of Lower California are also interesting in extending farther south the known distribution of many Californian species. The authors hope to publish the full account shortly.

Variation of Wind with Height

A DISCUSSION of the variation of wind with height at Wadi Halfa (Sudan), by J. Durward, is the subject of Professional Note No. 72 of the Meteorological Office, Air Ministry. The direct observation of upper

winds by pilot balloons is being extended into many parts of the world where the average values of those winds were formerly deduced from cloud movement, or from maps of computed pressure distribution at different heights deduced from observed surface pressure and assumed upper air temperature, and it is interesting to see to what extent observation supports theory. Wadi Halfa lies just inside the tropics, and is several hundred miles from the nearest point on the Red Sea. Were it not for its continental position, the predominance of winds from between north and north-east noted up to a height of about 4,000 feet might be described as appropriate for a place in the north-easterly trade-wind belt of the northern hemisphere, but these winds are better classified with the etesian winds of the Mediterranean and Egypt. At Wadi Halfa the wind from December to February generally backs with increasing height above 4,000 feet and normally blows from about north-west between 10,000 feet and 13,000 feet. In Shaw's "Manual of Meteorology" (2, p. 259 of 1928 edn.) is shown a map of normal pressure at a height of 4,000 metres (13,000 feet) due to Teisserenc de Bort, and on it the isobars run from about west-south-west to east-north-east. If the wind follows the isobars at that level there is therefore an apparent discrepancy of nearly 70° between observation and theory. Observation in this case covers one year only, but that is held to be a long enough period in which to obtain normal winds at Wadi Halfa, where the constancy of the pressure gradient throughout the year is remarkable and the wind is in consequence remarkably steady.

New Method in Geometrical Optics

IN a series of memoirs, starting in 1890, A. Gullstrand has made a deep investigation into the properties of optical systems, and in particular has put forward the thesis that no optical instrument can give a point-to-point correspondence between two surfaces, but that there are, on each surface of the object space, two systems of lines that can be represented point by point in the image space. Unfortunately, Gullstrand's methods are very complicated. Boegehold and Herzberger managed to simplify them in a particular case, that of his "fundamental law". Now C. W. Oseen ("Une méthode nouvelle de l'optique géométrique", *Kungl. Svenska Vetenskapsakademiens Handlingar*, Tredje Serien, 15, No. 6; 1936) has given a general method, based upon contact transformations and their invariants. Because the calculations have a character independent of the choice of co-ordinates, all the terms introduced have a geometrical or optical significance. This new method gives a large part of Gullstrand's results, in some cases making them almost obvious, and also gives other results not previously obtained. Oseen comes to the conclusion that Gullstrand's theory of representable lines is not general, and that there really is an optical image corresponding to any surface of the object space. He attributes Gullstrand's failure to reach this conclusion to the illegitimate assumption that the ray always cuts the surface considered at an angle different from zero.

Diameter of Lightning Discharge

THEORIES of the processes taking place in a lightning discharge channel involve the size of the channel, but the experimental evidence on this point has been confused. B. F. J. Schonland (*Phil. Mag.*,

March) has been able to examine a photograph of a lightning flash taken at short range (about 250 metres) which enabled him to make a direct estimate of the diameter of a discharge. Successive strokes of the flash were separated by the wind, and may readily be distinguished on the photograph—there were about ten strokes separated by intervals of about 0.05 sec., so that the whole flash lasted about $\frac{1}{2}$ sec. The negative was sufficiently free from over-exposure and halation to allow a determination of the discharge diameter, the distance of the flash from the camera being known. The values found ranged from 23 cm. for the heavy first strokes to 11 cm. for weak branch strokes. There is a discussion on the question whether these figures represent the actual diameter of the electrical core of the discharge.

Further Atomic Transmutations by Means of γ -Rays

THE production of radioactive isotopes by bombarding elements with an intense beam of γ -rays from lithium recently reported in these columns (*NATURE*, 139, 555; 1937) has been further extended (W. Bothe and W. Gentner, *Naturwiss.*, 25, 126, 191; 1937). The isotope of bromine ^{78}Br has been obtained, with a half-life of 3.5 min. Silver gives ^{106}Ag with a half-life of 24 min. Zinc gives a nucleus with a half-life period of 38 min., probably to be identified with ^{68}Zn . Gallium gives two isotopes, ^{70}Ga and ^{68}Ga , with half-life periods of 20 min. and 1 hr., respectively. Tantalum gives ^{180}Ta with a half-life of 14 min. In some cases radioactive isotopes were produced which have not yet been identified. Thus molybdenum gives a nucleus of half-life 17 min., and antimony gives one with a half-life of 13 min., which is probably ^{120}Sb . Indium gives either ^{112}In or ^{114}In with a half-life of 1 min., and tellurium either ^{127}Te or ^{129}Te with a half-life of 1 hr.

