NATURE

SATURDAY, MAY 5, 1934

No. 3366 Vol. 133

CONTENTS

Rewards for Scientific Discoveries

THE continued growth of nationalism during the past few years has brought clearly to the mind of many people the thought that, *pace* the League of Nations and all it represents, the struggle among nations will in the future, as so often in the past, result in the battle going to the strong and the race to the swift. One consequence is that the governments of the more important nations, aware of the futility of trusting to mere numbers of man power, are turning more and more to the encouragement of the best minds among their own nationals in the hope that their discoveries will place their own nation in the fore-front and so enable it to reap the due reward, be it either in war or in peace.

Although this encouragement has taken various forms in different countries, and includes in most countries the granting of honours and the general esteem of the public, in no country has it taken a form which is regarded as entirely satisfactory, while in most countries the reward, whether to workers in science or in art, must be regarded as deplorably inadequate from the financial point of view. In Great Britain, the difficulties of the Department of Scientific and Industrial Research in the realm of science are only too apparent, while the inadequacy of the reward of composers, in view of the vast development of broadcasting and the gramophone, is a matter for keen regret. In other countries similar problems are forming the subject of most searching inquiry, an example of such inquiry being the first of a series of papers which the Council of the American Association for the Advancement of Science is authorising, the paper being the Report of the Committee on Patents, Copyrights and Trade Marks entitled, "The Protection by Patents of Scientific Discoveries", published as a Supplement to *Science* in January last (New York : The Science Press). Extracts from the Report appear elsewhere in the present issue of NATURE.

Much discussion has occurred upon the question of the patenting of scientific discoveries. In an attempt to formulate a policy or agreement upon principles, it may be worth while to consider first those inventions which have possible industrial uses and are patentable, and whether scientific investigators should obtain patents on such inventions which have resulted from their work, medical patents being for the moment excluded as presenting peculiar difficulties. Many objections

have at various times been raised against patenting by scientific investigators, among them, for example, being that it is unethical for scientific men or professors in universities to patent the results of their work; that publication or dedication to the public is sufficient to give the public the work of a scientific man; that patenting will lead to the debasement of research; that patents will place unfortunate strictures on other men who afterwards do fundamentally important work in the same field; and so on.

After considering these and other objections, the opinion of the Committee is that the patenting of the results of research (other than medical research) which have some possible commercial importance or industrial application is highly desirable; and indeed it is difficult to understand how any opposite opinion could be held either in the United States or elsewhere.

The question of medical patents is in Great Britain admittedly difficult, mainly because the preponderating weight of medical opinion is against the granting of medical patents to medical practitioners. At the annual general meeting of the British Medical Association in July 1931 there was a prolonged debate which resulted in a resolution:

"That the Association approves the traditional usage in accordance with which it is unethical for any medical practitioner who discovers or invents any substance, process, apparatus, or principle likely to be of value in the treatment of patients to act against the public interest by unduly restricting the use and knowledge of such discovery or invention for his own personal advantage."

It should be remembered, however, that although medical opinion in Great Britain is opposed to the patenting of medical inventions by medical practitioners, the recently revised patent law (see the Patents and Designs Acts 1907–1932, Section 38 A) permits the patenting of medical inventions by any person under rigidly defined conditions which adequately protect the public interest. Whether in these circumstances it is either in the best interests of the medical profession or in the public interest that medical practitioners should hold aloof from patenting medical inventions, may reasonably, it is submitted, be open to doubt.

Probably most of the discoveries made by scientific investigators cannot be protected under our present patent laws even if the investigators so desire; and there remains, therefore, the question whether the present inadequate reward of investigators in fields outside patentable inventions can be increased by any means alternative to those at present employed, for not even the most exalted scientific man can subsist solely on honours and public esteem.

The brief history of alternative means which have been suggested is that before the War vague proposals were, from time to time, put forward for the protection of scientific property, that is, the property which a scientific investigator might reasonably be held to have in the whole of the results attributable to his work. After the War, however, definite proposals were made and soon became an issue with the League of Nations, resulting in the adoption in 1922 by the International Committee of Intellectual Co-operation of the following motion:

"The Committee, considering that intellectual property is not sufficiently protected and that scientific property particularly is at present not protected at all, entrusts a subcommittee consisting of MM. Destree, Millikan, Ruffini and de Torres Quevedo with the duty of examining the means by which this protection may be assured."

Western European nations weighed and pondered the issue: France, Italy, Norway, Switzerland, Spain and Portugal announced in favour of the protection, while Great Britain, Austria and Germany opposed it. In the United States, almost dead silence was maintained, "due probably and mainly to an ignorance of the question". (R. Spencer, "Scientific Property", *American Bar Association Journal*, February 1932.)

Different plans were proposed for affording protection: (1) by the establishment of an international bureau; (2) by the creation of a fund contributed to by manufacturers; (3) by donation of government funds to the discoverer; and (4) by the extension of the patent system to include scientific discoveries.

The conclusion of the whole matter from the American point of view seems to be that no practicable and desirable means alternative to those in operation at present has been proposed. It is probably the fact that in Great Britain a similar opinion is held. So far as inventions form subject matter for the grant of Letters Patent, the law has been recently revised and brought up-to-date in the Patents and Designs Act of 1932. Any person, be he scientific investigator, medical practitioner or otherwise is at liberty, unless as in the case of the medical practitioner he is restrained

by ethical or similar considerations, to apply for the grant of a patent for any invention which constitutes a new manner of manufacture. If the invention or discovery lies outside the field covered by the Patents Acts, no alternative to the present means which is practicable and desirable has been suggested; and if scientific investigators in this field are to be adequately rewarded, it seems that the only way open is for a more generous support to be accorded to them both by public and private benevolence than has hitherto been the case.

Myths of Polynesia

Religious and Cosmic Beliefs of Central Polynesia. By Robert W. Williamson. Vol. 1. Pp. xxi+399. Vol. 2. Pp. vi+398. (Cambridge: At the University Press, 1933.) 50*s*. net.

A REVIEW of these two volumes must be the funeral oration not only of a good worker, but also of a school the best traditions of which he worthily represented. Of this school Tylor may be considered the father. He proceeded by culling illustrations from the whole world and in making generalisations without any strict method. It was the only course open to those pioneers to whom only fragments were as a rule available. They were like surveyors on the top of a mountain picking out the salient features of the landscape, indicating roughly the trace, and leaving it to others to work it out in detail.

In this second line of survey, Mr. Williamson holds an honourable place. As a rule such systematisers lack the vision of pioneers. Mr. Williamson is no exception. Nor has he the gift of style to help us over the crowded shingle of facts. To take a specimen at random: "Tyerman and Bennet say that Orion was known by name. According to J. R. Foster the stars forming his Belt were called E-whettoo-mahoo. Moerenhout says the stars of the constellation were called Fehone-tarava, and guided their navigators at night. The London missionaries say . . ." (vol. 1, p. 125); but even the expert wants a pause in the midst of these enumerations.

Lack of imagination leaves the treatment rather mechanical. The geographical boundary is drawn by latitude and longitude rather than by a point of view. By restricting himself to Central Polynesia (except for a few temptations to glance at islands just out of bounds) the author makes difficulties for himself. Thus he is puzzled by the fact that in the Paumotuan myth of the separation of sky and earth the sky is female, not male as we have been brought up to expect. This he has to explain as "an accidental mistake" (vol. 1, p. 28). Had he allowed himself a peep at Egypt he would have found the same myth with the sky as female. What seems a mistake is really an important piece of evidence: it proves there are two versions of the myth occurring side by side from the Near East to Polynesia. But it is an axiom with this school that nothing ever travelled before our own culture except within restricted areas, such as Polynesia. Any interchange of ideas outside those areas, as between Polynesia and India, or Polynesia and America, is rigorously taboo.

Equally mechanical is the classification, for example, into creation, sun, moon, stars, winds, and so on. It is not with natural phenomena we are concerned, but with the minds that think about these phenomena, and there is not one department of the mind that deals with creation, another with the sun, another with the moon. All these different phenomena may figure in the same system of thought, such as the creation cycle, which is one big system including myth and ritual of sun, moon, stars and many other things; on the other hand, the sun may figure in different systems, as in our creation myth and in our astronomy, two systems which some people manage to keep completely apart in their minds.

For purposes of reference, however, nothing can be more suitable than a mechanical classification such as the author adopts. After all, no one has discovered a better arrangement of words in a dictionary than the purely mechanical one of following the alphabetical order. It is as a work of reference that Mr. Williamson's book has to be judged. For new and fruitful points of view we shall look in vain. The conclusions boil down to waves of migrations which are neither proved, nor worth proving, a mere variation on that most unfortunate theme, vol. 2 of "The History of Melanesian Society". It is sad that Rivers at his best should find no imitators, while Rivers at his worst is still taken seriously.

The author could have laid the fault at the door of his authorities, but, like a good workman, he does not blame his tools. Yet he might have done so with justice. The literature on Polynesia is too much made up of scraps for the most part to give us a picture of any single culture as a whole. It is only recently that we have come to realise that all these scraps are parts of recurrent patterns, and

that it is those patterns that really matter (see, for example, "Myth and Ritual", ed. S. H. Hooke, Oxford, 1933). Mr. Williamson could scarcely be expected to bring out those patterns since they are not in the materials he had at his disposal. All he could do was to rescue for the student all those fragments which lie scattered in endless volumes, and leave the student to infer from the fragments the presence of patterns known elsewhere in their entirety. That work Mr. Williamson has done right well.

As work of reference these volumes deserve nothing but praise. The Tylorian school shines in such tasks. With its best qualities the author is liberally endued. It is easy to see the weak points of a school that is passing away; but when it has been dead for the lapse of a generation men begin to regret its virtues. Mr. Williamson almost makes one regret them before it has completely passed away, for in these days of competition for renown it is not common to find an equal degree of thoroughness, absolute honesty, self-dedication to a laborious task, absence of demagogic arts, as we find in these pages. The result is a complete and reliable survey of Polynesian mythology indexed in a manner which it is no exaggeration to describe as ideal. The work will never have to be done again, because Mr. Williamson has left nothing more to do. A. M. HOCART.

Medical Genetics

The Chances of Morbid Inheritance. Edited by Dr. C. P. Blacker. Pp. xi+449+7 plates. (London: H. K. Lewis and Co., Ltd., 1934.) 15*s*. net.

THIS book, which is edited by the secretary of the Eugenics Society, sets out to help the practitioner to answer three questions which, as the editor states in his admirable preface, are often asked. "Ought I to get married?" "If I get married, ought I to have children?" "If I get married and have children, what are the chances of their inheriting my disease, or a disease which occurs in my family?" Clearly only the third question can receive a scientific answer. Many believers in negative eugenics will question the advice given elsewhere in the book that sufferers from certain diseases should be sterilised before marriage. Such a course, among other things, virtually sterilises a healthy spouse. Nor will the political views which are expressed by certain contributors meet with universal acceptance.

The articles in the book are of very unequal value. Some, such as Dr. Campbell's on cardiovascular diseases, are not only excellent summaries of existing knowledge, but also contain new contributions to it. The majority appear to be written in ignorance of certain essential facts disclosed by research on animals. The most important of these is that genes causing abnormality often (probably in the majority of cases) do not manifest themselves in all individuals carrying them. Thus Timofeeff-Ressovsky found that in one genetically homogeneous line of *Drosophila funebris* carrying a certain pair of genes a particular abnormality showed in all members, while in another line it manifested itself in only 53 per cent of females and 80 per cent of males. In certain crosses the gene, which was generally nearly recessive, behaved as a dominant in about 5 per cent of heterozygotes. This at once disposes of the statement in the chapter on "Genetic Principles" that "if a condition . . . appears several times from normal parents, then the conclusion that it is recessive is a safe one"; and it renders unnecessary the hypothesis quoted by various authors (for example, pp. 48, 60, 421) as to the implication of several pairs of genes in certain family histories.

Other authors appear to have overlooked much of the existing literature. Thus the section on hereditary diseases of the eye contains no reference to Waardenburg's book on this subject, which is certainly the most complete in existence, or to the Nettleship memorial volume of the "Treasury of Human Inheritance". Still more unfortunate is the lack of reference to Cockayne's "Inherited Abnormalities of the Skin". The author of the chapter on skin diseases quotes three family histories of epiloia, and suggests that the condition is recessive. Cockayne, after an analysis of twenty-five families, comes to the opposite conclusion. It is twice stated that infantile amaurotic idiocy is confined to Jews. Slome listed eighteen cases in non-Jews.

The article on skeletal defects is mainly concerned with embryology rather than genetics. It devotes two pages to congenital club-foot in mice without mentioning Bonnevie's remarkable discovery that it is caused by the escape of fluid from a foramen in the embryonic myelencephalon which upsets the development of the limb rudiments. No mention is made of such well-known hereditary defects as osteopsathyrosis and multiple exostoses.

If Mendelian studies are misinterpreted, the biometricians fare still worse. Thus we read

(p. 396) that "Karl Pearson found in his series that tuberculous infection in a family tree bore vaguely the same ratio as the inheritance of other more easily recognizable characteristics". I take this to mean that the coefficient of correlation between parent and offspring for tuberculosis fell within the limits found for characters which are clearly inherited.

When all criticisms are made, those chapters whose authors, instead of writing essays on heredity and environment, devoted themselves to giving facts on which a prognosis can be based, are a valuable collection of data, enormously superior to that of Baur, Fischer, and Lenz, the only comparable work in English. If a second edition is called for, we may hope that some of the mistakes will be corrected and the deficiencies made up, in which case the value of the book would be very greatly increased. The index is imperfect.

From the point of view of eugenics, serious inherited abnormalities may be classed as follows :

(1) Dominants and sex-linked recessives with approximately 100 per cent manifestation, for example, hæmophilia and blue sclerotics. Here affected persons, or women who are certainly carriers, should not have children, but normal relatives can do so with comparative safety.

(2) Dominants with incomplete manifestation, for example, cleft palate. Here, unfortunately, unaffected persons may transmit the disease, and it is important to find means of detecting the gene where it is not clearly manifested, as Campbell and Warner did (pp. 224, 272) in acholuric jaundice.

(3) Autosomal recessives. Here parents who have produced one abnormal child should produce no more, but it is not obvious that heterozygotes should abstain from marrying unrelated persons, as suggested on p. 36. About 0·5 per cent of the population of Sweden carry a recessive gene for amaurotic idiocy, and probably few of us are devoid of undesirable recessive genes. It is doubtful whether the knowledge that one such is carried should deter a healthy person from parenthood.

(4) Conditions which may be due to several genes. Here a family analysis is necessary. But the chance of transmitting to the children a character which is not found in any of the parents or grandparents is usually small.

A classification on these lines would not be difficult, and would greatly enhance the value of the book to practising physicians. J. B. S. H.

Applications of Fluorescence Analysis

Fluorescence Analysis in Ultra-violet Light. By J. A. Radley and Dr. Julius Grant. (Monographs on Applied Chemistry, Vol. 7.) Pp. xi+219+14 plates. (London : Chapman and Hall, Ltd., 1933.) 15*s.* net.

THIS book is designed to fill a gap in our technical literature, which up to now has yawned both deep and wide. It is written by chemists for their *confrères*, but while the analyst and works chemist will appreciate every chapter, there are many others to whom it will prove valuable for guidance in empirical testing of their own special materials. This will be so in the examination of textiles, minerals and gems, paints and varnishes, paper and various cellulose derivatives, museum specimens, various foreign postage stamps, and numerous other objects which are dealt with in nineteen classes, to each of which a separate chapter is devoted.

Each section closes with a more or less extensive list of bibliographical references, which, the authors claim, amount in the aggregate to nearly 800. Each is numbered, and each number finds a place in the text where some indication of the contents of the paper is given, and all this is of permanent value. Unfortunately, however, some of these undoubtedly enlightening passages are blurred by the statement being so confused as to leave the reader no alternative to resorting to the originals for instruction. For example :

"*Glasses which Transmit Ultra-Violet Light.*—W. E. S. Turner and D. Starkie[9] examined a number of commercial glasses covering the ranges 7000 to 2000 A. and 2950 to 3150 A. (which, however, is usually of therapeutic interest), and the following percentage transmissions were observed : —Corex, 89. Sanalux, 73. Sun Ray, 62. Holvi, 61. Vita, 54. Helio, 52. Uviol, 46. Quartz Lite, 4. Ordinary window-glass[35] is taken as unity. After use the various glasses showed a decrease in power of transmission varying from 13 per cent. for Vita glass to 7 per cent. for Sanalux" (p. 23).

"35" refers to a paper by H. Valentin.

The first 55 pages are devoted to "Theory and Technique of Fluorescence Analysis", which is arranged in five chapters dealing with theory, production of ultra-violet light, filters, measurement of intensity, and methods of examination. Unfortunately, here also a similar laxity of expression prevails ; thus on p. 3 :

"(2) *The Ultra-Violet Region*, with which we are mainly concerned. This is divided into the 'near'

and 'far' ultra-violet and extends from about 136 to 4000 A.; the rays of the near ultra-violet have the longest wave-lengths and overlap with the violet rays of

(3) *The Solar or Visible Region*, the extreme wave-length limits of which are about 0·0003 mm. (near ultra-violet) and 0·007 mm. (infra-red). This region constitutes what we call 'white light', which, of course, is the resultant effect on the eye of the colours of the visible spectrum."

and lower down on the same page:

"*The Ultra-Violet Region.*—The position of this region is interesting. It falls between the shortest rays visible to the human eye and the X-ray region of longest wave-length, about which little is known. Generally speaking, therefore, ultra-violet rays may be considered as intermediate in properties, such as penetration, between X-rays and solar rays."

On p. 2 we are told "the shorter the wave-length the longer is the frequency".

A few typographical inconsistencies occur: 0·007 for 0·0007 (p. 3), A. F. Kitchen (p. 93) and A. F. Kitchin (p. 215) for A. F. Kitching, T. Brewis (plate No. 2) for E. T. Brewis.

The book is so useful in its scope that one must hope that a second edition will be called for, and so provide the authors with opportunity for improving the text, and at the same time rendering some of the more important sections a little more comprehensive.

The book is uniform in style with others in the series edited by Dr. E. H. Tripp, and is very well produced, especially the ten pages of luminograms on art paper at the end. S. JUDD LEWIS.

History of Geography

(1) *A History of Exploration: from the Earliest Times to the Present Day.* By Brig.-General Sir Percy Sykes. Pp. xiv+374+25 plates. (London: George Routledge and Sons, Ltd., 1934.) 25*s.* net.

(2) *The Making of Geography.* By R. E. Dickinson and O. J. R. Howarth. Pp. vi+264+5 plates. (Oxford: Clarendon Press; London: Oxford University Press, 1933.) 8*s.* 6*d.* net.

EXPLORATION has provided the material out of which a science of geography has been created. The gradual expansion of man's knowledge of the earth, obtained by voyages of discovery and journeys of travel, has been followed at every stage by a development of geography as a scientific subject. The workers in the study and the map-room have slowly absorbed the results of exploration into the common stock of knowledge and welded them into a system. It is therefore possible to write a history of two parallel developments; on one hand, the history of exploration, and on the other, the history of geographical thought and ideas. As the two subjects are closely related to one another, it is appropriate that two books dealing with these distinct aspects of geography should be discussed together.

(1) Sir Percy Sykes is himself an explorer and he has been able to enrich his "History of Exploration" by personal knowledge of many of the regions described. He followed in the track of Alexander the Great in 1894. He identified many sites in Persia that are mentioned by Arabian geographers. He states that his chief ambition was "to tread the Pamirs in the footstepp of Marco Polo and to shoot an *Ovis Poli*, and on no expedition that I have made does the golden haze of reminiscence lie more brightly than that on which I successfully stalked these mighty rams in the remote upland valleys of 'the Roof of the World'."

As might be expected, the author pays special attention to the exploration of Asia, the continent in which most of his own journeys have been made, and includes an unusually detailed study of the unveiling of Arabia. By comparison with his treatment of Asia, the author's accounts of the exploration of the Americas and of Australia are rather summary in character. The book is well illustrated and includes a series of 36 maps, but it should be noted that 25 of these are reproduced directly from Mr. J. N. L. Baker's "History of Geographical Discovery and Exploration". Sir Percy Sykes's book will not replace Mr. Baker's standard work, but it should have a wide popular appeal and will serve as a useful introduction to the vast subject with which it deals.

(2) Within the narrow compass of two hundred and sixty pages, Mr. R. E. Dickinson and Dr. O. J. R. Howarth have endeavoured to describe the history of the development of geography as a subject, and they have been severely hampered by the limitations of space. Dr. Howarth has written the earlier chapters which deal with the history of geography before the great age of discovery; and this is probably the most satisfactory part of the book, although the achievements of medieval geographers are not fully appreciated.

The task of writing the history of geography from the year 1500 up to the present day is a

heavy one and perhaps the time is not yet ripe to make such a general survey. Work such as that contained in Prof. E. G. R. Taylor's recent volumes on Tudor and early Stuart geography are the necessary preliminary before the history of geography as a whole can be written. It is certainly too early to assess the place of contemporary British geographers in the development of the science, as is attempted in this book. Mr. Dickinson does not appreciate the relative importance of the geographers of the seventeenth century, and devotes a disproportionate amount of his space to some of the minor figures. He barely mentions the great achievements of James Rennell, who was justly described by the late Sir Clements Markham as "the greatest geographer that Great Britain has yet produced". The map which is supposed to show the progress of exploration is inexcusably inaccurate. Mr. Dickinson says that the goal of geography is the region, and writes at some length on the development of "the regional concept" in the nineteenth and twentieth centuries. It will not be easy for regional geography to develop if, as Mr. Dickinson suggests, much of the peripheral field of geography is to be abandoned to persons called "specialists in the other camp" (p. 250). The reason that regional geography is so difficult and is so seldom successful is surely that it cannot be written without mastering the disciplines of several other camps.

The second half of the book contains an unusually large number of errors in the spelling of names and similar mistakes. The bibliography provided for the first half is very incomplete, and while the references are fuller in the later chapters of the book, many of them are difficult to verify. The volume as a whole is not an improvement on the far less ambitious "History of Geography" previously written by Dr. Howarth in collaboration with the late Sir John Scott Keltie, a work which is still useful and deservedly popular. E. W. G.

Short Reviews

A Text Book of Chemistry. By H. A. Wootton and C. W. R. Hooker. Pp. xii+488. (Cambridge: At the University Press, 1933.) 6*s*.

THIS textbook bases the justification for its appearance on, in particular, the fact that chemistry is a cultural subject, and that many pupils will not continue a study of the subject after leaving school. It may be said at once that the book is clearly and interestingly written, covering the range of the School Certificate examinations, and emphasises the applications of chemistry to everyday life and the paramount importance of the science in modern industry and manufactures.

An outline of molecular theory is introduced immediately after the study of only oxygen, hydrogen and the gas laws, then follow atomic theory and formulæ, and, separated by a chapter on water, equivalents, valency and equations. Carbon, its oxides and the hydrocarbons are outlined before any of the common elements other than the halogens and nitrogen. Although the scope of the book includes the theory of solution and molecular weights of dissolved substances, nothing is said about the periodic classification. Experimental work is relegated to the second half of the book, where it is dealt with exclusively. The net result is that it is difficult to find or co-ordinate particular facts to which one may wish to refer. The valuable interpretation of reactions afforded by the broad concepts of oxidation and reduction is largely lost since these concepts are not fully dealt with until after the non-metals. One would like, moreover, to see more prominence given in an up-to-date textbook to the generalisation of types of reaction. The authors have, however, carried out their scheme with conviction, and the student will have every reason to appreciate the importance of chemistry in all branches of life and industry. There are eight excellent photographs as well as the usual line diagrams. N. M. B.

The Rise of the Celts. By the late Henri Hubert. Edited and brought up to date by Prof. Marcel Mauss, Raymond Lantier and Jean Marx. Translated from the French by M. R. Dobie. (The History of Civilization Series.) Pp. xxv+335+4 plates. (London: Kegan Paul and Co., Ltd., 1934.) 16*s*. net.

