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Magic and Administration in Africa

IT is inevitable that the anthropologist should suffer a feeling of disillusion, almost at times mounting to the level of discouragement, when he looks back on the history of our official relations with 'native' races during the period of, say, the last fifty years. The lessons of his science, in his eyes plain so that he who runs may read, have been neglected time and again. Racial prejudices and tribal customs and beliefs have been flouted. Sometimes they have been ignored through lack of knowledge, sometimes deliberately set aside or suppressed. Even where there has been little or no overt resistance, tribal organisation has been weakened, with a consequent deterioration in the character of the people; but often acceptance of the decree of the European administration has been enforced only by a heavy expenditure of blood and treasure, of which both sides have had to bear the cost.

In many instances much that has proved detrimental to the subject race and a source of innumerable difficulties, and even of danger, to their rulers might have been avoided had the administration been inspired by the sympathetic understanding which would have followed from a scientific knowledge of the social and religious pattern in the everyday lives of those they governed. Individual officers have not necessarily been to blame. Usually without any scientific training in the study of backward peoples, many of them acquired empirically an adequate knowledge of native institutions; and at times, especially in India, their knowledge has probed deep into native ways of thought and action. Yet the whole trend of administration either attained no more than the preservation of law and order without any specific idea of direction, or at best aimed at the amelioration of the conditions of the native in accordance with European ideals. Customs out of harmony with, or repugnant to, these ideals, such as cannibalism, human sacrifice, or head-hunting, were sternly suppressed without thought of their place or meaning in tribal life, even as missionary influence discouraged or forbade polygamy and the bride-price in Africa without heed or knowledge of the inevitable disintegration of the tribal, social and economic system which was bound to ensue.

When the anthropologist, in urging the application of the results of anthropological science in practical affairs, deplores the suppression of custom in certain instances, it must by no means be taken that he approves these practices or advocates their

preservation, however interesting or vital they may be for the academic study of man and the development of his institutions. It is their suppression without due regard to their function in the social organisation that he deplores. Head-hunting, for example, among certain peoples of Papua or in the Naga Hills of Assam, was of vital significance in tribal life. Suppression would have broken economic, social, and religious bonds in the community. A wise policy in administration, taking cognisance of the wide ramifications of the custom, retained the form of the institution, while securing the substitution of a pig or other animal for the human victim. A grasp of the essential function of the custom averted the disaster which would have followed its total suppression. The tribal organisation was saved from the danger of disintegration, and faith in the essential fair dealing of the administration was assured.

In Africa the problem of the attitude of the administration towards native custom is of the greatest moment on account of both the inherent difficulty of the question and the magnitude of the issues involved. A recent case of witchfinding in Kenya, to which reference is made in a well informed article by Frank H. Melland which appeared in the *Times* of April 13, and subsequent letters from Lord Lugard and others in later issues, serves to illustrate the difference in outlook between white and black which lies at the root of the difficulties of a European administration in dealing with the native. The Kenya case has attracted considerable attention owing to the number of defendants involved; but it is only one of many similar with which the authorities in different parts of Africa have had to deal within the last few years. In this latest case, a witch was beaten to death with staves by the members of the tribe, after she had been smelled out by the witchfinder. This action was in accordance with tribal custom; but as a result sixty persons were arrested, put on trial for murder, and condemned to death at Nairobi.

From the strict point of view of the law, the proceedings at Nairobi were in order, and the sentence awarded a penalty in accordance with the law. Witchfinding is forbidden by law, and the punishment of a witch by death as the outcome of a witchfinding ceremony is technically murder. From the point of view of the native, however, the law of the European administration is both illogical and unjust. The fact that in this and other cases the sentence has been remitted or commuted to a term of imprisonment is irrelevant. Nor is it of any avail to attempt to meet the native with the argument that the witchfinder is seeking something that does not exist. The majority of the natives of Africa hold firmly to the belief in the reality of magic. To them the evidence of innumerable happenings in everyday life bears out their assurance of its powers; and the deaths and other misfortunes of individuals are proof positive of the malevolent efficacy of the witch.

It is, of course, common knowledge among those familiar with the African, that magic enters deeply into his life; but how this belief and its relation to witchfinding reacts in unexpected directions and incidentally affects the relations with Europeans may be illustrated further by the difficulties which arose in the South African mines some twenty-five to thirty years ago. One of the elements which contributed very largely to the shortage of native labour then experienced in the mines was the fear of the magic which, in native conception, was the cause of the high death-rate, and the prohibition by the authorities of the 'throwing the bones' by means of which the magician who had caused the deaths in individual cases, was smelled out. It was their belief that death was caused solely by magical agency; and even now no members of the Bathonga tribes who leave their country to work in the mines and elsewhere are readmitted without an elaborate purification ceremony to remove the evil magic which clings to them and might bring death and pestilence to other members of the tribe.

Witchfinding, however, is only one of the various means by which the native seeks to protect, not himself alone, but also the whole of his group from the influence of evil magic. To forbid witchfinding and to inflict the death penalty on those who mete out the customary retribution on the witch — in the eyes of the tribe a murderer and worse—is as irrational a proceeding in the eyes of the native as it would be Gilbertian in a civilised community if the detective who tracked down a criminal, and the court that inflicted punishment, thereby became liable to the extreme penalty of the law.

It might be thought that in course of time knowledge of the penalty inflicted by the law will have its effect and the employment of witchfinders die out. This is improbable, at least within a reasonable time, for more reasons than one. The example of what happened in England is instructive in this connexion. Even in the middle of the eighteenth century, a hundred years after the Essex witchfinder Hopkins had been discredited and long after witchcraft as such had ceased to be recognised in law, certain individuals caused the death of a suspected witch by the ducking test, and were convicted

of murder. As both Lord Lugard and Mr. Melland point out, the situation in regard to witchcraft in Africa calls for an alteration in the law. Unless, moreover, the law recognises the African point of view, no measure is likely to provide a solution. However much it may be repugnant to European ideas, and whether magic be regarded as an illusion or not, the African's belief in magic must at least be accepted as a reality.

The acceptance of witchcraft and magic as something more than futile superstition which may be disregarded or swept aside goes deeper than a mere concession to the native's failure as yet to grasp the facts of existence as the European sees them. Nor should such beliefs be treated lightly if, as is conceivable, cases of suspected witchcraft were made the subject of inquiry, instead of being left, as they are now, as a matter purely of concern to the native, unless they result in some action which brings him within reach of the European's law. In present conditions, the only element in the witchcraft superstition of which the administration takes cognisance is the witchfinding and the execution of the witch—the very means whereby the native gives expression to the solidarity of the group, and tribal society acts in self-preservation against an anti-social force.

Tribal solidarity, and with it tribal discipline and the authority of the chief, are being assailed on many sides by the rapid changes now taking place in Africa. Since the War, the increased facilities for transport have made the native more mobile. He goes far afield to find employment and in increasing numbers. He earns money as an individual, whereas formerly his earnings were the property of his group. With this individual wealth at his disposal for furnishing the bride-price, no longer in many cases payable in cattle, he marries without reference to his family or tribal group, and often when he returns home he is a wealthier man than his chief.

What may be the effect in the modification of native institutions of these varied influences brought into play by the impact of white civilisation is now being made the subject of a much-needed inquiry by the International Institute of African Languages. The African is being hurried from his status of merely a component part in a unitary group, the family or tribe, into that of an individual independent of traditional ties, before he has had an opportunity of learning the responsibilities of the individual. Administrative action which in any way hastens this process prematurely may precipitate disaster.

Forests and Forestry

(1) *An Outline of Forest Pathology.* By Prof. Ernest E. Hubert. Pp. viii + 543. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1931.) 30*s.* net.

(2) *Seeding and Planting in the Practice of Forestry: a Manual for the Guidance of Forestry Students, Foresters, Nurserymen, Forest Owners, and Farmers.* By Prof. James W. Toumey. Second edition revised and enlarged by Prof. Clarence F. Korstian. Pp. xviii + 507. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1931.) 25*s.* net.

(3) *Histoire des bois et forêts de Belgique.* Par le Comte Goblet d'Alviella. (Des origines à la fin du régime autrichien, Tome 4.) Pp. 448 + 23 planches. (Paris: Paul Lechevalier; Bruxelles: Maurice Lamertin, 1930.)

(4) *A Handbook of Coniferæ: including Ginkgoaceæ.* By W. Dallimore and A. Bruce Jackson. Second edition. Pp. xiv + 582 + 32 plates. (London: Edward Arnold and Co., 1931.) 42*s.* net.

(5) *Ökologie des Waldes: mit besonderer Berücksichtigung des deutschen Wirtschaftswaldes: ein Lehr- und Handbuch für Naturwissenschaftler.* Von Prof. Dr. Alfred Dengler. Pp. vi + 272 + 2 Tafeln. (Berlin: Julius Springer, 1930.) 25 gold marks.

(1) THE author of this book requires no introduction to those who have followed his work on the decay of timber. As may be expected in a book written by a professor of the University of Idaho, forest pathology is dealt with almost entirely from the point of view of North America, but as the causes of disease and decay, and the control measures necessary, are largely common to other regions, the book should be of interest to foresters generally.

The book is divided into three parts. Part 1 (introductory) contains a classification of tree diseases, and deals with the factors influencing disease, the relative importance of tree diseases, economic losses, and symptoms of disease and decay. Part 2, which bears the title "Forest Pathology", deals with various forms of injury, such as that caused by frost, drought, insolation, smoke, and other agencies, and describes certain specific diseases; it concludes with a short account of control methods. Part 3, headed "Wood Pathology", deals with the decay of timber, both converted and unconverted.

The book has a practical outlook, and the fungi

most effectively dealt with are those of special economic importance, for which reason it should prove of service more particularly to the practical man. It is well illustrated, and contains useful references to literature at the end of each section.

(2) This is a second edition of Prof. Toumey's "Seeding and Planting in the Practice of Forestry" (1916), revised and enlarged by Prof. Korstian. In general arrangement the book follows the first edition fairly closely, and is divided into two main parts, the first dealing briefly with the sylvicultural basis of regeneration (including methods of reproduction, choice of species, spacing, and the composition of the crop), and the second and by far the larger part dealing with the formation of forests by seeding (sowing) and planting. This part goes in considerable detail into the technique of artificial regeneration, including the collection, extraction, storage, and testing of seed, the preparation of planting sites, the establishment of plantations by direct sowing and transplanting, and nursery practice.

In some respects the new edition is more definitely an American textbook than the original one, since most of the additions refer to American practice; nevertheless, it should prove of much value to British foresters, even though some of the methods described are scarcely applicable to British conditions, while some of the methods practised in Great Britain are not dealt with. It is interesting to note that more use is made of horse-drawn implements in American than in British forest nurseries. There are useful references to bibliography at the end of each chapter, the illustrations are good, and the book is attractively got up.

(3) Three volumes of the Comte Goblet d'Alviella's "Histoire des bois et forêts de Belgique" have already appeared. The present volume deals with communal and private forests in the Netherlands during the seventeenth and eighteenth centuries, and is in a sense supplementary to vols. 2 and 3, which deal with State forests during the same period. This period is important in showing a sudden transition from the old feudal system, which had an intimate bearing on the forest, to a new regime brought about by legislation which democratised it. This radical political change, although it inaugurated an era inimical to the forest, did not effect an immediate transformation in methods of sylviculture and management, since here, as elsewhere, economic rather than political considerations had a deciding effect on the production, and thus on the conservation and treatment, of the forests.

Under the old regime, forestry was dominated by the demand for (1) oak timber for construction, agricultural purposes, and shipbuilding, and (2) charcoal for the metallurgical industry, which had been much developed since the sixteenth century and required material of moderate size in large quantities. The system best adapted to meet these requirements was coppice with standards, and hence it was the one almost exclusively employed. In spite of political changes it continued long after the end of the old regime, although there were drastic administrative changes in the direction of centralised control. The author's aim has been to give a comprehensive view of the development of forestry during the period in question without entering into minute details, and he has produced an authoritative work which will be of much interest to foresters and historians alike.

(4) The first edition of Dallimore and Jackson's valuable "Handbook of Coniferæ" appeared in 1923. In the present edition the opportunity has been taken to include in an appendix descriptions of a number of species, varieties, and hybrids omitted in the first edition, together with short descriptions of the more important new species brought to light in recent years chiefly as the result of exploration in China and elsewhere. Another innovation is the inclusion of a list of synonyms, giving the correct botanical names under the Vienna rules, of a number of species, of which the names in common use among arboriculturists are retained in the text. Thus, to take a few examples, *Abies pectinata* D.C. becomes *A. alba* Miller, *Araucaria imbricata* Pav. becomes *A. araucana* K. Koch, *Larix europœa* D.C. becomes *L. decidua* Mill., and *P. Laricio* Poir. becomes *P. nigra* Arn. The use of generic instead of family headings on the right-hand pages is a definite improvement. This book is likely to retain its value as a standard work on conifers, and none interested in this subject can afford to dispense with it. If there is one suggestion that might be made, it is that in the next edition the opportunity might be taken to revise the keys.

(5) Prof. Dengler's "Ökologie des Waldes" is a separate issue of Part 1 of his larger work, "Waldbau auf ökologischer Grundlage", of which Part 2 deals with sylvicultural technique. As the title denotes, the ecology of woods is taken as the basis of sylviculture. The first section deals with the forest as a vegetation type, considers its relationship to other types of vegetation, and gives a brief account of forest types throughout the world, from tropical to polar and alpine regions. This is followed by a

more detailed account of the natural distribution in Europe and Western Asia of the principal German trees and the development, prehistoric and historical, of German forests. This section concludes with an account of the present distribution of forests in Germany, with their chief component species.

The second section contains a discussion of climatic and edaphic factors in relation to tree growth, and touches on the question of local races. A summary is given of the results of work on forest soils carried out in recent years by various investigators. An interesting diagram, based on the work of Hartmann, shows the range of hydrogen ion concentration of a number of common herbaceous and shrubby forest plants: this demonstrates, for example, the intolerance to acid conditions of *Geranium Robertianum*, *Brachypodium silvaticum*, and *Dactylis glomerata*, the acid tolerance of *Vaccinium Myrtillus* and *V. Vitis idœa*, and the wide range of tolerance of *Hypnum Schreberi* and *H. purum*. A short account of the physiological life-history of the forest completes the volume.

The scope of this work is mainly limited to German conditions, and the literature cited is almost entirely that of German-speaking countries; nevertheless, the book should prove of value to students of the fundamental principles of sylviculture in other countries.

The Geological Age of *Pithecanthropus*

The Age of Pithecanthropus. By Dr. Ir. L. J. C. van Es. Pp. xii + 142 + 4 plates. (The Hague: Martinus Nijhoff, 1931.) 8 guilders.

LITTLE is known about the exact geological age of the oldest fossil human remains hitherto discovered, and every contribution to the subject is welcome. The age especially of the most primitive ancestral man, *Pithecanthropus*, found by Prof. Dubois in a river deposit in Java, has already been much discussed without any definite conclusion. We are, therefore, glad to receive a most valuable small volume on the Tertiary geology of Java by Dr. L. J. C. van Es, who seems to prove that this remarkable fossil dates back to the Lower Pleistocene period. Dr. van Es bases his work on the researches of Prof. E. Dubois, K. Martin, and G. A. F. Molengraaff, to whom he dedicates his publication. He has studied thoroughly the geology of Java, and he illustrates his description by a series of sections and maps, which have been prepared with the help of the Chief of the Geological Survey of the Netherlands Indies.

Since the beginning of the Upper Miocene period at least, there has always been much volcanic activity in the region of Java, and extensive volcanic breccias and tuffs are associated with the deposits containing corals and marine shells, up to those of the Middle Pliocene. They then occur also with lake and river deposits of Upper Pliocene, Pleistocene, and more recent date. There have indeed been many alterations in the level of the land and sea, and there seems to have been a connexion with the Asiatic continent, through Sumatra, in the Upper Pliocene, when land mammals, such as the primitive elephants *Mastodon* and *Stegodon*, *Hippopotamus* and *Cervus*, first invaded Java. The successive marine deposits which now form part of the land are marked by an increasing percentage of existing species of shells among the fossils, as might be expected. It is thus possible to identify them even when they are not seen directly superposed.

The river deposit at Trinil, in which *Pithecanthropus* was discovered, rests unconformably on a marine formation, which is shown by its fossils to be of Middle Pliocene age. The gap in the geological series indicated by the unconformity is filled in other districts by marine deposits, which contain 66-70 per cent of existing species of shells and are therefore Upper Pliocene. Hence the conclusion, that if a marine formation equivalent in age to the Trinil river deposit were found, it would contain more than seventy per cent of existing species of shells and must be regarded as Pleistocene. The percentage of existing species of freshwater shells in the Trinil deposit itself supports this conclusion, and as the associated land mammals (*Stegodon*, *Hippopotamus*, etc.) are much like those in the Lower Pleistocene Narbada river deposits of India, *Pithecanthropus* evidently dates back to the beginning of the Pleistocene period. A. S. W.

Nature and Man in Arabia

Arabia Felix: Across the Empty Quarter of Arabia. By Bertram Thomas. With a Foreword by T. E. Lawrence and Appendix by Sir Arthur Keith. Pp. xxix + 397 + 48 plates. (London and Toronto: Jonathan Cape, 1932). 25*s*. net.

THIS book embodies so many important contributions to the common stock of scientific knowledge that the reader marvels that one man should have been able, within the period of twelve months, unaided by public funds or private beneficence, to accomplish so much. Mr. Bertram Thomas, who crossed the great empty quarter of

Arabia, an area hitherto wholly unknown, as great as France and Germany combined, just a year ago, approached his task in a purely scientific spirit, after years of patient preparation. Having learned on board H.M.'s ships to fix his position by the stars, he has produced an excellent map, full of topographical and other details, which would do credit to a trained survey party. He was at pains to measure heads with callipers, and to describe systematically the features of the tribes he encountered, hitherto wholly unrecorded, and in a valuable appendix Sir Arthur Keith and Dr. Krogman discuss the anthropological material he has amassed, on which they place a high value. Mr. Thomas collected everything he saw, and preserved his specimens so effectively that Dr. Calman and his colleagues at South Kensington, who have contributed another lengthy and valuable section, have been able to describe a baker's dozen of specimens new to science, and very many hitherto unrecorded in Arabia.

The geological results are meagre—due to the unpromising uniformity of the formations traversed, but include a meteorite and a valuable series of specimens of rocks and sands, with an analysis of the water in a score or more of wells along the route traversed.

Perhaps, however, the most important contribution to science is the author's description of 'singing sands'. Lord Curzon, in his "Tales of Travels", published in 1923, brought together all known sources of information on the subject, but records nothing so circumstantial as Mr. Thomas's experience.

"We were floundering", he writes, "through heavy dunes when the silence was suddenly broken by a loud droning on a musical note. I was startled for the moment, not knowing the cause.

"The hour was 4.15 P.M., and a slight north wind blew from the rear of the cliff.