Lead-Uranium-Thorium Ratio in Uraninite

RECENT investigations show that the composition of a single crystal of uraninite may not be uniform throughout the crystal. C. M. Alter and L. A. Yuill (*J. Amer. Chem. Soc.*, 59, 390; 1937) have now examined a single well-developed crystal of uraninite from the Wilberforce locality weighing approximately 42 gm., which was divided into three parts, outer, middle and core, by filing each face down an equal amount, the particles of steel being removed magnetically. Determinations of the lead-uranium-thorium ratio of the sections confirmed the variation of composition disclosed in previous work, in which the sections were removed by solution in acid. The ratio $\text{Pb}/(\text{U} + 0.36\text{Th})$ was 0.1668, 0.1678 and 0.1864 for the outside, middle and core, respectively. The higher ratio in the core is unusual, and the ratios are different from those found previously with other crystals. The discrepancy in age using the data for the whole crystal and those for the core amounts to approximately eighty million years, while the discrepancy between the ages calculated for the whole crystal and the outside portion is about forty million years. The age of the mineral, as calculated by a formula given in the paper, is 1,100-1,200 million years, so that the relative error is not so serious, although the results emphasize the need for careful selection of material in order to obtain reliable data for age calculations. Erroneous results may be obtained by the analysis of a single crystal if the whole crystal is ground and analysed.

Distribution and Characteristics of Early Man

IN celebration of the one hundred and twenty-fifth anniversary of the founding of the Academy of Natural Sciences of Philadelphia, an international symposium on early man was held at the Academy on March 17-20, when a number of representative archaeologists from all parts of the world were present. In addition to the introductory address by Dr. John C. Merriam, president of the Carnegie Institution of Washington, and chairman of the committee for the symposium, thirty-two communications were presented, and four round-table discussions on problems of chronology and distribution took place. Broadly, the programme was arranged so that the communications presented on each day dealt with the problems of a continental area: on March 17 communications dealing with Europe or bearing on general problems of correlation with European cultures, on March 18 communications concerned with America, on March 19 matters relating to Asia and the Pacific and general problems arising out of the evidence therefrom, and on the closing day a small group of miscellaneous communications. The proceedings closed with a review of the problem of early man, based on the communications presented at the symposium, by Dr. G. Grant McCurdy.

In the following report mention is made only of the communications of wider general interest.

The proceedings on March 17, following on the introductory address, opened with a communication by Dr. G. H. R. von Koenigswald reviewing man's geological record in Java, and this was followed by a survey of the palaeolithic industries of China by Mr. W. C. Pei, which suggested some striking correlations with the palaeolithic industries of Europe. The most ancient artefacts of China identified by Abbé Breuil are the Nihowan, a piece of worked stone and some pieces of worked bone, in geological age Upper Pliocene and equivalent to the Villafranchian of Europe. Locality 13 industry, represented by a chert implement of undoubted human origin, corresponds to the Abbevillian of France and geologically is attributed to an early phase of Lower Pleistocene. Of the four main industries of China, *Sinanthropus*, which begins the true industry of China, is also attributed to the Abbevillian and the Lower Pleistocene; the newly discovered and as yet little studied Locality 15 industry of Choukoutien, of the early Middle Pleistocene, corresponds to the Late Lower Palaeolithic of Europe; the Ordos industry, contemporary with part of the Chinese loess, belongs to the late Middle Pleistocene; and the Choukoutien Upper Cave industry, which is the Upper Palaeolithic of China, corresponds to Aurignacian, Solutrean and Magdalenian.

Two communications came from Palestine. Miss Dorothy Garrod dealt with "The Near East as a Gateway of Prehistoric Human Migrations" and Sir Arthur Keith and Mr. Th. McCown, in a joint communication read by the latter, reported on the early human skeletal remains from Palestinian caves on Mount Carmel. It was pointed out that the human remains from the Levallois-Mousterian layers of these caves not only provide new additions to the considerable list of fossil specimens of man from the

middle part of the Stone Age, but they also provide a new perspective concerning Neanderthal man, present a new type of humanity, which is the probable stock ancestral to the inhabitants of Europe in late Palaeolithic times, and place in a new orientation the central problem of the evolution of the modern races of man.

The stratigraphic culture sequence in the three Wady Mughara caves overlaps in such a manner that the record carries us from the Acheulean, through the Levallois-Mousterian, to the Aurignacian and culminates in the Natufian, a new epi-palaeolithic culture. The human inhabitants of the caves are represented from the Levallois-Mousterian and the Natufian periods.