THIS study of the Celts, the result of many years' work, was still incomplete when the author died in 1927. It was completed in part and seen through the press by his friends with the assistance of lecture notes and a draft of the concluding chapter which will appear in a second volume. M. Hubert had an original outlook; and this was backed by a vast erudition, upon which to base a synthetic view of the linguistic, archæological, anthropological and historical material, which it is necessary to master for an adequate discussion of the Celtic problem. His analysis of the linguistic evidence, as it appears in this volume, where it is brought to bear upon the place of the Celtic people in relation to other Indo-European peoples and on the relation of the Celtic people one to another, is of great value. It deserves careful consideration, especially among

those who hitherto have shown a tendency to pay too exclusive an attention to archæological evidence. It was M. Hubert's opinion that anthropology, that is, the study of physical characters in their racial aspect, can give little assistance; and it is a special merit of his study that he insists repeatedly on the distinction between 'a race', which the Celts were not, and 'a people', which they were, in the sense of a number of groups more or less closely related in a common culture and language. In the use of linguistic evidence also he is careful to point out its limitations in arguments on races and peoples.

The present volume gives only one half of the story, carrying it up to the Hallstatt period. La Tène and the general characteristics of Celtic culture will be considered in the later volume.

Geschichte der gegorenen Getränke. Von Prof. Dr. A. Maurizio. Pp. viii+262. (Berlin: Paul Parey, 1933.) 18 gold marks.

THOSE who hope to glean from the pages of this book authoritative information on modern methods of the manufacture of alcoholic liquors or to learn something about recent theories of fermentation will be disappointed, for it is written mainly from the historical point of view. It is, however, a veritable encyclopædia of interesting facts relating to fermented beverages from the earliest times to the present day, and from the numerous references quoted, must have involved considerable industry and literary research. Not only are the history and geographical distribution of the more common liquors, for example, beer and wine, fully described, but similar details are given relating to lesser known beverages, such as mead, spruce beer, koumiss and various berry and herb wines. There are also sections dealing with potato spirits and distillation, the latter being illustrated with interesting drawings of primitive distilling vessels.

In addition to the account of the beverages themselves, the value of the book is enhanced by the inclusion of references to the basic materials—honey, sugar, herbs, grapes, malt, hops, fruits—and to the different implements such as the wine press, used in the production of the various beverages. The book concludes with a systematic catalogue of a large number of plants from which fermented beverages have been obtained.

A. J. H. G.

A Text-Book of Inorganic Chemistry. By Prof. Dr. Fritz Ephraim. English edition by Dr. P. C. L. Thorne. Second edition, revised and enlarged. Pp. xii+873. (London and Edinburgh: Gurney and Jackson, 1934.) 28*s.* net.

THE success of the first English edition of this textbook, published in 1926, has justified the preparation of an up-to-date version. Based upon the fourth German edition, the new issue contains also a good deal of supplementary matter supplied by Prof. Ephraim and incorporated in the English text by Dr. Thorne. The general plan of the work, including the headings of sections and chapters, remains unaltered. The revision has entailed an increase of about 8 per cent in the bulk of the book, and in the opinion of the reviewer a further expansion in future editions should be avoided. Although by reason of its unusual plan it appears in some respects as predominantly a textbook of the non-metals (see NATURE, 119, 7, Jan. 1, 1927), the work has proved to be attractive and useful to students who have already secured a grounding in the subject, and the new edition will be welcomed.

Sexual Regulations and Human Behaviour. By Dr. J. D. Unwin. Pp. xv+108. (London: Williams and Norgate, Ltd., 1933.) 7*s.* 6*d.* net.

DR. UNWIN has made an inductive study of the effect of sexual repression and its relation to progress in human societies, of which this volume is a preliminary statement. He has taken eighty societies under review, classifying them according to status as determined by certain characters. He finds that the place of each in this grouping agrees with the degree to which pre-nuptial sexual relations are subjected to repression; and in a final chapter he rapidly surveys the history of civilisation, showing that decadence has invariably followed the relaxation of sexual regulation. While it is more than probable that Dr. Unwin is right, he has made out a case for further investigation rather than proved his contention. No doubt the fuller treatment promised will strengthen the argument.

Physical Mechanics: an Intermediate Text for Students of the Physical Sciences. By Prof. R. B. Lindsay. (University Physics Series.) Pp. x+436. (London: Chapman and Hall, Ltd., 1933.) 21*s.* net.

THE vector method is followed in this book, and the treatment which usually ends with the mechanical properties of matter is continued to cover the kinetic theory of gases using the virial, the Bohr atom, α-particle deflection, electrical oscillations and wave mechanics. The author's aim has been to make mechanics an introduction to advanced physics, in which he has succeeded admirably.

An Introductory Course of Mechanics. By E. G. Phillips. Pp. viii+255. (Cambridge: At the University Press, 1933.) 10*s.* 6*d.* net.

THE book opens with a short account of vector analysis, going as far as scalar multiplication and the differentiation of vectors. The vector method of representation is kept to the fore throughout. In this respect it has an advantage over the older books on mechanics, but the mathematics is of a higher order than that acquired by the average student at the time of beginning the study of mechanics. However, the book will be of value to many students for the clearness of the treatment and the comprehensive set of examples.

The John Murray Expedition to the Arabian Sea

By LIEUT.-COL. R. B. SEYMOUR SEWELL, C.I.E., F.R.S.

SINCE the previous report on the work of the John Murray Expedition (NATURE, Jan. 20, 1934, p. 86), H.E.M.S. *Mabahiss* has twice traversed the width of the Arabian Sea, and in addition has cruised off the African coast between Mombasa and Zanzibar, and to the east of Pemba Island.

The *Mabahiss* sailed from Bombay on a traverse of the Arabian Sea to Mombasa on December 13. During the whole passage the weather was favourable, and good progress was made, observations being carried out at 12 stations. As we approached the African coast we encountered a strong head current that kept us back somewhat, so that we did not arrive in Mombasa until the morning of January 1, 1934. We remained at Mombasa until the morning of January 9 and then sailed for Zanzibar in order to report to the Sultan and obtain permission to work off this region of the African coast. Unfortunately, during the whole of our stay in the Zanzibar area we experienced strong winds and there was a sufficiently heavy sea running to render the *Mabahiss* most uncomfortable, while several members of the expedition contracted malaria.

One very noticeable feature of the African coast in this region round Mombasa and Zanzibar is the extent to which coastal erosion is, and has in the past, been going on; this is particularly evident on the west side of Pemba Island where most, if not all, of the bays and inlets are fringed with coral reefs on which small detached islets are to be seen, still indicating the limits to which the original land extended in times past, though now only the most resistant areas are left. This erosion is particularly clearly seen in Chumbi Island, about seven miles to the south of Zanzibar. At the request of the authorities of the British Museum, a visit was paid to this island in order to try to obtain evidence of the presence on the island of the giant robber crab, *Birgus latro*; the whole island consists of a raised 'coral rock', the upper surface of which has been weathered into holes and pinnacles by rain, while the seaward margins have been eroded and undercut by wave action (Fig. 1). The greater part of the island is covered with a profuse growth of a species of *Euphorbia* such as to render a thorough investigation impossible; the crab, however, appeared to be well known to the resident lighthouse keepers and examples have been obtained on other islands in the group.

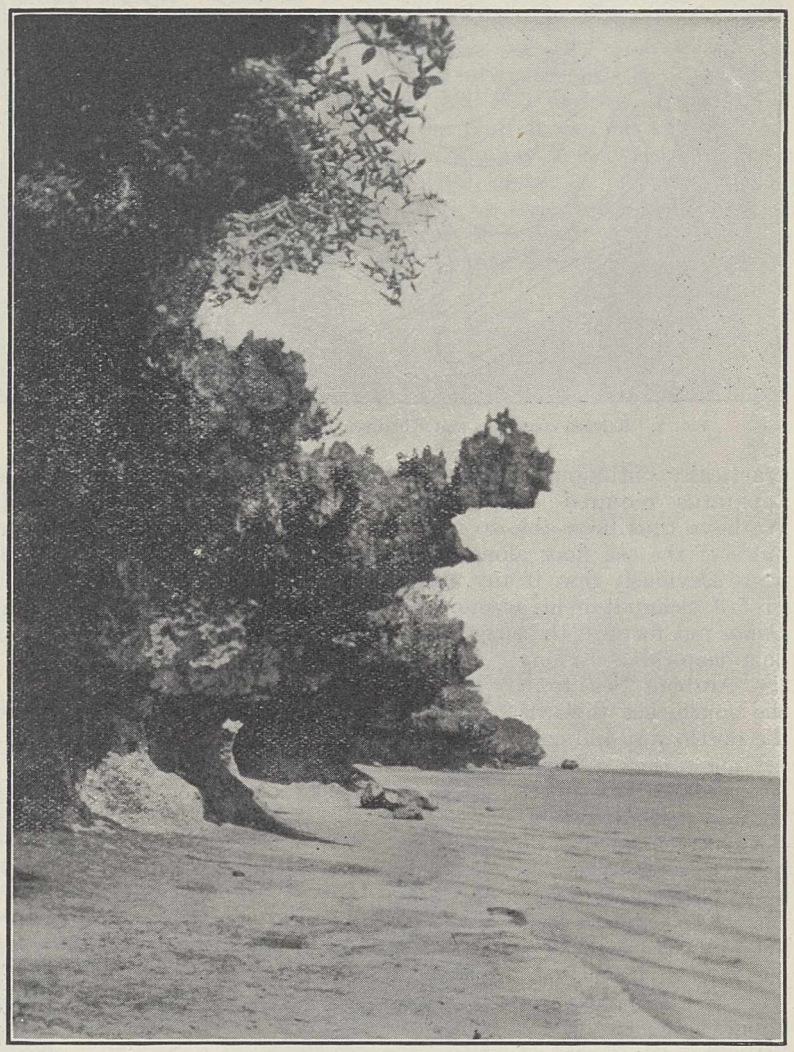


FIG. 1. Chumbi Island, showing coastal erosion.

After leaving Zanzibar on our return passage across the Arabian Sea, we encountered moderate winds and seas during the first few days, but after that the weather again improved, and, after calling in at the Seychelles for extra coal, we had a comfortable voyage past the Maldive Archipelago to Colombo, though owing to a strong head current during the greater part of the journey our speed was considerably reduced. During these

three cruises we have carried out work at 45 stations, making a total of 135 stations in all up to date.

Topography and Bottom Deposits

Lieut.-Commdr. Farquharson, R.N., has successfully managed to keep the echo-sounder running practically continuously, though towards the end the apparatus required almost constant attention. We have thus been able to map more than 5,000 miles of the sea floor along lines on which there were previously few, if any, soundings. The late Prof. J. Schmidt, in his account of the voyage of the *Dana*, put forward the suggestion that there must be a deep ridge crossing the Arabian Sea from the south-east towards the north-west and connecting the Chagos Archipelago with Socotra and the entrance to the Gulf of Aden; we have now crossed this area twice and there can be no doubt that Schmidt was right. On our voyage from Bombay to Mombasa in about long. 59° E., a little to the west of where the Admiralty chart shows a sounding of 1,950 fathoms, we crossed a ridge on which the depth of water was only 1,650 fathoms (3,020 metres), though to the north-east the depth fell to 2,400 fathoms (4,392 metres) and to the south-west it increased to as much as 2,910 fathoms (5,325 metres). On our return voyage from Zanzibar to Colombo we again crossed this ridge.

After leaving the Seychelles, we found that the bottom was very irregular. In about lat. 1° 20′ S., long. 60° 30′ E. we crossed a low ridge on which the depth of water shoaled to 1,570 fathoms (2,873 metres). To the east of this the depth of water increased to 2,600 fathoms (4,758 metres) and then the bottom rose again in a second ridge that lies between long. 66° 00′ and 67° 30′ E., and over which there appears to be a general depth of from 1,600 to 1,200 fathoms (2,928 to 2,196 metres), though at two points depths as small as about 900 fathoms (1,737 metres) were obtained, with a deep gully having a depth of some 1,800 fathoms (3,294 metres) between them.

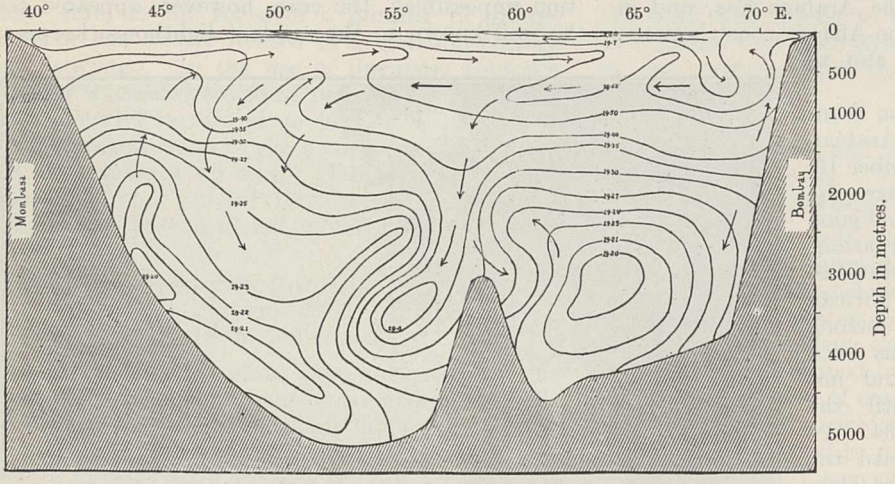


FIG. 2. Halogen content of water between Bombay and Mombasa (Cl °/₀₀).

Having crossed the first of these shallow areas and thinking that we were in the eastern basin, we carried out a complete station and were fortunate enough to bring up in the trawl a number of rock fragments; one of these has been examined by Mr. J. S. Coates, mineralogist to the Ceylon Government, and he informs me that the rock consists of dolerite, a rock of the basaltic series that is frequently found associated with the Deccan Trap in India; the occurrence of this rock is of particular interest in view of the theory, held by many geologists, that a large section of basalt-covered Gondwanaland now lies submerged to the west of India. Between this portion of the ridge and the western side of the Maldive archipelago the depth of water again increased to some 2,300 fathoms (4,209 metres).

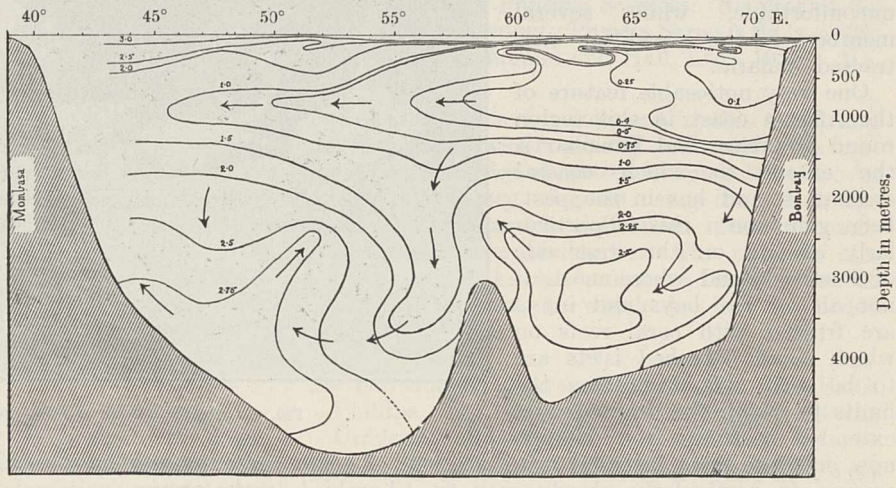


FIG. 3. Oxygen content of water between Bombay and Mombasa.

It thus seems clear that there are two separate

basins in the Arabian Sea, one lying to the north-east and the other to the south-west of the diagonal ridge, and it is of interest to note that a bottom sample obtained in the north-eastern basin from a depth of 2,352 fathoms (4,305 metres) is of quite a different character from those obtained to the south-west of the ridge; it was a core 62 inches long of a comparatively soft reddish-yellow ooze, in which there appears to be very few Foraminifera, and it seems probable that this is the type of deposit that Sir John Murray showed to lie between lat. 5° and 12° N. and long. 62° and 72° E., and classified by him as "red clay", though the depth is much less than would be expected for such a deposit.

Hydrographic Observations

During our voyage from Bombay to Mombasa, and again during the return voyage from a point about lat. 7° 30′ S., long. 44° 10′ E., past the Seychelles to the entrance to Kardiva Channel in the Maldive Archipelago, lines of hydrographic stations were run across the Arabian Sea. The results obtained in the first of these traverses have now been tabulated and are given in Figs. 2 and 3. In this section between Bombay and Mombasa there appear to be a series of currents and counter-currents in the upper levels. A study of the halogen content (Fig. 2) shows that, on the surface, the water is streaming towards the south-west under the influence of the north-east monsoon wind, while immediately beneath this upper stratum there is a counter-current in the opposite direction at a depth of some 136 fathoms (250 metres). At a still deeper level, approximately 400 fathoms (732 metres), the current is again moving towards the west, but in long. 68° E. this mass of water becomes deflected downwards. In this connexion it is interesting to note that in the region to the east of the Arabian Sea there are indications of a similar deep current at about the same depth and moving in the same direction*.

As already mentioned, the presence of a deep ridge separates the Arabian Sea into two basins, and it is into the south-west basin that the greater part of this descending mass of water is directed. In each basin a mass of water of low salinity was detected that is almost certainly derived from the great antarctic bottom drift. A study of the oxygen content of the water (Fig. 3) at the different levels and at different stations gives an almost identical picture of the movement of the water masses, the descending mass of tropic water, with a low oxygen content, being clearly distinguishable from the antarctic polar water in which the oxygen content is relatively high; and in each basin there appears to be a vertical rotatory movement in progress, the water on the eastern side passing downwards towards the bottom.

Our work off Bombay has now made it possible to trace the movements of the water masses into and out of the Gulf of Oman (Fig. 4). The main interest is the flow of water of a high halogen content (20·0 and above) out of the Persian Gulf towards the south-east. At the head of the Gulf of Oman this mass of water lies at a depth of 110–160 fathoms (200–300 metres), but as it is followed out of the Gulf it can be seen to sink gradually until off Bombay it is lying at a depth of 382 fathoms (700 metres). At a series of stations off Bombay we encountered the same or a very similar type of deposit to that found in the curious azoic region in the Gulf of Oman referred to in the earlier report of the Expedition. The deposit from a depth of 156 fathoms was similarly, though to a rather less extent than off the Arabian coast, impregnated with sulphuretted hydrogen, and here too the result of three trawls yielded remarkably little in the way of animal life.

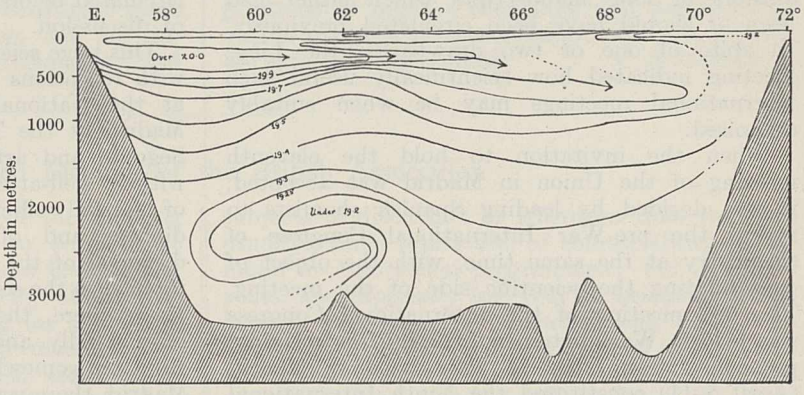


FIG. 4. Halogen content of water in the Gulf of Oman (Cl °/₀₀).

Biology

The region of the African coast under investigation proved to possess a very rich fauna, and good catches were made at a number of stations in water the depth of which ranged from 100 to 500 fathoms (183 to 915 metres). In shallower depths our nets were badly torn by coral, while in depths greater than 660 fathoms (1,200 metres), there seemed to be evidence of a distinct falling off in the quantity of life at the bottom. Sometimes large catches were made; thus at one station at a depth of 802 metres, an hour's haul with the Agassiz trawl resulted in our securing a hundred examples of a species of *Phormosoma*, probably *P. indicum*, and masses of a species of *Virgularia*. At another station we secured some 114 examples of fish belonging to about twenty

* Sewell, R. B. Seymour, 1932, "Geographic and Oceanographic Research in Indian Waters; Part VI. Temperature and Salinity of the deeper waters of the Bay of Bengal and Andaman Sea". *Mem. Asiatic Soc. Bengal*, **9**, No. 6. See pp. 377–378.

species and nearly as many genera ; together with some 58 asteroids and about 700 examples of an ophiuroid.

The general richness of the fauna provided a very marked contrast to the comparatively barren region round the Arabian coast and the azoic area of the Gulf of Oman. Until the collections have been worked out, it is impossible to give any details of the fauna of this African region, but the general impression created is that this region round Mombasa and Zanzibar has a fauna much more nearly allied with the fauna of the southern coast of the Gulf of Aden than with that of the northern coast of the Gulf.

Chemistry and Chemists in Spain

AT the tenth meeting of the Union Internationale de Chimie held at Liège in 1930, apart from formal business, an adequate amount of time was devoted to consideration of problems connected with the constitution and properties of the simple and complex carbohydrates. Comprehensive papers previously circulated by recognised authorities prepared the way for useful discussions, and only in one or two cases was discussion rendered impossible by the tedious reading by authors of long manuscripts which either had been or should have been circulated previously. In spite of one or two drawbacks, the Liège meeting indicated how scientifically useful such international meetings may be when suitably organised.

When the invitation to hold the eleventh meeting of the Union in Madrid was accepted, it was decided by leading Spanish chemists to revive the pre-War International Congress of Chemistry at the same time, with the object of consolidating the scientific side of the meeting. The last meeting of the International Congress was held in Washington in 1912 and the meeting, postponed from 1932 to 1934, held in Madrid (April 5–11) constituted the Ninth International Congress. Some confusion may have arisen even among those attending that Congress and the eleventh meeting of the Union Internationale.

In spite of all the difficulties which have attended their work of organisation during the last two years, our Spanish colleagues have entertained their guests with lavish hospitality, both scientific and otherwise. The Congress and the meeting of the Union were opened in the ultra-modern Salle Capitol in the presence of the president of the Spanish Republic, who made what appeared to be an impressive speech in Spanish after the reading in Spanish by Prof. Fernandez of an account (previously circulated) of the developments in chemistry since the Eighth Congress. There were about 1,200 on the list of ordinary members of the Congress. This list included also the ladies who were kept busy enjoying the artistic and other treasures of Madrid, while the chemists were supposed to be busy discussing some of the 245 scientific communications, attending the four special lectures such as that of Prof. G. N. Lewis on "The Different Kinds of Water" and listening to the twenty special papers such as those given by Profs. P. Walden ("Anomale Elektrolyte in nichtwässerigen Lösungen"), G. Barger ("On the Alkaloids of the *Iso*chinolin Group"), R. Robinson ("Molecular Architecture of Plant Products"), R. H. Kruyt ("The Modern Development of Colloid Chemistry"), P. Karrer ("Untersuchungen über Carotinoide und Vitamine") and Miss Jordan Lloyd ("The Chemistry of the Tanning Process with Special Reference to Vegetable and Chrome Tanning"), the only lady chemist taking a leading part in the last two groups of special papers. Nearly all the communications to the Congress were circulated beforehand and intended to be the basis of discussion.