"Before this, in similar winds, we had passed many such cliffs, but they had emitted no sound, only the light surface sand being carried up the gentle windward slope to spill like smoke over its top. The leeward face of the cliff was a fairly steep slanting wall, and I looked in vain for a more funnel-shaped sand gorge that by some rushing wind action might account for so great a volume of noise. The usual term 'singing sands' seems to me hardly appropriate to describe a sound indistinguishable from the siren of a moderate-sized steamship. The noise continued for about two minutes and, like a ship's fog-signal, ended as abruptly as it had begun."

This description raises very interesting issues. The question was first scientifically discussed by C. Carus Wilson,[1] who ascribed the phenomenon to "the *rubbing together* of the surfaces of millions of perfectly clean grains of quartz, free from angularities, roughness, or adherent matter, . . . investing the grains"; he adds that, "though the vibrations emitted by the friction of any two grains might be inaudible, those issuing from millions approximately of the same size would give an audible note".

Two American experts, Drs. Bolton and Julien, on the other hand, claimed [2] that—

"The true cause of the sonorous property is connected with thin pellicles or films of air or of gases thence derived, deposited, and condensed upon the surface of the sand-grains during gradual evaporation, after wetting by the sea, lakes, or rains. By virtue of these films the sand-grains become separated by elastic cushions of condensed gases, capable of considerable vibration. The extent of the vibration and the amount and tone of the sound thereby produced, after any quick disturbance of the sand, is largely dependent upon the forms, structures, and surfaces of the sand-grains, and especially upon their purity or freedom from fine silt or dust."

This explanation postulates some degree of previous moisture, induced or exhausted by evaporation: it is tenable in relation to beaches, but not to dunes.

Poynting and Thomson, on the other hand ("Sound"), offer the following explanation:

"There is an arrangement of minimum volume for a number of equal spheres in contact. We may suppose the sand to consist of equal spheres arranged, when undisturbed, so as to occupy minimum volume. When disturbed the mass may pass through many successive minima of volume before coming to rest, and if we can suppose the time occupied in passing from one minimum to the next is constant, a musical note should issue."

None of these explanations seems to cover the production of sound like a ship's siren, and it appears more probable that electrical phenomena may be involved.

These, and many other matters of interest, such as tribal customs, exorcism, marriage, birth and death, clothing and food, the dietetic value of raw gastric juices of camels and gazelles, invest the book with high scientific interest and eugenic significance.

It remains to say that the book is finely written, illustrated by a wealth of photographs which show the author to be no less competent with his camera than with pen, and adorned with a wealth of stories which go to prove that the inhabitants of this part

of Arabia, both male and female, are freer than we are from the bonds of convention in some vital matters, such as sexual relations and taboos, though still in bondage in other directions to ghostly fears and the terror of the unknown.

A. T. W.

[1] Nature, **44**, 322, 1891.
[2] *Trans. N. Y. Acad. Sci.*, **8**, 10; **10**, 28, 1890.

Universities of the British Empire

The Yearbook of the Universities of the Empire, 1932. Edited by Sir H. Frank Heath. Published for the Universities Bureau of the British Empire. Pp. xiv + 953. (London: G. Bell and Sons, Ltd., 1932.) 15*s*. net.

BEFORE 1914 the only general directory of the staffs of the British universities was in the German yearbook of the learned world, "Minerva". It was in 1912 that the late Sir George Parkin, then organising secretary of the Rhodes Trust, urged upon the members of the first congress of the universities of the British Empire that they ought to arrange for the setting up of a central office charged with the duty, among others, of producing a yearbook. The idea found acceptance and the "Universities Yearbook" has now become a valuable aid to intercourse in the sphere of science and higher education between the countries belonging to the British Commonwealth of nations.

The main concern of the 1932 issue of this "Yearbook", as of its predecessors, is to provide, (1) in respect of each of the universities (seventy in number), a directory of its administrative staff and the professors and lecturers, etc., in each of its fields of study, a description of its material equipment, organisation, conditions of graduation, etc., and a summary of events of the past year; (2) a general account of the universities of each national group in their relationship to one another and to the national system of education; (3) particulars of open post-graduate scholarships, etc., and of centres of scientific research and scientific information.

An interesting new feature of this year's issue is a short bibliography giving particulars of books dealing with the British universities and with facilities for study abroad, but not including (as it well might) references to important articles that appeared during the past year in periodicals. The chapter on the Australian universities has been rewritten and brought up to date by Prof. J. T. Wilson, professor of anatomy at the University of Cambridge and formerly Challis professor of anatomy at Sydney. The result is not such an intriguing story as the Canadian chapter (revised for the 1931 issue), but all these university group surveys, including those for the British Isles, South Africa, and India, are eminently readable essays whether taken singly or together.

The very useful appendix describing centres of scientific research and information, for the most part not directly connected with universities, has been expanded and now covers fifty-five pages. Like other annual publications, the "Yearbook" exhibits a tendency to increase in bulk with advancing years, but, thanks to improvements in arrangement and indexing, this has not had the effect of making the search for any particular item of information more difficult. Succinct and lucid, it is fit to take a place in any collection of quick reference books dealing with the cultural life of the English-speaking world.

Short Reviews

Reports of the Progress of Applied Chemistry. Issued by the Society of Chemical Industry. Vol. 16, 1931. Pp. 748. (London: Society of Chemical Industry, 1932.)

"Bis dat qui cito dat" is a true saying, which applies to no publications more forcibly than to annual reports. Again the report on the progress of applied chemistry, as comprehensive and as invaluable as ever, has been published early in the year following that reviewed. The contents are as follows: general, plant, and machinery (R. E. V. Hampson and J. N. Vowler); fuel (J. G. King); gas, carbonisation, tar, and tar products (H. Hollings and W. A. Voss); mineral oils (A. W. Nash and A. R. Bowen); colouring matters and dyes (L. J. Hooley); fibres, textiles, cellulose, and paper (V. E. Yarsley); bleaching, dyeing, printing, and finishing (P. E. King); acids, alkalis, and salts (A. Proven); glass (M. Parkin); refractories, ceramics, and cements (J. H. Chesters and W. J. Rees); iron and steel (A. L. Norbury and F. K. Neath); non-ferrous metals (A. R. Powell); electrochemical and electrometallurgical industries (H. T. S. Britton and R. A. Robinson); oils, fats, and waxes (E. R. Bolton and K. A. Williams); paints, pigments, varnishes, and resins (G. C. Attfield, S. Marks, L. R. Hickson, and W. Singleton); rubber (T. R. Dawson); leather and glue (W. R. Atkin); soils and fertilisers (E. M. Crowther); sugars, starches, and gums (J. P. Ogilvie); fermentation industries (H. Ll. Hind and F. E. Day); foods (G. D. Elsdon); sanitation and water purification (A. Parker); fine chemicals, medicinal substances, and essential oils (E. Stedman); photographic materials and processes (A. Batley and E. E. Jelley). The participation of members of the staffs of official organisations — H.M. Fuel Research Station, the British Launderers' Research Association, the British Cast Iron Research Association, the Research Association of British Rubber Manufacturers, and the Water Pollution Research section

of the Department of Scientific and Industrial Research—is noted with satisfaction.

Only too frequently is it necessary to refer to the effect of the industrial depression on activity in the chemical industries, but the degree to which the flow of new knowledge has been maintained is a factor of great significance for the future. Already many definite improvements in the situation as it affects those industries are recorded. Among many matters of general interest referred to are the collapse of the price and production agreement between the Chilean and synthetic nitrogen interests and the operation of a price-fixing agreement reached between the Russian, Columbian, Canadian, and South African producers of platinum.

A. A. E.

A Descriptive Petrography of the Igneous Rocks. By Prof. A. Johannsen. Vol. 1: *Introduction, Textures, Classifications and Glossary.* Pp. xxii + 267. (Chicago: University of Chicago Press; London: Cambridge University Press, 1931.) 21*s.* net.

IN this first volume the author provides an introduction to the science of petrography. After dealing with the constituents (minerals), and their relations (textures), he gives in summary some twenty-five systems of classification of the igneous rocks. As many of these are now of historical interest only, he rightly pays more attention to those of present practical importance. Thus the systems of Osann and Niggli, the American normative system, and the author's own, which the second volume will fully illustrate, have each a chapter devoted to them, whilst those of Rosenbusch, Zirkel, and Shand are adequately described. Most of them are illustrated by examples, and as the same rock analysis is used in several, a very fair comparison may be made. No formal criticism of the different methods is ventured upon. Two admirable glossaries of mineralogical and textural terms with sundry tables and two indexes complete the volume.

The book is well printed and illustrated; the selection and reproduction of the photomicrographs illustrating textures are all that could be desired. An interesting feature is the inclusion of photographs, with short biographies, of the authors of the more important classifications. Throughout the work abundant references to original sources are made, and the text is enriched with many quotations. It is pleasing to note that where the author has been unable to check a reference it is starred. The errata noted are exceedingly few; on p. 130, quantitative has been used for qualitative, and on p. 157 Orders 1 and 2 should be 1 and 4.

The classification advocated by the author is based on the mineral composition of the rocks as determined in thin slices. Four classes are recognised from the relative proportions of light and dark coloured constituents; division into orders depends on the character of the plagioclase present, whilst further subdivision into families and subfamilies is determined by the proportions of quartz or felspathoids, or the ratio of potash felspar to plagioclase. Certain new terms and names, built on the 'portmanteau' method, are suggested. The full exposition in the second volume will be awaited with interest.

A Monograph of the Recent Cephalopoda based on the Collections in the British Museum (Natural History). Part 2: *The Octopoda (excluding the Octopodinæ).* By G. C. Robson. Pp. xi + 359 + 6 plates. (London: British Museum (Natural History), 1932.) 20*s.*

THIS work gathers into one volume practically all the available knowledge of the Octopoda (exclusive of *Octopus* and some allied genera monographed in Part 1 in 1929), and includes a great deal of new information due to the author's comprehensive studies of these animals, not only in the British Museum, but also in Paris, Monaco, Berlin, Leyden, and elsewhere. Our knowledge of the whole group is definitely advanced, so that it is now possible to review the systematic interrelationships of the Octopoda with some confidence.

Apart from the Palæoctopoda, based on *Palæoctopus*, the only known fossil octopod, which has been re-examined and yields fresh evidence, three suborders are recognised, the Vampyromorpha, which are the least specialised and apparently most archaic group, the Cirromorpha (*Cirroteuthis*, *Opisthoteuthis*, etc.), and the Incirrata. This last group includes forms more familiar to the general naturalist, such as *Argonauta*, *Octopus*, and *Eledone*. The species commonly associated under *Eledone* prove to be a polyphyletic group now distributed among Octopodidæ and Bathypolypodidæ.

The chapter on "Classification and Evolution" is of special interest, and considerable ingenuity is shown in distinguishing resemblances due to convergence from those due to relationship: in some places the general discussion is a little vague, but definite results are reached in most of the major problems. The systematic part, which occupies about three-quarters of the volume, is throughout excellent, and, so far as we have been able to test it, wholly trustworthy.

Health and Social Evolution. (Halley Stewart Lectures, 1930.) By Sir George Newman. Pp. 200. (London: George Allen and Unwin, Ltd., 1931.) 4*s.* 6*d.* net.

THIS comprehensive review of the health of the people, and the gradual recognition of public health as an aim of State activity, shows the hand of a master throughout. Beginning with the Middle Ages, which saw the horrors of the Black Death, and also the beginnings of anatomy and physiology, the author goes on to describe the medical and the humanitarian contributions of the eighteenth century, and the effects upon public health of the industrial revolution, political and social reform, and the growth of State intervention in the field of public health as in other fields. The present position of the State medical service in relation to infant and maternal mortality, the health of the school child, the health insurance services, and the international health

services is then dealt with. Finally the author asks: What are the gains and the losses in national health? Some of the gains are obvious, but there are failures and losses also: failure to get ignorant people to recognise quackery, and loss in average fitness through success in saving feeble infants of the type that used to contribute to the infant mortality rate. Here, as the author implies, we come upon a problem which has its moral as well as its medical aspect.

Common Pests: how to Control some of the Pests that affect Man's Health, Happiness and Welfare. By Rennie W. Doane. Pp. viii + 397. (Springfield, Ill., and Baltimore, Md.: Charles C. Thomas; London: Baillière, Tindall and Cox, 1931.) 21*s.* net.

THIS book sets out to be a handy manual for the farmer, stockman, gardener, and the householder. Being intended for American readers, it deals exclusively with American pests, and much of the information given is of little value to readers outside the United States. It contains many Americanisms, and descends at times to a childishness which is extremely irritating. Little is left to the intelligence of the reader; for example, on p. 119, the author, referring to the use of hydrocyanic acid gas, remarks: "As this gas is deadly to all animal life, rats, mice, and all kinds of insects will be destroyed. Any cats, birds, or other household pets left in the house while the fumigating is being done will, of course, suffer the same fate."

The field which the author has attempted to cover is too large to admit of satisfactory treatment, and the ambitiousness of the project defeats its own ends. Spiders, mites, insects, parasitic worms, birds, and mammals are all included. In many cases the descriptions are too meagre to be of use to any but the specialist, and much of the matter is unintelligible to any but the scientific reader. Nevertheless, a vast amount of interesting information is given, much of it very useful to those for whom it is intended, particularly in the chapters on insecticides and the control of insect pests. The matter is well arranged and convenient for reference, and the book is profusely illustrated.

J. O. C.

Applied Personnel Administration. By J. E. Walters. Pp. ix + 338. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1931.) 18*s.* 6*d.* net.

ALL human affairs seem to be in process of reorganisation, notably the industrial situation. The contrast between the inter-relationship of master and man to-day and prior to the year 1832 is marked. Formerly, the employee was normally regarded as a mere producing factor, without human interest to the employer. A pioneer in humanisation was Robert Owen, who not only pointed, but also led, the way on the path of Christian socialism in industrial affairs. Sir Walter Besant's later efforts in the same direction met with a practical response in the People's Palace which Mr. Beaumont established in Mile End, but this, unfortunately, became side-tracked. The United States, as Mr. J. E. Walters shows in this well-arranged and comprehensive book, has gone steadily forward on lines of industrial progress; and though some may consider that there is an excess of officialdom and of official methods, yet the practical outcome of the movement has been beneficial, not to employees and employers alone, but also to the public at large. It may well be that the swing of the pendulum has been excessive, and that a certain tendency towards over-guidance and over-control has resulted; this may, however, presently swing slightly backward, whereby individual self-dependence will be better established.

P. L. M.

The History of the Maya: from the Earliest Times to the Present Day. By Thomas Gann and J. Eric Thompson. Pp. x + 264 (26 plates). (London: Charles Scribner's Sons, 1931.) 8*s.* 6*d.*

THIS brief history of the Mayas should do much in helping to stimulate interest in the archæology of Central America. Notwithstanding the fact that one British and several American expeditions are now at work each season on Central American sites, very little interest is taken in the results by the English public. Yet the work of these expeditions is adding rapidly to our knowledge of a remarkable civilisation, of which the problems are as fascinating as they have proved baffling. The authors of this little book have not attempted to discuss controversial matters, nor have they aimed at a detailed description of the sites. They give a historical outline of Maya history as revealed by the most recent discoveries of the earliest and latest dates of occupation of the Maya settlements, and sketch briefly the main features of Maya art, industry, daily life, and religion. The book, in fact, contains in readable form exactly the information which will give the background essential for the appreciation of the character and bearing of the discoveries now being made by scientific exploration.

Social Organisation and Ceremonial Institutions of the Bomvana. By P. A. W. Cook. Pp. xi + 171 + 16 plates. (Cape Town and Johannesburg: Juta and Co., Ltd., n.d.) 10*s.* 6*d.*

THE Bomvana are a Bantu people of the Transkei who, according to their own tradition, are derived from the Amanguema, a people said to have lived in Natal. It is probable that it was somewhere about the middle of the sixteenth century that they were driven out of Natal and settled among the Pondos, with whom they remained until the beginning of the nineteenth century. It is evident that although all call themselves Bomvana, the tribe is composite. Mr. Cook has made a very thorough study of their social organisation, religion, and ritual. While their institutions generally conform to type, it is indicated very clearly that, speaking broadly, no generalisation about the Bantu peoples of South Africa is sound. Each must be studied individually. This warning is not unnecessary, even for anthropologists, and still less for the administration.

Young, Champollion, and Hieroglyphics

By Dr. ALLAN FERGUSON

IT is a seemly thing to "praise famous men . . . renowned for their power, giving counsel by their understanding . . . who were honoured in their generation, and were the glory of their times", but it is well, even in a centenary notice, to be strictly accurate in assigning priority. Champollion accomplished great and lasting work for Egyptology, but it is not correct to describe him as the man "who first deciphered the hieroglyphics" (NATURE, p. 307, Feb. 27, 1932). The phrase implies a rounded-off and complete contribution to knowledge such as is seldom made by any pioneer, and was certainly not made by Champollion. He did notable work in the deciphering of hieroglyphics, but he owed much to the labours of at least one of his predecessors, and unfortunately was not at all ready to acknowledge the help which such work had afforded him.

To-day it is not a question for discussion—it is a matter of fact that the first successful steps towards the solution of the problem of hieroglyphics were due to the genius of Thomas Young; and it is demonstrable that Champollion had not realised the correct mode of attack on the problem until Young's discoveries pointed out the way.

Young's is an arresting character—he crowded into his fifty-six years of life (1773–1829) more and more varied discoveries than seems possible for any one man, however greatly gifted. His work in optics, in the theory of surface forces, and in the science of Egyptology is in the first rank. Less important, but illustrating his amazing versatility, are his contributions to medical science and to the theory of the tides, his articles on subjects so diverse as life assurance, bridges, carpentry, and pendular oscillations. His gifts of scholarship are well exhibited in recorded notes of conversations with London scholars—notes which show that, at the age of eighteen, he could argue questions of criticism and emendation, on not unequal terms, with the great Porson himself.

The study of the development of genius is always interesting, and never more so than in the case of Young.* In spite of the immensity and variety of his learning, the amount of his reading was not very large, but "he adhered strictly through life to the principle of doing nothing by halves. Whatever book he had begun to read, he read completely and deliberately through; whatever study he commenced, he never abandoned; and it was by steadily adhering to this principle . . . that he was accustomed to attribute in after life a great part of his success, both as a scholar and as a man of science."

It is noteworthy that he took small account of any gifts of inspiration of genius, laying weight rather on concentration and on an accurate knowledge of, and attention to, matters of detail. This last-named power is shown in his exquisite Greek script—calligraphy in the literal sense of the term—and its application as a weapon of research cannot be better exhibited than in his copies of the Rosetta stone inscriptions and in his laborious piecing together of their texts.

The story of the Rosetta stone has not been told so often as to have lost its interest, and in view of Champollion's centenary, may bear retelling.

It was in 1799 that the stone was unearthed by a French engineer engaged in digging the foundations of a fort in the neighbourhood of Rosetta, a small Egyptian town some miles north-east of Alexandria and situated on an arm of the Nile near its mouth. With many other antiquities it was handed over to the English after the capitulation of Alexandria, and was deposited in the British Museum in February 1802. It is a slab of black basalt 11 inches thick, and in surface dimensions is now about 3 feet 9 inches by 2 feet 4½ inches, but it has lost large fragments from the upper corners and from the right-hand bottom corner. In its unmutilated state it was probably 5 or 6 feet high. It carries three inscriptions, written in two languages. The uppermost inscription is written in the sacred character, the middle in the cursive demotic character, and both these inscriptions are in the Egyptian language. The third and lowermost inscription is written in the Greek language and in Greek uncial characters.