Three and a half years intensive work on the bones of the Mousterian peoples of Mugharet es-Skhul and el-Tabun has led finally to the conclusion that we here have two distinct types of man, both living in Palestine at about the same time, and before the marked change in the character of the Pleistocene fauna and in the climate which are to be related with the period of the last glaciation in Europe. Mount Carmel man is certainly pre-Würmian.

The first type is represented by a young adult woman of small stature (1520 mm.) from el-Tabun. The skull is small and low with a heavy frontal torus, the mandible is chinless and the face prognathous. The pelvis, especially the pubic parts, exhibits primitive anthropoid features not seen heretofore in any human race. This is a type similar to, but not identical with, the Western European Neanderthals; at the same time it bears an unmistakable relationship to the Skhul people.

The other type of Mount Carmel man comes from the Mugharet es-Skhul. The material consists of two tall adult males, 1738 mm. and 1780 mm., that is, nearly or quite six feet. Their lower limb bones in measurement are closest to those of the tall Cromagnon males. Other parts of the skeleton corroborate with varying emphasis. The large well vaulted skulls exhibit frontal tori with greater or lesser degrees of development, the large palate protrudes, and is completed by a mandible with a clearly defined chin and a modern internal conformation to the symphysis. The teeth do not show the taurodont condition of Neanderthal man, nor indeed do those of the Tabun type. The teeth of a well-preserved child, as well as of other young individuals, show unmistakable traces of a primate ancestry.

In all there are the remains of ten individuals on which conclusions are based. One of the most important points to emerge is their great variability. Their anatomical characters fall into three categories. In the first group, which is small, are the characters like those of the Western European Neanderthals; in the second, slightly larger, are intermediate characters between those of Neanderthal and of Neanthropic man; and the third, which contains by far the greater number, comprises the characters similar to those found in the Upper Palaeolithic inhabitants of Europe, leading to the conclusion that there is a genetic relation between the ancient Palestinians and the Cromagnons. In reviewing the

evidence as a whole, it may be said that the Skhul people are at least contemporaries, and possibly considerably earlier than the men of La Chapelle, La Ferrassie, of Spy and Neanderthal. They bear the imprint of characters inherited from a type ancestral both to themselves and to the European Neanderthals. These new fossils show conclusively that the Western European Neanderthals were not ancestral to the modern races of mankind; they clearly demonstrate for the first time that evolution was well advanced in the different groups of *Homo sapiens* in the middle Pleistocene. "Chronologically the Skhul people are too recent and physically they are too distinctive to serve as a form ancestral to *Homo sapiens* in the widest sense of that term. They do provide us with a variety of man who may be considered as the prototype of the earliest modern Europeans".

More immediately based upon the European evidence relating to early man was a communication by Prof. A. W. Brögger, dealing with the extension in distribution of late Palæolithic man to the extreme north in northernmost Norway. The remainder of the first session was devoted to the application of recent developments in method in European archaeology to American conditions.

In the American session on March 18, the number of communications offered was considerable, opening with Dr. A. Hrdlička's discussion of early man in America in the light of the skeletal evidence. Chronological problems were discussed by Mr. Herbert J. Spinden, and Dr. Ernst Antevs dealt with climate and early man. The Folsom problem received attention from Dr. Frank H. Roberts and others, and several communications dealt with the question of the evidence of geology and palæontology. Mr. Edwin H. Colbert on the pleistocene mammals of America and their relation to Eurasian forms argued for a considerable interchange in pliocene and pleistocene times, with eventually a much later survival in America of certain typical pleistocene forms, such as mammoth, camel, horse, extinct bison and sloths, into recent times.

On March 19 communications dealing with the prehistory of Asia were taken, opening with a contribution by P. Teilhard de Chardin dealing with the Late Cenozoic relations of North China, Malaysia and Central Europe, in which the entry of *Sinanthropus* into China, probably from the south, was shown to follow an eastern Asiatic uplift which was responsible for changes in earth surface, climate and fauna, and a review of the traces of fossil man in Mongolia by Prof. C. Charles P. Berkey, of Columbia University.

A communication by Prof. V. Gordon Childe, reviewing the evidence relating to the North Eurasian Forest Culture in the Mesolithic and Neolithic phases, drew an interesting parallel between the conditions, which had to be faced by the hunting peoples of northern Europe from Britain to the Urals at about 7000 B.C. with those which had confronted the aboriginals of north America in comparable zones. This forest culture, the Maglemosean, had adapted itself to specialized forms of hunting and fishing, using dog-sleighs (runners found in boreal peat in Finland are the oldest dated evidence for any vehicle for the use of man) conical arrow-heads for killing fur animals, and ice-picks. This East Maglemosean equipment is found right across Central Russia, where, however, it seems to be post-boreal and may mark local survivals of a boreal extension of the Maglemosean. With the more favourable climatic