This huge scientific programme was interspersed with receptions by the president of the Republic at the National Palace and by the Mayor of Madrid at the Town Hall, visits to Toledo and Segovia and artistic entertainments terminating with a well-attended banquet. One heard also of several official or semi-official lunches and dinners and of private excursions before the dispersal of the delegates to the many places of interest in the south of Spain and even to Morocco. Everywhere, the members of the Congress were most kindly and graciously received and, apart from the somewhat adverse climatic conditions in Madrid, there was no sign anywhere of discomfort, alarm or even disquietude. The graciousness of our hosts was shown in a more permanent fashion by the conferring of honorary doctorates of the University of Madrid on seven delegates, among whom are Profs. H. E. Armstrong and R. Robinson, the election of ten foreign members of the Spanish Academy of Exact Sciences, among whom is Prof. G. Barger and, finally, the conferring of the new Order of the Spanish Republic on another eight delegates, among whom is Prof. E. Biilmann, president of the Union Internationale.

The permanent result of the Ninth International Congress is not easy to forecast. Many hope that its scientific proceedings will not be buried in a separate huge volume, but will find their way into more accessible journals devoted to the publication of contributions to chemical knowledge.

The meeting of the Union Internationale seemed to be overshadowed and was confined to two sittings of the Council and one of the Bureau, apart from those of several of the committees. In formal business, Prof. N. Parravano (Rome) was elected to succeed Prof. Biilmann in the presidency and the new members of the Bureau are Profs. M. Bodenstein (Berlin), E. Bartow (Iowa), F. Fichter (Basle), K. Matsubara (Tokyo)

and W. Swietosławski (Warsaw). The decision to accept the invitation to hold the twelfth meeting of the Union in Switzerland in 1936 was confirmed.

The chief subject of discussion by the Council concerned future arrangements for organisation concerning chemical nomenclature. The existence of separate committees for organic and biochemical nomenclature has for some years been regarded as unfortunate by many chemists in different countries, and the British Federal Council for Chemistry has been active in trying to have the two committees combined. The tone of the discussion was somewhat heated, and 'Anglo-Saxon' opposition to the existing committee on biochemical nomenclature was referred to in terms which created an atmosphere scarcely suitable for critical consideration of the best policy regarding a question of fundamental importance in chemistry.

The following proposals by Prof. F. Swartz were submitted: "In conformity with the decision of the Union the Committees on nomenclature are dissolved. The Council decides to constitute three new committees on nomenclature, one for inorganic chemistry, one for organic chemistry and one for biochemistry. These committees are asked to present a scheme of organisation of the future work of the committees on nomenclature to the Union before 31 December, 1935. Their presidents will assure the co-ordination of the work of these committees. The members of the committees will be chosen as far as possible from among the members of the former committees." These proposals were voted on according to countries adhering to the Union and passed by 29 to 28 votes. That there should be five members of each commission was again voted on in the same manner and passed by 31 to 27 votes. It was finally left to the Bureau to choose the members of the committee.

It may be questioned whether decisions of such a nature should be determined by countries having a number of votes based on their population and not by individual votes of representative chemists keenly interested in the matter; but an important advance will be made if, by 1936, the relative positions of organic chemistry and biochemistry on the question of nomenclature common to both are satisfactorily defined. C. S. GIBSON.

Aberdeen Meeting of the British Association

THE preliminary programme of the meeting of the British Association to be held at Aberdeen on September 5–12 has now been issued. In certain respects a university city affords the best and most appropriate setting for a meeting of the Association, and Scottish meetings are anticipated with pleasure, for their standard of organisation has always been high, and they have always attracted a notable measure of public interest.

In Aberdeen, the accommodation for the sessions will be very convenient, for eight of the sections will be housed in Marischal College, and of the rest, four will find rooms within a quarter of a mile of the College. Only the Section of Botany will sacrifice nearness to the centre to the convenience of meeting in the appropriate department of the University, with its fine gardens, at St. Machar. The Reception Room will be in the Music Hall, a building of special historical interest to the Association, for it was opened in 1859, and the first ceremony which took place in it was the inaugural meeting of the Association in that year, when the Prince Consort occupied the chair. He conveyed a message from Queen Victoria to the Association, and delivered an address which is a pronouncement of no little interest in the history of science. His own sympathetic and well-informed attitude toward science is well known, and is clearly defined in this address; and no less clearly is indicated the general position of science in the life of the community at that time.

This point is apposite to the present programme, since particular contacts between science and the life of the community will be more prominent as subjects of discussion at Aberdeen than they are usually. Such topics are, of course, always to be found in Association programmes; but in recent years, and especially last year at Leicester, it has become clear that lay members and those who follow the proceedings of the meeting in the Press wish to hear more of them. It seems natural and proper that this should be so, and it is obviously within the stated objects of the Association that such a demand ought to be met. It is announced in the preliminary programme that "several Sections are including in their programmes papers or discussions within the scope of the resolution forwarded by General Committee to Council at the Leicester Meeting last year, on the relation between the advance of science and social progress"; and a number of appropriate subjects are already announced. If from some of these there should emerge at Aberdeen applications for the appointment of committees to pursue investigations, this will mean that the Association's machinery is being used for the advancement of science in specific directions of public importance. There will be nothing new in this. The Association's record affords sufficient evidence for that statement. But the giving of "a more systematic direction" to scientific inquiry was one of the charges laid upon the Association by its founders; and here, surely, is a systematic direction which has been rightly pointed out and will be rightly followed.

Sir James Jeans, who has succeeded the late Sir William Hardy as president of the Association, announces the title of his address as "The New World-Picture of Modern Physics". It is stated

that one of the usual evening discourses will be given as a Sir William Hardy memorial lecture, and will deal with the preservation of meat, fish and fruit, a subject peculiarly appropriate to Aberdeen, where the work of the Torry Research Station is very well known. The name of the lecturer is not yet announced. The other evening discourse will be given by Prof. W. L. Bragg on "The Exploration of the Mineral World by X-Rays". Reverting to the subject of science and the community, the programme states tentatively that an evening symposium on the general relations of these may be arranged. The sectional programmes, so far as can be judged from the short summaries furnished in this preliminary announcement, are certainly no less wide-ranging than usual. An ambitious series of excursions is under consideration, and inasmuch as the occasion of a meeting in a centre commanding this part of Scotland must needs be rare, the opportunity should be taken.

This programme is accompanied by a circular addressed to those who are not life-members of the Association, which in effect asks them to pay regular subscriptions to the Association by signing a banker's order form, whether they attend the meetings regularly or not. The hope is to assure a more stable income for the Association, and thus "alleviate the difficulty of allocating grants in aid of important research", for which the applications "habitually exceed the sums available". The Association's support of research, and the preparation of "reports on the state of science", which began in 1834 and has never since been intermitted, sufficiently justifies this appeal.

Obituary

Dr. Walter Rosenhain, F.R.S.

IT is a grief and a shock to me, on returning from a holiday abroad, to read of the death of Walter Rosenhain. I have had many pupils, but none more gifted with the imaginative insight of the discoverer, more discriminating in criticism, or more skilful in the technique of the experimentalist. He came to me, in the late 'nineties, with a research scholarship from the University of Melbourne, when I was professor of mechanism at Cambridge, and asked me to suggest a piece of research which he might undertake in my laboratory. At that time Roberts-Austen, Arnold, J. E. Stead, Osmond and others were applying to metallurgical analysis the microscopic methods which had been initiated by Sorby in his earlier study of metals, and it was beginning to be recognised, somewhat vaguely, that the irregular grains which a polished metal revealed in the microscope were crystals the boundaries of which had interfered with one another in the process of crystal growth. I suggested to Rosenhain that this opened up a good field, and that it would be interesting to see what happened when a plastic metal was overstrained. The supposed crystal grains must alter their form, but how?

Rosenhain had already begun in Melbourne a research on steam-jets which he was anxious to finish first, and we arranged that as soon as he had completed that he should take up the metallurgical inquiry. This was done, and I recall very vividly how, after he had acquired some skill in polishing and etching metallic surfaces so as to bring out the granular structure, we put a plastic strip one day under the microscope, fixed in a straining stage so that it could be stretched while one watched the surface of the grains. As the straining proceeded we saw lines appear, sharply defined parallel lines which were black in the reflected illumination, becoming more numerous the more the specimen was stretched, and tending to develop criss-cross patterns. The laboratory was closing for the day, so we went our several ways, each brooding on what these curious lines might mean. That evening I saw the interpretation: the lines must mean finite slips, taking place on parallel layers within the grain. Consequently the grains *were* definite crystals, and remained crystals after the deformation: they gave way, when the straining passed the elastic limit, by the sliding of bands or layers on a group of parallel planes, much as a pack of cards might be sheared. Slips of this kind in three directions inclined to one another within each grain would allow the grain to assume a new form consistent with the plastic straining of the piece as a whole. Next day we met again, and I found that Rosenhain had, quite independently, come to the same conclusion. That was the discovery of 'slip-bands' which we published jointly in a preliminary notice to the Royal Society in March 1899 (*Proceedings*, vol. 65), and later (along with much more) in the Bakerian Lecture of that year (*Phil. Trans.*, A, vol. 193, p. 353).

We pursued the research hotly together. It was a happy as well as a fruitful association. To work with such a pupil was, for the professor, a rare delight and a constant stimulus. It turned out that metallurgy did offer to Rosenhain the most congenial field that could have been chosen. Looking back now, I feel a natural pride in having guided him to it. Afterwards, when the days of pupillage were past, I had the continued pleasure of watching him go on from strength to strength and receive growing recognition, of visiting him from time to time at the National Physical Laboratory where he made a position worthy of his powers, and of listening to his admirably lucid expositions, public or private. An old man, such as I am, must reckon with the loss of his contemporaries, but it was far too early for us to lose Walter Rosenhain. J. A. Ewing.

DR. WALTER ROSENHAIN, whose death at the early age of fifty-eight years occurred on March 17 last, had a world-wide reputation as a metallurgist, and for more than thirty years had taken a leading part in the development of the new science of metallography. Born in Melbourne, Australia, on August 24, 1875, he graduated in engineering at the University of Melbourne, in 1897, and proceeded to Cambridge as the holder of an 1851 Exhibition Scholarship. Here he worked with Prof. (now Sir Alfred) Ewing, and began to use the microscope in the study of metals. In 1899 appeared a memorable joint paper, describing in detail the mechanism of deformation of metals by slip, which has formed the basis of all later work on the subject.

Rosenhain then entered the works of Messrs. Chance Bros., and for about six years was engaged in work on optical glass, although continuing his studies of metals. His well-known textbook of "Glass Manufacture" was first published in 1908, a second edition being called for in 1919. In 1906 he became superintendent of the Department of Metallurgy at the National Physical Laboratory, succeeding Dr. (now Sir Harold) Carpenter. This post he held for twenty-five years, during which time the staff increased from four to about seventy, whilst the long series of important communications which issued from the Department under his direction was evidence of his success in guiding and inspiring his collaborators, his loyalty towards whom was unfailing. This work covered a wide range. His own interests lay chiefly in the field of what he preferred to call "Physical Metallurgy" (the title of his textbook published in 1914)—the study of the properties of metals and alloys in relation to their structure.

On the practical side, perhaps the most striking achievement during this period was the work on the light alloys of aluminium, largely conducted in view of the requirements of the War, and carried out under conditions of urgency. The results were of great importance for the progress of aircraft construction, and the Eleventh Report of the Alloys Research Committee, in which they are recorded, marks an epoch in the development of the alloys of aluminium.

This Committee, established by the Institution of Mechanical Engineers, was later transformed into the Alloys of Iron Research Committee, and a series of studies of the binary alloys of iron with other elements was begun, special attention being given to the production of the elements used in the highest state of purity. Such work involved the introduction of new methods of research at high temperatures, and the improvements of technique have done much to smooth the path of future investigators.

On the theoretical side, Rosenhain was particularly associated with conceptions regarding the behaviour of metals on deformation and when undergoing thermal treatment. The hypothesis of an 'amorphous' phase, existing between the crystal grains of a cast metal and in the deformed portions of crystalline metals, was applied by him with the greatest ingenuity to explain creep and other effects depending on time and temperature.

As a lecturer and debater on metallurgical subjects Rosenhain was unrivalled. He could give an account of experimental work or expound a theory in simple language, with a fluency which never hindered the logical arrangement of the steps in his argument, whilst his quickness of thought and skill in debate gave interest to his frequent interventions in metallurgical discussions. He was often involved in controversy, and could be scathing in his criticisms, but maintained an even good humour under all conditions. In 1931 he retired from his post at the National Physical Laboratory, and until his death carried on a successful practice as a consulting metallurgist, without slackening his scientific activities.

Rosenhain was elected a fellow of the Royal Society in 1913. He was active in the formation of the Institute of Metals, of which he was president in 1928–30, also delivering the May Lecture in 1923. He received the Carnegie Medal of the Iron and Steel Institute in 1906 for an early research on the strength of steel at high temperatures, a subject which he pursued with great success at the National Physical Laboratory, and was awarded the Bessemer Medal in 1930. His fluency in French and German made him a valuable link with foreign metallurgical bodies, and he took a special interest in the International Association for Testing Materials, of which he became president, and would have presided at the congress planned to take place in London in 1935. On such bodies, and on committees of the British Standards Institution, his clear ideas as to what should be done and his courage in maintaining his opinion gave great weight to his collaboration.

Dr. Rosenhain is survived by his wife, a sister of the late General Sir John Monash, of Melbourne, and by two daughters.

PROF. S. H. VINES, F.R.S.

WITH the death of Sidney Howard Vines at the age of eighty-four years, another leading botanist of the older generation has passed away. Though he had lived in retirement at Exmouth since 1919, his help and advice were not infrequently sought, and he still took an active interest in botanical matters.

Born in London in 1849 and educated at a private school, Vines afterwards entered Guy's Hospital, but gaining a scholarship to Cambridge, he went up to Christ's College in 1872. Being somewhat more mature than the average undergraduate, and having some preliminary training in science, he distinguished himself already in his undergraduate years and as such was offered in 1874 the appointment of demonstrator in Huxley's course of general biology at South Kensington. As he says in the Huxley Centenary number of NATURE (1925), Huxley's lectures were a revelation to him, so lucid, so well proportioned, so

convincingly expressed. Altogether it was a memorable and an invaluable experience in the art of teaching. In the following two years the botanical portion of Huxley's general biology course was given by Thiselton-Dyer, and in both courses Vines acted as demonstrator.

In 1875 Vines graduated with first class honours in botany and in the following year was elected fellow and lecturer of his College. By way of equipping himself still further for his future work, he decided to visit some well-known German laboratory, and having been stimulated while at Cambridge by the teaching of Sir Michael Foster, desired to devote himself to the physiological side of botany. He was anxious therefore to study under Julius Sachs, then at the zenith of his activity and fame as a plant physiologist, and having obtained leave of absence for the Easter term of 1877, he spent this time at Würzburg under the stimulating direction of Sachs, taking up the study of the growth of plants in relation to light. In an account he published some years ago of his studies abroad, he tells us that Sachs's lectures were "delivered with such lucidity and force that familiar things became instinct with new life". He formed a lasting friendship with Sachs and was both the instigator of, and a generous donor to, the fund which was raised a few years ago to acquire the portrait of Sachs for the Linnean Society.

On his return to England, Vines started a botanical laboratory in Cambridge through the kindness of Sir Michael Foster, who lent him a room in the newly erected Physiology Laboratory. Later, when he was appointed reader in botany at Cambridge, more permanent accommodation was provided in the ground floor of the Botany Department. But though now provided with a laboratory, then an innovation, Vines found that he could not do justice to the practical side of the various branches of botany and felt particularly, as he tells us, the need of acquaintance with methods for the study of fungi. He consequently decided to visit the laboratory of De Bary, the eminent mycologist. In 1880 he obtained two terms' leave of absence and spent the beginning of this time with De Bary, but the greater part with Sachs at Würzburg. Thus, in those early days when there were no facilities for practical work in botany in Great Britain, Vines obtained the necessary training for the development of practical botany on his return. Other leading botanists of those days like D. H. Scott, Marshall Ward and F. O. Bower did the same. They sought and found in Germany what was at the time unobtainable in England.

In 1883, Vines was appointed reader in botany in Cambridge, and when the Sherardian chair in Oxford became vacant in 1888, he was appointed successor to Prof. Bayley Balfour. The chair of botany at Oxford had been held by a number of distinguished men and botany had received no small encouragement at the hands of the University. Still, Vines considered it necessary in his inaugural lecture to put in a further plea for botany as an academic subject, actuated in part by a desire to meet the severe and unsympathetic attitude of Ruskin, who a few years previously had criticised "the vulgar and ugly mysteries of the so-called science of botany". As Vines said, he felt these strictures all the more keenly because of his deep sense of indebtedness to Ruskin "for much that adds charm and interest to life".

For thirty-one years, until his retirement in 1919, Vines held the professorship with distinction, witnessing the growth in importance of botany in the University curriculum and the addition of the cognate school of forestry, the organisation of which entailed considerable addition to his duties. His interest in the practical side of botany led to the publication, in conjunction with Prof. Bower, of a most useful "Course of Practical Instruction in Botany" in 1888. He adapted a leading German textbook of botany by Prof. Prantl for the use of English students (1895). In 1886 he had already published his excellent course of "Lectures on the Physiology of Plants", which was for long the standard English book on the subject.

Though primarily a physiologist, Vines was interested in the valuable herbarium of the University of Oxford and with the help of Dr. Claridge Druce published an account of "The Dillenian Herbaria" (1907) and later of "The Morisonian Herbarium" (1914), both full of interesting historical and biographical matter. For many years Vines was one of the editors of the *Annals of Botany*, to which he contributed numerous papers on physiological subjects. The earlier of these dealt with more general problems such as root pressure and transpiration, the mechanism of the stomata, epinasty and hyponasty; the later ones were concerned with proteolytic enzymes, and this latter series taken together give an excellent account of the occurrence and function of the proteases in the vegetable kingdom.

Vines always preserved, however, a general interest in botany, as is shown by his article on "Plant Morphology" in the eleventh edition of the "Encyclopædia Brittanica", which is still well worth reading. He naturally refers in it to Sachs's theory, that morphological differences are the expression of differences in material composition, and though this theory had to be considerably modified, he held that the discovery by Sachs that a small quantity of a substance can affect the development of an entire organ, foreshadowed the subsequent discovery of growth-promoting substances or hormones.

Vines's eminence in botany was recognised by his election to the Royal Society in 1885, while still reader at Cambridge. He joined the Linnean Society in 1878 and acted as president in 1900–4. A good portrait of him by the Hon. John Collier hangs in the rooms of the Linnean Society.

Both when in Oxford and afterwards during his retirement at Exmouth, Vines took a keen interest

in his garden, devoting himself with skill and enjoyment to the cultivation of plants. Unfortunately, his health latterly left much to be desired, and he passed away on April 4.

The charm of Vines's personality gained for him a large number of warm friends among his colleagues, and botanists of a younger generation will always be grateful to him for the kindliness with which he treated them and the ever ready help he so willingly extended to them.

F. E. W.

Dr. Maria A. Van Herwerden

THE cause of biological sciences as linked to the evolution of man has sustained a severe blow in the death of Dr. Maria Anna Van Herwerden on January 26 at Utrecht, where she had long taught in the University in the Department of Embryology, Cytology and Genetics. From its early days she was a leader in the International Federation of Eugenic Organisations, as well as being one of the first supporters of the International Union for the Scientific Study of Population Problems, and had a wide circle of friends in Great Britain. In Holland her foresight and untiring work contributed much to building up the Central Committee of societies working in the field of human genetics, which resulted in the foundation last year of the Netherlands Institute for Research in Human Genetics and Race-biology. *Mensch en Maatschappij*, No. 2, says of her: "She was a modest woman, never putting herself forward, without self-seeking, simply serving the cause for which she stood, with great enthusiasm and devotion; her strong will and sense of duty found her always ready with help and advice. Her counsels always carried the greatest weight, founded as they were on wide knowledge illumined by clear insight and judgment and presented sympathetically as the outcome of a benevolent spirit in clear-cut elegant form . . . the Sciences of Human Genetics and Eugenics have lost their most outstanding exponent in our country in the passing of this courageous and talented woman."

WE regret to announce the following deaths:

Prof. R. Chodat, since 1889 professor of botany in the University of Geneva, rector of the University in 1908–10, and first president, in 1901, of the Association Internationale des Botanistes, aged sixty-nine years.

Sir George Duckworth, C.B., secretary of the Royal Commission on Historical Monuments (England) in 1908–33, on April 27, aged sixty-six years.

Prof. W. H. Welch, emeritus professor of the history of medicine and emeritus director of the School of Hygiene and Public Health at Johns Hopkins University, Baltimore, on April 30, aged eighty-four years.

Mr. W. G. Whiffen, manufacturer of drugs and fine chemicals, one of the original fellows of the Institute of Chemistry, on April 28, aged eighty-two years.

News and Views

Prof. C. V. Boys, F.R.S.

PROF. C. V. BOYS, who is delivering the Guthrie Lecture of the Physical Society on May 4, is the doyen of physicists of what may be called the classical age of experimental physics. In one of his earliest researches he succeeded in photographing rifle bullets in flight. To Boys we owe the production of quartz fibres, those almost invisible threads having remarkable elastic properties which are indispensable in many galvanometers, etc. Boys produced them very simply by shooting an arrow, to which a short piece of partially fused quartz was attached, across the room, the unfused part being held behind. Employing these fibres, Boys was able to eliminate most of the errors of the Cavendish experiment and succeeded in weighing the earth with an accuracy neither before nor since surpassed. His experiments with bubbles set out in his fascinating book "Soap Bubbles and the Forces that mould them" are still an unfailing source of interest to old and young. Telescope design, sun dials and a camera for following a lightning flash throughout its course, have also occupied his attention. With the passage of the Gas Regulation Act, 1920, the design and construction of a calorimeter for measuring and recording the calorific value of towns' gas became a matter of urgency. Boys had already invented a gas calorimeter, but the step from a 'snap' test device to a recording instrument was a long one. Boys succeeded, however, in constructing such a recorder, and it has been in continuous use recording the calorific value of gas supplied in certain parts of the country. The instrument incorporates a very large number of most ingenious but typically 'Boysian' devices. To mention but one, a 'thinking machine' automatically corrects the volume of gas burnt in the calorimeter to normal temperature and pressure and continually records the correcting factor.

Research and Development Lectures

WITH the object of promoting attention to the importance of research—both purely scientific and technical—and the utilisation of its results in the service of mankind, the British Science Guild arranged last year for the delivery of a Research and Development Lecture by Sir Harold Carpenter on "Metals in Industry". It was originally intended that one such lecture should be delivered annually, but Lord Melchett, president of the Guild, has given the scheme much wider national significance by arranging several discourses in which the broad trend of scientific development of subjects will be illustrated by experiments and practical demonstrations. By kind permission of the managers, the lectures will be

delivered in the historic lecture theatre of the Royal Institution. The first of the lectures, at which the Prime Minister will preside, is to be delivered as we go to press, on Wednesday, May 2, by Sir William Bragg on "The Development of the Principles of Refrigeration"; and the second, on Wednesday, May 30, by Lord Rutherford on "Helium and other Rare Gases". It is hoped to arrange for two further lectures of the same type to be delivered in the autumn.

THE particular aim of these Research and Development Lectures is to enable legislators, administrators and other responsible leaders to make contact with outstanding achievements of practical science. There is no lack of interest in scientific work and thought among most of these representatives of progressive national life, but few lectures have been specially designed to appeal to them. Lord Melchett's action in providing for such lectures has, however, been warmly supported by men of science and laymen alike, and we congratulate him and the British Science Guild upon the success of a notable national endeavour.