It follows from the manner in which the stone has been mutilated that the hieroglyphic text has suffered most. The demotic text contains 32 lines, 14 being imperfect at the beginnings; the Greek text contains 54 lines, 26 being mutilated at the ends; the hieroglyphic text contains some 14 lines, about half of the text having disappeared.

In the year 196 B.C., there was a general assembly of Egyptian priests held at Memphis to commemorate the accession of Ptolemy V. By reason of the benefits that Ptolemy had conferred upon the land—benefits which included gifts to the temples, remission of taxes, the administration of justice, abolition of the press-gang for the navy, and the founding of temples—the priests assembled in council decreed that certain specified additional honours should be paid to him and to his ancestors; and they further ordained that the decree should be inscribed upon "a stele of hard stone in the writing of the words of the gods, and the writing of books, and the writing of the lords of the North, and it shall be made to stand in the sanctuaries in the temples . . . near the statue of the King of the North and South, Ptolemy, living for ever, beloved of Ptah, the God who maketh himself manifest, whose deeds are beautiful".

* Peacock, "Life of Young"; Leitch, "Young's Miscellaneous Works" (3 vols.); E. A. Wallis Budge, "First Steps in Egyptian"; E. A. Wallis Budge, "The Decrees of Memphis and Canopus" (3 vols.).

This, then, is the import of the inscriptions on the famous stone.

Egyptian writing exists in three forms—hieroglyphic, the sacred picture-writing; hieratic, a simplified form of hieroglyphics; and demotic, an abbreviated form of hieratic writing. We have to remember, in order to realise fully the difficulties that faced the pioneers in this work, that a hieroglyphic symbol may be an ideograph, or may represent a sound, and in the latter case it may represent either a syllable or a letter. The difficulties of elucidation are further emphasised by the existence of determinatives, or signs which help to represent the meanings of words written with the aid of alphabetic or syllabic symbols. Thus, to take a very simple example, the word for *obelisk* (*tekhen*) may be written by drawing the picture of an obelisk; if, however, we write the word by means of the alphabetic symbols t, kh, n, we make assurance doubly sure by following this by a picture of an obelisk, used as a determinative.

The Greek text was early deciphered, and a conjectural restoration of the ends of the mutilated lines was made by Porson. The Oriental scholars, Silvestre de Sacy and Akerblad, worked at the demotic text with some small measure of success, but the first seriously successful attack on the Egyptian inscriptions was made by Young. So early as 1814, Young had made translations of these texts, and in his "Account of some recent Discoveries in Hieroglyphical Literature and Egyptian Antiquities", published in 1823, he enumerates some nine of his early deductions—that simple objects are represented by their actual delineations, and that many signs are used in a figurative sense; he gives the signs for the dual and the plural, for units and for tens, the rule for the direction in which hieroglyphics must be read, remarks that the name of Ptolemy alone existed on the Rosetta stone, and that proper names are included in an oval ring.

This account of his early work was published in 1823 and, in a disputed question of priority, needs careful and critical comparison with the earlier dated publications; we have now, however, to chronicle the publication of a work which, without the slightest possibility of cavil, establishes Young's priority in this region of research. This is the article on "Egypt", originally published in 1819 in the supplement to the "Encyclopædia Britannica". In the plates which accompany this article he prints a word list, and, most important of all, gives a list of alphabetic and syllabic characters. Out of thirteen signs, six are correct, three partly correct, and four wrong. This article, as Sir E. A. Wallis Budge remarks, "is practically the foundation of the science of Egyptology, *because it contains a list of a number of alphabetical Egyptian characters to which, in most cases, he had assigned correct value.* In other words, the idea of a phonetic principle in the reading of hieroglyphics, which had been but dimly comprehended by Warburton, De Guignes, Barthélemy, and Zoega, was clearly grasped by Dr. Young, and was accurately applied by him FOR THE FIRST TIME in the history of the decipherment of the Egyptian hieroglyphic. As Chabas rightly expressed it, 'Cette idée fut, dans la réalité, le *fiat lux* de la science'."

Now let us briefly consider the claims of Champollion (1790–1832) to be described as the first decipherer of the hieroglyphics. Devoted as he was to classical and Oriental studies from an early age, he accumulated a mass of knowledge which, in this field, far surpassed that of Young. In 1812 he was appointed professor of ancient history at Grenoble, and in 1821 he published his treatise, "De l'écriture hiératique des anciens Égyptiens". In the course of this work he states unambiguously that hieratic writing is not alphabetic, that it is a simple modification of the hieroglyphic system, differing therefrom merely in the form of the signs, that it must be considered as hieroglyphic tachygraphy, and that *hieratic characters are signs of things and not signs of sounds.*

It is obvious, therefore, that despite Young's publication of 1819, Champollion, in 1821, was convinced that there was no trace of an alphabet in the hieroglyphic and hieratic characters. In 1822 all is changed. Champollion now publishes his famous "Lettre à M. Dacier, relative à l'alphabet des hiéroglyphes phonétiques employés par les Égyptiens pour inscrire sur leurs monuments les titres, les noms et les surnoms des souverains grecs et romains", in which the alphabetic character of many of the symbols is clearly defined and an alphabet published. As we have seen, Young had already published an alphabet based on an analysis of the names Ptolemy and Berenice. Moreover, it should be noted that Bankes had identified *as a whole* the set of signs which make up the name of Cleopatra. With the letters obtained from Ptolemy and Berenice as a guide, it becomes a matter of cryptogram analysis to find the meaning of the unidentified symbols in the signature of Cleopatra, and with every further extension to a new name the process becomes more easy and more certain.

What is to be assigned as the cause of the remarkable change in the opinions of Champollion? Peacock states categorically that Champollion endeavoured to suppress his unfortunately expressed work of 1821; it is certain that he sent the illustrations of the work to Young without the letterpress—a method admirably adapted to obscure the date of publication—and it is difficult to give any reason, at all creditable to Champollion, for his persistent misstatements concerning the relation of Young's researches to his own.

The probability is that Champollion, who must, before 1821, have become acquainted with Young's Egypt article of 1819, had not appreciated its full significance, more especially as some of its results are stated by Young in a characteristically diffident fashion. If we assume that Champollion realised the full meaning of Young's great advance only after he had published his work of 1821, the matter seems tolerably clear.

However this may be, it is certain that Champollion's contributions to the elucidation of hieroglyphics, great as they were, and carried as they

were to a point which Young could never hope to reach, were posterior to, and probably determined by, Young's fundamental contribution.

"In a lapidary inscription a man is not upon oath," said Johnson. That is very true; and the great mass of such inscriptions may be permitted an affectionate exaggeration of the qualities of the departed. But when we read on the tablet inscribed to Young's memory in Westminster Abbey a eulogium of Young as one who "alike eminent in almost every department of human learning, patient of unintermitted labour, endowed with the faculty of intuitive perception . . . first penetrated the obscurity which had veiled for ages the Hieroglyphics of Egypt", we are reading no more than the literal and unadorned truth.

Oil and Petrol from Coal*

By Prof. C. H. LANDER, C.B.E.

ALL fuels consist essentially of carbon and hydrogen combined in different proportions. In oil, the proportion of hydrogen to carbon is higher than in coal; further, oil contains less oxygen than coal. It is thus obvious that in order to turn coal into oil the proportions of carbon, hydrogen, and oxygen must be suitably readjusted. Various ways of doing this have suggested themselves to the scientific mind, but oil was first produced commercially from coal almost, as it were, accidentally, for it is one of the by-products in the manufacture of gas from coal.

Gas is made by the destructive distillation of coal, usually termed carbonisation. In this process, the coal is heated to a high temperature in closed retorts; the gas and condensable vapours which are driven off are collected, and from the resulting liquid products a certain quantity of oil can be prepared. In the course of these reactions there is a redistribution of the carbon and hydrogen atoms; the coke, which is left behind in the retort, consists mainly of carbon, and has a lower proportion of hydrogen than the original coal, while the liquid and gaseous products have a higher proportion of hydrogen than the original coal.

If the carbonisation is carried out at a lower temperature, say at a dull red heat instead of the bright white heat associated with normal gas-making processes, the yield of gas is less and the yields of coke and liquid products greater, while the latter are more nearly akin to natural petroleum. This process is usually known as low-temperature carbonisation.

Since light spirit is at the present time far more valuable than heavy oils, there have been introduced methods of again redistributing the molecules in the liquid products from the carbonisation of coal, so as to obtain higher yields of the lighter spirit. During this process, which is known as cracking, a residue, which has been deprived of hydrogen, appears as coke. Cracking is also widely applied to the heavier fractions obtained in the distillation of petrol from natural oils.

In obtaining petrol directly from the carbonisation of coal, low temperature carbonisation, cracking pushed to its limits, and the scrubbing of the gas to recover further small quantities of light spirit have not up to the present been able to raise the total yield of motor spirit beyond 6-7 gallons per ton of raw coal. It must, however, not be forgotten that the primary object of carbonisation processes is the manufacture of coke and gas, and that light spirit, valuable as it may be per gallon, is still only a by-product.

The enormous importance of oil and petrol in modern civilisation has naturally focused attention on the possibilities of reshuffling the molecules in the coal in a way favourable to greater oil production; but, as I have already pointed out, coal, as compared with oil, is deficient in hydrogen. The possibility therefore suggests itself of adding extra hydrogen to the coal substance in order to make up this deficiency, and then, by some means or other, inducing the molecules of the mixture to reshuffle themselves into oil molecules. This has actually been accomplished, and for this success due credit must be paid to the work of Dr. Friedrich Bergius, at Mannheim, who was the first to liquefy coal by direct hydrogenation.

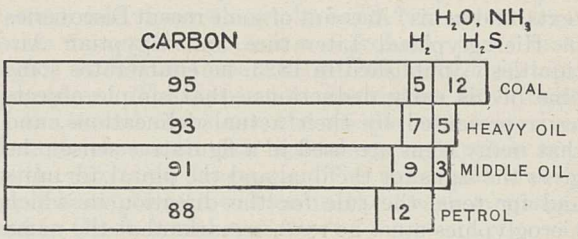

FIG. 1.

Important and striking developments of the hydrogenation process as applied to coal have been made during the past six years, in Great Britain mainly by the Fuel Research Board and Imperial Chemical Industries, Ltd. Fig. 1 † shows how the oxygen, nitrogen, and sulphur in the coal are removed as water, ammonia, and sulphuretted hydrogen. The residual hydrocarbons in the coal (95 per cent C, 5 per cent H) break down and combine with hydrogen to give a large percentage of petrol (88 per cent C, 12 per cent H), the solid material probably passing through heavy oil (93 per cent C, 7 per cent H) and middle oil (91 per cent C, 9 per cent H). It will be seen that although at present

* From the Friday evening discourse at the Royal Institution delivered on Nov. 20, 1931.

† For this and the other illustrations selected from the original discourse for publication here, thanks are due to Imperial Chemical Industries, Ltd.

petrol forms the most attractive product on account of its comparatively high price, the process could be stopped at an intermediate stage and so made to yield kerosene, diesel oil, or fuel oil.

So important to the interests of Great Britain did the possibilities of the hydrogenation of coal appear that active work was inaugurated at the Fuel Research Station in 1922, with results so encouraging that in 1926 an intermediate-scale continuous plant, on the lines of Bergius' latest development, was set up at the Fuel Research Station, and, largely through the foresight of Dr. W. R. Ormandy, who had organised a syndicate to explore the possibility of applying the Bergius process to British coal, an agreement was entered into between the British Government and Dr. Bergius for the pooling and mutual discussion of the results obtained in both laboratories.

Bergius Process

The Bergius process consists essentially in subjecting coal to the action of hydrogen at a high temperature and a high pressure. The powdered coal is prepared for treatment by mixing it with a small quantity of alkaline iron oxide (luxmasse), which acts as a catalyst, and a suitable oil or tar, which may be a fraction of the liquid product obtained from previous runs.

For the preliminary exploration of the process on a small scale, converters consisting of steel-walled vessels, closed by means of a blank flange, and of capacity about 2 litres, are used. A spindle projects from each end of the closed converter so that it can be carried on bearings and rotated over a row of gas flames. The pressure is measured by means of a gauge attached to one of the spindles through which there is drilled a passage to the interior of the vessel, and the temperature is measured by a thermocouple contained within a closed tube carried by the cover and projecting into the converter along its axis.

In hydrogenating coal by the original Bergius process, a thoroughly well-mixed paste is made from 20 parts of coal, 1 part of iron oxide (luxmasse), and 8 parts of oil, the oil being taken from some of the heavier fractions obtained from previous runs. This paste is inserted into the converter, which is then closed. Hydrogen is pumped into the converter until a pressure of about 100 atm. is reached, when the converter is placed in its bearings and rotated over the gas flames, the temperature being raised to about 450° C., while the pressure at the same time rises to about 200 atm. The reaction is allowed to proceed for two hours, after which the converter is cooled and the products extracted.

In these discontinuous experiments it is possible to use coal either in the dry powdered state or in a paste. In a continuous plant, however, there would be great difficulty in injecting a solid material in powdered form into an enclosure which is already under a high gaseous (hydrogen) pressure. By mixing the fine coal with oil into a paste a material is obtained which can be pumped, and this expedient formed one of the most important claims in the Bergius patents.

In the small continuous Bergius plant, capable of dealing with about one ton a day, installed at the Fuel Research Station, the product is a relatively mobile oil, and the rough balance-sheet of the process shows that 50 per cent of the coal is transformed into distillable oil, 20 per cent into gas, and about 15 per cent remains as partially converted material. Some of the partially converted solids remain in suspension in a very fine state in the crude hydrogenated product, and make it very difficult to distil, but by taking proper precautions a series of fractions can be obtained. The heavier fractions can be rehydrogenated for the production of a further quantity of light spirit.

Fuel Research Station Modified Process

Further experimental work was carried out at the Fuel Research Station in order to increase the yield of the lighter fractions at the expense of the heavier oils, and to examine the process in the absence of a complicating factor such as a liquid vehicle for converting the coal into a paste. Improved catalysts were used, and the work was carried out in two stages. In the first stage, coal mixed with a suitable catalyst was heated under pressure in a stream of hydrogen. The reaction products were carried over by the hydrogen and through a second catalyst, in which further conversion to motor spirit took place in the gaseous phase. Experiments have been carried out using 50 lb. of clean coal, and a yield of 140 gal. of motor spirit was obtained per ton of dry, ash-free coal. The net hydrogen required amounted to 8·8 per cent by weight of the coal, giving, together with the 5·6 per cent already present, a total of 14·4 per cent of hydrogen required for the reactions.

The yields of the different products obtained in the processes of high and low temperature carbonisation and a hydrogenation process are shown in the accompanying table:

Yields from Bituminous Coals submitted to Different Treatments

	Carbonisation.		Hydrogenation (Fuel Research Station).
	High temperature.	Low temperature.	
Motor spirit	1·1	1·1	45·1
Diesel oil and creosote oil	2·1	3·4	4·4
Fuel oil	0·5	..	..
Lubricating oil	..	0·5	..
Pitch	2·4	4·4	..
Ammonia	0·2	0·1	0·5
Water	6·3	5·3	6·8
Gas	10·0	15·8	30·4
Organic matter insoluble in benzene	..	..	7·8
Coke	63·4	64·4	..
Ash	5·0	5·0	5·0
Total	100·0		

(*To be continued.*)

York Meeting of the British Association

THE British Association, after celebrating its centenary in London last year, will return this year appropriately to its birthplace, York. The annual meeting will be held there on Aug. 31–Sept. 7, and the preliminary programme has just been issued. The reception room will be in the Exhibition Buildings. The inaugural meeting and evening lectures will be given in the adjoining exhibition hall, a structure which, when it served the same purpose for Ramsay, Huxley, and Spottiswoode at the jubilee meeting in 1881, was labelled as 'temporary', but through various vicissitudes has stood the test of time, and now has been amply restored since its service as a post-office sorting-shed.

Under the new arrangement of the period of the presidency, Sir Alfred Ewing has already assumed that office for the present year, and the subject of his presidential address is now announced as "An Engineer's Outlook". Many other topics of wide interest are already set down for addresses, lectures, or discussions: some of them are even intriguing. Thus a pleasing anticipation cannot but supervene when, reading on from the title of the presidential address, the eye is held by that of Prof. Miles Walker's address to Section G (Engineering)—"The Call to the Engineer to Manage the World". Again, those who have wisely fostered co-operation between the sections should be no less satisfied than interested by the announcement of a joint meeting between Sections A (Mathematical and Physical Sciences) and J (Psychology) to discuss the quantitative relation of physical stimuli and sensory events.

Among the sectional presidents, Prof. A. O. Rankine's address to Section A will deal with physics in prospecting for minerals. Stereo-chemistry will be an important topic in Section B (Chemistry), as the presidential address by Dr. W. H. Mills will deal with it, and it will also be the subject of a discussion. Prof. P. G. H. Boswell, undertaking an onerous double duty in presiding over Section C (Geology) while also a general secretary of the Association, will give his address on "The Contacts of Geology: The Ice Age and Man"; and this section also announces a joint discussion with Section H (Anthropology) on geology and prehistoric archæology. Primates and early man will be considered by Sections D (Zoology) and H (Anthropology). The subject of Lord Rothschild's address to Section D is not yet announced. Prof. H. J. Fleure will address Section E (Geography) on the geographical study of society and world problems; Prof. R. B. Forrester, Section F (Economics), on Britain's access to overseas markets; Dr. Randall MacIver, Section H (Anthropology) on the place of archæology as a science; Prof. Beatrice Edgell, Section J (Psychology) on current constructive theories in psychology, and Prof. J. H. Priestley, Section K (Botany), on "The Growing Tree". The department of forestry under the last section will hear an address from Mr. T. B. Ponsonby on a system of forestry for the British Isles. The Association, through the work of committees and otherwise, has long striven to foster the advancement of science in schools. This will be the subject of Mr. W. M. Heller's address to Section L (Education), and, it is understood, may be also discussed at a special evening meeting. Prof. R. G. White's address to Section M (Agriculture) will deal with sheep farming. It may be added here that Section I (Physiology) will not meet in view of the simultaneous meeting of the International Physiological Congress in Rome.

Among other subjects, the interests of York, Yorkshire, and north-eastern England will rightly find a prominent place. The chemists will discuss water pollution with special reference to the present investigations in the River Tees. The relation of the millstone grit to the carboniferous limestone, the gravels of the Wolds margin, and the concealed coalfield of East Yorkshire appear in the geological programme. Section E announces a series of communications on local physical, historical, and industrial geography; and Roman archæology will appropriately receive close consideration in Section H. The university movement and adult education in Yorkshire will be discussed in the educational section. Lastly, in so important a railway centre as York, the home also of a railway museum (which will be visited), it is fitting that Section G (Engineering) will consider railway traction by steam, oil engine, and electric power.