conditions around Denmark of the Littorina transgression, the Ertebølle shell-mound culture is to be regarded as an adaptation of the Maglemose to new conditions, its pottery being due to the foreign influences, which afterwards produced the Nordic neolithic cultures of north Germany, Denmark and southern Sweden. East of the Baltic the environmental change was insignificant, and the old economy persisted. Later in Finland the hunting and fishing economy was transformed by battle-axe folk, who introduced agriculture and stock breeding. The same transformation was effected in central Russia by the Fatyanovo battle-axe folk, yet there pit-comb pottery survived into the Iron Age after 800 B.C. In the Urals late sub-boreal peats have yielded pottery like the Finnish and Central Russian neolithic wares and the aforementioned bone-work of Maglemosean character. Thanks to such survivals, the makers of pit-comb pottery and so also their Maglemosean ancestors can be linked up with the historical Finno-Ugrian peoples.

A more remote problem was considered by Milo S. Hellman and Prof. W. K. Gregory, in examining the evidence of dentition in its bearing on the origin of man in the light of the new anthropoid ape material obtained in the Siwalik Hills, North India, by Dr. de Terra and Mr. G. E. Lewis. The communication was limited to two problems, the origin of the *Dryopithecus* pattern of the lower molar crowns and the known limits of variation of that pattern in fossil and recent anthropoids, and its transformation into the cruciate or four-cusped pattern in the more advanced lower molars of man. Among the conclusions put forward may be mentioned that while the *Dryopithecus* pattern is subject to extreme variation in regard to proportions, it is constant in the fundamental arrangement of the five principal cusps and the several grooves at their base; that of all the variations of the pattern, that of the first lower molar of *Australopithecus* is the closest to the human modification of the *Dryopithecus* pattern, though the tooth itself is far too broad to give rise to that of man; that of the known human first lower molars, that of the palæoanthropic division of man, especially of the Ehringsdorf child and *Sinanthropus*, are the least modified away from the *Dryopithecus* pattern; and finally, contrary to most authors, the opinion is expressed that the older palæoanthropines are at least structurally ancestral on one hand to *Homo neanderthalensis* and on the other to *Homo sapiens*.

In this connexion much interest is attached to certain conclusions at which Dr. H. de Terra has arrived as a result of his investigations in the Siwalik Hills. He states that there is evidence to show that the late tertiary mammals of India migrated to south-east Asia, guided by a shifting of the tropical belt from north to south. It was suggested that such migration should be considered as a major factor in human evolution so far as Asia is concerned. The stone age records of early man in India indicate a great expansion of the old palæolithic races from southern India to the Siwalik Hills in the middle pleistocene, shortly after the Himalayan glaciers had retreated from their second major advance. Towards the close of the Ice Age, another group of stone manufacturing people invaded the lower Indus valley, settling in a region which recent investigation shows to have also an advanced civilization 5,000 years old. Hence the Indus valley shares with other large drainage areas a long tradition of human pre-history.

The Biological Station at Barents Sea

IT will interest British biologists and especially fishery research workers to learn that a big new biological station is being built by the Academy of Sciences of the U.S.S.R. at Murmansk on the Barents Sea. The new biological station is intended for extensive research in morphology, anatomy, embryology, physiology, biochemistry and ecology of sea organisms.

Owing to the penetration of the warm waters of the Atlantic into the Barents Sea, the fauna of the latter is extremely rich and diverse. Of importance is the fact that at Dalnye-Zelenets Bay the water is transparent to a depth of 10 metres, and that large stretches of the sea bottom are visible from the surface. The scientific workers at the station will make a detailed study of the problems of evolutionary physiology, embryology and the relationship of the fauna with changed hydrological conditions effected by the Gulf Stream.

The Murmansk biological station will supply biological material to the various research institutes and higher educational institutions of the U.S.S.R. Superintending the building of the station is a special commission consisting of S. A. Zernov (director of the station), L. A. Orbeli, V. I. Vernadsky and N. M. Knipovich, Prof. K. M. Deryugin of the University of Leningrad, Prof. L. N. Fedorov, director of the All Union Institute of Experimental Medicine, and Prof. E. M. Kreps.

The cost of building the Murmansk Station is estimated at 3½ million roubles, excluding equipment. A scientific library, the zoological, botanical, microbiological and hydrochemical laboratories and the libraries of other departments will be housed in the main building of the station. An aquarium designed for scientific work will be installed on the first floor of this building while several other aquaria, open to the public, will be erected in the basement of the building. Premises containing students' laboratories will be situated near the central building, and will also be equipped with large aquaria. Special interest is attached to an open-air concrete reservoir intended to accommodate large sea animals including seals.