Progress of Automobile Engineering

FOR the James Forrest Lecture which he delivered at the Institution of Civil Engineers on May 1, Sir Henry Fowler took as his subject "The Progress of Automobile Engineering". After a tribute to Forrest, whom he had known when a student, Sir Henry said that to-day the automobile industry is the fifth in point of size in Great Britain, while in the United States in 1928 the industry used no less than 6,000,000 tons of steel. The industry is also one of the greatest consumers of rubber, cotton and light alloys. The first self-propelled vehicle was that built in 1769 by Cugnot, and this was followed by those of Murdoch and Trevithick. Between 1823 and 1840, many patents were taken out for steam carriages, and the same period saw the experiments of Hancock, Gurney, Dance and others. Of the details then invented, the chain drive and differential gear of Hills and the steering gear of Gibbs has survived. Prohibitive tolls, vested interests and the railways, however, led to the abandonment of these early experiments and then came the "Red Flag" Act of 1865, with restrictions which were not removed until 1896. But the matter was taken further by the work of Otto in 1876 and Daimler in 1883, the latter giving us a power unit which has changed our lives, much as the railway did a century ago. The outstanding personality of the early period of automobile development was Levassor, whose arrangement of the various parts of a motor-car has been followed generally. Progress from about 1895 until 1901 can be traced from the records of trials, one of the most important of these being that held by the Royal Automobile Club in 1900, when eighty-three cars, most of foreign origin, started on a 1,000 miles run.

A GREAT part of the lecture was devoted to the details of the subject—materials, tyres, engines, gears, clutches, springs, brakes, etc. Improvements in materials have been continuous and have led to the introduction of various alloy steels and alloys of aluminium such as duralumin, "Y" alloy and that known as "R.R.". The investigation of these light alloys has led to an almost new technique. Recently, success has been achieved with a lead-bronze alloy for bearings. As for the tyres, pneumatic tyres were first conceived by Thomson in 1846, and developed by Dunlop in 1888 and first made for motors by Michelin and Co. In 1906 it was said that tyres cost "perhaps five or six times what the fuel cost per mile run", but the cost to-day is probably less than one quarter of the cost of fuel. In engine design the greatest advance of recent times has been the development of engines for using heavy oil. Compared with the petrol engine, the compression-ignition oil engine is slightly heavier, but has a higher efficiency and greater turning moment at low speeds. The problem of transmission, perhaps, is given more consideration to-day than any other. Many alternatives to the 'crash' gear have been tried, and not only in automobile but also in other classes of engineering, the matter has proved one of the most difficult problems in mechanics to be solved at a low cost and with high efficiency. In connexion with this part of his subject, Sir Henry described the Wilson gear, the Austin-Hayes gear, the Leyland hydraulic converter, the so-called fluid fly-wheel and the automatic clutch manufactured under the Newton patents. He also touched upon types of brakes, and methods of suspension, and in his conclusion recalled the remark of a friend that in early days cars were extremely simple and extremely unreliable, whereas at the present time they are extremely complicated, but leave nothing to be desired so far as reliability is concerned.

Spicer-Dufay Colour Film

SINCE 1926 the Spicer-Dufay process of colour photography has been the object of very intensive research and a demonstration of colour films made by this process was given at a Royal Society soirée in 1931 (see NATURE, May 30, 1931, p. 821). It is stated that the new product will shortly be marketed for 16 mm. cinematography, and later it is intended to supply also roll films for ordinary cameras and standard 35 mm. cinematograph film. The new film consists of a transparent base on which is first coated a three-colour mosaic of regular pattern; in intimate contact with the colour mosaic screen is a very thin waterproof layer and above this is a highly sensitive panchromatic photographic emulsion. Exposure is made through the film base and colour mosaic. A positive image is formed by reversal. In principle, the process is thus similar to many which have long been operated with great success for still photography in colour.

THE application of this general principle to cinematography has necessitated a very thorough study of every detail of the process. For example, in still photography it has been found quite satisfactory to use an irregular colour mosaic, the primary coloured elements being distributed in an entirely

haphazard manner ; it is reported that when this type of mosaic is used for cinematography, the superimposition of successive pictures built up of colour elements arranged in entirely different ways gives rise to a very unpleasant effect known as 'boiling', every part of the picture on the screen appearing to be in rapid internal movement. With the Dufay regular mosaic this trouble does not occur. The success of a process for colour cinematography depends on a variety of factors besides its power to yield pleasing coloured pictures. Two very important desiderata are that films should be capable of projection with normal projectors as used for ordinary black and white pictures, and they must be capable of yielding coloured duplicates by a process of automatic printing. In respect of the first of these requirements, the Spicer-Dufay process has already achieved its object and the luminosity of the projected pictures is at least adequate, while a method of duplicating by machine printing is now available. The process is therefore one in which technical achievement is already very high.

Royal Institution and Davy Faraday Laboratory

THE annual meeting of the Royal Institution was held on Tuesday, May 1, under the chairmanship of the treasurer, Sir Robert Robertson. The Visitors' Report for the year 1933 showed a substantial addition to the membership, the total (1020) at the end of the year, including honorary members, members and associate subscribers, being the highest reached since the War. The following officers were re-elected : *President*, The Right Hon. Lord Eustace Percy ; *Treasurer*, Sir Robert Robertson ; *Secretary*, Major Charles E. S. Phillips. The fulfilment by the Trustees of the Rockefeller Foundation of their promise, made in 1930, to give £20,000 for endowment of research in the Davy Faraday Laboratory, was publicly announced some months ago. In the Visitors' Report reference is made to this and other gifts to the Research Endowment Fund which has now been established at the Institution ; and the Report of the Davy Faraday Laboratory Committee, which is printed with the Visitors' Report, gives interesting evidence of the work which is in progress with the funds now available from this and other sources.

THE majority of the workers in the Davy Faraday Laboratory are engaged, under the direction of Sir William Bragg, "in a combined effort to map out exactly the spatial distribution of the atoms in organic molecules", using X-ray methods. An X-ray tube with revolving anti-cathode has been in regular use now for about two years, and a much larger tube, to operate up to about 50 kw., is in the experimental stages. With these powerful sources, very small crystals can be used, and in recent work successful photographs have been obtained with crystals weighing less than one twenty-fifth of a milligram. From large numbers of reflection measurements calculations can be made, using a method based on the Fourier principle, of the electron density at every point within the crystal. "The result is given in the form of contour maps. Each contour line shows the electron density expressed in whole numbers of electrons per cubic Angstrom unit. The map is in general accurate to the width of a line." This interesting method of mapping the molecules is illustrated in the Report by a contour map of the durene molecule, taken from a recent paper by Dr. J. M. Robertson, one of the workers in the Laboratory.

Rotation of the Earth

ON May 1, a public lecture was delivered at Oxford by Dr. J. K. Fotheringham, reader in ancient astronomy and chronology in the University, on the rotation of the earth. Dr. Fotheringham spoke of the importance of the fact of rotation in regard to such practical matters as the alternation of day and night, the march of the seasons, the tides, and the measurement of time. Some of the Greeks, perhaps including Plato, held the Pythagorean view that the earth and not the sky rotated ; but in either case the rotation was generally held to be uniform. The fact of precession was known to Hipparchus, but may be an older discovery. A further disturbance of uniformity, namely, nutation, with a period of 19 years, was determined by Bradley at Oxford. Since his time, further changes have been measured, such as a shifting of the position of the pole in relation to the earth's figure ; this has a period of 15 months and may affect latitude to the extent of two-fifths of a second of arc. A change in the speed of rotation is no doubt a real physical fact, "the day is getting longer by one second in many thousand years". The apparent acceleration of the sun is modified by that of the moon. Fresh facts bearing upon this have been collected by Dr. Fotheringham and others, but their full explanation awaits further research.

Chemical Patents Committee

A CHEMICAL PATENTS COMMITTEE of the Department of Scientific and Industrial Research has been appointed to advise on the patenting and exploitation of results of the Department's chemical researches that may have industrial possibilities. The Committee is the result of negotiations that have been taking place for some time between the Department and various industrial organisations with the object of promoting closer co-operation and of avoiding unnecessary overlapping. It is hoped that one result of the Committee's advice will be that research results may be brought to the notice of industry and translated into practice at an earlier stage than hitherto, and under conditions that will take existing industrial activities into account. Sir Frank Smith, secretary of the Department of Scientific and Industrial Research, will act as chairman, and in addition to departmental members, the Committee will include : Mr. F. H. Carr and Mr. J. Davidson Pratt, representing the Association of British Chemical Manufacturers, and Mr. J. Arthur Reavell, representing the British Chemical Plant Manufacturers Association.

Scientific Progress and Employment

AT the recent annual meeting of the London branch of the Association of Scientific Workers, the chairman, Mr. R. W. Western, read a paper on "How Scientific Research may best help in the Present World Crisis". Mr. Western pointed out that there is a widespread belief that the progress of science tends to create unemployment by substituting machinery for men and replacing highly-trained operatives by unskilled labourers. Innovations resulting from scientific research are generally found to have injurious secondary effects because : (1) land formerly employed in production may be rendered useless, for example, that utilised for a railway is spoilt for other purposes, while ferro-concrete constructions cost nearly as much to demolish as to erect ; (2) fixed capital sunk in superseded processes is rendered obsolete ; (3) the number of workers required to produce a given output is reduced ; (4) innovations may necessitate costly expenditure on advertisements to get the product known—but the trading community is reluctant to undertake this and prefers to advertise opportunities for gratifying wants already realised. These considerations lend support to the view that what is most wanted are new ways of meeting unsatisfied needs by adapting available capital, rather than innovations which save labour or supersede capital assets. If an innovation founded on the results of scientific research is to produce good results, free from immediate drawbacks and therefore wholly beneficial at the present time, it should render possible the application of idle plant to the commercial utilisation of the waste products of existing processes by employing labour now surplus. The best help that scientific research can give in the present crisis will consist in exploring the channels least subject to the drawbacks previously enumerated.

Race and Culture in India

IT is not without interest to note that Dr. J. H. Hutton's tentative correlation of race and culture in his Indian Census Report for 1931 not only receives commendatory reference but also is closely followed in method in the presidential address on "Sramanism" delivered by Rai Bahadur Ramaprasad Chanda to the Anthropological Section at the recent Bombay meeting of the Indian Science Congress. Analysing the concepts of Sramanism, which underlie the doctrine of renunciation, the animating principle of the mendicant and ascetic orders, the president showed that in early times the Vedic religion stressed the rites of the householder and had no place for the Sramanas, the forest dwellers and religious mendicants. Hence he deduced that the Sramanas are to be derived from the pre-Vedic, pre-Aryan peoples and their practitioners of magic, tracing the practice of asceticism back to the initiatory period of seclusion and abstinence of the shaman. This interesting conclusion, which traces one of the most important elements in modern Hinduism to a non-Aryan origin, is supplemented by further considerations bearing on certain of Dr. Hutton's ethnological arguments which have been subjected to critical comment. Ramaprasad Chanda suggests that the ingrained love of life disclosed by the religions of Saktism and Vaisnavism among the Bengalis, comparable to that found among the Aryans, is a racial psychological trait to be associated with the brachycephalic Bengali castes, the Indo-Alpines, of whom Dr. Hutton has suggested that they had acquired an Aryan language before they entered India. Hence, it is suggested, the strength of the Durga-Kali cult in Bengal, which only in recent times has begun to give place to the renunciation of sramana.

Palæolithic Gravels of Farnham

FOLLOWING the exhibition of Miss Garrod's finds on Mount Carmel, a series of flint implements has been arranged at the British Museum to illustrate the sequence of industries in the terrace-gravels south of Farnham, Surrey. Two cases at the head of the main staircase, in the Department of British and Mediæval Antiquities, contain not only a number of accurately located specimens in the Sturge collection as presented by Major A. G. Wade, but also maps and diagrams showing the terraces of the Wey and the Pleistocene history of the Farnham branch of that river. The area has been recently surveyed by the Geological Survey ("The Geology of the Country around Aldershot and Guildford, 1929"), and Mr. Henry Bury's papers in the *Quarterly Journal of the Geological Society* and *Proceedings of the Geologists' Association* have been freely drawn on in order to explain the importance of this area for the dating of terrace-deposits and the classification of implements. It may be eventually possible to identify these four levels with the recognised sequence of terraces in the middle and lower Thames ; and the local river-captures should explain the presence of some types and the absence of others in the Blackwater and Wey valleys. This exhibition will remain open until the middle of July.

Recent Acquisitions at the Natural History Museum

IN connexion with the gorilla group to be arranged in the Upper Mammal Gallery, the British Museum (Natural History) has received from Mr. Reginald Akroyd a quantity of vegetation collected during a trip which he made for this purpose to the Birunga Mountains, Uganda, last winter. This vegetation consists of sections of trees, boughs of giant heaths and giant groundsels, a number of giant lobelias, ferns and tree-ferns, and a large quantity of the arboreal lichen which is so characteristic a feature of these mountain forests. The Zoological Department has recently received as a donation from the Rowland Ward Trustees a female specimen of a rare howling monkey (*Alouatta ursina*) from Brazil. A male, presented by the same donors some years ago, is bright orange-red in colour, whereas the female is brown. Isolated crystals of native gold from alluvial deposits on the Muti stream, Buhwezhu county, Uganda, have been presented to the Department of Minerals by Mr. Michael Moses. Two minerals new to science have

been presented, namely, lusakite, a new mineral composed of cobalt and aluminium silicate, from 120 miles east of Lusaka, Northern Rhodesia, by Mr. A. C. Skerl, and bismuth tungstate, from Cornwall, by Mr. E. H. Davison.

THE Department of Botany has received the plants from Capt. Kingdon-Ward's recent expedition to Tibet. The bulk of the collection is from north of Rima, north and south of the great snow range which runs approximately north-west to south-east. In Zayul, south of the range, the mountains are well wooded with deciduous and evergreen forest whereas in Nagong, north of the range, there is no forest. It was possible to recognise three floral regions in Tibet, and the discovery that the snow range is an eastern extension is of considerable phytogeographical importance. About 750 items were obtained and these include some new and interesting plants; and add to our knowledge of the distribution of many others. The Department has received by exchange 536 San Thomé and Principe plants from Coimbra. Many of them are duplicates of the types of a number of species not previously represented in the Museum collections. From Edinburgh, 1,423 specimens of *Rhododendron* have been received. The majority of the species represented are new to the Museum collections, and in many instances are portions of type collections.

Palæontographical Society

THE eighty-seventh annual meeting of the Palæontographical Society was held in the Geological Society's rooms at Burlington House on April 27, Prof. W. W. Watts in the chair. The Council's report recorded with regret the death of the president, Dr. F. A. Bather, and of one of the vice-presidents, Dr. F. L. Kitchin. Since the last annual meeting, some arrears of publication have been overtaken by the issue of two volumes of monographs. Instalments of the monographs of Corallian Lamellibranchia, Gault Ammonites, Cambrian Trilobites and Dendroid Graptolites are included. Another instalment of the monograph of Pleistocene Mammalia deals with the red deer, reindeer and roe. Sir Arthur Smith Woodward was elected president, and Mr. Henry Woods was elected vice-president; Mr. Robert S. Herries and Dr. C. J. Stubblefield were elected treasurer and secretary respectively. The new members of Council are Mr. A. J. Bull, Prof. W. T. Gordon, Dr. J. Pringle and Mr. W. P. D. Stebbing.

Natural Conditions of Soil Formation in India

AT the last meeting of the International Society of Soil Science it was decided to prepare a soil map of Asia, and the work of compiling the available materials was entrusted to a sub-commission headed by several of the leading Russian workers. This sub-commission has already published a number of contributions dealing with the soils of Japan, Manchuria and certain portions of China. A contribution by Dr. Z. J. Schokalsky, published by the Academy of Sciences of the U.S.S.R., Leningrad (1932), covers, in a similar way, the conditions in India. The materials which have been in the hands of the author are so carefully worked out that it is hard to believe that the map has been made by one who has never visited India. If it is open to criticism in certain directions, this is only because the materials placed before Dr. Schokalsky have been unsatisfactory and imperfect. It must, however, be recognised that the references cited in the present contribution are far from complete and in a number of cases do not include the best materials available. Thus, for example, in connexion with the soils of north-east India, the whole of the admirable work done by the experts of the Indian Tea Association is omitted, though their studies are probably the best that have been done over a large area of Assam and Bengal. Again, probably the best information about actual soil conditions and their distribution in peninsular India will be found in the various survey and settlement reports, much of which is summarised in the "Gazetteers" issued more than a generation ago, and these do not appear to have been consulted. A very large area in the north-east of the Peninsula, which forms perhaps the largest forest tract still existing in the country, is marked on the map as consisting of steppe soils. Even with regard to the black cotton soil, or *regur*, the account given takes no account of the radically different types of the soil in the northern and the southern parts of the black soil area. Before the present map is finally issued as an authoritative account of Indian soils, it will have to be subjected to very careful constructive criticism.

Landscape Gardening

THE Institute of Landscape Architects is to be congratulated upon the appearance of *Landscape and Garden*, a new quarterly journal devoted to garden design and landscape architecture (vol. 1, No. 1, 1934, pp. 74. 2*s*. 6*d*.). The volume is edited by Mr. Richard Sudell. The Garden Theatre at the Herrenhausen, Hanover, is described briefly by G. A. Jellicoe, who shows by means of plans and photographs the lay-out of this very artistic piece of garden architecture. R. V. Giffard Woolley contributes a helpful study on "The Management of Small Spaces". Various considerations for the production of vistas, and the incorporation of stone-paving and ornament, are given. A park to link Karlsruhe with the Rhine is described by P. Morton Shand, and particulars of an interesting bird sanctuary are included. Capt. R. C. H. Jenkinson writes about "New Shrubs for Old", and in addition to describing several of the more recently introduced shrubs, discusses possibilities for their artistic grouping. "Birdseye" is a series of aerial photographs showing forms of community housing in England through the last five hundred years. A. J. Cobb writes on "Tree Surgery", outlining methods for the lengthening of life, or the complete repair, of damaged trees. The use of focal points in design is very ably treated by Hervey Bennett, in an article entitled "Where Shall I Look ?" A series of photographs showing the illumination of gardens, together with a short

description, are provided by Waldo Maitland. Some very striking effects, produced by flood-lighting trees, are shown. "Roof-gardens, the Lungs of the Future" are given adequate treatment in an article by Lady Allen of Hurtwood, who introduces many practical suggestions. One might advance the suggestion that the 'extremely small spaces' such as are included with the majority of present-day houses might receive adequate treatment in future numbers, though the editor seems to be alive to this need. A study of the development of the 'garden city' is promised for the next number (July).

Research on Oranges and Related Crops

THE British South Africa Co. has issued a report on the activities of the Mazoe Citrus Experimental Station up to the end of 1932 (Oxford Univ. Press, 192 pp.). The Director, Dr. W. J. Hall, and Mr. W. K. Ford are engaged in a study of the citrus insects of Southern Rhodesia, and publish detailed descriptions of a considerable number of pests. Soils of the Mazoe Estate are under investigation by Dr. A. A. Morris, who contributes a paper on the relation between soils and field practices. Special attention has been devoted to irrigation, cover crops and manures. Problems of artificial coloration, maturity and transport wastage of oranges have engaged the attention of Mr. G. R. Bates. The work of the Station is comparatively recent, but the various problems are being studied with a detail which should ensure the production of valuable results.

Electrical and Magnetic Units

BULLETIN No. 93 of the National Research Council, Washington, reproduces the papers on units presented before the American Section of the International Union of Pure and Applied Physics at Chicago in June last. After discussion it was recommended :—that in view of the long use of the classical centimetre-gram-second units, no change should be made at present, but that the Gaussian system should be considered in future; that the practical units—ohm, volt, ampere, coulomb, farad, henry, joule and watt—might be extended into a complete absolute system either through the metre–kilogram–second or the centimetre–10^7 gm.–second, the former by preference. These proposals will in due course be considered by the Committee on Symbols, Units and Nomenclature established by the International Union.

Health of the British Army during 1932

LIEUT.-GEN. H. B. FAWCUS, director-general of the Army Medical Services, states that the health of all ranks throughout 1932 was satisfactory ("Report on the Health of the Army for the Year, 1932". London: H.M. Stationery Office, 1934. 2*s*. 6*d*. net). The admission rate to hospital, 412·5 per 1,000 of the strength, was the lowest on record, and the invaliding and constantly sick rates were also the lowest recorded since the War. All the more important diseases have shared in the decline, namely, malaria, dysentery, influenza, tonsillitis, venereal diseases and others. In consequence of the high incidence of tonsillitis over many years, a Joint Medical Services Committee has studied the subject, but without reaching any very definite conclusion as to causation or prevention. A summary of research work is given in the report.

German Exhibition of Chemical Plant

"ACHEMA" is the Ausstellung für chemisches Apparatewesen, the seventh of which is to be held at Cologne on May 18–27 under the auspices of "Dechema", the Deutsche Gesellschaft für chemisches Apparatewesen. In anticipation of this exhibition the Achema-Jahrbuch 1931/1934, a report of some 230 pages on the position and development of the study and construction of chemical plant, has recently been published by Dechema at Seelze bei Hannover. Those who are interested in the exhibition and apply before May 10 can obtain a copy of the Jahrbuch, which is priced at 10 m., on sending only 0.40 m. to cover the cost of postage. The "Wissenschaftlicher Teil" includes articles on the development of technique and plant construction, on standards in apparatus, on welding in the building of chemical plant, on instruments for the measurement of therapeutically active ultra-violet light emission, and on the Drawinol process for dehydrating ethyl alcohol. The "Technisch-industrieller Teil" contains information concerning constructional materials, laboratory apparatus, technical apparatus, plant and machinery. The book serves also as a guide to the exhibits. We are reminded that in describing the sixth exhibition held at Frankfurt-am-Main in 1930 we said that there could never have been a more comprehensive show of aids to chemical manipulation; at Cologne 300 firms will exhibit more than 2,000 types of apparatus and plant, so that the forthcoming exhibition is unlikely to be less valuable and impressive.

Congress of History of Medicine

THE International Society of the History of Medicine has received an official invitation from the Spanish Government to hold its tenth congress at Madrid in the second fortnight of September 1935. The following subjects, of which the executive committee has to select two, have been suggested for discussion: Spanish colonial medicine; Pre-Columbian medicine; the history of syphilis; medical folk-lore, and the introduction of biological ideas into the domain of history, a subject proposed by Prof. E. Jeanselme of Paris. This Congress of 1935 must not be confused with that organised by the International Academy of the History of Sciences, which will be held this year at Barcelona, Madrid, Toledo, Coimbra and Lisbon, on September 19–October 2.

Television Inquiry

THE Postmaster-General stated in the House of Commons on April 30 that he hoped to announce shortly the composition of a committee which will advise on the conditions under which any public

television service should be provided. It is understood that the Committee to be appointed will consist of representatives of the Post Office, the British Broadcasting Corporation and the Department of Scientific and Industrial Research.

Announcements

DR. JOSEPH PEARSON, who recently resigned his post as director of the Colombo Museum and marine biologist to the Ceylon Government, has been appointed director of the Tasmanian Museum, Hobart, as from March 1 last.

AT the meeting of the London Mathematical Society to be held on May 17 at 5 p.m. in the rooms of the Royal Astronomical Society, Burlington House, Prof. E. A. Milne, of Oxford, will give a lecture on "World-Gravitation by Kinematic Methods".

THE Institution of Civil Engineers has awarded a Charles Hawksley Prize of £150 for 1934 to Mr. H. G. Cousins, for his design of an aerodrome. The prize is awarded for the best design of an engineering structure combining artistic merit with excellence of constructional design, and the competition is open to students and associate members of the Institution less than thirty years of age.

KEDDEY FLETCHER-WARR Studentships of the University of London, each of the value of £210 a year for three years, have been awarded to Dr. E. G. Jones, for the continuation of research in spectroscopy, and to Dr. A. C. Offord, for the continuation and extension of research in pure mathematics.

THE Frazer Lecture, founded in honour of Sir James Frazer, is delivered annually at the Universities of Oxford, Cambridge, Glasgow and Liverpool in turn, and this year goes to Oxford for the fourth time. It will be delivered on May 10 at 5.30 p.m. in the Examination Schools, Oxford, by Prof. H. J. Rose, of the University of St. Andrews, who will take as his subject "Concerning Parallels".