Evening discourses will be given by Sir Arthur Hill on plant products of the British Empire in relation to human needs, and by Mr. C. C. Paterson on uses of the photoelectric cell; while Mr. H. E. Wimperis will give an afternoon lecture, not for members exclusively, on high speed flying.

An evening reception will be given by the Lord Mayor of York (Alderman Vernon Wragge) and the Sheriff (Mr. Arnold Rowntree). Many points of interest in the neighbourhood of York (and none is richer in them) will be visited. The Yorkshire Philosophical Society, mother society of the Association, will welcome its well-grown daughter by throwing open its museum and gardens to members daily throughout the meeting. The museum itself, scene of the first meeting of the Association in 1831, and headquarters of its organisation under John Phillips, will now house Section D (Zoology) in its more modern Tempest Anderson hall.

Local officers and a committee in York already have the local arrangements fully in hand, including the important question of housing visitors. In this connexion, it is impossible to resist a quotation from the announcement of the first meeting, in 1831. Therein it was provided that on the first day of the meeting "the Managing Committee will receive, at the Museum, the names of Persons intending to be present; and will deliver tickets for the Morning and Evening Meetings, and Dinners, and references

for Lodgings. The Committee will think it right to pay regard to œconomy, as well as convenience, in these arrangements." Without doubt the present local committee shares this aspiration; but members will not fail to take cognisance of a footnote to the above announcement, which appears in the Report for 1831: "On Tuesday a public dinner was provided at Twelve Shillings a Ticket; on the other days, during the session, ordinaries at from Five to Seven Shillings a head: venison, game, and fruit being contributed...." In this respect at least there need be no fear that history will repeat itself.

Obituary

M. Guillaume Bigourdan

THE death of M. Bigourdan has taken from us a veteran astronomer, well known to many of his English colleagues. He attended the meeting of the Paris Academy of Sciences on Feb. 22, in his usual health, but died suddenly on Feb. 28. Born at Sistels (Tarn-et-Garonne) on April 6, 1851, M. Bigourdan graduated in the École d'Astronomie in Paris, and was in 1877 appointed by M. Tisserand as an assistant in the Observatory at Toulouse. Here he was employed on meridian astronomy and devoted his leisure to historical studies in astronomy, which interested him all his life.

In 1879, M. Bigourdan was appointed assistant at the Paris Observatory and had charge of the large equatorial. Here he spent many years in the most assiduous observations of the positions of nebulæ and clusters. In this very trying work he determined the positions of the known nebulæ with all the precision possible from visual observations, discovered many new ones, and incidentally made measures of comets and double stars. The intention underlying these arduous observations was to provide such accurate positions of the nebulæ that future astronomers might detect small movements in these very distant objects. The results were published in the *Annales* of the Paris Observatory, and have since been collected in five large volumes, consisting of about three thousand pages. The gold medal of the Royal Astronomical Society was awarded to M. Bigourdan in 1919 for this monumental work.

Owing to differences between French and English observers in the values for the longitude of Paris, a re-determination was made in 1902 by M. Bigourdan and M. Lancelin working simultaneously with Sir Frank Dyson and Mr. Hollis. The results were in satisfactory accordance, and the mean differs by only $0{\cdot}01^{s}$ from the recent determination made by 'wireless' transmission of time-signals. M. Bigourdan was from its commencement interested in the transmission of time by wireless, which is due to so great an extent to the initiative of General Ferrié. When Paris became the centre of the international time service, he was, until 1928, director of the Bureau.

In 1882, M. Bigourdan took part in the observations of the transit of Venus in Martinique, and he was a member of eclipse expeditions to Senegal in 1892, to Spain in 1900, and to Tunis in 1905. He was for many years a member of the Bureau des Longitudes, and enriched many volumes of the *Annuaire* by articles on astronomical topics. His most important work on the history of astronomy was the bringing out of the "Annales célestes du dix-septième siècle" by A. G. Pingré. This work was completed in manuscript in 1791 and a beginning made of its publication. This went on slowly until the death of Pingré and then ceased. The manuscript was lost, but was found by M. Bigourdan under a wrong designation in the Paris Observatory. It was printed in 1901 under the auspices of the Academy of Sciences.

M. Bigourdan was courteous and affable, and always put his point of view with vigour and vivacity. An incident which took place at the meeting of the International Astronomical Union at Rome in 1922 may be recalled. The discussion was bilingual. One of the British delegates spoke in French, which his British colleagues all understood. Whether M. Bigourdan had not been listening, or whether he wished maliciously to indicate that the French was not perfect, I do not know, but he amused his British colleagues by calling out "Traduction".

He married a daughter of Admiral Mouchez, and they had nine children, to whom we would offer our respectful sympathy. F. W. Dyson.

News and Views

Oliver Heaviside's Work

At a meeting of the Institution of Electrical Engineers on April 21, Dr. W. E. Sumpner gave the annual Kelvin Lecture, choosing as his subject the work of Oliver Heaviside. Before the lecture, the Faraday medal, the highest honour the Institution can give, was presented to Sir Oliver Lodge. Dr. Sumpner said that the work of Heaviside blended telegraphy, the earliest activity of electrical engineers, with radio communication, their latest activity. The older electricians were in the habit of applying Kelvin's formulæ, which apply only to submarine cables, to telephony. Heaviside's idea of increasing the self-induction of the line was diametrically opposed to the prevailing practice. The whole industry was in the hands of a government department very properly reluctant to try expensive experiments. Heaviside's mathematics were not easy to understand and wanted laborious study even by professed mathematicians. This was why some of his theories, although suggested several years before they were practically tried in France and America, were never actually put to the test in Great Britain. His 'distortionless' circuit enabled signals to be transmitted at high speed in submarine cables and made telephony through long cables possible. His work on the cable problem did

a great deal more than lead to the theory of the 'loading coil'. It showed that ordinary telegraphy was only a special form of directed wave telegraphy. Heaviside was the first radio-telegraphist. His analysis of Maxwell's theory was of the orthodox type, but when he dealt with the cable problem, he threw over all the conventional methods used by mathematicians.

The Mellon Institute at Pittsburgh

THE nineteenth Annual Report of the director, Dr. E. R. Weidlein, to the trustees of Mellon Institute of Industrial Research, Pittsburgh, Pa., with which the name of Mr. Andrew Mellon, the new U.S. Ambassador in London, is associated, has recently been issued. It appears that the sum of 722,541 dollars was received by the institution from industrial fellowship donors during the fiscal year ended Feb. 29, 1932, bringing the total for the past 21 years to 8,277,018 dollars. Throughout the past year 75 industrial fellowships, employing 176 scientific workers and engineers, were in operation. At the close of the year, 58 fellowships were active, and of these, 28 have been at work for five years or longer and 13 have concluded more than ten years of research. Since 1911, when the industrial fellowship system was established at the University of Pittsburgh, Mellon Institute has had fellowships on 230 distinct subjects, on which 775 workers have been engaged, and 313 fellows and 357 fellowship assistants, having completed their services, have entered the fields of industry and education. As trained additions to the forces of manufacturing and teaching, these men constitute the Institute's greatest contribution to humanity. The constructional work on the Institute's new building is proceeding satisfactorily; it is thought that this edifice will be completed and ready for occupancy in the summer of 1933.

Testing Work for the Building Industry

IN recent years there has been a growing demand on the Building Research Station of the Department of Scientific and Industrial Research for tests and reports on building materials and forms of construction. In order to enable the Station to cope with these requests, a panel of approved testing laboratories is being established to act in association with the Station. The essence of the scheme is to put the Station in the position to have tests carried out at laboratories on the panel and then to incorporate the results in Government reports or certificates issued by the Station. The bulk of the tests will probably be mechanical or physical; of the chemical tests, most will probably be simple analyses. Applications are invited from testing laboratories wishing to participate in the scheme. Further particulars and forms of application can be obtained from the Director, Building Research Station, Garston, Herts.

Building Research

WE have received the Report of the Building Research Board for the year 1930 (London: H.M. Stationery Office, 2*s*. 6*d*. net), which is a document of 136 pages with an index. The report deals with a number of important aspects of building materials and construction. In a section on damp walls it is pointed out that it does not seem possible to guarantee that a solid brick or masonry wall will exclude damp under all conditions, but no instance has been recorded of the failure of a properly constructed cavity wall to exclude damp. Experiments on noise in buildings showed that where the weight of material necessary to obtain sound insulation is excessive, a considerable reduction of noise can be obtained by the use of composite structures with air spaces between the component parts. The efflorescences on brickwork, due to soluble salts in the bricks, mortar, or external sources, are best removed by washing by hand when the amount of soluble salts is limited. The preparation of standard specifications for building materials is receiving special attention by the Board in conjunction with the British Standards Institution, and it is highly satisfactory to note that a considerable measure of co-operation between the Building Research Station and industry has been achieved. The report also refers to a considerable amount of work on concrete and reinforced concrete which has been carried out, and a new laboratory is being erected to house this work. The report shows that a very useful purpose is being fulfilled by the Board, the activities of which may be expected to increase in several directions as time goes on.

Agricultural Parasites Research in Canada

INTERNAL parasites are one of the stock-farmer's biggest problems all over the British Empire. They are the poultry-farmer's worst enemy, and, in all probability, constitute the most severe check on the growth of the poultry industry in the British Isles. In Canada it has been estimated that parasitic infestation causes an annual loss of £4,000,000 and is responsible for the death of one-tenth of the Dominion's live stock. A new Empire centre for the scientific study of internal parasites has been established in Canada, with the assistance of a grant from the Empire Marketing Board. New buildings, which will house the Institute of Parasitology, are now being erected by the Quebec Government at Macdonald College, the agricultural college attached to McGill University. The scheme is being financed for three years jointly by the Empire Marketing Board and the National Research Council of Canada. It marks the first occasion on which the Canadian Government and the Empire Marketing Board have combined to support a joint scheme of research. It is hoped that the new Institute may eventually become an Empire headquarters for the study of internal parasites, somewhat as Onderstepoort, in South Africa, has become recognised as an Empire centre for animal diseases research. The scheme therefore provides a fresh example of Empire team-work in the field of agricultural research.

Change-Over from Direct to Alternating Current

AT the present time electricians are interested in the problem of the change-over from direct current to alternating current systems of supply. Where new systems are being laid down in Great Britain the

three-phase, four-wire alternating current system of supply is being taken as the standard, the pressure of supply from the three outers to the neutral main being 230 volts. There is still a large number of supply stations in Great Britain which do not use the standard system, and if they are to reap the benefits of standardisation they must change to a.c. In a paper by H. Blades and A. C. MacQueen, read to the Institution of Electrical Engineers on March 31, this change-over is discussed. They show that the problems arising in dealing with small towns and suburban and residential districts are different from those arising in industrial and city areas. In the former areas the change-over from d.c. systems to a.c. systems should take place at the earliest possible opportunity. As the life of a.c. low pressure cables is, as a rule, about twice as long as that of d.c. cables, the costs for renewals would be considerably diminished. Some eight years ago a supply undertaking replaced a large section of its direct current network with very satisfactory results. The total cost of the change-over was cheaper than the estimated cost of replacing the old d.c. system and the maintenance and development charges were appreciably reduced. The faults which frequently occurred in the mains when direct current was used now practically never occur. The best methods of carrying out the change-over are given in the paper, and the necessary arrangements that have to be made with the consumers explained. As the number of consumers who have radio receivers actuated from the mains is rapidly increasing, the change-over costs to the supply companies increases concurrently, and this in addition to the engineering and technical reasons makes an early change from d.c. to a.c. advisable. In industrial and city areas the best rate at which the change-over should occur depends on the demand and the condition of the direct current plant.

Clocks Worked from the Electric Supply Mains

When a house is supplied with alternating current electricity on the time-controlled system, it is possible to use an electric clock which keeps almost exact Greenwich time, the error being at the most only a few seconds per week. The principle used in their working is that of the synchronous motor, which keeps in exact step with the frequency of the alternating current, and the frequency is controlled by a ' master controller ' regulated by Greenwich time so as to make it easy to synchronise the generators connected with the network. The clocks cost from thirty shillings upwards, depending on the size and design of the case used. The first synchronous clocks were used in the United States about twelve years ago, and, from their inventor, were called Warren clocks. In America more than six million have been sold and in Great Britain about a quarter of a million (*Electrical Industries*, March 16). They are made of two types. In one class the clock is self-starting and in the other it has to be started if the current stops even for a fraction of a second. In the latter class a red disc usually appears on the rare occasions when it stops. The clocks require only about half the power taken by an ordinary electric meter, and so the cost of running them is only a few pence a year. In America the sales are usually made by the electric supply companies, but in Great Britain the dealers who sell electric accessories and the clock-makers have taken up their sale. As a rule, the clocks require no attention for many months. In districts supplied by suitable alternating current, it is probable that this type of clock will supersede the escapement and pendulum type. Electric movements can be obtained to replace the ordinary clockwork movement of an existing clock.

The *Akron*, the Airship of the United States Navy

In the new airship *Akron* built for the United States Navy there are incorporated several improvements which set new standards of efficiency for subsequent lighter-than-air machines. The ship is larger than most ocean liners and, unlike most of its predecessors, it is largely actuated by electricity and electrical apparatus. Particulars of the ship are given in the *Westinghouse International* for the first quarter of 1932. The power plant consists of two petrol-driven 11-kilowatt generators, with a motor generator set for battery charging. The total weight allowed for the electrical system on board was only 3000 lb. Aluminium alloys were largely used for the machines and cables, and all the circuits are controlled from the generator room. The radio system takes the heaviest load from the generators. The antenna system consists of two trailing antennæ and a fixed wire antenna. The latter is used for landing manœuvres and for auxiliary purposes. Fire risk is practically eliminated, the twelve supporting gasbags of the ship being filled with helium; but even if they had been filled with hydrogen there would have been little risk of explosion, as every power outlet on the ship is so constructed that the plug cannot be removed or inserted unless its switch is in the ' off ' position. Miniature lightning arresters protect the ship from static charges of electricity picked up while the ship is in flight, especially when she changes from one equipotential surface of the earth's electric field to the other. These arresters also drain off any electrostatic charges that might be induced by the ship's radio. The telephone system has seventeen telephones, the switchboard on which the keys and lamps are mounted weighing only thirty pounds. A special feature of the *Akron* is the powerful searchlight which is used for signalling and for landing. It consists of a 500-watt lamp with a fourteen-inch reflector. In daylight tests its light is brilliantly visible at a distance of four miles.

Recent Acquisitions at the Natural History Museum

The Zoological Department of the Museum has secured a mounted example of an exceedingly rare marsupial mouse, *Cœnolestes obscurus*, from Mount Pichincha, Quito, Ecuador. This species belongs to that group of marsupials which, from the possession of only two incisor teeth in the lower jaw, is known as the Diprotodontia. Except for this solitary species, found in a restricted area of the high Alpine country of the Central Andes in Venezuela, Colombia, Ecuador, and Peru, the diprodont marsupials are found only in the Australian region. The Department of

Entomology has acquired the important collection of British Coleoptera (beetles) formed by the late Dr. David Sharp, who died in 1922. The collection comprises nearly 114,000 specimens, most of which were collected by Dr. Sharp himself. Dr. Sharp's general collection of Coleoptera, consisting of at least 300,000 specimens from all parts of the world, was purchased by the Museum in 1905. More than 4000 additional foreign specimens have been received with the British collection. The Trustees have approved the purchase for the Department of Geology of a collection of Nothosaurs from the Alpine Trias of Besano. These small swimming reptiles were precursors of the better known Plesiosaurs. The specimens acquired appear to belong to two species of the genus *Pachypleurosaurus*. There has been placed on exhibition in the Department of Geology, near the entrance, the first of a contemplated series of scenes representing the fish-fauna of succeeding geological epochs. It shows reconstruction-models of fish-like animals and true fishes that lived just when the Silurian was passing into the Devonian period. They are the earliest 'back-boned' animals of which fossil remains have been found. The models are posed in an illuminated scene, the surface of the underwater scene being just below the eye of a spectator of average height; at the eye-level, the distant hills of the Old Red Sandstone period are seen.

Minerals at the Natural History Museum

IN 1930 the experiment was tried of issuing a free guide-leaflet to the exhibition collections in the Mineral Department of the Natural History Museum at South Kensington. The distribution of the leaflet is helped by some attractive exhibits of popular interest placed near the entrance to the gallery. By these means a considerably larger number of visitors have been induced to take an intelligent interest in the collections. The fact that 20,000 of these leaflets have been taken away by visitors, none being left as litter, proves that they have been appreciated. In the four-paged leaflet, attention is especially directed to the various uses of minerals by giving lists of gem-stones, ores of the metals, other minerals of economic importance, building and road stones, ornamental stones, and radium-bearing minerals, with the number of the cases in which each may be seen. A third issue of 10,000 copies of the leaflet is now available.

Fellowships for Medical Research

THE Rockefeller Medical Fellowships and the Dorothy Temple Cross Research Fellowships in Tuberculosis for the academic year 1932–33 will shortly be awarded by the Medical Research Council, and applications for either should be lodged with the Council not later than June 1. The Rockefeller Fellowships are provided from a fund with which the Medical Research Council have been entrusted by the Rockefeller Foundation, and 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. A fellowship held in America will have the value of not less than £350 a year. The Dorothy Temple Cross Research Fellowships give special opportunities for study and research to persons "intending to devote themselves to the advancement by teaching or research of curative or preventive treatment of tuberculosis in all or any of its forms". Candidates must be British subjects and must possess suitable medical, veterinary, or scientific qualifications. The fellowships will preferably be awarded to candidates who wish to make their studies or inquiries outside Great Britain, and are of the value of not less than £350 a year. It may also be possible to award a senior fellowship of considerably greater value to a specially well qualified candidate wishing to undertake an intensive study of some particular problem of tuberculosis at a chosen centre of work in another country. Particulars of these fellowships are obtainable from the Secretary, Medical Research Council, 38 Old Queen Street, Westminster, S.W.1.

International Congress for Anthropology and Ethnology]

THE proposal for the constitution of an international congress for anthropology and ethnology, which was put forward by the Royal Anthropological Institute, has elicited some interesting expressions of opinion from continental anthropologists. Two communications which have been received by the Council are published in *Man* for April. Dr. Fritz Krause, of Leipzig, president of the Gesellschaft für Völkerkunde, has been in communication with a number of ethnologists in Austria, Sweden, Holland, and Denmark, and has found that nearly all of them would prefer a congress covering ethnology only. Dr. Krause himself personally is in favour of a congress of 'ethnic sciences', of which the mainstay and principal field would be ethnology; but with 'adjacent sciences'—ethnic psychology, sociology, etc.—taken into account and permanently recognised. Dr. Krause has offered to push his inquiries further, and this offer the Council of the Institute has cordially accepted. The second communication is from the Very Rev. P. W. Schmidt, who concurs in the view that the interests of ethnology will be best served by a separate congress. In fact, he and his colleagues in Vienna consider that there should be separate congresses for ethnology, anthropology, and prehistory. It is felt, however, that a great advantage would be obtained from a periodically recurring joint congress of all three branches of study. A rotation of four meetings at intervals of two years between each, of which the fourth in each series should be a joint meeting of the three studies, is suggested. This has the obvious disadvantage of an inordinately long interval between the independent meetings in each subject.