The spawn of crabs will be brought from the Far East for acclimitization and breeding in the Barents Sea. A special vessel, 30 metres long, built for scientific work in the open sea will maintain uninterrupted communications between the station and the city of Murmansk.

At the beginning of this year, the Academy of Sciences of the U.S.S.R. commenced extensive work in the Dalnye-Zelenets Bay, east of the Kola Bay (Teriberka district, situated in the Northern Province) for the construction of this biological station, which will be the finest in the Soviet Union. The Soviet architect N. V. Ryumin and his assistants have designed all the buildings.

Irradiation of Plants with Neon Light

AFTER years of experiments in Holland and elsewhere, an appreciable measure of success has recently been achieved in promoting the development of plants by irradiation with artificial light. J. W. M. Roodenburg and G. Zecher, in a paper in *Philips Technical Review* (Eindhoven) of July last describe recent technical developments, and show that it is now possible for the market gardener and the amateur horticulturist to employ irradiation on a practical scale.

The growth of plants is naturally intimately connected with their photosynthesis. As photosynthesis is most active in red light, it is necessary to use red rays. Twenty years ago neon light was suggested, but this light is not so easy to manipulate as glow lamp light, so further experiments were made with glow lamps. These showed that although the development of leaves was promoted, the general quality of the plants suffered, as the stems and stalks grew too 'leggy'. Experiments have now shown that provided the proper 'dosage' is given, neon light is exceptionally suitable for plant irradiation. The stems become thicker, the roots are stronger and frequently the formation of blooms and fruit is much promoted.

When neon lights were introduced for the irradiation of plants, they had already been employed for

several years as luminous advertisements. For these purposes long glass tubes are used, into the ends of which two iron electrodes are fused. The tubes contain a neon filling at a pressure of approximately 10 mm. They are run at a pressure of 3,000 volts and emit a comparatively small luminous flux per metre of tube-length. For use in damp forcing houses for the irradiation of plants, these tubes would be objectionable owing to the risk of shock; moreover, their low brightness makes it difficult to obtain the best illumination. To get a satisfactory illumination, it was necessary to reduce the pressure to 1 mm. or less. But at this pressure the iron electrodes disintegrated rapidly, so that the life of a tube was only a few hours. A solution was obtained by using hot cathodes similar to those used in gas-discharge tubes for highway lighting. This enables the tubes to be run at low pressures.

The hot cathode tubes are connected directly to 220 volts mains supply, through a series-connected 'choke' coil. A simple device is employed for starting up the tube, since the running voltage is too low to initiate the first electric discharge through the low-pressure neon gas. During the burning of the lamp, the cathode suffers practically no disintegration and the light output remains uniform. After 2,000 hours.

the cathode begins to be atomized and a black deposit forms on the glass walls. The tube should then be replaced. The tubes are short and mounted in reflectors which considerably increase the efficiency of the irradiation.

Photographs are given which show the effects produced by subjecting flowering plants and strawberry beds to irradiation for periods up to three months at eight hours per night in mid-winter. Compared with plants which have not been treated in this way, the forcing effect is very pronounced.

Power and Light for North Wales

AN interesting article on power and light in North Wales by Brig.-General R. F. Legge, manager of the British Power and Light Corporation, Ltd., appeared in the December issue of *Trade and Engineering*, a monthly review of industrial progress, issued by *The Times*. A subsidiary of this company called the North Wales Power Co., which generates all its electricity from water-power, supplies the north of Wales. The area over which the North Wales Power Company operates covers more than 4,000 square miles. The supply is practically unlimited and the price compares favourably with most other industrial areas in Great Britain.

The full exploitation of this area and to a great extent the well-being of its inhabitants depend largely on sound electrical development. Not only has the North Wales Power Company its own water resources, drawn from its lakes in the Snowdonia mountain ranges, on which it has spent several millions in recent years, but also its transmission system has been linked with that of the Central Electricity Board at Crewe. Hence although at present the hydro-electric system is capable of meeting continuous demands, the whole supply is safeguarded by this link with the national Grid and its controlled steam stations. By agreement with the Central Electricity Board, the output of two of the hydro-electric generating stations of the North Wales Co. is controlled and purchased by the British Power and Light Corporation, from which the North Wales Co. repurchases its requirements. In this way the stations are used by the North Wales Co. for peak load operation and supplement the Board's system by meeting the fluctuating demand at various times of the day.

There are more than 1,000 miles of high-tension distribution lines and 300 miles of low-tension, excluding the systems of eighteen local authorities which are supplied in bulk. The North Wales Power Co. itself distributes to some 300 points within the area, affording supplies to more than 150 townships, to rural villages and to independent farms.