THE Association of Special Libraries and Information Bureaux (ASLIB) will hold its eleventh annual conference at Somerville College, Oxford, during the week-end beginning on September 21. Particulars may be obtained from the Secretary of the Association, 16, Russell Square, London, W.C.1. Sir Richard Gregory has agreed to accept nomination as president of the Association for 1934–35.

THE Rockefeller Medical Fellowships for the academic year 1934–1935 will shortly be awarded by the Medical Research Council, and applications should be lodged with the Council not later than June 1. These Fellowships, of the annual value of £350, are awarded to graduates who have had some training in research work in the primary sciences of medicine, or in clinical medicine or surgery, and are likely to profit by a period of work at a university or other chosen centre in the United States before taking up positions for higher teaching or research in the British Isles. Full particulars and forms of application are obtainable from the Secretary, Medical Research Council, 38 Old Queen Street, Westminster, S.W.1.

THE "Handbook of the Collections Illustrating Electrical Engineering" (Science Museum, South Kensington. Part 4.) (H.M. Stationery Office. 2*s*. net) gives the substance of the detailed descriptive labels associated with the exhibits in the Electric Power Collections in the Science Museum. By means of asterisks, attention is directed to the more important exhibits which have influenced future developments. It will be most useful to those who desire to study the historical development of the use of electric power.

MESSRS. OPPENHEIM AND CO. (RARE BOOKS), LTD., 174 Fulham Road, London, S.W.10, now in liquidation, have issued a special sale catalogue of journals and periodicals of British and foreign learned societies. The list includes long runs and shorter sets of publications on most branches of science, natural history, medicine, engineering and economics. Among the more important items is a complete run of the *Annals and Magazine of Natural History*, from the commencement in 1838 to 1927, to be had for the bargain price of £115. This is a low-priced list which should appeal especially to librarians.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—An assistant lecturer in metallurgy in the University of Manchester—The Registrar (May 7). An engineer and surveyor to the Brentwood Urban District Council—The Clerk of the Council, Council Offices, Brentwood (May 7). A lecturer in engineering at the Wigan and District Mining and Technical College —The Principal (May 7). An assistant master to teach two of the following subjects : machine drawing, mechanics, physics, mathematics, at the Portsmouth Junior Technical School—The Town Clerk, Guildhall, Portsmouth (May 10). A principal of Kilburn Polytechnic—The Secretary, Middlesex Education Offices, 10, Great George Street, Westminster, S.W.1 (May 16). An assistant lecturer in physics in the University of Manchester—The Registrar (May 26). A teacher of electrical engineering at Dartford Technical College—The District Secretary, Education Offices, 15, Lowfield Street, Dartford (May 26). A headmaster of the Ashton-under-Lyne Junior Technical School—G. W. Handforth, Education Office, 8, Warrington Street, Ashton-under-Lyne (May 26). An Imperial mycologist at the Imperial Institute of Agricultural Research, Pusa, Bihar and Orissa, India—The High Commissioner for India, General Department, India House, Aldwych, London, W.C.2 (May 31). An assistant engineer to the Water and Sewerage Board, Corporate Area of Kingston and St. Andrew, Jamaica—The Crown Agents for the Colonies, 4, Millbank, London, S.W.1. A woman tutor in mathematics at the Edge Hill Training College, Ormskirk—The Principal.

Letters to the Editor

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Magnetic Properties of Supraconductors

I SHOULD like to report the results of experiments which bear on the recent discovery of Meissner and Ochsenfeld, regarding the magnetic properties of matter in the supraconducting state. I feel that our results will add something to this original contribution and the further contribution made recently by Mendelssohn and Babbitt[1].

According to Meissner's results, if a supraconductor be lowered from a temperature above the transition point to a temperature below that point, with a constant magnetic field applied, we should expect to observe a change in flux in search coils placed in various positions relatively to the supraconductor and the field. A supraconducting body

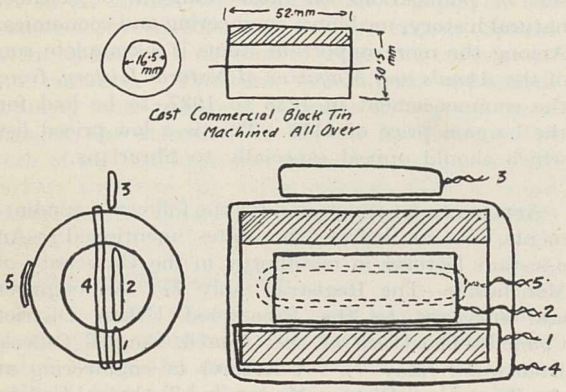


FIG. 1.

in the shape of a hollow cylinder of tin was used, and small coils wound about the tin or placed near the tin, as indicated in Fig. 1. Coil No. 1 was wound around one side of the cylinder. Coil No. 2 was placed inside the hollow cylinder. Coil No. 3 was placed near the surface of the cylinder tangential to the applied field. Coil No. 4 was wound so as to enclose the whole cylinder in the plane of the coil. No. 5 was placed at the outer surface of the cylinder perpendicular to the applied magnetic field. According to the results reported by Meissner, if one applies a magnetic field when the tin is above its supraconducting point, and leaves this field constant while the temperature of the sample is taken through its transition point to a temperature definitely below the supraconducting temperature, one should observe the following: In coil No. 1, decrease to zero flux; in coil No. 2, no change in flux; in coil No. 3, increase of twice the applied field intensity; in coil No. 4, decrease in flux due to wiping out of the flux in tin; in coil No. 5, decrease to zero flux.

In our experiments these search coils were arranged to be connected directly to a flux meter, and the deflections were read by means of a lamp and scale. Our preliminary results, which have been checked two or three times, are as follows: As the tin cylinder was taken from above the transition point to below, coil No. 1 showed a decrease of 90 per cent in the flux; No. 2 showed a slight increase up to 10 per cent; coil No. 3 showed an increase of 25 per cent; coil No. 4 a decrease of 30 per cent; and coil No. 5 a decrease of from 20 to 25 per cent in the flux. It should be noted that coil No. 3 projected about 5 mm. from the surface where there was undoubtedly a magnetic field of high gradient, and also that coil No. 5 of necessity enclosed a considerable space where the field was not theoretically zero, but only relatively weakened. The field strengths used were approximately 30, 150 and 200 gauss respectively. Repeated readings were carried out with the stronger field.

This work was carried out with the assistance of Mr. J. O. Wilhelm and Mr. F. G. A. Tarr.

E. F. BURTON.

McLennan Laboratory,
University of Toronto.
April 5.

[1] NATURE, **133**, 459, March 24, 1934.

Constitution of Hafnium and other Elements

TAKING advantage of the exceptionally favourable setting of the anode discharge tube used in the analysis of the rare earths already reported[1], I have obtained further results of great interest.

Hafnium gives a mass-spectrum indicating five isotopes, a weak line at 176 and four strong ones, 177, 178, 179, 180, of which the even numbers are rather more abundant. Thorium appears to be simple 232; no line of higher mass number could be seen. Rhodium gave the feeblest effect of any element yet analysed; only one line, that expected at 103, could be clearly detected.

Very intense spectra were obtained from calcium, disclosing faint new isotopes, 42 and 43, in addition to 40 and 44 previously discovered by Dempster. It also appears very probable that a line at 41 was partly due to an isotope of calcium, but the difficulty of making an accurate estimate of its intensity and the impossibility of entirely excluding potassium are obstacles still in the way of a definite proof of this interesting conclusion.

Numerous attempts to analyse titanium in the past have yielded very inconclusive results. Satisfactory mass-spectra have now been obtained which show its main line, 48, flanked by four new faint lines, 46, 47, 49, 50, the whole forming a most striking symmetrical group. It is noteworthy that with the discovery of these isotopes and that of argon 38 recently reported by Zeeman, all the numbers from 9 to 56 are now filled.

New mass-spectra obtained from zirconium not only show an additional and fairly abundant isotope 91, hitherto overlooked owing to insufficient resolution, but also confirm the presence of the very rare and previously doubtful constituent 96, which is of particular interest as it forms with molybdenum and ruthenium the lightest known isobaric triplet.

Further work with samarium has disclosed two faint isotopes, 144 and 150.

Only four common elements, palladium, iridium, platinum and gold, still remain to be analysed; even with the present setting, all attempts with these have given negative results.

F. W. ASTON.

Cavendish Laboratory,
Cambridge.
April 21.

[1] NATURE, **133**, 327, March 3, 1934.

Small Angle Scattering of Electrons in Helium

IN July 1933[1] one of us (R. W.), in collaboration with T. Emmerson and J. E. Taylor, pointed out that, in agreement with Mr. S. N. Van Voorhis[2], we had been obtaining curious scattering effects using narrow electron beams passing through helium at low pressures.

The effect, which was very marked at energies of between 100 and 200 electron volts, consisted in a very obvious maximum in the number of inelastically scattered electrons at a few degrees out from the main beam. This result was so remarkable and unexpected as to demand further and much closer examination, and with that end in view a special apparatus has been set up in this laboratory.

Briefly, the electron gun is rotated slowly and continuously by a synchronous electric motor, the scattered electrons, after passing through a slit system, being analysed by a magnetic field and the resulting spectrum recorded on a photographic film kept in continuous motion by a second synchronous motor. The result is a continuous record of all the scattered electrons both elastic and inelastic over the desired angular range; energy and number being simultaneously recorded in terms of position on the film and photographic density respectively.

The photograph here reproduced as Fig. 1 indicates the elegant kind of record which can be obtained by this method. The two separate spectra show

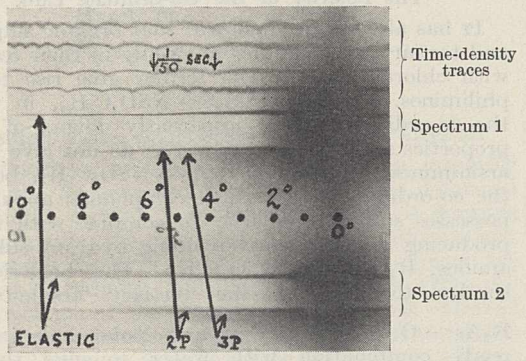


FIG. 1.

the variation in probability up to 10° from the main beam of elastic impacts, and those which have resulted in the two most likely transitions ($2P$ and $3P$). At the top of the record are to be seen four wavy traces which have been produced by sweeping the electrons (at zero beam setting) rapidly across the film with a time-marking device. By suitably accelerating the motion, a range of wave-lengths can be obtained, as shown, from which density-intensity information can be derived for interpreting the spectral traces themselves.

The anomalous results previously reported have not, so far, been confirmed with this more refined apparatus.

We have measured the relative probabilities of the elastic and inelastic ($2P$) collisions at angles up to

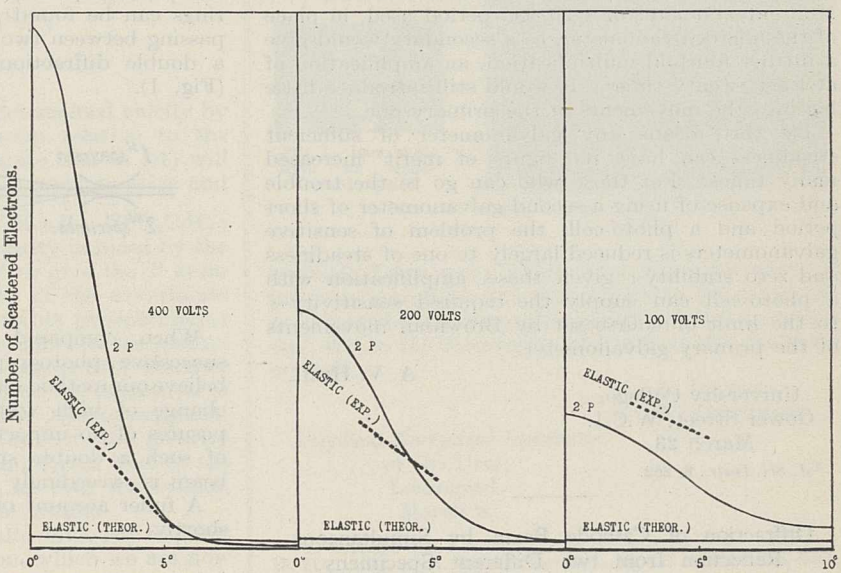


FIG. 2.

10° at energies of impact varying between 100 and 400 electron volts with the results shown in Fig. 2. Here, the inelastic probabilities given by the most recent form of theory (Massey and Mohr)[3] have been taken as the basis and in agreement with our experimental results (full curves marked $2P$). It will be seen how very different are the calculated (full lines) and experimental (dotted lines) values for the elastic probabilities. In particular, at the lower impacting energies this divergence is specially remarkable.

F. C. POULTNEY.
R. WHIDDINGTON.

Physical Laboratories,
University, Leeds.

[1] NATURE, **132**, 65, July 8, 1933.
[2] *Phys. Rev.*, May 1, 1933.
[3] *Proc. Roy. Soc.*, A, **140**, 613; 1933.

Galvanometer Amplification by Photo-Cell

IN 1931[1] I described the use of a differential photo-electric cell connected to a 'secondary' galvanometer for amplifying the movements of a 'primary' one. The only suitable cell available then was a cuprous oxide one, and the current produced by it was not great enough to allow a quick (and therefore insensitive) secondary galvanometer to be used; consequently, although sufficient amplification was obtained, the movements were slowed. This slowing of movements is an even greater objection to the thermal relay of Moll and Burger since the thermo-couple introduces a further lag which the photo-cell does not.

I have recently tested a Weston 'photronic' cell for

the same purpose. This cell was opened and a groove cut down the centre of the disc. Lead fuse wires were then inserted to make contact with the faces of the two halves. These lead wires were joined to terminals by which the cell was connected to a Kipp micro-galvanometer of period 0·2 sec. With this a five to tenfold amplification can be obtained, of a galvanometer of 1·5–5 sec. period, without introducing any measurable lag into its movements. A Moll galvanometer of 1·25 sec. period used, in place of the microgalvanometer, as a secondary would give a further fourfold multiplication, an amplification of at least twenty times. It would still introduce little lag into the movements of the primary one.

By this means any galvanometer of sufficient steadiness can have its 'figure of merit' increased many times. For those who can go to the trouble and expense of using a second galvanometer of short period and a photo-cell, the problem of sensitive galvanometers is reduced largely to one of steadiness and zero stability; given these, amplification with a photo-cell can supply the required sensitivity—to the limit of course set by Brownian movements of the primary galvanometer.

A. V. HILL.

University College,
Gower Street, W.C.1.
March 23.

[1] *J. Sci. Instr.*, **8**, 262.

Diffraction of Cathode Beam by Simultaneous Reflection from two Different Specimens

FROM the first investigations of G. P. Thomson[1] dealing with the structure of surface layers up to the present time, the method of using a specimen ground flat has remained apparently without change[2], though the construction of a crystal holder for this method is comparatively complicated and the results obtained in such a way cannot apparently be of high

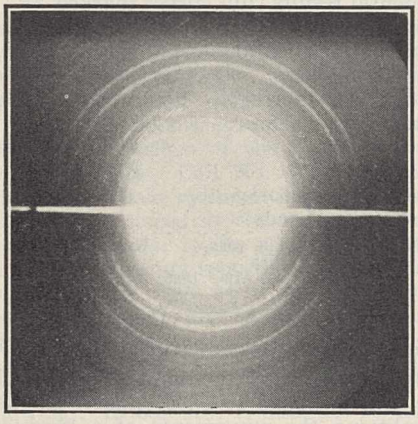


FIG. 1.

degree of accuracy. The investigation of the surface structure by reflection is, however, of great interest. We have recently succeeded in obtaining very exact results by means of a simultaneous reflection of a cathode beam from two specimens; one of them was a substance the lattice constants of which were very exactly known, such as sodium chloride.

As has been shown by H. de Laszlo and V. Cosslet[3], the cathode beam is hollow. The results of our study confirm this. Therefore for obtaining a sharply outlined diffraction pattern, it is evidently not necessary to use the entire cross-section of the cathode beam, but only one side of it, and this can be done only with a convex specimen. From Fig. 1 it can be seen that this method not only gives a sharp diffraction pattern, but also simultaneously a very sharp spot from the cathode beam may appear in the photographic plate, so that the centre of the rings can be found at once. If a cathode beam is passing between two such convex specimens (Fig. 2) a double diffraction pattern appears as is shown (Fig. 1).

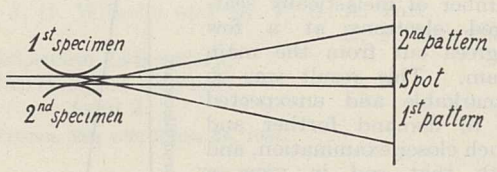


Fig. 2.

When compared with the method of taking successive photographs one after the other[4], we believe our method has the advantage that the possible change of high voltages is with simultaneous exposures of no importance. Moreover, the mounting of such a double specimen and its setting in the beam is exceedingly simple.

A fuller account of this method will be published shortly.

N. A. SHISHACOW.
L. I. TATARINOWA.

Cement Institute,
Moscow, 17.
March 9.

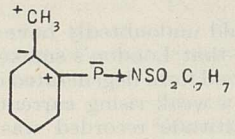
[1] G. P. Thomson, *Proc. Roy. Soc.*, A, **128**, 641, 649; 1930.
[2] See for example: J. Cates, *Trans. Farad. Soc.*, **29**, 817; 1933. G. D. Preston, *Phil. Mag.*, **17**, 466; 1934. R. O. Jenkins, *Phil. Mag.*, **17**, 457; 1934. A. G. Emsli, *Phys. Rev.*, **45**, 43; 1934.
[3] NATURE, **130**, 59, July 9, 1932.
[4] G. I. Finch and A. G. Quarrel, NATURE, **131**, 842, June 10, 1933.

The Polarity of the Co-ordinate Link

IT has already been shown[1] that organic sulphides and tertiary arsines differ markedly in their reaction with chloramine-T. The former give rise to sulphilimines, of formula $R_2S \rightarrow NSO_2C_7H_7$, in which the co-ordinate link is apparently devoid of polar properties: the arsines, however, do not give stable arsinimines, of formula $R_3As \rightarrow NSO_2C_7H_7$, because the co-ordinate link in such compounds apparently possesses sufficient polarity to combine with water, producing thus the corresponding hydroxy-sulphonamides, $R_3As(OH).NHSO_2C_7H_7$. This behaviour is similar to that of the tertiary arsine-oxides, $R_3\overset{+}{As} \rightarrow \overset{-}{O}$, where the strongly polar link induces ready combination with water to give the dihydroxides, $R_3As(OH)_2$.

We are undertaking a systematic study of the action of chloramine-T on the organic derivatives of the elements of Groups 5 and 6, and the tertiary phosphines in this respect come midway between the sulphides and the arsines, the final product depending primarily on the nature of the tertiary phosphine. Thus tri-*o*-tolylphosphine gives a true phosphinimine, $(C_7H_7)_3P \rightarrow NSO_2C_7H_7$, (*A*), and no other product has been detected: tri-*p*-tolylphosphine gives a mixture of the phosphinimine isomeric

with (*A*) and the corresponding hydroxy-sulphonamide, $(C_7H_7)_3P(OH).NHSO_2C_7H_7$, (*B*). Tri-*m*-tolylphosphine apparently gives no phosphinimine, the only product isolated being the hydroxysulphonamide isomeric with (*B*).



These results are apparently determined chiefly by the position of the methyl group relative to the phosphorus atom. The co-ordinate link in (*A*) will tend to give the P and N atoms a weak positive and negative charge respectively, $(C_7H_7)_3\overset{+}{P}\rightarrow\overset{-}{N}SO_2C_7H_7$; simultaneously, however, the polarity induced by the three *o*-methyl groups will tend to give the P atom a negative charge. The polarity of the co-ordinate link is thus suppressed and a stable phosphinimine results. In the *p*-compound, the effect of the methyl groups is similar but, owing to the greater distance involved, definitely weaker: hence the formation of both the phosphinimine and the hydroxysulphonamide. In the *m*-compound, however, the polarity induced by the methyl groups reinforces that of the co-ordinate link, and therefore, as with the arsines, the hydroxysulphonamide alone results.

This interpretation of our results obviously requires considerable further confirmation, which we are now seeking with aromatic phosphines containing other electropositive or electronegative groups: meanwhile, aliphatic phosphines apparently all give stable phosphinimines. We are also attempting to prepare a dissymmetric phosphinimine, $R_1R_2R_3P\rightarrow NSO_2C_7H_7$, in which R_1 contains an acidic or basic group for salt formation, since such a compound should clearly be capable of resolution into optically active forms.

E. J. CHAPLIN.
F. G. MANN.

Chemical Laboratory,
University of Cambridge.
March 29.

[1] Mann, *J. Chem. Soc.*, 958; 1932.

Multiple Laue Spots from Aluminium Crystals

INVESTIGATING the distribution of the intensity along the Laue spots from thick (6 mm.) deformed aluminium crystals, we have found that it depends strongly upon the degree of the plastic deformation. The spots from a thick undeformed crystal are elongated radially and uniformly black (Fig. 1). Each portion of the spot is formed by rays reflected from a corresponding region of the crystal along the beam. The spots from the same crystal only slightly plastically deformed (0·5 per cent) are no longer uniformly black (Fig. 2). The blackening increases on the ends of all spots and also in the inner parts of several spots. The spots become double or triple and similar to the multiple spots which have been described in other investigations[1]. This result indicates that the exterior layers, and certain layers situated inside, scatter more energy and therefore are more imperfect than other layers. We conclude that the degree of the plastic deformation and, therefore, the distribution of the residual stresses along the path of the beam are not uniform. The dependence of the doubling on the distance from the crystal to the photographic plate is an indication of the focusing property of the differently oriented blocks, situated along the path of the beam (the beam was one of small divergence). It seems that

FIG. 1. Laue spots from an undeformed crystal.

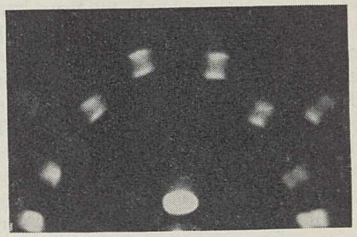


FIG. 2. Laue spots from a deformed crystal.

multiple Laue spots which have been described in previous investigations[1] may be due to the reversible or irreversible changes of the perfection of the crystals and also to the focusing in the case of the deformed crystals.

A. KOMAR.
W. OBUKHOFF.

Physical-Technical Institute
of the Ural,
Leningrad.
March 9.

[1] Y. Sakisaka and I. Sumoto, *Proc. Phys.-Math. Soc. Japan*, (3), **15**, 211; 1931. C. S. Barret, *Phys. Rev.*, **38**, 832; 1931. L.-S. Cork, *Phys. Rev.*, **42**, 749; 1932.

Height of the Aurora in Canada

DURING the winter of 1932–33, a number of measurements of the height of the aurora borealis were made at Saskatoon (lat. 52° 07′ 53″ N., long. 106° 37′ 47″ W.). It was found that the height at which the lower limits of the auroral arcs and bands were most frequently seen was 105 km., a value in

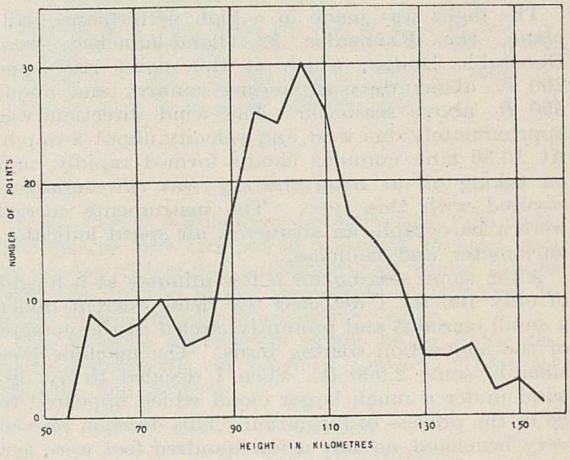


FIG. 1.

close agreement with that found by Størmer and others in Norway. Fig. 1 shows the distribution curve, the number of auroral points measured being plotted against their height in kilometres. In plotting this curve, 220 points were used and they were taken in 5 km. groups.