Medieval Sussex

IN attempting to reconstruct the past geography of England, one of the chief difficulties is to bridge the gap between the Domesday Survey of 1086 and the topographical county descriptions of the seventeenth and eighteenth centuries. In a paper in *Geography* for March, Mr. R. A. Pelham has indicated

some sources from which data can be obtained for these centuries, and has outlined the use to which they may be put in the county of Sussex. The distribution of various types of building-stone, when a stone was used outside its area of occurrence in the fabric of a church, throws light on means of transport, especially the navigability of rivers, since waterways were the only satisfactory means of moving heavy materials. Evidence of this source can be strengthened by sheriffs' administrative accounts. These do not give the precise route but the distance and the cost of transport. The sheriffs' accounts also give much evidence concerning the distribution of crops, timber, and wool production. Lastly, much valuable information can be obtained from taxation accounts, particularly the lay subsidy of 1327. This gives a guide to the location of the areas of greatest prosperity. Mr. Pelham has illustrated his paper with maps of various aspects of the fourteenth century geography of Sussex.

Ice in Arctic Seas

THE Danish Meteorological Institute has published its report on the ice in arctic seas in 1930 (*Isforholdene i de Arktiske Have*). There appears to have been a repetition of the unusual conditions marked by the lack of ice in many seas in 1930. In Spitsbergen the fjord ice was late in forming and relatively thin, and so early as April the western part of the north coast had open water, and by June there was access to the north-east. During July and August the waters of the archipelago were almost free from ice. In the Barents Sea the edge of the ice was unusually far north throughout the summer, and in August a great deal of Franz Josef Land was accessible in open water, which is not usual. The Kara Sea had scattered ice in July but was almost entirely clear in August. So late as November there was little ice in the White Sea. In the east coast of Greenland conditions were less abnormal, but from August until November there was little or no ice off Angmagssalik. The coasts of Iceland were free from ice throughout the year, and south-west Greenland had less ice than usual. Hudson Strait was clear of ice about a month earlier than usual and, except for icebergs, was still free in October. From Siberian waters there were few reports. On the north coast of Alaska the ice lay closely packed throughout the summer. The report is illustrated with the usual charts for each of the spring and summer months.

Abstracts of Meteorological Literature

THE *Meteorological Magazine* for March 1932 contains particulars of a collection of abstracts of meteorological literature which has been undertaken by the Meteorological Office, Air Ministry. The abstracts are being gathered from various sources, including authors' own summaries, translated into English where necessary, and a number of meteorologists have volunteered their assistance in summarising papers for which no abstracts are otherwise available. The collection already numbers about a thousand, covering a period of nearly ten years, and it is hoped to include every important paper published in future. The abstracts are being classified according to subject, the classification adopted being that of the International Catalogue of Scientific Literature, which is also employed in the Royal Meteorological Society's Bibliography; the new collection of abstracts will thus form a very useful complement to the latter. The abstracts will not be published, but will be kept in the Meteorological Office Library for reference.

Bibliography of Seismology

THE study of earthquakes and of the transmission of earthquake waves through the earth has lately made such rapid advances that any attempt to enumerate the memoirs published is welcome. We have received from the Dominion Observatory at Ottawa, which is now solely responsible for its publication, copies of recent issues of the *Bibliography of Seismology*, edited by Mr. E. A. Hodgson. The number for July–Sept. 1931 contains the titles, with occasional brief abstracts, of a hundred papers. Most countries in which earthquakes are studied are represented, though somewhat unequally, more than one-half of the papers being published in the United States and Great Britain and only two in Italy.

British School of Archæology in Iraq

IT is announced that the subscribers to the fund for establishing a British School of Archæology in Iraq in memory of the late Miss Gertrude Bell have appointed a council on which the Universities of Oxford, Cambridge, Edinburgh, Durham, and London are represented. In addition, there are representatives of the British Museum, the British Academy, the Royal Geographical Society, the Royal Asiatic Society, the Society of Antiquaries, and other learned societies. The following have been appointed as officers: Sir Percy Cox (president), Sir Edgar Bonham Carter (chairman of the executive committee), Mr. E. H. Keeling (hon. secretary), and Brigadier-General Sir Osborne Mance (hon. treasurer). The offices of the School for the present will be at 20 Wilton Street, London, S.W.

Scenery Preservation in New Zealand

THE preservation of natural scenery by the institution of reserves is an active policy of the New Zealand Government. The report on scenery preservation of the year ending March 31, 1931, records additional reserves during the year of 131,415 acres, making a total of well over half a million acres. Notable additions include Lake Okareka and surroundings, and some two hundred square miles embracing the Fox Glacier, and the Copland and Twain Rivers, and many prominent mountain peaks. Some of the smaller reserves have been set aside for historical and anthropological reasons, but most are scheduled in order to preserve scenery and natural vegetation.

Announcements

THE Kelvin Medal of the Institute of Civil Engineers for 1932 has been awarded to the Marchese Guglielmo Marconi, and the presentation will be made by Lord Rutherford at the Institute on Tuesday next, May 3, at 5 P.M.

A VARLEY centenary commemoration meeting will be held at the Institution of Electrical Engineers on

May 5. A short discourse on the lives and work of Cromwell Fleetwood Varley (April 6, 1828) and Samuel Alfred Varley (March 22, 1832) will be delivered by Lieut.-Col. A. G. Lee. The annual general meeting of the Institution will follow this meeting.

THREE public lectures arranged by the National Institute of Industrial Psychology (under the Heath Clark Bequest), on "Psychological and Social Factors in Business Rationalisation", will be delivered by Dr. Charles S. Myers, principal of the National Institute of Industrial Psychology, May 4, 11, and 18, at 5.30 P.M. The lectures will be given at the London School of Economics and Political Science, Houghton Street, Aldwych, W.C.2.

THE writer of the obituary notice of the late Sir Horace Plunkett which appeared in NATURE for April 16 has been reminded that Sir Robert Blair was Assistant Secretary for Technical Instruction in the new Irish Department from 1900 until 1904, before he became Education Officer of the London County Council. The two 'aliens' whom Sir Horace introduced were thus both Scots.

A PRELIMINARY programme has been issued of the centenary meeting of the British Medical Association, to be held in London on July 21–30 under the presidency of Lord Dawson of Penn. The meetings will be held at the British Medical Association House, Tavistock Square, W.C.1. Lord Dawson will deliver his presidential address on July 26 at the Queen's Hall. The popular lecture to the Association will be delivered on July 29 by Prof. Julian S. Huxley. An exhibition of surgical appliances, drugs, foods, books, etc., will be open on July 26–29 at the University of London, Imperial Institute Road, S.W.7. On July 24 a pilgrimage will be made to Worcester to unveil two memorials to Sir Charles Hastings, who founded the Association there in 1832.

THE programme of experiments to be carried out during the coming season at Jealott's Hill, the Agricultural Research Station of Imperial Chemical Industries, Ltd., at Bracknell, near Maidenhead, Berks, includes experiments on fertilisers for grain, root, and green crops, and also on the intensive management of grassland. The demonstrational small-holding has entered its second complete season, and the results of the first year's working are available. An open invitation is extended to all interested in agriculture to inspect the Station. Visitors are the guests of the Station at lunch or tea, but it is desirable that two or three days' notice should be given of an intended visit.

THE advanced courses in anthropology, sociology, and comparative philology in the University of London announced for delivery in May promise to be of exceptional interest. On May 2, 4, and 6, Prof. G. Morgenstierne of the University of Gothenburg will lecture on "The Káfirs of the Hindu Kush". The lectures will be delivered at 5.30 P.M. at the School of Oriental Studies, Finsbury Circus, E.C., and will deal with the ethnology and culture of the people, as well as with their linguistics. On May 5 and 12, at 5 P.M., Dr. R. R. Marett, Rector of Exeter College, Oxford, will lecture at the London School of Economics on "Covenant in Primitive Economics, Law, and Religion". Prof. A. M. Tallgren, professor of archæology of Finland and the Northern Countries in the University of Helsingfors, will lecture at University College on May 23 and 25 on "Central Asiatic and Siberian Rock Pictures". The lectures will begin at 5.30. Admission to all these lectures is free and without ticket.

A CATALOGUE of second-hand books on natural history has been issued by James Thin, 54-56 South Bridge, Edinburgh. The 2497 items in the list range over a wide field in zoology, botany, and agriculture and husbandry.

A NEW book by Max Planck, entitled "Where is Science Going?", with introduction and epilogue by Einstein, is promised by Messrs. Allen and Unwin for the autumn. These publishers also announce "Science: A Symposium", a collection of essays by Bertrand Russell, Prof. Julian Huxley, Prof. J. B. S. Haldane, Hilaire Belloc, Sir Oliver Lodge, Sir Thomas Holland, John Baker, Hugh L'Anson Fausset, and Prof. H. Levy.

A NEW publication dealing with general and comparative physiology has been undertaken by the Wistar Institute of Anatomy and Biology, Philadelphia. This *Journal of Cellular and Comparative Physiology*, which will be published in alternate months, under a responsible board of editors, commenced publication on Feb. 20. The volume will contain about 500 pages and may be closed with any issue. The price will be 5.50 dollars outside the United States.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An assistant lecturer in agricultural economics in the University of Leeds—The Registrar, University, Leeds (May 2). An assistant veterinary inspector under the Surrey County Council—The Chief Veterinary Officer, County Hall, Kingston-upon-Thames (May 10). A superintendent of Epping Forest—The Town Clerk, Guildhall, E.C.2 (May 11). A woman lecturer in geography at St. Gabriel's College, Camberwell—The Principal, St. Gabriel's College, Cormont Road, Camberwell, S.E. (May 14). A lecturer in geography at Armstrong College—The Registrar, Armstrong College, Newcastle-upon-Tyne (May 14). Two assistant lecturers in the School of Economics and Commerce, Dundee, in, respectively, industrial administration and commerce—The Principal, School of Economics and Commerce, Dundee (May 23). A director of the British Non-Ferrous Metals Research Association—The Chairman of the Association, 168 Regent Street, W.1.

ERRATUM.—In the article "Flame Movements in Gaseous Explosions", in NATURE for April 16, p. 565, line 5, for "Campbell and Woodward (1926)" read "Campbell and Woodhead (1926)".

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.*]

Disintegration of Lithium by Swift Protons

In a previous letter to this journal [1] we have described a method of producing a steady stream of swift protons of energies up to 600 kilovolts by the application of high potentials, and have described experiments to measure the range of travel of these protons outside the tube. We have employed the same method to examine the effect of the bombardment of a layer of lithium by a stream of these ions, the lithium being placed inside the tube at 45° to the beam. A mica window of stopping power of 2 cm. of air was sealed on to the side of the tube, and the existence of radiation from the lithium was investigated by the scintillation method outside the tube. The thickness of the mica window was much more than sufficient to prevent any scattered protons from escaping into the air even at the highest voltages used.

On applying an accelerating potential of the order of 125 kilovolts, a number of bright scintillations were at once observed, the numbers increasing rapidly with voltage up to the highest voltages used, namely, 400 kilovolts. At this point many hundreds of scintillations per minute were observed using a proton current of a few microamperes. No scintillations were observed when the proton stream was cut off or when the lithium was shielded from it by a metal screen. The range of the particles was measured by introducing mica screens in the path of the rays, and found to be about eight centimetres in air and not to vary appreciably with voltage.

To throw light on the nature of these particles, experiments were made with a Shimizu expansion chamber, when a number of tracks resembling those of α-particles were observed and of range agreeing closely with that determined by the scintillations. It is estimated that at 250 kilovolts, one particle is produced for approximately 10^9 protons.

The brightness of the scintillations and the density of the tracks observed in the expansion chamber suggest that the particles are normal α-particles. If this point of view turns out to be correct, it seems not unlikely that the lithium isotope of mass 7 occasionally captures a proton and the resulting nucleus of mass 8 breaks into two α-particles, each of mass four and each with an energy of about eight million electron volts. The evolution of energy on this view is about sixteen million electron volts per disintegration, agreeing approximately with that to be expected from the decrease of atomic mass involved in such a disintegration.

Experiments are in progress to determine the effect on other elements when bombarded by a stream of swift protons and other particles.

J. D. Cockcroft.
E. T. S. Walton.

Cavendish Laboratory,
Cambridge,
April 16.

[1] Nature, **129**, 242, Feb. 13, 1932.

Isotopic Constitution of Lead from Different Sources

Thanks to the generous co-operation of Dr. v. Grosse and other chemists in supplying me with the requisite rare materials, I have been able to repeat and amplify my analyses of lead from different geological sources. During these experiments, which I hope to extend, technical improvements were effected so that, in spite of the difficulties inherent in the problem, results have been obtained upon which considerable reliance may be placed.

The effect of the presence of hydrides due to the methyl compounds has been measured and can be allowed for. Under the particular conditions used, it amounts to 2·3 per cent. Thus in the lightest lead (II) though the line 207 had an apparent intensity of 9·5 (line 206 = 100), its true relative abundance is estimated to be $7{\cdot}2 \pm 0{\cdot}3$, in good agreement with the value 7 assumed by Lord Rutherford [1] for his calculations on actino-uranium. Several rare isotopes previously suspected in ordinary lead [2] have now been confirmed but their abundances are too small to be certain. The percentage analyses are as follows :—

Chemical	I	II	III	IV
Atomic Weight	207·22	206·048	206·195	207·90
203	(0·04)	..	..	..
204	(1·50)	..	..	..
205	(0·03)	..	..	..
206	27·75	93·3	85·9	4·6
207	20·20	6·7	8·3	1·3
208	49·55	(0·02)	5·8	94·1
209	(0·85)	..	..	..
210	(0·08)	..	..	..
Mean Mass Number	207·19	206·067	206·20	207·895

I. Ordinary lead.
II. Lead from Katanga pitchblende (Hönigschmid and Birkenbach, *Ber. Deutsch. Chem. Gesell.*, **56**, 1837 ; 1923).
III. Lead from Wilberforce uraninite (Baxter and Bliss, *J. Amer. Chem. Soc.*, **52**, 4851 ; 1930).
IV. Lead from Norwegian thorite (Fajans, *Sitz. Heidelberger Akad. Wiss.*, **3** ; 1918).

The packing fractions of the leads will be very difficult to ascertain, but appear to be in the region 0 to +1. They will tend to cancel the correction (still uncertain) to the chemical scale, so that the mean mass-numbers should show agreement with the chemical atomic weights, which is the case. It is noteworthy that the quantities of 206 and 207 in (IV) do not correspond to those expected from ordinary lead present as an impurity.

F. W. Aston.

Cavendish Laboratory,
Cambridge,
April 12.

[1] Nature, **123**, 313, March 2, 1929.
[2] Nature, **120**, 224, Aug. 13, 1927.

Oxygen and Everest

On the interesting subject of the need for oxygen on Mount Everest, Prof J. Barcroft has made the remark, before Section I of the British Association, that the whole matter is now merely "an engineer's problem" : the problem of designing a light and efficient oxygen breathing apparatus. This point of view is ably supported by Prof. Margaria.[1] There is, however, something more : namely, the disadvantage of acclimatisation in a man using such apparatus. If it is one of the 'open circuit' type, acclimatised breathing causes a huge waste of oxygen and adds correspondingly to the difficulty of transportation. Yet a man dare not relinquish this physiological condition, even if he could. For if he relinquished it, he would die of asphyxia as soon as he took the apparatus off.

A man adjusted to sea-level conditions breathes about ten litres of air for each gram of carbon dioxide exhaled. When acclimatised to 20,000 ft. he breathes about twenty litres per gram of carbon dioxide. At rest at sea-level he breathes 5-7 litres of air per minute. At rest on the North Col of Mount Everest, with the same carbon dioxide production, he probably breathes 10-14 litres. This does not incommode him at all. When he exercises and produces 4-6 gm. of carbon dioxide per minute, he breathes 40-60 litres at sea-level, but 80-120 litres on Mount Everest. 40-60 litres per minute is merely heavy breathing; but 80-120 litres is intolerable for more than a minute or two. A man cannot walk while doing it. The reason for this difference lies in the fact that, in acclimatisation, the blood alkali is reduced in proportion to the altitude and oxygen pressure to which the man has become adjusted; and the less the blood alkali, the larger must be the 'dilution ratio': that is, the volume of air breathed per gram of carbon dioxide produced and exhaled. This adjustment is acquired very slowly, and is reversed again equally slowly, through days or even weeks, on return to sea-level.

As Prof. Barcroft was the first to show, the balance of acid and alkaline elements in the blood is the same at altitudes as at sea-level; but the amounts of each are not the same. The acid element is carbonic acid in equilibrium with the carbon dioxide in the air of the lungs and controlled by their ventilations. It was shown by Haldane, Douglas, Schneider, and Henderson on Pike's Peak that, because of the increased breathing, the partial pressure of carbon dioxide in the lungs and, therefore, the carbonic acid of the blood are diminished in proportion to the altitude. So also are the bicarbonates, which are the alkaline element in the blood. The reduction of the acid proportionally with the alkali is essential to maintain the hydrogen ion concentration of the blood at its normal value. In order to keep the quantity of carbonic acid down to an amount to correspond with the decreased blood alkali, the volume of breathing must be increased in inverse proportion to the bicarbonates in the blood.

Accordingly, when a man fairly well acclimatised to the altitude of the North Col puts on an oxygen apparatus and does the heavy work of climbing with it on his back, the increased production of carbon dioxide induces so large a volume of breathing that he can make but a few steps at a time. The hyperpnœa may be almost as intolerable as if he were breathing merely the thin air; for in the main it is induced by the large 'dilution ratio' due to the low blood alkali. Without the apparatus, the oxygen deficiency merely reinforces, to some extent, the hyperpnœa due to carbon dioxide. Inhalation of oxygen, therefore, does little to ease the violence of the breathing after each few yards of the struggle upward.

Some men acclimatise slowly and with difficulty. They suffer from prolonged mountain sickness, as Dr. Douglas and Prof. Schneider did on Pike's Peak,[2] and as, I believe, Prof. Barcroft does to an even greater extent. For them oxygen is the very breath of life. Others like Dr. J. S. Haldane (as I saw on Pike's Peak), and like Mr. Odell and others of the advanced parties in the attacks on Mount Everest, acclimatise so easily and well that oxygen helps them less than the weight of an apparatus impedes. For the first type, who have what we may call 'sea-level respiratory centres', the ascent of Everest is largely an "engineer's problem". They should fly direct and wholly unacclimatised to the North Col, don an improved apparatus, make the ascent, and get back below 15,000 ft. while the supply of oxygen holds out. The other type acclimatises readily; and during the gradual ascent through Tibet they become so well adjusted to low pressures of oxygen that, although the risks are great, a party of such men with no apparatus may some day reach the summit.