The principal industries in North Wales are the quarrying of slate, granite and limestone, the mining of coal, lead and gold, the manufacture of bricks and tiles, wool textiles, artificial silk and chemicals, and agriculture. According to the annual report of the Secretary of Mines, in 1935 the production of slate in Great Britain was the highest for more than twenty years, and the best slate comes from North Wales. The aggregate power required for working the granite and slate quarries is 20,000 h.p. The L.M.S. Railway at Crewe has a connected load of

approximately 16,000 h.p. Extensive developments have taken place in milk food production factories. The local farmers in distant rural districts are availing themselves of the power companies' supply for milking and other farm work. In 1914, the Marconi Telegraph Co. erected at Caernarvon the first long-distance transmitting station to be built in Great Britain. It is still in operation, the North Wales Power Co. supplying it with the necessary current.

The diversity of the loads supplied to the various industries is very beneficial. This is seen by the load factor being about 0.56. During the last three years, purchases per annum have increased from 35 to 106 million units.

University Events

BIRMINGHAM.—Mr. A. E. Hills, the donor of the new chemistry block, has made a further benefaction of £25,000, to be used for the provision of post-graduate scholarships open to all students of the University, in any faculty, who have taken a bachelor's degree and shown themselves qualified for post-graduate work. The minimum value of a scholarship is to be £150, but the Council may at its discretion increase the sum. The maximum period of tenure is two years, and the scholarships may be used for study in Leeds or any other place approved by the Council of the University. They will be known as the A. E. Hills post-graduate scholarships.

Dr. R. Peierls, assistant-in-research at the Royal Society Mond Laboratory, Cambridge, has been appointed to the newly instituted chair of applied mathematics as from October 1.

LEEDS.—In the recently issued annual report, the significance of the outstanding benefaction of the year, a gift of £50,000 from an old student of the University, Mr. Frank Parkinson, is stressed. The object of the gift is to establish an endowment fund for scholarships and it is noteworthy, apart from its magnitude, for the guiding principle prescribed by the donor for the administration of the fund. Education for citizenship is, he holds, a university's highest service to the community. His gift is intended "to fructify in the development of those types of manhood and womanhood which the country needs if it is to hold its place amongst the nations in the strenuous years that lie ahead", and he asks that in selecting beneficiaries the University be mindful of the supreme importance of "keeping the realities of life and the need for breadth of vision in human affairs well before its students".

Among the important developments of the year were the completion of the great new Library, the Brotherton, additions to the staff of the school of medicine and the inauguration of a scheme for closer co-operation with Yorkshire theological colleges. Student enrolments have steadily increased since 1930-31 and in the last session reached the record figure of 2,161 (full-time, 1,663). Nor do there seem to be grounds for fearing that the number is excessive in relation to the opportunities for employment open to graduates. On the contrary, year by year, says the report, we see an increasing reliance upon the value of university education on the part of the public.

Science News a Century Ago

Experiments with the Thermo-Electric Pile

ON April 24, 1837, writing from King's College, London, Wheatstone sent a note to the editor of the *Philosophical Magazine* (May 1837, 414) "On the Thermo-Electric Spark, etc." In this, he directed attention to some experiments recently made in Italy with Nobili's pile, the production of thermo-electric sparks and the effects of thermo-electric currents. The original experiments had been made by Cav. Antivori, director of the Museum at Florence, and Wheatstone had repeated them at King's College, where they were seen by Daniell, Faraday, Henry and Bache, of whom the last two were on a visit to Great Britain from the United States. The thermo-electric pile Wheatstone used had 33 elements of bismuth and antimony formed into a cylindrical bundle $\frac{3}{4}$ in. in diameter and $1\frac{1}{2}$ in. in length. The poles of the pile had wires leading to a mercury cup. One face of the pile was heated by a red-hot iron brought within a short distance of it, and the other was kept cool by ice. When contact was broken with the mercury cup, small sparks were observed. Writing of the results, Wheatstone said: "I conclude, therefore, that the experiment of Antivori is a real addition to our knowledge of electrical phenomena . . . it supplies a link that was wanting in the chain of experimental evidence which tends to prove that electricity, from sources however varied, is similar in its nature and effects, a conclusion rendered more than probable by the recent discoveries of Faraday. . . . It is not too much to expect, seeing the effects produced by a pile of such small dimensions, that by proper combinations the effects may be exalted to equal those of an ordinary voltaic pile."

Ornithological Society

THE first general meeting of this Society, which was formed on October 21, 1836, was held on April 26, 1837, at the Thatched House Tavern, St. James Street, with Mr. N. A. Vigors, M.P., in the chair. Since the last meeting, 127 new members had joined the Society, and the Duke of St. Albans, the Earl of Derby and other noblemen had made the Society presents of valuable birds. Several birds belonging to the Society had already been placed in the enclosure in St. James's Park; and the Committee intended to apply to the Government for a plot of ground for the use of the Society, on the plea that the hardy birds would be exhibited in the parks.