Størmer[1] has stated that the lower limit of height observed in Norway is 80 km. In connexion with this, our observations of April 16 and April 20, 1933, are particularly interesting. On these two occasions bands were photographed the lower limits of which were at a height of only 60 km. Thirty-seven measurements were made on auroral features the heights of which were less than 80 km., and eighteen of these showed heights of less than 70 km., the lowest recorded being 59 km. In these photographs the intensity was good and the edge of the aurora clearly defined. The calculations were made by the 'network chart' method of Harang and Tonsberg[2], and the direction of the displacement of the aurora relative to the fixed stars was quite favourable. The length of the base line used for the photographs was 112 km.

In addition to the results described above, several measurements were made on long ray structures in the aurora. One of these was found to extend from a height of 336 km. at its upper limit to a height of 71 km. at its base, while a second extended from 155 km. to 74 km. It therefore appears that, in Western Canada, the lower limit of the auroral displays is nearer to the earth's surface than in Norway.

These results will be published in detail later as part of the Canadian contribution to the International Polar Year work.

T. ALTY.
F. J. WILSON.

University of Saskatchewan,
Saskatoon, Saskatchewan.
March 10.

[1] Størmer, "Photographic Atlas of Auroral Forms", Supplement 1, p. 8.
[2] Harang and Tonsberg, "Investigations of the Aurora Borealis at Nordlys Observatoriet, Tromso", *Geofys. Pub.*, 9, No. 5; 1932.

Meteorology of a Gliding Flight

As meteorologists have shown a certain amount of interest in the experience of glider pilots, the following brief account of my flight from Dunstable to Rayleigh, in Essex, on April 22 may be worth recording.

The flight was made in a high performance sailplane, the Rhönadler 32, hand-launched from Dunstable Downs, which at this point rise some 200 ft. above the surrounding country and about 850 ft. above sea-level. The wind direction was approximately due west and velocity about 8 m.p.h. At 10.30 a.m. cumulus clouds formed rapidly, and on taking off at noon the sky was three-quarters covered with this type. The instruments carried were a barograph, an altimeter, air speed indicator, variometer and compass.

After slope soaring for a few minutes at a height of only 100 ft., I detected the rising current under a small cumulus and promptly circled in the manner of the convection soaring birds. The machine rose steadily some 2,000 ft., when I decided to fly upwind under a much larger cloud which appeared to be in the process of formation. This decision proved very beneficial, as only a few hundred feet were lost in the journey, and height was very rapidly regained under the cloud. At 3,500 ft. I entered the cloud base and thus commenced my first cloud flight with neither parachute nor appropriate instruments—a distinctly stirring experience. The rising current inside the cloud was considerably more violent than underneath it, so much so that one felt definitely forced into the seat. Unfortunately, my variometer, an experimental type, was not working very well so I cannot say what was the maximum rate of climb. I emerged from the side of the cloud at approximately 5,000 ft. above the start in brilliant sunshine and steered in a south-easterly direction, finally landing near Southend; an approximate distance of 54 miles from the start.

The flight could undoubtedly have been prolonged but for the fact that London's smoke caused a thick haze, and the cloud form degenerated into a stratiform type with only a weak rising current.

The lowest altitude recorded was 1,200 ft., but circling under and into a cloud again restored me to 5,000 ft.

Perhaps meteorologists could tell us if a sensitive thermometer would be useful in detecting rising air and also indicate, generally, how sailplane pilots can assist the science of meteorology.

G. E. COLLINS.

London Gliding Club,
Dunstable,
Beds.

Field Studies and Physiology: a Further Correlation

IN a previous letter to NATURE[1] one of us directed attention to certain striking correlations between the findings independently arrived at by physiologists in the laboratory and students of bird behaviour in the field. Since then a further parallelism has come to light which it seems of sufficient interest to record. Wiesner and Sheard[2] state that partial removal of the prepituitary in adult male rats usually results in what they style 'partial diserotisation'. The normal copulatory process consists in a definite and rapid sequence of acts. In partially hypophysectomised males, the sequence is usually slowed down and interrupted, consisting merely of hesitant acts of mounting, often abortively repeated many times.

Observations on moorhens (*Gallinula chloropus*) show that behaviour of a similar nature is often encountered in the wild state. Here too the normal male mating process consists of a sequence of actions, usually performed very rapidly so as to appear like a unitary act. During cold disagreeable weather, however, the sequence is often much slowed down, and interrupted in the middle. For example, after mounting on the female's back, the male may appear confused, and after an interval of hesitation descend without proceeding further. Or the sequence may be interrupted earlier, for example, after the male has merely placed a foot on the female's back. A curious fact is that such incomplete sex behaviour usually ends in the male viciously pecking the female.

Such behaviour is to be observed in the same birds which on previous fine days had been mating normally. The cold appears to act more or less quantitatively, very cold weather entirely extinguishing all sexual behaviour, moderate cold inducing only slight 'diserotisation'. Poultry-keepers are familiar with similar effects of cold weather on cocks.

Pavlov[3] has observed similar phenomena in non-sexual reactions in his experimental dogs, both as regards the dissociation of acts normally associated, and in the slowing down and the meaningless repetition of acts. In addition, 'negativism', a negative reaction to a stimulus which usually induces a positive reaction, is often seen: this may be compared with the male moorhen's incomplete

sexual behaviour terminating in an attack on the female. Pavlov speaks of these phenomena as hypnotic, and ascribes them to special types of spread of inhibition in the cortex.

We have thus similar modifications of normal action due in one case to glandular deficiency, in another to depressant external conditions, and in a third to psychological causes. Further investigation of such phenomena, whether in the field or the laboratory, should be of great interest for the science of animal behaviour.

JULIAN S. HUXLEY.
ELIOT HOWARD.

King's College, London, W.C.2,
and Clareland, Stourport.
April 12.

[1] NATURE, **129**, 166, Jan. 30, 1932.
[2] NATURE, **132**, 641, Oct. 21, 1933.
[3] *Character and Personality*, **2**, 189; 1934.

Rings of Cork in the Wood of Herbaceous Perennials

APPARENTLY the only plants reported to have successive rings of true cork in the wood are certain species of *Sedum*[1,2]. There are, however, the closely related cases of *Gentiana cruciata*, *Aconitum Lycoctonum*, *Salvia* spp.[3], *Delphinium* spp.[4,5], and *Mertensia* spp.[6], in which cork develops to some extent in the xylem, but is rarely found there in the form of concentric layers. In these plants, as also in *Sedum* spp., internal cork is said to arise in connexion with the splitting of the rhizome or root into strands and the segregation of vascular bundles directly connected with effete leaves and annual shoots. There are also on record[7] examples of localised and anomalous cork layers round groups of vessels in the wood of various species. Finally, there is the case, recently described by Lemesle[8], of concentric suberised layers in the wood of *Hymenocrater* spp.; but here, no cork cambium is formed and the suberised layer is properly described by Lemesle as a pseudoperiderm.

My discovery of concentric rings of periderm, as a constant feature, in the wood of older subterranean organs of several herbaceous perennials, namely *Epilobium angustifolium*, L., *E. latifolium*, L., *Gaura coccinea*, Nutt. and *Artemisia dracunculoides*, Pursh. is therefore of interest. In the first of these species, the horizontal roots, likewise the underground 'stumps' of former aerial stems, may live for many years, and each year may send up flowering shoots. As many as twenty concentric rings of periderm have been observed in the wood of old roots, while numbers ranging from one to ten have been commonly encountered. The 'wood' of this species includes not only vessels and fibres but also a large proportion of phlœm and parenchymatous elements. Each summer a zone of periderm arises in the parenchymatous part of the wood formed near the close of the previous summer, or less frequently in a more deep-seated position in the wood. When mature this interxylary periderm commonly consists of two or three layers of cork cells with alternating layers of non-suberised cells.

The point of chief interest here is the development of interxylary periderms in relation to the dying down of flowering shoots and the origin of new annual shoots. Each new interxylary periderm arises in June, between the wood that served last year's aerial stem and the thin sheet of new wood connecting with the young shoots. Above the point of insertion of the uppermost of the new shoots, very little, if any, new xylem develops, and in that region this internal periderm makes connexion across the phlœm with an external periderm. Furthermore, the interxylary periderm extends as a continuous layer throughout the entire subterranean system with the exception of the younger roots. As a consequence, the various tissues in direct connexion with the new shoots are segregated by a barrier of cork from necrotic tissues as well as from the older wood. The younger parts, fitting in sleeve-like fashion over the older decadent cylinder, are therefore protected against possible desiccation and invasion of destructive organisms. For, as the 'stump' of a floral shoot disorganises, a broad, hollow path, bordered mainly by soft tissues, becomes exposed to various external agencies. Thus the interxylary periderm may function in somewhat the same way as does suberised tissue below the abscission layer of a leaf. Persistence of plants in particular locations may be largely due to the protection afforded by this internal suberised barrier.

In both species of *Epilobium* and in *Gaura coccinea*, fission of older roots into strands commonly occurs. This phenomenon is related to the occurrence of concentric rings of interxylary cork and to the mode of production and dying back of shoots and of rootlets. Nevertheless, fission in these species differs in certain important respects from all previously described examples[2,3,4,5,6] of this phenomenon.

The discovery of interxylary cork reported here raises questions regarding the general occurrence and the significance of the internal suberised barrier as well as questions concerning the physiology and ecology of perennating herbs devoid of this structural feature. I would welcome references to literature and comments bearing upon these problems. Detailed descriptions of the subterranean organs of the species in hand are now being prepared for publication.

E. H. Moss.

University of Alberta,
Edmonton, Canada.
March 14.

[1] Solereder, H., "Systematic Anatomy of the Dicotyledons", Oxford, 323, 1908.
[2] Jost, L., *Bot. Z.*, **48**, 503–512; 1890.
[3] *ibid.*, 433, 485, 501.
[4] Kingsley, M. A., *Bull. Torrey Bot. Club*, **38**, 307–318; 1911.
[5] Pfeiffer, H., "Linsbauers Handb. der Pflanzenanatomie", Bd. 9, 191; 1926.
[6] Skutch, A. F., *Ann. New York Acad. Sci.*, **32**, 1–52; 1930.
[7] Lemesle, R., *Bull. Soc. Bot. France*, **75**, 272; 1928.
[8] Lemesle, R., *C. R. Acad. Sci.*, **186**, 455; 1928.

The Neutrino

ALTHOUGH it seems very unlikely that neutrinos, after having been emitted in a nuclear process, give rise to any detectable ionisation[1], we would like to point out that it is not impossible in principle to decide experimentally whether they exist.

One possible experiment would be to check the energy balance for the artificial β-decay. Take, for example, the process

$$B^{10} + \alpha \rightarrow N^{13} + \text{neutron}$$
$$N^{13} \rightarrow C^{13} + e^{+} + \text{neutrino}.$$

One can safely assume that if the positive electron is emitted with the greatest possible energy, the kinetic energy of the neutrino will just be zero. The balance of energy in this case will therefore determine the mass of the neutrino. For this purpose one would have to know the mass defects of B^{10}, C^{13} and the

neutron*, the kinetic energy of the α-particles and the neutrons and the upper limit of the spectrum of the emitted positive electrons.

A second way of deciding the question would be to observe the recoil of the nucleus in β-decay. With natural β-rays this is in practice impossible because the recoil energy is too small, but the nuclei involved in artificial β-decay are much lighter. The kinetic energy of recoil of a disintegrating N^{13} nucleus would be of the order of some hundreds of volts if there were no neutrinos. If the neutrino hypothesis is correct, there would be a defect of momentum which would be uniquely connected with the lack of observable energy in each individual process.

In addition to the nuclear processes mentioned in our previous communication, it may also be expected that a nucleus catches one of its orbital electrons, decreases by one in atomic number, and emits a neutrino. (A corresponding process with increase in atomic number is not possible because of the absence of positive electrons.) This process further limits the possible mass differences between stable neighbouring isobares, and particularly between neutron and proton. If the hydrogen atom is to be stable, we must have (for the masses):

Proton + electron < neutron + neutrino.

The probability of such a process is less than that of a process involving emission only, the energy of the neutrino being the same. The reason is that the momentum of the electron, which enters in the third power, is about a hundred times smaller. But even for a surplus energy of 10^5 volts, the life-period of hydrogen would be only 10^{10} years, which seems incompatible with experimental facts. If therefore the neutrino is not heavier than the electron, the neutron must be at least as heavy as the proton.

H. BETHE.
R. PEIERLS.

Physical Laboratory,
University, Manchester.
April 1.

* The accuracy with which the mass of the neutron can be determined at present is, however, far from being sufficient for this purpose.

[1] H. Bethe and R. Peierls, NATURE, **133**, 532, April 7, 1934.

Optical Constants of Alkali Metals

A NUMBER of recent researches[1] have shown that electrons in some metals—in the first place in alkali metals—can be considered with sufficient approximation as free. The transparency of alkali metals in the ultra-violet region discovered by Wood[2] has been recently explained by Zener[3] from the point of view of free electrons. Immediately after the publication of Zener's communication, we calculated the optical constants n and k of the alkali metals, using the free electron gas model and taking into account the collisions of the electrons with the atomic lattice, and we obtained satisfactory agreement with the measured values.

Kronig in a recent letter[4] states that the calculation of the optical constants of alkali metals can be carried out with the help of the formulæ of his dispersion theory in metallic conductors if one takes into consideration only the free electrons. In connexion with this, it is interesting to note that our calculations based on the simple Sommerfeld theory of metals give the same results, as can be inferred from the comparison of our results with the numerical values published by Kronig. Our calculations have been made taking into account (1) the motion of free electrons under the influence of the variable external field, (2) the collisions which stop this motion. The average velocity of electrons was calculated in just the same way as in the Lorentz theory of the collision damping. With this average velocity the current is obtained, which is substituted in Maxwell's equations. The complex dielectric constant is given by the final formula

$$\varepsilon = 1 - \frac{\omega_0^2}{\omega^2}\frac{(\omega\tau)^2}{1+(\omega\tau)^2} - i\,\frac{\omega_0^2}{\omega^2}\frac{\omega\tau}{1+(\omega\tau)^2},$$

where $\omega_0^2 = 4\pi Ne^2/m$ and τ is the time between two successive collisions of the free electron with the lattice calculated according to the Sommerfeld formula from the specific conductivity. The formula contains two parameters which are determined by non-optical measurements: (1) the specific conductivity, σ; (2) the number of electrons, N, per

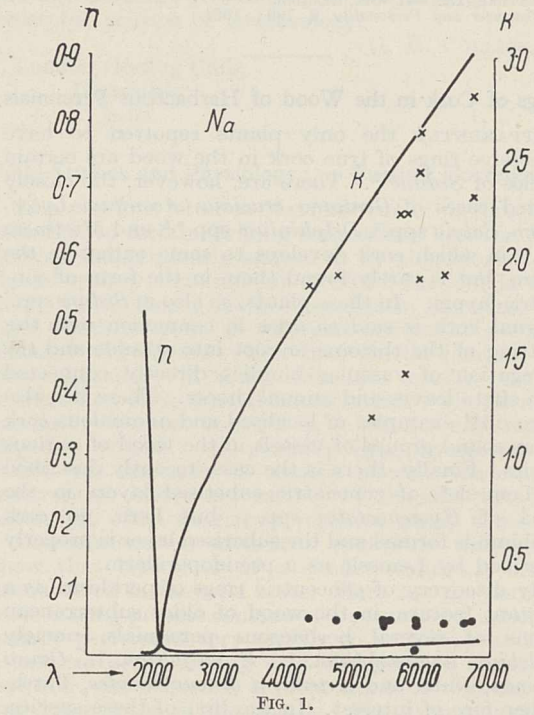


FIG. 1.

cm.^{3}. Putting $\varepsilon = (n - ik)^2$ we obtain n and k represented for the case of sodium by the curves in Fig. 1. Dots and crosses denote the measured values[5] n and k.

The scattering of experimental values is very large, which is explained by the low accuracy of measurements, due to the difficulty of preparing a clean metallic surface. For potassium the agreement with regard to n in the region of small values is somewhat worse, but the order of magnitude remains the same. The values of k in this case came out better than for sodium. When $\omega\tau < 1$, our formulæ go over into the classical expressions of Drude.

J. HURGIN.

Physical-Mechanical Institute,

N. PISARENKO.

Physical-Technical Institute,
Leningrad, 21.
March 13.

[1] O'Bryan and Skinner, *Phys. Rev.*, **44**, 602; 1933.
[2] Wood, *Phys. Rev.*, **44**, 353; 1933.
[3] Zener, NATURE, **132**, 968, Dec. 23, 1933.
[4] Kronig, NATURE, **133**, 211, Feb. 10, 1934.
[5] Landolt-Börnstein, "Phys. Chem. Tab."

Research Items

Pathology and Deformation in Ancient Egypt. A theory to account for the peculiarities of the human body as depicted in the art of Amarna recently put forward by Herr Felix Proskaues is discussed by Dr. Edith M. Guest in *Ancient Egypt and the East*, 1933, Pts. 3–4. The theory in question suggests that rickets was widespread in Egypt from the time of the Heliopolitan priesthood, who derived their influence from the discovery of the healing powers of the sun, this also explaining Akhenaton's devotion to sun worship. As against this theory, it is pointed out that neither was the anti-rachitic vitamin D likely to have been deficient in the food of the ancient Egyptians nor were the conditions of their life such that they would have suffered from a deficiency of sunlight owing to avoidance of excessive heat. The dwarfism, of which there are representations in Egyptian art, is not rachitic but achondroplastic. Five, and probably all six, of the representations of dwarfs at Amarna exhibit the inward turning feet due to talipes, which is of a pathological origin quite different to rickets. Turning to the evidence of osteology, among the thousands of skulls which have been examined, there is no evidence of rickets. It is suggested that the peculiar head form of the royal family is an inheritance of hyperdolichocephaly due to a deformation of the pelvis ; but there is no evidence to support the view that hereditary dolichocephaly could be produced in this way, or that a flat pelvis prevailed at any time in Egypt. The figures given by Dr. G. M. Morant from early predynastic to Roman times show no evidence for any progressive rachitic dolichocephaly. Although owing to the destructibility of the pelvis the evidence is not exhaustive, no flat pelvis has been recorded. The exaggerated female waist found in certain of the Amarna figures is probably due to a ritual dress.

Seasonal Festivals in Sumeria, Persia and India. In the *Indian Antiquary* for December, Dr. B. C. Mazumdar institutes a comparison between two Hindu social customs and the Babylonian and Persian Sacæa with the view of illustrating the historical significance of the former. Of these, one is a very ancient custom obtaining in the Chauhân ruling houses of Sonpur and Patna in western Orissa, the object of which is to give a fresh lease of life to the ruler in a magical way. In the bright fortnight of the lunar month of Âśvin, a Brahmin goes out riding on a pony, declaring that he has become ruler of the territory. He returns to the palace to doff his authority in a ceremonial at the close of which the rajah takes his place. It is to be noted that the Sumerians began their year in the autumn, just as in ancient India, where the carnival of the 'Lord of Misrule' took place. In this festival a pseudo-king was set up during the five or six days of the carnival, and on the final day he was hanged or scourged. At a later period, in Babylonia and Assyria the New Year was transferred to the spring ; but the old calculation was retained and there were thus two New Year festivals, the custom also passing into Persia. The Persian festival shows a close resemblance to the Hindu *Holi* festival. In the Sacæa festival a bogus king rode naked through the crowd, over whom reddened water carried in pots was bespattered. In some of the villages of Bengal the practice still survives of dressing up a fool in a funny fashion and carrying him on a litter through the streets, while the crowd sing obscene songs and sprinkle one another with reddened water. The fool is called 'King of the *Holi* festival'. In many districts an earthen *mañca* is erected with three graduated floors, on the topmost of which an idol of the presiding deity is seated for purposes of worship. This structure bears a close resemblance to the ziggurat. The *Holi* festival, it is noted, does not appear in the Vedic literature, and is evidently a feast of the people.

Transport of Tetanus Toxin to the Central Nervous System. Tetanus or 'lock-jaw' is caused by the action of tetanus toxin upon the brain and spinal cord. A wound becomes infected with the tetanus bacillus, which there forms its poison or toxin, and when the toxin reaches the central nervous system, the spasms and convulsions characteristic of the disease result. In the past it has been held that the toxin is not conveyed by the blood or lymph, but by the nerves themselves, either by the nerve fibrils, by the neural lymphatics, or by the nerve tissue spaces, according to different hypotheses. These views are not accepted by Prof. John Abel in his presidential address to the American Association meeting at Boston in December last (*Science*, **79**, 1934, pp. 63 and 121). He points out that there is no valid evidence that nerve fibrils convey toxin. Experiments with convulsant dye-stuffs show that these reach the brain by way of the circulating blood. As regards the neural lymphatics, recent anatomical studies show that these do not discharge into the cerebro-spinal fluid, but into the lymph glands of the general lymphatic system, nor does it seem possible that the tissue spaces of the nerves are capable of conducting the toxin. Prof. Abel concludes, therefore, that tetanus toxin reaches the central nervous system by the circulating blood. He also finds that, contrary to the old ideas, after an injection of toxin, the toxin does not quickly disappear, but considerable amounts persist in the blood and lymph up to the time of the death of the animal.

Crabs in Corals. The crab genus *Cryptochirus* consists of small crabs occupying pits in heads of living coral. There is no means of boring into the coral skeleton, therefore the pit is produced by the growth of the coral about the crab, which when young settles down in a calicle, causes the death of the polyp therein, and remains more or less passive while the living material is gradually laid down about it by the activity of the surrounding coral polyps. Dr. C. H. Edmondson ("*Cryptochirus* of the Central Pacific", *Bernice P. Bishop Museum, Occasional Papers*, **10**, No. 5 ; 1933) describes four new species and gives notes on two others. One of these new species, *C. minutus*, is shown to have a peculiar zoea which has a close resemblance to that of *Haplocarcinus marsupialis*, Stimpson, inhabiting galls on many species of corals, an interesting fact which helps to clear up the question of the affinity of the two genera, about which there has been some discussion. *C. minutus* is a small species, the female with carapace only 3 mm. long, inhabiting pits in *Cyphastrea ocellina* and *Leptastrea purpurea*. Some of the pits concealing the females reach a depth of 12 mm. and many are curved or angular in their course. The males, about 1·5 mm. long, do not

inhabit the pits with the females, but are found on the surface of the coral in shallow depressions or in a calicle in which the coral polyp has been destroyed.

Systematic Position of Stromatoporoids. In a paper on *Gypsina plana* and on the systematic position of the Stromatoporoids (*Quart. J. Micro. Sci.*, **76**, Pt. 3, Jan. 1934) Prof. S. J. Hickson states that the study of the collection of large specimens of this species made by Prof. J. Stanley Gardiner in the Indian Ocean, suggested to him there was some relationship between these large Foraminifera and the ancient Stromatoporoids. Recent investigation of specimens collected by Dr. Crossland in Tahiti has confirmed his opinion and he has now no doubt that the Stromatoporoids were Foraminifera, a view that was held last century by W. B. Carpenter and others. All the specimens from the Pacific and Indian Oceans, the Red Sea and the West Indies belong to the same variable species and this may lead to a reconsideration of the validity of the specific distinction of many other sedentary Foraminifera. Two small examples of *Gypsina* are described; they are thin flat discs, 0·6 and 0·9 mm. in diameter respectively, and each exhibits a central chamber surrounded by a spiral of five or six chambers, and a thin crust of thin-walled acervuline chambers. It is suggested these may possibly be the microspheric forms, the large encrusting examples being the megalospheric forms. A detailed description of the encrusting forms is given. The systematic position of the Stromatoporoidea is fully discussed and the author points out that if the current view is maintained that the fossil forms referred to the Stromatoporoidea were Hydrozoa, then it follows that the Hydrozoa were in existence in Early Palæozoic times; but if, as the author concludes, they were allied to recent Foraminifera, then there is no clear evidence of the existence of Hydrozoa earlier than late tertiary times.