There is one development, however, that, I think, we shall never see: namely, agreement between the advocates of oxygen apparatus and those whose experience teaches them to rely wholly on acclimatisation.[3] Prof. Margaria comments upon the fact that on this matter "there is no accord among physiologists"; to which I would add that the disagreement lies not in their minds merely, but fundamentally in their respiratory centres. How can a man of either opinion accept the other, when his own is to him as obvious as breathing? The whole science of respiratory physiology would to-day be different from what it is if its author, Dr. Haldane, had not happened to have a respiratory centre of the type that is most completely controlled by carbon dioxide, yet acclimatises fairly easily. Those who disagree with him on such matters as acclimatisation, do so, not so much because they think differently, as because they breathe differently.

YANDELL HENDERSON.

Yale University,
New Haven, Conn.,
March 30.

[1] Margaria, R., NATURE, **129**, 397; March 12, 1932.
[2] Douglas, Haldane, Henderson, and Schneider, *Phil. Trans. Roy. Soc.*, B, **203**, 185; Feb. 7, 1913.
[3] Henderson, Y., NATURE, **117**, 747; May 29, 1926.

The Cry of Tin

IT is an observation of respectable antiquity that when a bar of tin is bent it emits a characteristic creaking, known as the 'cry of tin'. According to Mellor,[1] who is one of the few authorities to refer to the subject, the cry "is supposed to be produced by the grinding of the crystals against one another during the bending of the metal", and I have been unable to find in the literature any more definite explanation of its origin. In the course of some experiments which I have been carrying out with Prof. E. N. da C. Andrade on single crystal wires I have made observations which, I think, make possible a rather more precise attribution of the sound.

I have obtained the cry with cadmium as well as with tin. When single crystal wires of these metals are stretched, the deformation takes place in two stages, a slip on the glide planes, which constitute in both cases a unique system, being succeeded by a mechanical twinning on a specified plane. The twinning does not take place until after a definite amount of glide extension has occurred, which enables the two phenomena to be studied separately.

With single crystal wires no sound is produced during the glide stage of extension, but with both metals twinning is accompanied by the characteristic creaking or tearing sound. The same sound also occurs when such wires are violently bent or twisted, a process which gives rise to the surface marking characteristic of twinning, although it does not allow the separation of twinning from other effects in the way that simple extension does.

The tin with which the phenomenon is normally observed is in a polycrystalline state. Although the cry occurs when polycrystalline cast rods of both tin and cadmium are bent, drawn wires of small diameter do not give it unless they are annealed, or, in other words, the production of the sound depends on the size of the crystallites being greater than a certain minimum—larger crystals, of course, being subjected to more severe strain when the metal is bent. It is reasonable to suppose that the cry is an accompani-

ment of twinning in the case of the polycrystalline state as well as in the single crystal state.

Preliminary measurements on cadmium indicate that whereas the heat evolved in the twinning is of the order of 0·1 calories per gram, less than one-tenth of this amount is produced during the whole extension accompanying gliding, although this extension is considerably greater than that due to the twinning. The measurements, which are being followed up with more accurate methods, give, at present, only rough approximations, but suffice to establish clearly this very much greater heating which accompanies twinning. This observation suggests that some of the mechanical energy that is supplied to the lattice to cause twinning is afterwards liberated as heat energy and, in particular cases, as sound energy, the cry of tin and cadmium being a manifestation of the latter.

It may be added that while a cry can be produced from zinc, which crystallises in the hexagonal system and twins readily, I have not been able to produce a cry with any metal crystallising in a cubic system, for which twinning does not take place.

BRUCE CHALMERS.

Physics Laboratory,
University College, London,
April 6.

[1] "Complete Treatise of Inorganic Chemistry", vol. 7, p. 296.

THE observations of Dr. Chalmers described in the above letter, which are being followed up, seem to me likely to prove of considerable importance for elucidating the problem of twinning. The generation of heat agrees with the view that, in twinning, the molecules, when sufficient energy is applied, slip from one equilibrium position to another, about which they then execute heavily damped vibrations, the energy of vibration dissipating itself in heat and probably in radiation of a frequency of the *Reststrahlen* order. The sound indicates that the twinning does not take place over the whole region of twinning simultaneously, for the sound frequency is much too low to be connected with the vibration of molecules or molecular units, but is propagated from layer to layer with a velocity or velocities of the order of sound velocity. It is possible that in the case of substances where sudden twinning is unaccompanied by audible sound, the sound exists, but is of too high a frequency to be heard.

E. N. DA C. ANDRADE.

Climatic Changes in British Somaliland

THE alternation of climatic conditions in East Africa during Pleistocene time has recently been brought into prominence in connexion with the history of early man, and it accordingly became of interest, the opportunity presenting itself, to ascertain whether the results obtained in Kenya could to any degree be paralleled in Somaliland.

Fifteen months of almost continuous travel in the British Protectorate led to tentative first conclusions, which, if the coastal belt could have been included, would probably have been more definite. Evidence in the districts traversed was somewhat hard to find, but in the west, the Buramo district, tenanted by the Gadabursi people, steep V-shaped valleys give proof of an early and strong period of erosion, whereby bold, rugged scenery has been carved out of a complex of crystalline rocks. To this time may also be attributed sundry high-level deposits; that is, in the east on the Sorl Haud, and in the Gadabursi country, where conglomerates, often extremely coarse, were noted in several places, at various levels above the present surface of weak and spasmodic erosion.

It is interesting that, although the final movement of the coast-line was one of elevation, this was preceded, in the west at least, by subsidence, whereby deposits of coral and shelly sands and clays were laid down. At Zeilah, these proved to be about three hundred feet thick and were underlain by a spherulitic rhyolite. Some twenty-five miles to the south and about fifteen miles from the sea, these marine deposits are replaced by uniform sticky brown clays, containing occasional pebbles, doubtless deltaic and lagoon deposits. A bore put down in such a position did not reach the floor of crystalline or pre-Pleistocene rocks at 250 ft., but was probably not far off. It is to the later part of this period of steady deposition on the west that I would attribute the widely distributed infilling of the hollows and valleys formed by the earlier erosion with a remarkably uniform, slightly clayey sand, the 'tug alluvium',* of a reddish-brown colour, and sufficiently consolidated to stand in a vertical face. Occasionally small gasteropods, *Planorbis*, for example, are abundant.

This alluvium, although typically unbedded, shows evidence now and again of rapid deposition, for thin layers or strings of pebbles and local false-bedding can be seen in almost every section. In these sands occur, sparingly, artefacts which should afford an archæological date.[1] Of the period between the erosion of the valleys and the infilling with tug alluvium there appears little evidence, but near Buramo the bottom of the tug section is a very altered basic rock, clearly the result of weathering of the hornblende-schists of the neighbourhood, but to a certain extent reconstructed, as pebbles are found in it.

The alluvium itself, probably seldom exceeding a hundred feet in thickness, has been cut to form the characteristic drainage channels or 'tugs' of Somaliland. Now, these only occasionally contain flowing water, and although spates may assume torrential proportions and carry much sediment, it is clear that the tugs were formed by true rivers, which preceding the present period of slow desiccation, indicate a wet phase. During this time, the final uplift of the coast may have taken place, amounting, according to Dr. Macfadyen, to 750 ft. in the Berbera district, although apparently much less in the west, where, however, more work is needed. A considerable thickness of alluvium forms the great plains characteristic of the south-central part of the Protectorate.

A well, put down fifty miles east-south-east by south of Hargeisa, passed through 112 ft. of calcareous terra-cotta alluvial clay, before reaching the white and brown marls and limestones from which it was doubtless derived. It contained, in this bore, no pebbles, and its deposition is concluded to be of a lacustrine nature and to belong to the period of the tug alluvium. Leakey's "Second major pluvial" I would correlate tentatively with the deposition of the latter; with the period of the erosion of those valleys in which the alluvium lies and the formation of the old conglomerates, his 'Kamasian' and probably somewhat antecedent time; the dissection of the tug alluvium with a post-pluvial wet phase.

The correlation is admittedly unsatisfactory, and it is probable that the variations of climates in British Somaliland will, when worked out, show differences from those of Kenya.

JOHN PARKINSON.

Athenæum Club, S.W.1,
March 14.

* 'Tug': A sandy, usually dry, drainage channel, of very variable breadth and cross section.

[1] See R. A. Farquharson, "First Report on the Geology and Mineral Resources of British Somaliland", 1924, p. 18. I was unable to visit the 'tug' in which these implements were found. Also, M. C. Burkitt and C. Barrington-Brown, *Man*, **31**, p. 157; 1931: and "Stone Age Antiquities", Brit. Mus. Guide, p. 186; 1926.

The Nuclear Spin of Arsenic

THE fine structures occurring in the lines of the spectrum of As II have been observed by me in the region λλ6400–4300 by means of a Fabry-Perot interferometer with plate separations varying from 5 mm. to 25 mm. The source employed was a Geissler tube containing arsenic, helium at a pressure of 2 mm. being circulated through the tube. Fifty lines have been observed, thirty-three of which are single, the rest showing fine structure. Most of the lines showing structure involve transitions between the $4p\ 5s$ and $4p\ 5p$ electron configurations and divide themselves into two distinct groups. These are, first, degraded regular series, which arise from the fact that only one of the terms involved, usually the $4p\ 5s$ term, shows appreciable structure; and secondly, complex patterns due to appreciable structure in both upper

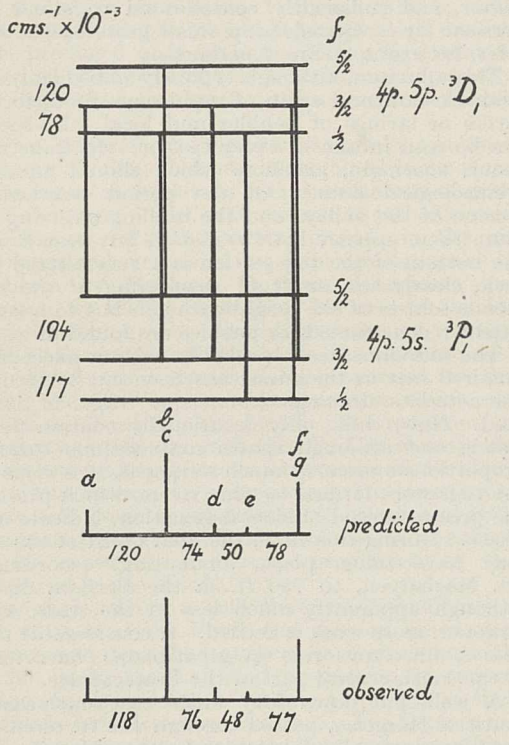

FIG. 1.

and lower terms. The gross multiplet structure has been analysed by Dr. K. R. Rao, who has kindly allowed me to use his unpublished data, and the fine structure observations confirm the gross structure analysis in detail.

Of the $4p\ 5s\ ^3P$ terms, the terms with $j=0$ are single, those with $j=1$ are triple, and those with $j=2$ are quadruple. The nuclear spin is therefore $\frac{3}{2}$. This value is amply confirmed by other data, and the fine structure analyses of the various lines check one another extremely well. For example, the line $4p\ 5s\ ^3P_0$–$4p\ 5p\ ^3D_1$ is a regular triplet degraded to the red, the intervals being 120 and 78 cm.$^{-1}$ × 10^{-3}. This is therefore the term structure for $4p\ 5p\ ^3D_1$, since $4p\ 5s\ ^3P_0$ remains single. Also, the line $4p\ 5s\ ^3P_1$–$4p\ 5p\ ^3P_1$ is an extremely sharp triplet degraded to the violet, with intervals 194, 117. Other data prove that the structure of the $4p\ 5p\ ^3P_1$ term is quite negligible, so that this gives the structure of the $4p\ 5s\ ^3P_1$ term. From these the fine structure of the line $4p\ 5s\ ^3P_1$–$4p\ 5s\ ^3D_1$ can be predicted, and, as shown in Fig. 1, the agreement with the structure actually observed is remarkably exact, both as to intensities and intervals. Since the components *bc* and *fg* respectively fall right on top of one another, their intensities have been added in forming the predicted pattern.

Attention may be directed to the relatively coarse structure of the $4p\ 5p\ ^3D_1$ term as compared with the $4p\ 5s$ terms. Since this term possesses no penetrating *s* electron, it is to be expected at first that the structure will be small. However, Breit [1] has shown that in the heavier atoms a $p_{\frac{1}{2}}$ electron behaves with respect to the nucleus as if it were penetrating, and since the $4p\ 5p\ ^3D_1$ term is built up out of two $p_{\frac{1}{2}}$ electrons with parallel coupling, this may be the correct explanation of the relatively coarse structure, as the atomic weight of arsenic is 79. A detailed account of the fine structures will be published elsewhere shortly.

S. TOLANSKY.

Physikalisch-Technische Reichsanstalt,
Berlin-Charlottenburg,
March 14.

[1] Breit, *Phys. Rev.*, **37**, 1182; 1931.

Infra-Red Absorption Spectra of the Oxides of Chlorine

WE have recently completed an examination of the infra-red absorption spectra of the monoxide and dioxide of chlorine. The unstable nature of these substances demanded the use of a monochromator method: this has the additional advantage of an increased purity of spectrum, but even under these conditions there is a considerable amount of scattered radiation in the region of longer wave-lengths. We have endeavoured to take advantage of the alteration in the chromatic foci of rocksalt to stop out most of the scattered light, but owing to the lack of transparency of this substance beyond 18μ (the optical train included rocksalt lenses and plates for the absorption cells and thermopile case), we obtained no measurable deflections on the galvanometer. The provision of optical parts of potassium bromide should eventually solve this difficulty. The observed bands for ClO_2 are recorded in the accompanying Table.

Band.	(λ)μ.	Maxima (cm.⁻¹).	$P-R$ Δν(cm.⁻¹).	Relative Intensity.	Origin.
B	10·57	932 963	31	30	ν_2
C	9·017	1095 1105 1123	28	80	ν_3
D	5·307	1870 1884 1900	30	0·5	$2\nu_2$
E	4·916	2034	—	4	$\nu_2+\nu_3$
F	4·246	2355	—	0·5	$2\nu_3$

ν_1 for this molecule falls outside the range of our spectrometer; recent work by Urey and Johnston [1] gives a probable value of 529 cm.$^{-1}$ for this fundamental. The spectrum is very similar indeed to that of sulphur dioxide; this fact is perhaps to be connected with the 'odd' electron structure of ClO_2, there being no corresponding proper function in this case to satisfy the odd electron, and except for the instability associated with this, we have for the rest of the molecule much the same external electronic structure in the two substances.

We have extended the examination of the possible modes of vibration for the symmetrical triangular

molecule, and a determination of the molecular constants with given conditions makes it finally probable that both SO_2 and ClO_2 are equilateral triangles, the length of side being approximately 1·37 A. in each case, while there is a single linking between the oxygens and the central atom. The two molecules both have in addition a non-localised proper function, which in the case of sulphur dioxide is filled with two electrons giving a non-localised bond accounting for the stability of the substance compared with the chlorine compound. This application of a conception recently due to Hund [2] is confirmed by the values of the force constants, which are $9{\cdot}7 \times 10^5$ dynes per cm. for SO_2, and $6{\cdot}7 \times 10^5$ dynes per cm. for ClO_2. An equilateral triangular structure is probably the only structure compatible with non-localised proper functions.

In the case of chlorine monoxide certain of the bands overlap, and the observed values cannot at present be taken as more than reasonable approximations. We have $\nu_1 = 639$, $\nu_2 = 973$, $\nu_3 = 1245$, $2\nu_1 = 1305$ cm.$^{-1}$. On the older polarisation theory one would have expected a rectilinear structure for this substance. Examination shows, however, that the molecule is triangular with vertical angle approximately 90° and again single linkings ($f_1 = 6 \times 10^5$ dynes/cm.) between the chlorine and oxygen atoms. The existence of a considerable repulsive force between the two chlorine atoms is shown by the magnitude of f_2, the force constant for the particles at the base of the triangle, which rises from $1{\cdot}7 \times 10^5$ dynes/cm. for SO_2 and ClO_2 to 5×10^5 dynes per cm. for Cl_2O.

C. R. BAILEY.
A. B. D. CASSIE.

The Sir William Ramsay Laboratories
of Inorganic and Physical Chemistry,
University College, London.

[1] *Phys. Rev.*, **38**, 2131; 1931.
[2] *Z. Phys.*, **73**, 1 and 565; 1932.

Fluted Band at λ3900 A. in the Spectrum of Mercury

IT has already been observed by J. Stark and by others that a fluted band system of mercury at λ3900 A. is superposed on the continuous spectra, covering the visible and the ultra-violet regions, but, so far as we know, nothing has been reported about the origin of this band.

We have observed the band, and Fig. 1 is a reproduction of its photometric curve. We excited the

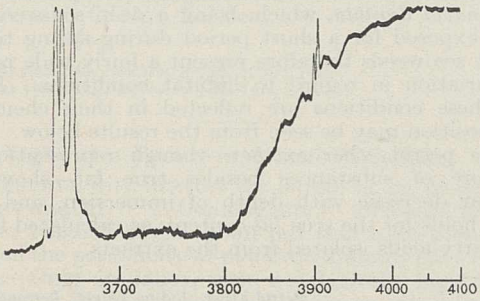

FIG. 1.—Photometer curves of the mercury band spectrum with wave-length scale in angström units.

vapour with a high-frequency oscillatory current of about 5×10^8 cycles. The oscillation was produced by a spark maintained by a valve oscillator working at 3×10^5 cycles. On plotting the frequency differences as a function of wave-number, as shown in Fig. 2, the convergence limit was estimated to be 27,150 cm.$^{-1}$, which falls near the strong triplet lines at λ3650 A. Therefore it seems reasonable to assume that the band has a close relation with these lines. From this point of view, it is considered that the bands are connected with the $3\,^3D$ state of the mercury atom;

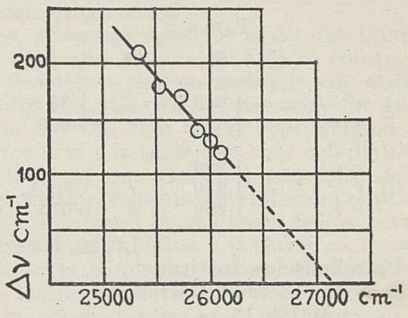

FIG. 2.

consequently they are emitted by the transitions between the levels the dissociation products of which are the excited $3\,^3D$ atom, and the normal, and the next lower levels connected with the $2\,^3P$ of the atomic states, from which, as it is usually accepted, the other visible and ultra-violet band systems are initiated.

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A New Band System of Beryllium Oxide

IN an attempt to get bands of the beryllium molecule, I found in an arc between a carbon and a beryllium electrode several new bands in the red and infra-red region. The analysis of these bands showed that they are, however, not due to beryllium but to the oxide, BeO, the lower level being the same as that of the well-known visible BeO-bands analysed by Bengtsson,[1] and Rosenthal and Jenkins.[2] As until now only two electronic states (both $^1\Sigma$) of the molecule BeO are known, namely, the lower and upper states of the visible bands, it seemed worth while to analyse the new bands in detail, in order to get more information about the electronic structure of this molecule, especially with respect to the question of valence and dissociation products.