Changes in the Ova of Mammals

AT a meeting of the Royal Society on April 27, 1837, Richard Owen communicated a paper by Thomas Wharton Jones entitled "On the First Changes in the Ova of the Mammifera, in consequence of Impregnation . . ." The report of the paper said: "The author having in a former paper described the structure of the unimpregnated ovum of mammiferous animals, now proceeds to investigate the changes which the ovum undergoes in consequence of impregnation. In the rabbit, the first perceptible difference is the addition of a thick gelatinous matter surrounding the parts of which the ovum was composed in its original state, and apparently derived from the ovaries. In the progress of development the vitellary membrane gives way, as happens in the ova of the newt, and of many of the oviparous animals. The gelatinous envelope acquired in the

ovary, and which is more especially circumscribed and defined after impregnation, constitutes the only covering of the vascular blastoderma, after the giving way of the vitellary membrane, and afterwards forms the chorion, which in rodent animals, at a further stage of development, presents itself under the form of a thin transparent membrane, very similar to the vitellary membrane of a bird's egg, and situated immediately outside the non-vascular and reflected layer of the umbilical or erythroid vesicle."

Brewster and Forbes

AMONG the letters of J. D. Forbes is one written on April 28, 1837, to Sir David Brewster, a part of which ran: "Your experiments on absorption must be most interesting. I think Wrede, the first pages of whose paper Taylor has lately translated, has done something of the kind you allude to, if I understand it correctly. If I recollect well, he imitates the phenomena of absorption by combinations of thin mica plates, that is by the colours of thin plates.

"I will do my best to capture a Wolf's lens for you, on condition that you will not require an affidavit that I saw the wolf make use of it. To stare a wolf in the face in the Black Forest would be enough to throw any optical philosopher into a fit of reflection."

The Zoological Society

THE anniversary meeting of the Zoological Society was held on April 29, 1837, at the Museum in Leicester Square, the Earl of Derby, president, being in the chair. The receipts for the year had been £19,123 14s. 10d., of which £9,463 2s. 0d. was from admission fees to the garden; the receipts from this source exceeded those of the previous year by £2,000. The giraffes had been a great attraction. The Society had 3,050 members, with 43 candidates, 112 corresponding members, 24 foreign and 10 honorary members. During the year 363,392 persons visited the gardens. The total number of specimens were 1,025, of whom 307 were quadrupeds, 704 birds and 14 reptiles. The number of specimens in the Museum was 6,720, and there had been 3,668 visitors.

Medicine in Italy

THE April issue in 1837 of the quarterly *British and Foreign Medical Review* contains the following account from a correspondent of the state of medicine in Italy at that time.

"From what I have seen of the Italian physicians, I would remark that they display considerable learning and much acquaintance with ancient authors, yet in their practice they do not appear to advance beyond the days of Hippocrates or Galen. Following closely the footsteps of the great Father of Medicine, they closely watch the natural progress of the complaint, but unfortunately they do little either to assist or counteract the operations of Nature. In their practice they seldom employ anything like decision or vigorous measures to cut short disease, and even in the most acute complaints, they depend more on diet and regimen than on the use of medicines. I would not assert that they lose more patients than the English physicians; but I have no hesitation in saying that the bad effect of their mode of treatment is apparent in the immense number of chronic diseases which are continually presenting themselves and which might probably have been prevented from becoming such, had depletion been more freely resorted to in the acute stage of the disease."

Societies and Academies

Dublin

Royal Dublin Society, March 23.

D. A. WEBB and W. R. FEARON: Studies on the ultimate composition of biological material. (1) Aims, scope and methods. A spectrographic survey has been made of peat from samples taken at different depths: (a) surface, (b) five feet down, and (c) twenty feet down. The following elements were plentiful in all samples: aluminium, calcium, magnesium, manganese, strontium. The following decreased with depth: lead, phosphorus, silver. The following increased with depth: barium, iron, silicon, zinc. The following were present as micro-constituents and showed no significant variation with depth: copper, molybdenum, potassium, tin. Surveys were made also of related organisms, namely, bakers' and brewers' yeast, and of various regions of a single structure, namely, the outer and inner layers of the testa and the endosperm of the Brazil nut. The data are discussed in connexion with the classification of biological elements into primary, secondary, and micro-constituents, and contaminants.

L. O'DROMA and M. GRIMES: A study of *Escherichia communior* found as a contaminating organism in 'starter'. A commercial 'starter' for use in cheese-making was found to produce a gassy curd. Manipulation of the mother starter failed to eliminate the gas former. Isolation revealed *Escherichia communior*, a coliform organism which ferments sucrose. Details of the cultural and physiological characters of the organism were given.