Classification of the Poppy. The cultivated poppy and the sesame have been the subjects of detailed investigations by the Institute of Plant Industry, U.S.S.R. In "The Poppy" (Supplement 56, *Bull. App. Bot., Gen. and Plant Breeding*, 1933, Institute of Plant Industry, Leningrad), Vesselovskaya offers a new classification of *Papaver somniferum*, L. based on geographical and ecological principles. The author also gives an interesting historical survey of the cultivation of the crop for both oil and opium; this, together with linguistic evidence, is used to support his hypothesis about the origin of the cultivated poppy. The investigation is based on a collection of 1,600 samples of seed from various parts of Europe and Asia, all of which were sown in different stations in the U.S.S.R. The species falls into a series of seven individual geographical races, formed under the special climatic features of certain areas. The parellelism of ecological types of the cultivated and dehiscent poppy indicate that the biological differences of form within the species are due to the prolonged action of various climatic conditions which occur over its area of distribution, stretching from the Atlantic to the Pacific, and from lat. 61° N. to India. The author differs from Bazilevskaya in attaching no value to the open or closed condition of the capsule for classification purposes, and in dividing the sub-species into a greater number of varieties according to the colour of the flowers and the shape of capsule.

Antirrhinum Rust. Snapdragons have recently been observed to suffer from a rather severe rust disease. Mr. D. E. Green, mycologist to the Royal Horticultural Society, first noticed the trouble in the early summer of 1933, and has since found that many gardens are infected ("Antirrhinum Rust, a Disease new to Great Britain, caused by the Fungus *Puccinia antirrhini*, Diet. & Holw." *J. Roy. Hort. Soc.*, **59**, 119, Feb. 1934). Symptoms of the disease are described—brown-coloured pustules on the under sides of leaves—and the fungus is shown to produce uredospores and teleutospores. The latter can germinate to form basidiospores, but these cannot apparently infect snapdragon plants, and no alternative host is yet known. It is suggested that the fungus persists on plants kept through the winter, and produces uredospores when conditions are suitable. Control has been effected in Canada and America by dusting infected plants with flowers of sulphur, whilst the temperature is maintained over 72° F. at least twelve hours a day for three days.

Protection of Stored Rice. According to a Mail Report issued by Science Service, Washington, D.C., a new method of protecting rice stored in bulk from insect attack has been tested by Dr. E. R. de Ong, consulting entomologist of the city of San Francisco. Weevil injury to stored stocks of rice becomes very severe when the stores have to be carried through the summer until the late fall. If unchecked, it may result finally in an almost complete destruction of the rice. It has been found that coating rice with finely powdered calcium carbonate has given encouraging results under experimental conditions. In a jar of uncoated rice, living rice weevils and bran bugs were introduced. A similar number of these creatures were likewise placed in another jar to which one per cent of calcium carbonate had been added. At the end of the year following the hot summer weather, the number of weevils in the coated rice remained stationary, that is, there had only been sufficient breeding to equal those which died. In the uncoated rice the weevils had increased by more than one thousand per cent. The weevil attack in the uncoated rice resulted in a loss in weight of 42 per cent—a cubic foot of the coated rice weighed 76 pounds, and the uncoated rice 44 pounds.

Jurassic Cephalopods of Kachh (Cutch). The "Revision of the Jurassic Cephalopod Fauna of Kachh (Cutch)" by Dr. L. F. Spath, which has been in course of publication since 1927, has now been completed (*Palæont. Indica*, N.S., 9, Mem. 2, part 5, 1931, pp. 551–658, pls. 103–124; part 6, 1933, pp. 659–945, pls. 125–130). Although nominally a revision of the work of Waagen (1875) it deals with a vast amount of new material. The author has examined more than 6,600 specimens, in which he recognises 23 species of belemnites, 12 of nautili and 521 of ammonites. The deposits, which have an estimated thickness of more than 6,000 ft., range in age from Bathonian to Tithonian and show a general agreement with the stratigraphical succession in Europe. The systematic part of the monograph, dealing with 556 species, may appal the stratigraphical geologist, but he will read with interest the concluding chapters on the analysis of the fauna, the palæontological conclusions, and the comparison of the fauna with those of similar age in all parts of the world. The author rejects Buckman's view of the universal distribution of ammonite zones since, at the present day, no group

of marine animals shows a world-wide range, and moreover in the Kachh fauna at least 400 out of the 556 species are to be regarded as local in their distribution. Waagen noticed the identity or resemblance of some species to those found in Europe, especially in the Mediterranean region. Further work, however, has considerably reduced the percentage of the species common to the two regions. Unlike many palæontologists, Dr. Spath, after a prolonged and extensive study of ammonites, has come to the conclusion that the evidence of ontogeny is of very little value as an indication of phylogeny and may be altogether misleading. Similarly, current views on orthogenesis find no favour in his eyes. We also read (p. 837) that faunal identity in different areas "may indicate anything but contemporaneity". A summary of Spath's views on the evolution of the Cephalopoda has been given elsewhere (*Biol. Rev.*, 7, 4, 418; 1933).

A New Test for Large Mirrors. In the April number of the *Observatory* appears a report of the meeting of the Royal Astronomical Society at which Prof. Zernicke propounded the wave theory of Foucault's test and a new method of testing optical surfaces, and Mr. Burch described the practical application of Zernicke's method. The method is extremely powerful, and errors in a mirror surface of the order of a tenth of a wave-length of light show up very clearly. An advantage of the new method is that the high and low areas of the imperfectly-shaped mirror appear in different colours, and it is much easier to decide which is a high and which a low area and polish accordingly. It is impossible to do justice to the method in a few words, but briefly, it consists in illuminating the mirror with a pin-hole source, and examining the image of this source through a tiny disc which retards the phase of the light by a fraction of a wave-length. Mr. Burch makes these phase-discs by pouring an acetone solution of resin into water and collecting the globules of resin which are precipitated. These are then pressed into small discs between microscope slides. The smallest discs are about 1/400 mm. in diameter.

Copper Oxide Rectifiers in Ammeters and Voltmeters. For the measurement of small alternating currents and voltages, the copper oxide rectifier used in conjunction with a moving-coil instrument possesses far greater sensitivity than any other arrangement. It is probable that this combination will be used extensively in the future. Hence the paper read by Dr. E. Hughes to the Institution of Electrical Engineers on March 2 on the accuracy of these combinations is a timely one. His tests show that the introduction of a rectifier into a circuit distorts the current wave and causes a rectifier ammeter calibrated as usual with a sine wave to read low. When used in conjunction with a current transformer, it is shown that the ratio of the primary to the secondary current may be rendered practically independent of the current frequency and wave form in two different ways. One of these is simply to design the transformer so that the secondary winding has a very large self-inductance. A paper was also read by R. S. J. Spilsbury in which he describes an instrument incorporating a copper oxide rectifier which gives the 'form-factor' of an alternating current wave by a direct reading. The 'form-factor', that is, the ratio of the effective value of a wave to its mean value, is of importance in several branches of electrotechnics. For example, it is necessary to know this quantity before we can compute the voltage of an alternator or calculate the eddy current losses when testing transformer steels. This instrument is being developed in the National Physical Laboratory.

Wireless Reception in Naval Ships. A paper read by Dr. W. F. Rawlinson before the Wireless Section of the Institution of Electrical Engineers on March 7 discussed problems encountered in the reception of wireless signals in naval ships, and described certain features of the types of apparatus which have been developed for this application. In a man-of-war, the choice of receiving aerials is limited, and it frequently becomes necessary to operate several receivers on different wave-lengths from the same aerial. Furthermore, in large ships the central receiving-room is placed well down below armour, and the distance between the foot of the aerial and the receivers may be up to 100 ft. The receivers themselves must be of robust design capable of withstanding the shock of gunfire and of working for years with a minimum of attention in a salt-laden atmosphere at temperatures varying from tropical heat to arctic cold. Three standard types of receiver were described in the paper, for short, medium and long waves, the total frequency range thus covered being 15–23,000 kilocycles per second. These instruments must be capable of rapid tuning to any predetermined wave-length; and they must be sufficiently selective to receive weak signals, which are invariably in Morse code, in the presence of a much more powerful signal on a different wave-length, transmitted either by the same or a nearby ship or by a shore station. The concluding portion of the paper dealt with the question of power supply to receivers. Common batteries are used to a large extent, but trials are being made with plant designed to take the supply from the ship's mains, special devices being incorporated to stabilise the output in the presence of considerable variation of the main's voltage.

Testing Petroleum Stills. A paper was read by A. H. Goodliffe on the practical testing of a continuous petroleum still before a joint meeting of the Institutions of Chemical Engineers and Petroleum Technologists on March 21. The paper gave a description of a plant on which experiments have been carried out, together with results obtained, and further included a detailed log of a particular run of the plant; there followed calculations on the plant and equipment and, finally, qualitative analyses of one of the distilling columns with special reference to the action of bubble trays in promoting fractionation. The description of plant included an explanation of a flow diagram of the continuous still employing two towers of similar design, with further details of heating equipment, duplex pumps for feeding the crude to the plant, and automatic temperature control. The log of the run of the plant set forth full details of a trial made last year both as regards specification of the crude, residue and product, which in this case was white spirit. The most constructive part of the paper, however, was that dealing with calculations on plant and equipment, which provided much valuable information usually only available from internal reports of refineries. No special apparatus was required to secure the necessary information for determining balances, performance and efficiencies beyond that in normal use in all refineries, and much of the testing apparatus used did not transgress the normal chemical requirements of all oil testing laboratories.

Dr. Harlow Shapley

AT the beginning of this year, Dr. Harlow Shapley, director of the Harvard College Observatory and Paine professor of astronomy at Harvard since 1921, was awarded the Gold Medal of the Royal Astronomical Society for his studies of the structure and dimensions of the galactic system. On May 11 he will deliver the George Darwin Lecture of the Society, taking as his subject "Some Structural Features of the Metagalaxy".

Dr. Shapley was on the staff of Mount Wilson Observatory from 1914 until 1921; and during that period probably his most important contributions were the photometric studies relating to stellar clusters. An adaptation of the relation between the apparent brightness and the period of a Cepheid variable resulted in his determination of the now universally accepted 'period - luminosity' curve, by the aid of which great celestial distances are derived.

By means of this or an allied method, Dr. Shapley found the globular clusters to be at distances from 20,000 to 200,000 light-years, a conclusion which revolutionised previous conceptions of the size and arrangement of the stellar universe. His many new ideas on various astronomical topics, especially variable stars, gave rise to pioneer investigations such as a study of spectral changes in Cepheids, whence came his 'pulsation theory' or 'periodic flow and ebb of heat' as the cause of such variation.

DR. HARLOW SHAPLEY

In 1921, Dr. Shapley was appointed Paine professor of astronomy at Harvard University and director of Harvard Observatory. He at once began to plan and carry forward a large variety of celestial explorations, extending from the casual meteor caught in the earth's atmosphere to the remotest nebulous patch on the Bruce photographs of long exposure for metagalactic surveys. His meteor project is apparently the first intensive professional attempt to study shooting stars systematically. A careful examination of about 100,000 Harvard photographs yielded a total of only 550 trails. Since many more meteors can be seen visually than are ever photographed, Dr. Shapley organised, about two years ago, with the assistance of Dr. E. J. Öpik, an expert corps for the study of these objects, with observations in the clear Arizona sky and analysis at Tartu, Estonia. About 26,000 meteors were seen. An interesting first result is that only thirty per cent of the visual meteors are from the solar system, the fainter ones coming from interstellar space. Therein lies a hope of additional knowledge concerning the great ocean of space around us.

A few other subjects in the large observational programme at Harvard may be mentioned. The Magellanic Clouds are being studied intensively by several members of the staff, and have already yielded numerous supergiants, new peculiar spectra, clusters and variables. The programme for systematic examination of the Milky Way in 196 selected regions has already resulted in the discovery of twenty-five hundred new variables and the determination of many periods.

The problem of the extra-galactic nebulæ is now progressing steadily. The publication in 1932 of a catalogue giving the positions and photographic magnitudes of all extra-galactic nebulæ brighter than the magnitude 13·0, left the way clear for observational work on the second survey reaching to the eighteenth magnitude and to the distance of about a hundred million light-years. The number already found on the Harvard plates exceeds one hundred thousand, and five hundred or more are often revealed by the examination of a single photograph.

The long-established practice of the Harvard Observatory in being a collector of facts has thus been continued by Dr. Shapley in many lines of research. The theoretical side is also being stressed; for example, discussions of orbits, statistical studies of star distribution, and researches upon the origin of spectral lines and on the universal abundance of elements.

Dr. Shapley's activities are, however, by no means limited to observatory tasks. All human problems

interest him, and his versatility is illustrated by helpfulness in various educational problems, it may be counselling non-scientific faculties of several colleges as to advantageous research problems, or perchance, advising the Board of Trade of a 'textile' city, during the present collapse of industrial values, as to the most judicious expenditures for educational purposes.

It is not generally known that Dr. Shapley's most interesting recreation is the study of ants. For two years on Mount Wilson, he observed and studied the habits of trail-running ants, seventy thousand of them on some summer days going along each file. Under varying atmospheric conditions, he measured their speed at fixed intervals of distance. The fact was established that their speed is a function of temperature alone, and increases fifteen fold with an increase of 30° C. in air temperature. Conversely, a single observation of the ant-speed led to the prediction of the temperature within 1° C. Thus to his 'period-luminosity' and 'spectrum-period' relations among the stars, he added the 'speed-temperature' relation among ants. Descriptions of some of these observations will be found in the paper "Thermokinetics of *Liometopum apiculatum* Mayr", published in the *Proceedings of the National Academy of Sciences* for April 1920. Dr. Shapley has also studied the morphology of ants, as evidenced by his large collection of worker ants with wing vestiges, described in a "Note on Pterergates in the Californian Harvester Ant" (*Psyche*, **27**, No. 4).

Perhaps his study of ants taught Dr. Shapley not only speed, but also conservation of energy, for with all his other activities, he has found time to compile the "Source Book in Astronomy" and to write books, such as "Star Clusters", and five chapters in the "Universe of Stars", a pioneer series of radio talks given in 1925 by members of the Observatory staff. As a lecturer either at universities or before the general public, he is very successful. Why this is so may be readily understood by reading his small books "Sidereal Explorations" and "Flights from Chaos" based on lectures given at the Rice Institute of Texas, and the University of the City of New York.

A. J. C.

Scientific Research in Relation to Patents in the United States*

SINCE the War, scientists have been called upon by industry in increasing numbers for assistance in overcoming technical difficulties involving such problems as improving old products or processes, or devising entirely new products. This dependency of industry upon science has been particularly marked in the chemical and electrical fields, where large industrial research laboratories have been established for investigating all phases of the products of their respective organisations. From their original task of mere laboratory control of the manufactured products, these industrial laboratories have extended their sphere of activity to such a large extent as to include research in the fundamental sciences. Industrial leaders have come to realise that fundamental research may be of vital importance to industry, for it may revolutionise existing practices or create new ones in the most unexpected quarters.

Patentable Inventions other than Medical

These increasing contacts of scientists with the problems of industry have brought to the fore the difficult problem of adequate remuneration for their services, as well as the problem of giving the public the effective benefit of their work. In many cases valuable solutions have been made to difficulties, which were patentable. Scientists have also begun to realise that many of the fruits of their research have valuable industrial applications which can be patented. The troublesome questions thus arise: Should they proceed to obtain patents? What are the advantages in doing this? What are the disadvantages? A good deal of discussion has already occurred on these questions, but no definite policy has yet been formulated. The investigator who takes advantage of our patent laws is perfectly warranted in his act not only for any possible financial returns but also for the good of the public. The obtaining of some remuneration from a patent is no more debasing or tainted with commercialism than the acceptance of copyright royalties from a text-book or even receiving a salary for teaching. We are at present living in an economic structure in which the making of legitimate profit is a fundamental assumption.

There are many advantages in securing patents for important advances, as only by means of patents can the legal right be secured to exclude others from practising a given process or commercialising a new product. By having such control of new discoveries the investigator is assured that his results will be used only for proper and meritorious purposes. He can prevent the exploitation of the public by dictating the terms under which his patent should be worked and even control the character of the commercial advertising.

Medical Patents

The committee recognises the fact that there exists in many quarters a strong feeling against medical patents. This feeling seems to be largely due to the unpleasant memories of the past exploitation of the public by means of 'patent medicines' which had doubtful or decidedly harmful effects on the public health. Government regulation during recent years has eliminated a great deal of misrepresentation and false claims in regard to this class of goods. The Patent Office, moreover, now seldom issues patents for the old-fashioned type of patent medicines. It is therefore an error to class all medical patents with the former types of 'patent medicines'.

The mere fact that medical patents offer the means of making profits is not a sufficient reason to condemn them entirely. It must be remembered that patents have other very important uses. Moreover, we must bear in mind that it is possible to obtain profits from medical discoveries in many other ways without resorting to patents if the medical investigator is so inclined. We must, after all, depend upon the integrity and character of the investigator when important medical discoveries are involved.

The ideal to strive for may perhaps be that no

* From "The Protection by Patents of Scientific Discoveries", being the Report of the Committee on Patents, Copyrights and Trade Marks. Joseph Rossman (Chairman), F. G. Cottrell, A. W. Hull and A. F. Woods. Occasional Publications of the American Association for the Advancement of Science. No. 1, January, 1934. Supplement to *Science*, vol. 79. (New York: The Science Press.) 50 cents.

medical discoveries should be subject to any restrictions whatsoever. In our present commercial economic system, however, and with existing laws and business practices, such an ideal is difficult to attain, since not all may live up to it. We must, therefore, guide ourselves in accordance with the economic situation that exists to-day and seek to attain our ideals through the existing economic machinery rather than to ignore it entirely on the ground of ethical consideration alone.

The act of securing patents for medical discoveries is not unethical in itself, and such act does not necessarily mean that personal profits are sought. Under our existing laws and commercial practices dedication to the public of important medical discoveries by mere publication is not always the best procedure to follow. The public can often be best served by receiving the benefits of a new medical discovery under the control of a patent. Through making a medical discovery it may become the duty of the investigator to make sure by means of patents that the public will actually benefit from his discovery and not be subjected to unfair exploitation by others who may commercialise his discovery.

Non-patentable Scientific Discoveries

The proposal that the discoveries of scientists be given some legal protection appears on its face to be very reasonable and plausible. It would seem that scientists should be the first to desire such rights as a means of receiving compensation for their contributions to industry and society. A careful analysis of the whole problem, however, has led the committee to the opinion that no effort should at present be made to develop a plan for protecting scientific property. There appears to be no need for such legal protection from the view-point of incentive to the scientist or public policy. The Committee recognises that the present economic crisis has tremendously diminished the normally available funds for carrying on research so that other sources of potential funds are to be carefully considered at this time. It believes, however, that the legal and practical difficulties involved in enforcing any scientific property would eventually arouse an unfavourable public opinion against scientists, owing to the difficulty of enforcing scientific property and the inherent nature of its broad monopoly. The results of irksome scientific monopolies would react to the disadvantage of scientists and thus defeat the very purpose for which this proposal is made.

University and Educational Intelligence

Cambridge.—The Jane Ellen Harrison Memorial Lecture will be given on May 5 at 5 p.m. in the College Hall, Newnham College, by Dr. L. S. B. Leakey, of St. John's College. The subject of the lecture will be "The Problem of the Origin of Man".

Prof. Buxton has been appointed to represent the University at the Twelfth International Veterinary Congress to be held in New York in August.

School libraries in the United States are credited with having contributed in no small measure to the improvement in efficiency which has taken place in the schools in the last three decades. According to the Dean of the Graduate Library School of the University of Chicago, Dr. L. R. Wilson, whose views on increasing the significance of the school library are published in *School and Society* of December 30, the once prevalent use of the single textbook recitation procedure has been superseded by a method of instruction by which many books and materials are studied. Although his theme is the development and fuller utilisation of the school library, his argument implies that its functions are already of great importance. He refers, for example, to the librarian's "responsibility of co-ordination and generalship in the field of supervised study" and to the library being "the principal integrating agency of the entire school". He mentions as deserving imitation the present effort on the part of the librarians of colleges and secondary schools in the Southern States to work out a co-operative plan for supplying school library facilities in rural areas. He advocates the provision, in library schools or teachers' colleges, of training for the part-time teacher-librarian in small schools, and the investigation of a number of problems relating to the school library which, he says, have as yet been only slightly considered. These he proceeds to discuss under the headings: administration, teaching the use of books in libraries, standards for school library service, distribution of library resources, measurement of school library influences. During the past twelve months, the *Journal of Education* (*London*) has published a series of articles, by specialists in various subjects, on the library requirements of secondary and public schools in Great Britain.

Tendencies in university education are discussed in the John Adams lecture given in the Institute of Education, University of London, on October 10 by Dr. E. Deller, principal of the University (London: Oxford University Press. 1*s*.). Dr. Deller examines some of the implications of the growth in number of students which has marked the recent history of so many universities. He discerns a danger of over-mechanisation, and a menace to academic freedom. University administration is susceptible of hypertrophy, as in those Russian institutions where the head is a director, responsible in the same way as the controller of a factory. Extensive student enrolment has led in Germany, where the number of unemployed graduates has been estimated to be 90,000, to other perils: "The university is to-day a temporary haven of refuge," said Prof. Dibelius recently, "for innumerable individuals who otherwise as soon as their school years were over, would sink to the ranks of the proletariat . . . what a dangerous mass of inflammatory, revolutionary material and social embitterment are heaping themselves up now in those old homes of German culture." The number of students in England is not as yet, Dr. Deller thinks, excessive, but he holds that the line of advance for the future must be qualitative rather than quantitative. How views as to the proper functions of a university increasingly diverge he shows by quoting from "The University in a Changing World": in Russia and Italy, and more recently in Germany also, the view prevails that all learning must be related to the dominant political creed. He suggests that universities can best help forward the rehabilitation of a distressful world by ascertaining truth rather than by attempting the adjustments and compromises, which are the proper task of the statesman, and also by extra-mural teaching.

Science News a Century Ago

Anode and Cathode

Faraday, when he read his Seventh Series of "Experimental Researches in Electricity" before the Royal Society in January 1834, made use of a number of new words in describing the electro-chemical phenomena with which the Series is concerned. When, later in the year, the paper appeared in print, some of these terms had been changed, and a footnote added in which it was explained that the alterations had been made in order that the new words should be "only such as were at the same time simple in their nature, clear in their reference, and free from hypothesis". In the interval Faraday had been in correspondence with friends, and the discussion produced that series of terms, essential to electro-chemistry, which has since passed into common usage. One of his correspondents was W. Whewell, afterwards Master of Trinity College, Cambridge, who wrote on May 6 :

"I still think *anode* and *cathode* the best terms beyond comparison for the two electrodes. The terms which you mention in your last shew that you are come to the conviction that the essential thing is to express a *difference* and nothing more. This conviction is nearly correct, but I think one may say that it is very desirable in this case to express an opposition, a contrariety, as well as a difference. The terms you suggest are objectionable in not doing this. They are also objectionable, it appears to me, in putting forward too ostentatiously the arbitrary nature of the difference. To talk of Alphode and Betode would give some persons the idea that you thought it absurd to pursue the philosophy of the difference of the two results, and at any rate would be thought affected by some. Voltode and Galvanode labour no less under the disadvantage of being not only entirely, but ostentatiously arbitrary, with two additional disadvantages ; first that it will be very difficult for anybody to recollect which is which ; and next that I think you are not quite secure that further investigations may not point out some historical incongruity in this reference to Volta and Galvani. I am more and more convinced that *anode* and *cathode* are the right words."

The letter, which is preserved at the Royal Institution, is reproduced in Facsimile in "Faraday's Diary", vol. 2.