The heads of the bands, which are shaded towards the red, are not very pronounced, and since there is much overlapping of different bands, the whole system looks under high dispersion rather like a many-line spectrum. The analysis showed that in spite of their complicated appearance, the bands have only single P, Q, and R branches. As the lower state is $^1\Sigma$, the transition is $^1\Pi \rightarrow {}^1\Sigma$, the $^1\Pi$ level lying between the two $^1\Sigma$ levels mentioned above. This upper level is just the state one would expect according to the electronic configuration of BeO.[3]

So far, three bands have been analysed (Table 1).

TABLE 1

v' \ v''	0	1
0	13647	
1	14710	
2		14293

The v'-numbering may be shifted, if more bands are found, farther in the red. The vibrational quantum of the upper state ($^1\Pi$) is very much lower than that of the ground state ($^1\Sigma$), as calculated by Rosenthal and Jenkins.[2] The ΔG values are: $\Delta G'_{\frac{1}{2}} = 1063$,

$\Delta G'_{\frac{3}{2}} = 1047$, $\Delta G''_{\frac{1}{2}} = 1464$, $\Delta G''_{\frac{3}{2}} = 1440$ (calculated from band origins, not from heads). The same is true for the values of B (Table 2). In Table 2 are given the B values for both states, as well as those for r and α. The B'' values coincide with those calculated by Rosenthal and Jenkins for the lower $^1\Sigma$ level.

TABLE 2

		B	
$^1\Sigma$	$v''=0$	1·643	$r''_0 = 1{\cdot}33$ A.
	$v''=1$	1·623	$\alpha'' = 0{\cdot}020$
	$v'=0$	1·296	
$^1\Pi$	$v'=1$	1·280	$r'_0 = 1{\cdot}50$ A.
	$v'=2$	1·266	$\alpha' = 0{\cdot}015$

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Technische Hochschule, Darmstadt,
March 15.

[1] *Ark. Mat. Astron. och Fys.*, **20** A, 1; 1928.
[2] *Phys. Rev.*, **33**, 163; 1929.
[3] Cf. R. S. Mulliken, *Phys. Rev.*, **32**, 186; 1928; and G. Herzberg, *Z. Phys.*, **57**, 601; 1929.

Coacervation

IN a preliminary communication Kruyt and Bungenberg de Jong [1] proposed the name *coacervation* for the phenomenon of separation into two liquid layers in systems containing one or more compounds in the colloidal state.

The separation takes place under the influence of several agents (for example, electrolytes, alcohols, polyphenols) at a temperature above the temperature of gelation.

Kruyt and de Jong suggested a typical difference between the analogous phenomena in molecularly dispersed systems, studied by the classical phase-theory, and the peculiar type of flocculation already mentioned.

We have analytically determined the composition of the co-existing liquids in the systems: water-gelatin-ethanol, w.-g.-sodium sulphate, and w.-g.-resorcinol. The preparation used in our experiments was ash-free iso-electric gelatin, prepared by means of Loeb's method.

It should be pointed out that, in all cases, we were dealing with perfect equilibria and that nearly all the protein was present in the lower layer, the upper layer being practically free of gelatin.

Moreover, there is a decided difference between the influence of ethanol and sodium sulphate on one hand and resorcinol on the other as indicated below.

Ethanol. Sodium sulphate.	Resorcinol.
Rather large concentrations required for separation.	Separation takes place at exceedingly small concentrations.
Ratio of water to agent greater in lower layer than in upper layer.	Ratio of water to agent smaller in lower layer than in upper layer.
Separation does not disappear at higher concentrations of the agent.	Separation disappears at a certain concentration of the agent.

The lower layer may be considered as an accumulation of micellæ, only separated by a binary liquid. This explains the name 'coacervate' for the sub-layer (*acervus* = heap).

It is well known that Einstein's formula for the relative viscosity of sols enables us to calculate the volume connected with the colloidal matter in solution. We have plotted this volume against the concentration of one of the above-mentioned agents. We have also, in the same diagram, shown the volumes of the corresponding coacervates, calculated per gram gelatin. As a matter of fact, the data used by the first method were obtained at lower concentrations, whereas the results of the second experiments were related to large concentrations of the agent. It is interesting to note that both curves nearly coincide.

Through these and other facts we are led to the conclusion that one might well consider the micellæ as a 'wall-substance' covered with a layer of solvating matter. It will be noted here that our analysis brings out the relationship existing between the composition of the solvate film and the upper layer.

The fact is that the presence of a solvate film has always been considered as one of the stabilising factors of a sol (electric charge and solvation), but in our case it is clear that we have to seek the stabilising factor especially in the transition: solvate film-medium.

The existence of stability is due to the fact that this transition bears a continuous character. Under the influence of dehydrating agents, this transition becomes discontinuous at the critical concentration of the agent: the diffuse solvation film has become concrete and thus gives rise to a surface tension. The origin of coacervation is decrease of the total free surface energy.

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[1] *Proc. Royal Academy of Amsterdam*, **32**, 849; 1929.

Fats of Brown Sea-weeds

INVESTIGATIONS recently carried out in this department on the marine algæ have shown that there would appear to be some connexion between the depth of immersion of such weeds and their metabolism, as expressed by their chemical composition. Such connexion has been traced in regard to their carbohydrate [1] and nitrogenous [2] constituents, and the present investigation was undertaken with the view of ascertaining whether a similar connexion holds for the fatty constituents.

The weeds examined in the present instance are *Pelvetia canaliculata*, *Pelvetia canaliculata forma libera*, *Fucus vesiculosus*, and *Laminaria digitata*. *Pelvetia libera* is a free floating marsh form which is exposed to desiccation for considerable periods of time, being immersed only during spring tides. *Pelvetia canaliculata* grows at a lower zone, fixed to stones or rocks, and is covered with water for fairly long periods daily. *Fucus vesiculosus* grows somewhat lower than *P. canaliculata*, but is considerably more exposed than *Laminaria digitata*, which, being a deep sea-weed, is only exposed for a short period during spring tides. These sea-weeds therefore present a fairly wide range of variation in regard to habitat conditions. How far these conditions are reflected in their chemical composition may be seen from the results below.

The petrol ether extract—though representing a mixture of substances besides true fat—shows a regular decrease with depth of immersion, and the same holds for the true fat content, as calculated from the fatty acids isolated from the extracts.

	Petrol Ether Extract.	Iodine Value of Extract.	Percentage True Fat.
Pelvetia libera .	8·0	106	6·2
Pelvetia canaliculata	4·9	115	3·6
Fucus vesiculosus .	2·6	114	1·9
Laminaria digitata	0·3	123	0·16

The figures in all cases are calculated on oven-dry material.

Analysis of the extracts was confined to a separation of the unsaponifiable residue and fatty acids and the determination of their iodine values. The unsaponifiable residue, calculated as a percentage of the petrol ether extract, was found to increase with depth of immersion as follows :

	Unsaponifiable Residue.		Iodine Value of Unsaponifiable Residue.
	Percentage of Extract.	Percentage of Weed.	
P. libera . .	7·6	0·61	124
P. canaliculata .	10·8	0·53	117
F. vesiculosus .	16·9	0·44	136
L. digitata . .	25·9	0·078	125

It will be seen, however, that the iodine value, as determined by the pyridine bromine method, shows no regularity. The percentages of fatty acids, calculated on the petrol ether extract, together with the iodine values of the acids, are given in the following table :

	Percentage of Fatty Acid.	Iodine Value.
P. libera . . .	72·5	107
P. canaliculata . .	69·9	124
F. vesiculosus . .	71·6	108
L. digitata . .	49·9	110

It should be noted that the fatty acids when isolated tend to reduce their iodine value on exposure to air, and although evaporations were carried out *in vacuo*, a certain amount of exposure was inevitable, and consequently the values given above may be somewhat low. A further separation of the fatty acids into solid and liquid acids was carried out in the case of two sea-weeds representing the extremes of habitat, and the results, calculated as percentages of the total fatty acids, are as follows :

	Solid Acids.	Liquid Acids.
P. libera . . .	11·5	78·7
L. digitata . .	17·7	72·2

It appears from the foregoing that, while the general character of the fats is about the same, there is a distinct difference in the proportion of unsaponifiable residue and in the absolute amounts of fat in these sea-weeds.

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March 29.

[1] Haas and Hill, *Biochem. J.*, **23**, 1000 ; 1929.
[2] Haas and Hill, *Biochem. J.*, **25**, 1472 ; 1931.

Light as a Factor in Sexual Periodicity

I OBSERVE with interest the letters of Dr. M. A. H. Tincker and Mr. J. T. Cunningham.[1] In regard to the former, I should like to point out that some observations on the periodicity of plankton diatoms have been made. Only in lakes with a relatively high percentage of dissolved salts do diatoms attain great maxima, and vast maxima have only been found to occur in a few British lakes. Many plankton diatoms occur in the greatest quantity in spring, that is, are reproducing at the fastest rate, but some attain their maxima in summer and autumn. A remarkable fact is that some forms have a double maximum, one in spring and one in autumn. In Lake Windermere the following are known to exhibit this phenomenon : *Asterionella gracillima*, *Rhizosolenia morsa*, and others. The maxima in the spring may be explained by light influencing reproduction, whereas other maxima may be due to differences in temperature and percentage of dissolved salts. Although a difficult task, observation of diatom and plankton maxima in the ocean might lead to interesting results.

Diatoms, of course, must be under the influence of the sun's light and heat to be able to continue their nutritive functions, and so maintain life within the cell. Sunlight is, therefore, a necessity for nutrition, but this is not the case where reproduction is concerned ; for it is a notable fact that cell-division (the usual method of reproduction) generally occurs at night. From this it appears that diatom reproduction is probably influenced by the lunar factor, mentioned in Mr. Cunningham's letter. If this is so, it would be of great interest to place a culture of diatoms at the optimum temperature in polarised light. Observations of the effect on their cycle of reproduction, and on their prolificacy under these conditions, should prove a very useful piece of research work.

GRAHAM PHILIP.

128 Westbourne Avenue,
Hull, April 9.

[1] NATURE, **129**, 543, April 9, 1932.

Climate and Parent Material in Soil Formation in South-West England

STUDIES of the profiles of soils in central Somerset have shown that typical podsols are developed on sands, whilst on the Lower Lias limestones and clays adjoining, the profiles are typical of the 'brown earths' described by Ramann.[1] The podsols are developed on recent deposits—Burtle Beds—and show very clear demarcation into bleached layer and layer of accumulation. The formation from these recent deposits gives us a maximum time for the formation of these podsols.

Whether podsols would ever develop on the clays and limestones of the Lower Lias it is difficult to say, because of the disappearance of all the old forest ; but they are not found on the present woodland, which may represent the remains of the indigenous forest.

These observations suggest that the climate is such that podsols would develop with suitable parent material ; but on the limestones and clays of the Lower Lias, the parent material is a dominant factor in the soil-forming processes on these deposits in south-west England, the climatic factor being recessive.

A. JAMES LOW.

South-Eastern Agricultural College,
Wye, Kent, March 23.

[1] " The Evolution and Classification of Soils ", Ramann.

Protection of Herbarium Specimens

THE letter from Messrs. F. K. Jackson and R. L. M. Ghose [1] on the protection of herbarium specimens makes a valuable suggestion. Perhaps I may be permitted to refer readers and others interested in the subject to a paper on the " Preservation of Herbarium Specimens and Insects on Celluloid ", by Mr. John Ritchie, of the Perth Museum, published in the *Museums Journal* for May 1930. If Mr. Ritchie's method of mounting on a transparent sheet of celluloid were combined with the cellophane covering employed by your correspondents, the plant would not only be protected, but would also be visible from both sides.

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London, S.W.19.

[1] NATURE, **129**, 402, March 12, 1932.

Research Items

The Lime, Rice-Straw, and Convolvulus in India.—Magical and other practices in India in which the lime, rice-straw, and the convolvulus play a part are discussed by Mr. R. E. Enthoven in *Folklore*, vol. 43, pt. 1. It is customary for village officials to offer two or three limes to a British official when he visits their district. This is more than a compliment; it is a widespread use in driving away evil influences. A lime stuck on the end of a knife is a well-known spirit-scarer. Recently its use in connexion with the Bombay rite of *muth mārana* has been noted. The exorcist prepares an image of wheat flour and worships it. A lime pierced by a number of thorns or pins is placed before it, and as water mixed with molasses is poured over the face of the image, the lime gradually fades away. It goes to the man whom it is desired to kill and strikes him in the chest. He falls to the ground vomiting blood. In the Central Provinces, it has been noted of late by police officials investigating cases of suspicious death, that a lime is frequently found by the body, especially where poison is suspected. Rice-straw tied in a bundle to an object, in the Rathnagiri district, prevents interference with it when it is the subject of a legal dispute. From this spell release can be obtained only by an appeal to the deity, who must grant a sign of his decision on the matter. The interest of the convolvulus lies in the fact of its close connexion with certain of the castes of the Deccan and Konkan. Although they differ in occupation and widely in social status, these castes have the convolvulus as their common *devak*, that is, an object of worship, which they must protect. It is a bar to marriage between all members of these castes.

West Indian Prehistoric Pottery.—A study of the prehistoric aboriginal pottery of the Dominican Republic, Haiti (*Bull.* 156, *U.S. National Museum*), by Mr. Herbert W. Krieger, is based largely on examples collected from sites excavated during expeditions to the island in 1928, 1929, and 1930. It was found that variation in decorative design, form, and style was much greater than had been anticipated. Forms and designs, which appeared to be examples of ready-made borrowing, proved to be parts of series linking up with characteristic Tainan designs of the Santo Domingo-Porto Rican pottery area. This, in turn, was found to extend well beyond the limits of the two islands, and to link up on the south with lowland forest areas of South America, and on the north with the margin of the eastern Indian pottery area, including the Iroquois of eastern Canada and the contiguous United States. Other designs occur in representative collections from the Upper Mississippi Valley, from the Gulf States of the south-east, and from the Florida Peninsula. This, however, does not imply cultural diffusion or conscious copying; but rather a marginal position in relation to some eastern pottery-producing centre. The entire Mexican, Middle American, lowland and highland South American pottery-producing areas share a common heritage in a culture complex which centres around the cultivation of maize, cassava, and other roots, with which is associated pottery-making. The development of the elements in pottery-making is determined by local environmental differences, physical and spiritual. Thus, for example, in Santo Domingo, the modelling and application of clay figurines, distinctive of decorative design in Middle American tribes, is further differentiated by the absence or presence in representation of certain reptiles and mammals, absent or present in the fauna of that area.

Individuality of Chromosomes.—During the interphase of nuclear division, the chromosomes usually lose their visible identity, but considerable evidence suggests that they do retain some kind of individuality during this period. It is, however, not clear exactly how we should apply the term individuality. Does it apply only to the chromatic material or should it include the achromatic substratum as well? Bearing on this question, Grégoire (*Bull. Roy. Acad. Sci. Brussels*, **17**, 1435-1448) has published an interesting note on some work carried out by one of his students on nuclei of *Impatiens Balsamine*, in which type prochrosomes or euchromocentres are characteristic features of the interphase nuclei. In number, these chromatic bodies are equal to or fewer than the specific chromosome number and occur close to the nuclear membrane, and it is an interesting new point that each one already shows the constriction or point at which the chromosomes will afterwards become attached to the spindle fibres. Another new observation is that during early prophase, bands of achromatic material gradually become evident as prolongations of the euchromocentres. This suggests that not only does the central part of the chromosome persist through interphase as the euchromocentre, but also that this is associated with a definite region of achromatic material which condenses again during prophase into the chromosomes. Though these observations are specific, the uniformity of nuclear behaviour is such that a point definitely shown for types with euchromocentres will in all probability be applicable also in general principle to types with a more uniform nuclear reticulum in the interphase.

Leaf Curl Disease of Cotton.—A recent paper upon "The Leaf Curl Disease of Cotton in the Sudan" (*Empire Cotton Grow. Rev.*, vol. 9, no. 1, Jan. 1932, pp. 32-45), by R. E. Massey and F. W. Andrews, describes a malady of cotton which appears to have general relations with a plant virus disease. The authors correctly use the term 'virus' very infrequently in their paper, as they have no evidence for the ultramicroscopic nature of the causal agent. Their work is nevertheless extensive, and detailed descriptions of symptoms, both external and histological, are given, with descriptions of transmission by insects, grafting, and juice inoculations. It is interesting to note that the lamina of a diseased leaf is more than three times as thick as that of a healthy leaf. The insect vector is apparently an aleurodid, and seems to be an efficient transmitting agent. Grafting is the only other successful method of transfer, for juice inoculations have proved unsuccessful. Chemical examination of healthy and diseased leaves showed no difference in the amounts of starch, pentosans and nitrogen, but revealed a striking increase in diastatic activity in diseased tissue. The curl disease reduces the number of bolls per plant, and so would seem to be of considerable economic importance.

Meteorological Tables.—The Smithsonian Meteorological Tables, that fill an entire volume of the Smithsonian Miscellaneous Collections (vol. 86 in the case of the revised edition under review), are of importance for all serious students and advanced workers in meteorology. These tables were badly in need of revision; the dates of previous editions were 1893, 1896, 1897, 1907, and 1918, and the long interval since 1918 has seen a rapid development of meteorological theory. In an abstract dealing with the new

edition issued by the Smithsonian Institution attention is directed to the more important features that appear for the first time. These include comparisons between sunlight, moonlight, and starlight; standards for the duration of astronomical and civil twilight; comparisons between linear metres and the dynamic metres of V. Bjerknes for variations of gravity with varying latitude and altitude; and tables for the determination of height by observation of the temperature of boiling water. The simpler conversion tables, such as inches to millibars, have not been crowded out. English meteorologists will be grateful for the inclusion of hygrometrical tables appropriate to British wet bulb thermometry. Another particularly useful item, and one not normally included in British publications, is the detailed relationship between the zenith distance of the sun and the mass of air traversed by the sun's rays in reaching the earth's surface. One serious omission may be noted. There are no tables relating to the calculation of the entropy, potential temperature, or pseudo-potential temperature of the air under different conditions of pressure and temperature. The preparation of these tables was done under the direction of C. F. Marvin, chief of the U.S. Weather Bureau, assisted by H. H. Kimball, senior meteorologist of that bureau.

A Simple Thermo-electric Pile.—M. Jean Gabreau has described the method used on the Chemin de Fer du Nord to notify at a distant cabin the failure of the light on a signal-post (*Bull. Soc. d'Encourag. l'Indust. nat.*, January). It is based on the action of a thermopile which is placed in the lantern above the flame in such a way that the hot air from the flame surrounds one set of junctions while the other set is exposed to the air outside the lantern. The current produced operates a relay in the cabin, which shows a red light and rings a bell when the thermo-current fails. The thermopiles, which have been in use since 1926, are made by winding forty turns of 0·2 mm. constantan wire around a sheet of mica with notched edges. The wire on one side of the sheet is then varnished and the sheet immersed in acid until the wire on the other side is reduced to half its original section. A thin layer of copper and over it a thicker one of silver, which brings up the section to its original value, are deposited electrolytically. After dissolving the varnish, the whole wire receives a thin deposit of platinum. In action the pile gives an electromotive force of about 400 millivolts, and a current of 4 to 5 milliamperes.