Paris

Academy of Sciences (C.R., 204, 829-924; March 15).

LAUGE KOCH: The question of the Ozakian in Greenland. The arrangement of the strata in northern Greenland is tabulated, in accordance with the author's view. The upper Cambrian is not represented, and the term Ozakian is omitted as being unnecessary.

MAURICE NICLOUX: The diffusion of ethyl alcohol in marine animals, and the hypothesis of combined water. Experiments bearing on the hypothesis of the existence of a protein-water complex in which the water has lost its usual solvent properties.

MENDEL HAIMOVICI: Finsler spaces.

CHRISTIAN PAUC: Ensemble of finite systems of points of a continuum.

LUBOMIR TCHAKALOFF: A problem of Laguerre.

MAURICE POTRON: Non-negative matrices.

HENRI MILLOUX: The Schottky-Landau theorem and the theory of normal families of functions.

ROBERT D'ADHÉMAR: The elementary theory of the gyroscopic movement of projectiles. Nature of the approximation. The Magnus effect.

JEAN LOUIS DESTOUCHES: The properties of the generalized Lorentz transformation.

OUANG TE-TCHAO: The size of smoke particles suspended in the air.

RAYMOND CHEVALIER and Mlle. SUZANNE MATHIEU: The variation of the magnetic susceptibility of a hæmatite powder as a function of the size of the grains. The magnetic susceptibility diminishes regularly as the grain size is reduced. No explanation can be given at present.

ROGER SERVANT: The examination and working of quartz plates cut perpendicularly to optic axis.

MARCEL CHÂTELET: The kinetics of the oxidation of cobalt in ammoniacal solution.

MARCUS BRUTZCUS: Combustion yields of hydrocarbons and energy values of the linkages of their atoms.

MME. ALMA DOBRY: The electro-chemical nature of cellulose solutions.

MARCEL SERVIGNE: A sensitive method for detecting traces of rare earth elements. The method is based on the production of a photo-luminescence spectrum, and will detect certain rare elements (samarium, dysprosium, europium) in concentrations so low as one part in a million.

PIERRE BONNEMAN: The tetrametaphosphates.

ARMAND MARIE DE FICQUELMONT: The mechanism of the polymerization of the phosphonitril chlorides, $(Cl_2PN)_x$.

THADÉE URBANSKI and MARIAN SLON: The nitration of the paraffin hydrocarbons by means of nitrogen peroxide. With normal paraffins ranging from pentane to nonane, mixtures of mono- and dinitro-derivatives were obtained.

JACQUES PARROD: The influence of some compounds on the formation of hydrocyanic acid, by oxidation of lævulose or of alloxan, in a copper-ammonium medium.

EUGÈNE WEGMANN: The Precambrian base of southern Greenland.

LOUIS EBLÉ: The values of the magnetic elements at the Val-Joyeux (Seine-et-Oise) station on January 1, 1937.

EMILE THELLIER: The so-called permanent magnetization of basalts. The magnetization of a basalt is altered by the action of even a very small magnetic field. Hence researches on the variations of the terrestrial magnetic field with time based on the study of the magnetic properties of basalts are of doubtful validity.

ROBERT LEMESLE: A new secreting apparatus with tannoids in the genus *Eupomatia*.

ROBERT ECHEVIN and ARTHUR BRUNEL: Nitrogen metabolism in the course of the germination of the lupin, *Lupinus albus*.

ROGER ULRICH: Some factors of the premature fall of the fruit in the ivy (*Hedera Helix*).

ROBERT QUETEL: The evolution of various forms of phosphorus in forced lily-of-the-valley.

ROGER GAUTHERET: The action of the root on the survival of isolated cells of the cap of *Lupinus albus*.

MARCEL MASCRÉ: Leucæmol, a definite principle extracted from the seeds of *Leucæna glauca* (Papilionatæ).

RENÉ SOUÈGES: The embryology of the Amarantaceæ. The development of the embryo in *Amarantus retroflexus*.

MARC SIMONET: A new case of chromosome division in a hybrid of *Iris pogocyclus*, *I. Ricardii*, var. *Leverrier* × *I. Iberica*.

JULES PAVILLARD: Hybridization (or perhaps mutation) in pelagic diatoms of the genus *Rhizosolenia*.

MAURICE ROSE and Mlle. M. HAMON: The physico-chemical conditions of bursting and of the dehiscence of the spermatophores of some Cephalopods.

Mlle. YVETTE NEEFS: Various cases of functional hermaphroditism in *Strongylocentrotus lividus*.

WLADIMIR DRABOVITCH and PIERRE WEGER: Two cases of experimental neurosis in the dog.