Mural Circle for Edinburgh Observatory

On May 6, 1834, at a meeting of the Institution of Civil Engineers, Mr. Simms gave an account of the six-foot mural circle just completed for Edinburgh Observatory. The instrument, he said, differed in no important respects from those at Greenwich. His paper contained a valuable review of the art of dividing instruments. Mr. Simms said that about the middle of the eighteenth century, Mr. Hindley, a clockmaker of York, introduced several important improvements. He gave motion to the plate of a tangent screw, invented a frame for carrying a point, in place of using a knife against the fiducial edge of a ruler, and also introduced the elliptical cutting point. The Duc de Chaulnes was the first who made use of double microscope micrometers in dividing. Ramsden's dividing engine, for which he was rewarded by the Board of Longitude, appeared in 1775. He adopted Hindley's inventions of the endless screw, the cutting frame and the elliptical point, but his machine abounded in beautiful and ingenious contrivances. Many dividing engines had been made in Great Britain, by Dollond, Stancliffe, John and Edward Troughton, and abroad by Reichenbach and Gambey. For the Edinburgh circle the divisions were cut on a band of gold inlaid on the circumference and the degrees were engraved upon a band of palladium slightly alloyed with silver.

Lyell on the Loess Deposits

At a meeting of the Geological Society held on May 7, 1834, Lyell read a paper on the "Loamy Deposit called Loess in the Valley of the Rhine", in which he described his investigations made in 1833 between Cologne and Heidelberg and in other districts. From his examination of the shells contained in the loess at various places and a study of the land and aquatic shells obtained from the banks of the Rhine, he concluded that : (1) the loess was the same material as the sediment with which the waters of the Rhine were charged ; (2) the fossil shells in the loess were all of recent species ; (3) the number of individuals belonging to land species usually predominated over the aquatic ; (4) although the loess when pure appears unstratified it must have been formed gradually ; (5) some volcanic eruptions must have taken place during and after the deposition of the loess. The deposits of loess between Heidelberg and Heilbronn, he said, appeared to attain a height of seven or eight hundred feet above sea-level.

Darwin in Patagonia

About a month before H.M.S. *Beagle* passed through the Straits of Magellan into the Pacific, and while the ship was still in the mouth of the Santa Cruz, Darwin recorded in his Diary on May 9–11, 1834 : "I took some long walks ; collecting for the last time on the sterile plains of the Eastern side of S. America." He also wrote : "The sportsmen have altogether been very lucky. Ten guanaco have been killed and eaten ; several condors, and a large wild Cat have been killed and Mr. Stuart shot a very large Puma." These various creatures were fully described in his "Journal of Researches", and of the guanaco he said : "The guanaco, or wild Llama, is the characteristic quadruped of the Plains of Patagonia ; it is the South American representative of the camel of the East. It is an elegant animal in a state of nature, with a long slender neck and fine legs. . . . The guanacos appear to have favourite spots for lying down to die. On the banks of the St. Cruz, in certain circumscribed spaces, which were generally bushy and all near the river, the ground was actually white with bones. On one such spot I counted between ten and twenty heads. I particularly examined the bones ; they did not appear as some scattered ones which I had seen, gnawed or broken, as if dragged together by beasts of prey. The animals in most cases must have crawled, before dying, beneath and amongst the bushes. Mr. Bynoe informs me that during a former voyage he observed the same circumstance on the banks of the Rio Gallegos. I do not at all understand the reason of this, but I may observe, that the wounded guanacos at the St. Cruz invariably walked towards the river."

Societies and Academies

LONDON

Royal Society, April 26. F. W. P. GÖTZ, A. R. MEETHAM and G. M. B. DOBSON. Vertical distribution of ozone in the atmosphere. A method has been developed for finding the average height of the ozone in the earth's atmosphere and also the general character of its vertical distribution. This method uses spectroscopic measurements of the light of the clear blue zenith sky as the sun is rising or setting. The necessary observations have been taken in Switzerland over the space of a year and the height and vertical distribution have been calculated. The average height is found to be about 22 km. above sea-level and most of the ozone exists between the ground level and 40 km. The vertical distribution depends on the total amount of ozone present, but apparently not greatly on other factors. F. P. BOWDEN and C. P. SNOW: Physico-chemical studies of complex organic molecules (1). A method is described for the production of monochromatic light of sufficient intensity to bring about reasonably rapid photochemical changes. The irradiation can be performed on very small amounts of material, and the progress of the reaction followed spectroscopically. Selective monochromatic irradiation is applied to some of the large molecules of biological importance, notably ergosterol and calciferol, vitamin B, carotene and vitamin A. F. P. BOWDEN and S. D. D. MORRIS: Physico-chemical studies of complex organic molecules (2). The absorption spectra of some important biological molecules have been measured at liquid air temperature. The bands of β carotene (in ethyl alcohol) become narrower and shift to 4990 A., 4670 A. and 4350 A., and a new band appears at 4060 A. The ultra-violet band at 2700 A. becomes sharper but is little displaced. The main band of vitamin A concentrates at 3280 A. is shifted to 3350 A. and new structured bands appear at 2900 A., 2770 A., 2580 A., 2510 A. and 2430 A. The absorption spectrum of vitamin E concentrates is due to several different molecules and some progress has been made in separating these out.

DUBLIN

Royal Dublin Society, January 23. T. N. RICHARDSON and K. C. BAILEY: The oxidation of hydrazine by potassium ferricyanide. When this reaction takes place in alkaline solution, supersaturation by nitrogen gas takes place so readily that the reaction can only be followed by the rate of evolution of gas if stirring is very efficient. Acetone retards the reaction by formation of dimethylketazine, which is not oxidised under the conditions of the reaction. ROBERT MCKAY: Injury to apple trees due to mineral oils used for the control of woolly aphis. A canker on maiden apple trees originating in a nursery in the south of Ireland was traced to the use of paraffin oil for the control of woolly aphis. Various types of injury produced by paraffin on apple trees of different ages and varieties are described, the injury being aggravated by the presence of woolly aphis. Paraffin oil or petrol should not be used alone on apple trees at any season.

PARIS

Academy of Sciences, March 5 (*C.R.*, 198, 861–996).* PIERRE CARRÉ and JEAN PASCHE: The relative mobilities of the propyl and isopropyl radicals and of their mono- and dichlor-derivatives. M. TIFFENEAU and MLLE. B. TCHOUBAR: The mechanism of formation of the cyclohexanones by the action of organomagnesium compounds on the α-chlorocyclohexanones. The indirect replacement of the halogen by alkyl. GEORGES RICHARD: A new example of an abnormal reaction of potassium cyanide on an α-chloroketone. LÉON ENDERLIN: Researches on the dissociable organic oxides. Two oxidation terms, reducible but not dissociable, of *bis*-paratolyl.1.1.diphenyl.3.3.rubene: the tetrahydro-*bis*-epoxyl and dihydrodihydroxyl derivatives. E. BALLA: Some aryl glycols. L. ROYER: Observations concerning substances which modify the facies of crystals depositing from a solution. PAUL GAUBERT: Liquid crystals obtained by the rapid evaporation of an aqueous solution. ANATOLE ROGOZINSKI: Crystal analysis with the X-rays by a method of focalisation. A. S. MIHARA: The altered form of the felspars in the granitic sands of the Vosges. M. E. DENAEYER: The chemico-mineralogical composition of the basic rocks, intrusive or metamorphic, of Kasaï (Belgian Congo). ERHART: The existence of palæo-soils in the Quaternary deposits of the Sarre valley and on their nature. JACQUES BOURCART and GEORGES CHOUBERT: Some eruptive rocks brought by the Ouezzan Trias (Morocco). RAYMOND FURON: The geological and geographical relations of the Hindu Kush and the Pamir. PIERRE URBAIN: The separation of the various constituents of clays. Description, with diagram, of an electrical method. G. GRENET: The measurement of the terrestrial electric field and of its variations. LOUIS EMBERGER: The vegetation of the massif of Seksaoua (Western Grand Atlas). A. MAIGE: Remarks on the metabolism of the nucleus and the plastids in plant cells. MLLE. GILBERTE PALLOT: Cytological researches on the neuro-muscular spindles. MLLE. L. GUYON: The phenomena which occur in solutions of collagen, at the limits of action of acids and neutral salts. RAYMOND-HAMET: The initial manifestations of sympathicolytic action of yohimbine. H. LAUGIER, E. TOULOUSE and D. WEINBERG: Biotypology and academic classification. L. LAPICQUE: Remarks on the preceding communication. MAURICE NICLOUX: The diffusion of alcohol in the organism and bound water. MME. YVONNE KHOUVINE: The reduction of W. C. Austin's α-*d*-glucoheptulose. MLLE. O. GROOTTEN and N. BEZSSONOFF: The factors which arrest the synthesis of a bacterial pigment. B. S. LEVIN and IWO LOMINSKI: The influence of colloidal lecithine on the phenomena of microbial lysis by the bacteriophage. L. BALOZET: Concerning the immunity towards infectious anæmia of horses. PIERRE ROSENTHAL: Embryotherapy. CHARLES RICHET: Remarks on the note by P. Rosenthal relating to embryotherapy.

* *Continued from p. 659*

LENINGRAD

Academy of Sciences (*C.R.*, No. 1, 1934). S. N. BERNSTEIN: The linear quasi-continual chains of Markov. I. M. VINOGRADOV: New applications of trigonometrical polynomes. M. ROMANOVA, A. RUBZOV and G. POKROVSKIJ: Silver-plating of mirror surfaces by means of cathode sputtering. Mirrors have been prepared in a hydrogen atmosphere of 0·004–0·005 mm. mercury pressure, with a current of 15–20 m.A., the voltage between the electrodes being 1,200–1,400. B. A. NIKITIN: A qualitative reaction for radium. If to 10 c.c. of a solution

of radium chloride heated to the boiling point, 0·3 c.c. of 50 per cent CCl_3COOH and 0·5 c.c. of 10 per cent potassium chromate are added and the mixture cooled to 0° C., then a crystalline precipitate is formed. Similar solution of barium produces no precipitation after such treatment. A. BACH, Z. ERMOLIEVA and M. STEPANIAN: Fixation of atmospheric nitrogen by means of enzymes extracted from *Azotobacter*. The juice of cultures of *Azotobacter* obtained under a pressure of 300 atmospheres and filtered through Chamberlain's L_3 candle, proved to be able to fix atmospheric nitrogen in the presence of a solution of glucose, or of mannite. This juice fixed ten to twenty times the quantity of nitrogen, as compared with live cultures. A. NIKOLAEV, V. VDOVENKO and P. POCHIL: Artificial dehydration of hydrated salts by means of solar energy. Having placed films of kerosene, petroleum and naphtha oil upon crystalline hydrated sodium sulphate, the authors observed its conversion, on exposure to sunlight, into dehydrated salt. This was due to the film preventing the evaporation from the salt and the consequent heating up of the latter. S. BALACHOVSKIJ: The problem of carotine in the organism. Burns and other wounds treated by a solution of carotine healed quickly. It appears that in wounds local avitaminosis occurs and the introduction of carotine restores the balance. J. KERKIS: Hybridisation between *Drosophila melanogaster* and *D. simulans* and the question of the causes of sterility in interspecific animal hybrids. The conditions favourable to normal development of germ cells in hybrids may sometimes occur, but further investigations are necessary to discover these conditions. M. TCHAILACHIAN: The effect of length of the day upon the chlorophyll apparatus of plants. The accumulation and the content of chlorophyll in plants growing under natural conditions increase under the influence of the length of day, as the distance from the equator decreases. O. VIALOV: The lower Palæogene in Bukhara.

(*C.R.*, No. 2, 1934). I. VINOGRADOV: New asymptotical expressions. V. KUPRADZE: The radiation principle of Sommerfeld. W. KRAT: On darkening at the limb in eclipsing binaries. N. ANDREIEV: The possibility of observing Brownian movement with the naked eye. Brownian movement of particles in a thin film of fat placed on the surface of a slightly oxidised metallic plate can be observed as fluctuations of light in a diffraction spectrum. G. TCHELINTSEV, I. KNUNIANG and Z. BENEVOLENSKAIA: The structure and synthesis of new antimalarial substances. Analyses of 'Plasmochin' and 'Atebrin'. A. CHARIT and I. FEDOROV: The oxidation and reduction processes during muscular contraction. The authors studied the changes in the oxidation-reduction potential of Ringer's fluid passing through the isolated pulsating heart. A. STUDITSKIJ: The potencies of the periosteum of primary and secondary ossification according to the data obtained by the cultivation of periosteal grafts on the allantois. A. A. PROKOFJEVA: Investigations on the chromosome morphology of some fishes and amphibians. The chromosome structure of the species under investigation corresponds to the principles of structure observed in plants and gives grounds for supposing a process of karyological evolution common to both the animal and the vegetable kingdom. S. SOLDATENKOV and M. CUBLI: The effect of ethyl alcohol on the ripening of tomatoes. Positive results have been obtained in the experiments. E. GURJANOVA: The Crustacea of the Kara Sea, and the ways in which the Atlantic fauna penetrates into the Arctic. The Atlantic species pass into the Arctic along the slope of the continental shelf, not far from the Scandinavian coast.

ROME

Royal National Academy of the Lincei: Communications received during the vacation, 1933. U. CISOTTI: Differential deductions from the definition of reciprocal vectors (1). Q. MAJORANA: New types of compensator for metallic photo-resistance. The mercury jet compensator may be replaced by a type in which a photoelectric cell is employed. L. FANTAPPIÈ: Integration by quadrature of the general parabolic equation with constant coefficients. G. SCORZA DRAGONI: The multiplication of series which converge conditionally (2). MARIA CIBRARIO: Certain generalisations of the numbers and polynomials of Bernouilli and Euler. B. DE FINETTI: The laws of distribution of values in a succession of equivalent aleatory numbers. E. PICASSO: The projective-differential geometry of the surfaces of S_4. A. TERRACINI: The congruences of straight lines associable with respect to a surface. B. SEGRE: Geometric-functional determination of groups of covariant points, relative to two linear pencils of curves on an algebraic surface. G. ARRIGHI: A generalisation of the equation of continuity. A. COLACEVICH: Spectroscopic observations of the variable star RS Ophiuchi (Nova Ophiuchi *n.* 3). F. PIRRONE and A. CHERUBINO: Studies on the hydroxyquinolines: Iodo-derivatives of *o*-hydroxyquinoline (1). α-Iodo-*o*-hydroxyquinoline and a number of its derivatives have been prepared. G. MORUZZI: Contribution to the study of cerebellar localisations by the method of transneuronic degenerations. G. AMANTEA: The antineuritic factor (B_1) and the conception of the beri-beri quotient (Q_b). A series of twenty points emerging from the author's investigations on beri-beri in pigeons is formulated so as to indicate the logical evolution of the idea of a beri-beri quotient. A. SALVATORI: A method for the micro-determination of bromine in blood and organs. Roman's method (1929), which consists in converting the bromine into potassium bromide by fusion with potassium hydroxide, liberating the bromine by treatment with hydrogen peroxide, treating with potassium iodide, and titrating the liberated iodine, gives unsatisfactory results. V. ZAGAMI: Food value of the seeds of *Vicia Faba*, L. The results of a large number of further tests show that these seeds form an incomplete or deficient nutriment for growing rats, the deficiency relating both to salts and to vitamins A and D. Vitamins B and E are, however, present in adequate proportions.

MELBOURNE

Royal Society of Victoria, Nov. 16. AUDREY M. ECKERSLEY: Some sap-staining organisms of *Pinus radiata*, D. Don, in Victoria. Two forms of *Ceratostomella* were isolated from sap-stained *Pinus radiata* case stock. When compared with stand cultures of *Ceratostomella*, it was found that these forms appeared to form a link between the American species *C. pilifera* (Fr.), Winther, and the European species *C. coerulea*, Munch., which are very closely related if not identical. The two new forms in their morphological characters approximate sometimes to

one and sometimes to the other, but the varietal distinctions are not all clear-cut and it is suggested that all four forms belong to a single species which is capable of exhibiting variation to a marked degree. *Hormonema dematioides*, Lagerberg et Melin, was also isolated from sap-stained *Pinus radiata*.

FREDERICK CHAPMAN: A Lower Cretaceous brittle-star from Queensland. This well-preserved brittle-star is named *Ophiacantha* (*Ophioglyphoida*) *fosteri*, *sub-genus et sp.nov.* It was obtained from a bore-core at Cleve, Longreach, Queensland, and is defined by the pentagonal covering plates of the disc. The new specific characters are the petaloid shape of the disc, long slender arms more than five times the diameter of the disc in length, with constricted vertebral ossicles and abundant slender, thorny spines. It occurred in the Tambo series, probably near the base. It is of great interest to note that, by the discovery of a fossil *Ophiacantha* in the Cretaceous of Longreach, this particular genus has persisted from Lower Cretaceous times to the present. It is also one of the most abundant of brittle stars living in Australian seas. Its present range is from southern Tasmania to the Philippines.

Forthcoming Events

[*Meetings marked with an asterisk are open to the public.*]

Saturday, May 5

UNIVERSITY OF CAMBRIDGE, at 5—(in the New Museums).—Sir Henry Dale: "Chemical Transmission of the Effects of Nerve Impulses" (Linacre Lecture).

UNIVERSITY OF CAMBRIDGE, at 5—(in the College Hall, Newnham College).—Dr. L. S. B. Leakey: "The Problem of the Origin of Man" (Jane Ellen Harrison Memorial Lecture).

Monday, May 7

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Dr. L. S. B. Leakey: "Lake Victoria in the Pleistocene".

Tuesday, May 8

ROYAL HORTICULTURAL SOCIETY, at 3.30—(at Greycoat Street, Westminster, S.W.1).—Dr. W. F. Bewley: "Health and Disease in Plants" (Masters Memorial Lectures. Succeeding lecture on May 9).

CHADWICK PUBLIC LECTURE, at 5.30—(at the Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, W.1). Dr. Jane Walker: "Village Hygiene".*

ILLUMINATING ENGINEERING SOCIETY, at 7—(at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W.1). Annual General Meeting.

S. G. Hibben: "Recent Progress in Illuminating Engineering in the United States".

Wednesday, May 9

INSTITUTE OF METALS, at 8—(at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1).—Prof. E. K. Rideal: "Gases and Metal Surfaces".

INSTITUTE OF METALS.—Prof. E. K. Rideal: "Gases and Metal Surfaces" (Annual May Lecture).

Thursday, May 10

UNIVERSITY OF OXFORD, at 5.30—(in the Examination Schools).—Prof. H. J. Rose: "Concerning Parallels" (Frazer Lecture).

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Annual General Meeting.

Friday, May 11

ROYAL ASTRONOMICAL SOCIETY, at 5.—Dr. Harlow Shapley: "Some Structural Features of the Meta-galaxy" (George Darwin Lecture).

ROYAL INSTITUTION, at 9.—Dr. C. Leonard Woolley: "This Year's Work at Ur".

Official Publications Received

GREAT BRITAIN AND IRELAND

Annual Reports on the Progress of Chemistry for 1933. Vol. 30. Pp. 462. (London: Chemical Society.) 10*s.* 6*d.*

Royal Institute of British Architects Report of the Slum Clearance Committee. Pp. 28. (London.)

Reports of the Council and Auditors of the Zoological Society of London for the Year 1933, prepared for the Annual General Meeting to be held on Monday, April 30th, 1934. Pp. 103. (London.)

Imperial Bureau of Plant Genetics. Bibliography of Baking Quality Tests (with particular reference to Tests for Small Samples for use by Wheat Breeders). Pp. 68. Plant Breeding in the Soviet Union: Achievements, Organization and Future Programme of the Institute of Plant Industry. Pp. 58. 3*s.* 6*d.* (Cambridge: School of Agriculture.)

The Men of the Trees. Ninth Year's Report and Review of the Tree Year 1933. Pp. 36+4 plates. (London: Hon. Secretary, 32 Warwick Road, S.W.5.) 6*d.*

OTHER COUNTRIES

Publications of the Vassar College Observatory. No. 4: Part 1, The Longitude of the Vassar College Observatory, prepared for publication by Caroline E. Furness; Part 2, A Study of Four Be Stars, by M. Alberta Hawes. Pp. iii+60+5 plates. (Poughkeepsie, N.Y.)

The Indian Forest Records. Vol. 19, Part 8: Entomological Investigations on the Spike Disease of Sandal (18) Fulgoridæ (Homopt.). By N. C. Chatterjee and M. Bose. Pp. 14. (Delhi: Manager of Publications.) 5 annas; 6*d.*

U.S. Department of Agriculture. Miscellaneous Publication No. 186: Reconnaissance Erosion Survey of the Brazos River Watershed, Texas. By H. V. Geib and Ira T. Goddard. Pp. 47. 10 cents. Technical Bulletin No. 402: Biology and Control of Tree Hoppers injurious to Fruit Trees in the Pacific Northwest. By M. A. Yothers. Pp. 46. 10 cents. (Washington, D.C.: Government Printing Office.)

Veröffentlichungen aus dem Kaiser Wilhelm-Institut für Silikatforschung in Berlin-Dahlem. Herausgegeben von Prof. Dr. Wilhelm Eitel. Band 6. Pp. 234. (Braunschweig: Friedr. Vieweg und Sohn A.-G.) 28 gold marks.

Achema Jahrbuch, Jahrgang 1931–34. Berichte über Stand und Entwicklung des Chemischen Apparatewesens. Begründet von Dr. Max Buchner. Herausgegeben unter Mitwirkung von Fachgenossen aus Wissenschaft und Technik von der Dechema. Pp. 236+xxxiv+44. (Seelze und Berlin: Deutsche Gesellschaft für Chemisches Apparatewesen E.V.) 10 gold marks.

The Science Reports of the Tôhoku Imperial University, Sendai, Japan. Second Series (Geology), Vol. 16, No. 2: Marine Mollusca from the "Ryûkyû Limestone" of Kikai-zima, Ryûkyû Group. By Sitihei Nomura and Noboru Zinbô. Pp. 56+1 plate. (Tôkyô and Sendai: Maruzen Co., Ltd.)

Proceedings of the American Academy of Arts and Sciences. Vol. 69, No. 2: The Rotation of Cobalt and Nickel by Magnetization and the Gyromagnetic Ratios of their Magnetic Elements. By S. J. Barnett. Pp. 119–135. (Boston, Mass.) 45 cents.

N.Z. Department of Scientific and Industrial Research. Apia Observatory, Apia, Western Samoa: Annual Report for 1932. Pp. vii+114. (Wellington, N.Z.: Government Printer.) 5*s.*

Bulletin of the American Museum of Natural History. Vol. 67, Article 4: Fossil Invertebrata from Northeastern Brazil. By Carlotta Joaquina Maury. Pp. 123–179+plates 9–19. (New York City.)

University Observatory, Oslo. Publication No. 8: i. On the Stability of Atkinson's Star Models; ii. A Note on Stellar Stability. By G. Steensholt. Pp. 8. Publication No. 11: Die Störungen des zirkularen Wirbels einer Homogen-Irkompressiblen Flüssigkeit. Von C. L. Godske. Pp. 130. Publication No. 12: On the Trajectories of Electric Particles in the Field of a Magnetic Dipole with Applications to the Theory of Cosmic Radiation, II. By Carl Størmer. Pp. 47. (Oslo: A. W. Broggers Boktrykkeri A.-S.)

The Imperial College of Tropical Agriculture. The Principal's Report for the Year 1932–33 and the Accounts for the Year ended August 31, 1933. Pp. 32. (Trinidad and London.)

CATALOGUES

The N and W Shockproof Mobile X-Ray Unit. (Publication No. 34/01.) Pp. 8. (London: Newton and Wright, Ltd.)

McGraw-Hill Books on Agriculture, Zoology and Botany, 1934. Pp. 20. (London: McGraw-Hill Publishing Co., Ltd.)

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.
ST. MARTIN'S STREET, LONDON, W.C.2
Telephone Number: WHITEHALL 8831
Telegraphic Address: PHUSIS, LESQUARE, LONDON