Infra-Red Photography of Aurora.—Supplementing his communication to NATURE of March 26 on spectrographic observations of infra-red lines in the auroral spectrum, Prof. L. Vegard informs us that Dr. Bauer, working on kinematographic exposures of northlight at the Auroral Observatory at Tromsø, succeeded in January of this year in obtaining a picture of an aurora with infra-red filter and plates sensitive to infra-red rays.

Cosmic Rays.—Some investigations on the cosmic rays, reported in the first February number of the *Physical Review*, are of particular interest at present in view of the possibility that these may be identical with neutrons. One by H. L. Mott-Smith confirms the failure of other investigators to deflect the rays by magnetic fields; a fine technique has been developed for this piece of work, which includes the preparation of sealed Geiger-Müller counters by good vacuum methods, a refinement which has been repaid by the reliability of the instruments. The main result of the two others, which are by R. A. Millikan, is that the ionisation of the air by cosmic rays is more intense than had been supposed; the rate of formation of ions at sea-level under standard conditions is now given as almost 2·5 per c.c. per second instead of about three-fifths of this. Prof. Millikan has also found that the sun has no direct influence on cosmic ray intensities, to within about $\frac{1}{3}$ per cent of the total ionisation, and has shown incidentally that there is an interesting source of error in connexion with the use of electroscopes containing gas at high pressure for precision work, arising from the effect of temperature on the rate of recombination of ions.

Elements 85 and 87.—Allison, Bishop, Sommer, and Christiensen (*J. Amer. Chem. Soc.*, Feb.) describe experiments with a magneto-optical method, depending on the time lag differences of the Faraday effect behind the magnetic field, on solutions of minerals. In solutions of pollucite and lepidolite, minima were observed which cannot be due to tin and rhenium compounds, and are attributed to element 87. This is also stated to exist in sea water, Searles Lake brine, Stassfurt kainite, crude cæsium chloride, monazite sand, and samarskite. Six minima are considered to indicate the probable existence of six isotopes of element 87. Element 85, present only in very small amounts, was detected in solutions of Brazilian monazite sand, from 100 lb. of which indications of $2{\cdot}5 \times 10^{-6}$ gm. of the lithium compound of 85 were obtained. The name alabamine (Am) is proposed for the element, and the solutions are supposed to contain salts of the acids $HAmO_4$ and HAm. The atomic weight of alabamine is estimated to be 221. The peralabamic acid is more stable than other oxy-acids of the element which are indicated in the solutions after appropriate treatment.

Intermetallic Compounds formed in Mercury.—A. S. Russell, with Cazalet, Irwin, and Lyons (*J. Chem. Soc.*, March) describes the formation in mercury of several stable compounds of the metals copper, tin, zinc, and iron produced by shaking the metals with mercury. These differ from the constituent metals in being insoluble in mercury and generally in reducing power. It was necessary to devise analytical methods for determining their empirical formulæ without removing them from the mercury in which they were suspended, and these methods are described. Some of the compounds are ternary, mercury being one constituent, and their formulæ are very varied, but the total numbers of valency electrons are 6, 9, or 12, or a simple multiple of these numbers. Iron does not form a compound with mercury, yet its action towards reducing agents in presence of mercury resembles closely that of copper, although the passivity does not depend on metallic compound formation. Many of the binary intermetallic compounds have not previously been reported.

The Glow of Phosphorus.—The *Collection of Czecho-Slovak Chemical Communications* for March contains an account of the influence of chlorine and bromine on the glow of phosphorus by Krejci and Schacherl. The inhibiting effect of these halogens on the glow had been previously noted, and the case of chlorine studied in detail by Bowen and Cavell in 1929. The present authors took special precautions to ensure the purity of the materials, the chlorine, for example, being obtained by the electrolysis of fused pure silver chloride. The pressure in the apparatus was followed by a Bodenstein quartz manometer, the effect on the glow in air and oxygen at temperatures of 15°, 20°, and 25° C. being investigated. Both halogens show a poisoning effect, which is

stronger in oxygen than in air. They are more effective than ethylene but weaker than propylene, whilst nitrogen dioxide, previously investigated, is about ten times as efficient as either. The results could be represented by the equation already used for nitrogen dioxide, namely, $p = k/(a + x)$, where x is pressure of halogen/pressure of oxygen ; p is the maximum pressure of the glow, and a and k are constants. Dry gases were used. The effect can be explained on the assumption that chlorine breaks reaction chains by forming chlorine monoxide with atomic oxygen.

Deterioration of Structures in Sea Water.—The Committee of the Institution of Civil Engineers which is investigating the deterioration of structures of metal, timber, and concrete in sea water, began its work in 1916 and published its first report in 1920. Interim Reports have been issued annually since then, and the twelfth of the series reviews the work done in 1930–31 (London : H.M. Stationery Office, 6*d*. net). The specimens under observation are exposed in many parts of the world—Nova Scotia, Ceylon, Australia, New Zealand, Kenya Colony, the Gold Coast, etc.—and the materials exposed include many varieties of iron and steel, many kinds of timber, and specimens of ferroconcrete. Of the various irons and steels under observation, those with the highest percentage of nickel and chromium appear to give the best results. The investigations of the Committee on methods of protecting timber against marine borers have been continued with the assistance of Profs. G. Barger and S. M. Dixon, and in his report Prof. Barger gives the results obtained through impregnating timber with creosote, fuel oil, arsenical poisons, naphthalene, or tar acids. Prof. Dixon, in a further report, gives some interesting figures showing the effects of incising timber before impregnation. A block of Oregon pine (Douglas fir), 10 in. × 6 in. × 2 ft., with incisions spaced ½ in. apart in rows round the periphery absorbed two to three times as much creosote as a similar unincised block.

Breaking Circuits and Clearing Faults on Large Networks.—The modern methods of linking together isolated electric distribution networks has given rise to problems in mathematics and physics, partial solutions of which are now being obtained. All the component networks are linked into a single network, every part of which responds to changes in every other part. The large amount of generating plant working in parallel distributed over a wide area, and its haphazard distribution, have introduced problems which do not occur in small networks. In a paper read to the Institution of Electrical Engineers on March 17, R. O. Kapp and C. G. Carrothers discuss from the mathematical point of view the design of systems to protect the network when a fault occurs. It is suggested that the fluctuations in the currents caused by a fault might be used to work the relays employed for the automatic isolation of a faulty portion of the network. At the same meeting H. Pearce and T. T. Evans read a paper on the design and performance of oil circuit-breakers, that is, switches which break the electric circuit under oil. The irregularity in the performance of these devices is generally considered to be due to the erratic movement of the oil. For the higher voltages, quick-break apparatus is considered advantageous. By suitably designing the two contacts with a shroud, improved and consistent results are obtained. The importance of short circuit testing is emphasised, and a plea is made for facilities for testing on the site. A description is given of the oscillograph equipment necessary for testing on the site, and reports of recent tests carried out on oil circuit-breakers fitted with a new type of shrouded contact are added.

Astronomical Topics

Parallaxes of Faint Stars.—Study of pairs of photographs taken at intervals of several years have revealed many examples of very faint stars with fairly rapid proper motions. *Mount Wilson Contributions*, No. 435, contains a paper by A. Van Maanen on an investigation of the parallaxes of some of these stars from photographs taken with the 100-inch and 60-inch reflectors. The largest parallax on the list is that of B.D.43°4305, for which the value 0·209″ was found. That star had, however, already been measured elsewhere. Another large parallax is that of Ross 41, mag. 13·4, parallax 0·110″. Altogether there are 15 stars on the published list that have absolute magnitude fainter than 10·0. The faintest is a star lately found by Hubble to have a proper motion of more than 1″; its absolute magnitude is 14·0. The fact that such a large number of extreme dwarfs are found comparatively near the sun shows that this type of star must really be very common in space, but they are too faint for observation unless their distance is small.

Astronomical Notes for May.—Venus continues to be a brilliant object, reaching its greatest brilliance on May 22 ; the illuminated fraction of the disc diminishes during the month from ⅘ to ⅕ ; it is near the moon at 5 P.M. on May 9.

Jupiter passes quadrature with the sun, and is still observable for half the night. Satellites I and II and their shadows are both on the disc on the evening of May 5 ; I and IV are simultaneously in eclipse late on the evening of May 20 ; there is a partial eclipse of III by the shadow of II on May 4 from 11.16 to 11.38 P.M.

Saturn can be observed late in the night, but its south declination of 19° renders the conditions difficult.

i Virginis is occulted by the moon at 8.5 P.M. on May 17 ; it is the only occultation visible in London before midnight.

Two comets may be visible with moderate telescopes ; the following ephemeris of Houghton's comet for 0^h is by Drs. Cunningham and Whipple ; an ephemeris given earlier proved to be erroneous :

	R.A.	Decl.
May 1 . .	12^h 42^m 48^s	S. 15° 20′
,, 5 . .	12 42 19	8 3
,, 9 . .	12 42 30	S. 2 2
,, 13 . .	12 43 13	N. 2 51
,, 17 . .	12 44 25	N. 6 47

The following ephemeris of comet Grigg-Skjellerup is from *B.A.A. Circular* 113 :

	R.A.	N. Decl.
May 15 . .	7^h 54^m 12^s	20° 23′
,, 20 . .	8 20 20	26 0
,, 25 . .	8 53 28	32 32
,, 30 . .	9 37 24	39 39

Ephemerides of three other periodic comets, Neujmin (2), Kopff, and Borrelly, are given in the B.A.A. Handbook for 1932 ; all are likely to be near the tabular positions ; the search for them will be most conveniently made by photography.

The times given above are Greenwich Mean Time ; 1 hr. should be added to give Summer Time.

Physiological Studies of Single Plant Cells

PHYSIOLOGISTS will welcome a summary ("Physiological Studies of Single Plant Cells", by W. J. V. Osterhout, *Biological Reviews*, vol. 6, pp. 369-411) of the extensive literature on the algæ *Valonia* and *Nitella* by one who has been so intimately associated with this work. The bibliography is a formidable one comprising 227 citations. The data obtained by three types of experimental procedure, namely, (1) chemical analysis, (2) measurement of potential differences at various boundary surfaces by the use of single cells suitably arranged to procure the desired electrical circuit, (3) measurement of electrical resistance or capacitance, are discussed.

The review is itself so condensed that any further summary of it would be impracticable. The electrical experiments are interpreted as supporting the idea that the external cell surfaces are non-aqueous in nature, of high resistance, and permitting little dissociation of salts. The relative order of the mobilities of ions in protoplasm (unlike the case of collodion) does not resemble that obtained for salts in water, but rather that for certain non-aqueous solvents. In spite of the discussion and the literature cited there will still be, no doubt, those who find it difficult to conclude that some of the theories advanced materially clarify the vexed question of the accumulation of electrolytes by living cells. It is a question whether (for example, in the case of the accumulation of KCl) the facts warrant the more complicated assumption that accumulation of KCl involves penetration of undissociated KOH, the energy necessary being furnished by metabolism with the liberation of an organic acid HA which is then exchanged for HCl of the external solution (see p. 377), rather than the simple statement that KCl accumulates against a concentration gradient, the energy necessary being supplied by metabolism. In this connexion the comprehensive experiments of Hoagland and Davis receive but incidental citation.

It seems curious that, whilst in certain connexions stress is laid upon the importance of the energy released by the cell and that salt accumulation is not a physico-chemical equilibrium, the multiple partition theory of Irwin should receive such favourable discussion, whilst the mathematical treatment seems to evade such energy supply and to involve mainly operations based on equilibria. It is possible that some of the interpretations of accumulation which apply solely to electrolytes, and not at all to non-electrolytes, may be premature, whilst the view that the cell has at its disposal a source of energy which may produce accumulation of both electrolytes and non-electrolytes seems to have been rather lightly dismissed, though it has figured somewhat prominently in other writings upon *Nitella*.

Many will reiterate one of the concluding remarks: "But mere complexity should not baffle the analytical resources of modern science if all the variables can be measured. The greatest difficulty is that in attempting measurements we may change variables or create new ones without being aware of it." The necessarily scanty attention paid to experimental technique in so brief a review covering so wide a field leaves one unable to say to what extent many of the experiments were affected by such uncontrolled variables. In particular, the effect of the often arbitrary technique adopted on two of the most important variables when dealing with respiring plant cells, namely, the oxygen and carbon dioxide concentrations in the environment, with its consequent effect on metabolism and any processes determined by metabolism, remains difficult for the reader to evaluate.

Meteorology of the Persian Gulf and Mekran

UNTIL after an international aerial route had been established along the Persian coast, meteorological information for this region was very scanty; the systematic study of its climate rested mainly upon a few observing stations, making observations once a day only, which had been established by the India Meteorological Department. A more elaborate organisation arose in 1927, in response to the needs of aviation, which took the form of a chain of telegraphic reporting stations extending from Karachi to Bushire and observing at 4 A.M. and 2 P.M. G.M.T., that is to say, at about 8 A.M. and 6 P.M. local mean time.

The records obtained in this way allowed of the construction of synoptic weather charts on modern lines; each station, moreover, kept a diary of phenomena occurring in disturbed weather. It is usually considered necessary to have records over a long period of years for any region before attempting to discuss its climate. To obtain reliable 'normal' values for the different climatic elements, this is a real necessity, but a careful perusal of Dr. Banerji's recent publication * suggests that he has done a useful service by presenting a preliminary study, which appears to give the salient climatic features of an interesting region, and connects these with meteorological events over a wide region extending to the Asiatic 'centre of action' in the north and to the south-east trade-winds of the southern part of the Indian Ocean.

As would be expected from geographical considerations, the climate of Mekran and the Persian Gulf has many points of resemblance with the better known climates of north-west India. There is a winter regime and a summer regime, and the differences between the two greatly transcend those that must inevitably arise through seasonal variations in the amount of solar radiation and in the length of the day. The explanation obviously lies in the disturbance set up by the great seasonal change of pressure over Asia, and by the invasion of the Indian area in summer by diverted south-east trades from beyond the equator, that cause the Indian 'rains'.

In winter, the Asiatic area of high pressure tends to show an extension south-westwards to Persia, but the fine and dry weather that might result from this is interrupted by the eastward passage of depressions known to Indian meteorologists as 'western depressions'. About eight of these occur on an average in a winter month. Dr. Banerji found, as a result of a careful analysis of his synoptic charts, that these are generally the remains of depressions that have passed out of the eastern Mediterranean, or secondary disturbances connected with them, such as are frequently found to occur when a depression crosses mountainous regions or is nearing the end of its life-history. Their behaviour and mode of formation are considered by him to conform with Norwegian views as to the origin of the depressions of temperate latitudes.

* India: Meteorological Department. Meteorology of the Persian Gulf and Mekran. By Dr. B. N. Banerji. Pp. iii+65+9 plates. (Calcutta: Government of India Central Publication Branch, 1931.) 3 rupees; 5*s*. 3*d*.

All the phenomena of the warm and cold 'front' and of the 'warm sector' are observed. In the cold front, the phenomenon of the line-squall, with or without thunderstorms, is often well developed, and is a danger to aerial navigation, for the northerly or north-westerly wind may arise with the force of a gale. There is little doubt that the outflow of cold air from the Siberian high-pressure area tends, owing to the general configuration of the land around the Persian Gulf, to take a north-west to south-east trend from Iraq, and it readily concentrates into a violent inrushing wave of polar air behind a depression. An analogous effect is to be observed in the lower reaches of the Rhone valley, where we have the violent 'mistral'. As the western depressions of the Persian Gulf often advance from regions lacking in meteorological reporting stations, the onset of the dangerous cold front squalls can only be anticipated well in advance from the other frontal phenomena and pressure changes that normally precede it, which does not allow of accurate anticipation of the time of its arrival. Owing, however, to the fact that the ocean swell to which it gives rise travels more rapidly than the front itself, an 'eleventh hour' warning of a much more definite kind is obtained from the arrival in suitable circumstances of such a swell.

In summer, conditions are more complex and less definite. The Asiatic low-pressure system has a local extension south-westwards to Arabia, and variations in the intensity and position of the centre of this extension, which is often to be found over the south-east of Arabia, are liable to cause big changes of wind and weather over the Gulf and Mekran. When the local centre retreats to Persia or north-west India, north-westerly winds tend to invade the whole region, and may reach the force of a gale; but they will do so only gradually, and violent frontal squalls need not be feared at this season. At the height of the monsoon, when south-west winds have advanced across the Arabian Sea so as to penetrate Persia and Baluchistan, depressions may travel into those countries and winds from south-west or west may extend from Mekran over at least a part of the Gulf. Occasionally also depressions moving westwards from the Bay of Bengal affect this area. More often at this season there is a cyclonic circulation around the south-east of Arabia, the wind being southerly to easterly in Mekran and north-westerly in the Gulf.

Between the winter and summer regimes there are transitional periods, when, apart from local thunderstorms, dust storms, and other disturbances of convectional character, the weather is for the most part fine and quiet.

The effects of the various seasonal tendencies, outlined above, can be traced in the climatic tables towards the end of the work, and some individual storms are illustrated by synoptic charts and records of autographic instruments. Apart from its practical importance for flying, the work links up the better known climates of north-west India, Mesopotamia, and Upper Egypt in an instructive manner. Considered simply as climate, the heat and small amount of cloud revealed by the tables are the outstanding features of this region. Shade temperatures above 90° begin to appear so early as February, and 100° is often exceeded from March to October. In July, nearly all the stations have a mean night minimum above 80°, while at Bushire it averages 87°. Within the short period under review, 112° has been attained in more than one place. It must not be supposed that dry healthy heat is the rule, for, at the entrance to the Gulf, the wet bulb thermometer averages 85° in July. E. V. N.

The Origin of 'Mare Sporco'

MASSES of a yellowish or greenish-brown gelatinous substance floating at the surface of the sea and at times colouring large areas are the cause of the phenomenon known as 'mare sporco'. It is especially noticeable in the Adriatic, but may occur also in many other places. Numerous authorities have written on the subject, and Dr. Vito Zanon has reviewed the literature in the paper before us ("Esame di un campione di 'Mare Sporco' del Golfo di Fiume". *Memorie della Pont. Accademia delle scienze—i nuovi Lincei*. Series 2, vol. 15. 1931). His conclusions, based on his own observations, show that these curious masses in the water have their origin at the bottom where innumerable diatoms, usually a few definite bottom-living species, in certain circumstances by rapid reproduction give rise to a large amount of a gelatinous substance impregnated with much oxygen.

When the water is warm the bubbles of gas swell and the gelatinous masses, which are full of diatoms, and with them a good deal of oozy mud, rise to the surface, causing the water to appear a dirty yellowish or greenish colour. When it is colder, or when storms, winds, and waves are in action, the masses are scattered and descend again to the bottom. Great inconvenience is caused to the fishing nets, as the masses clog the meshes and sometimes break them with their weight. This condition may last a fortnight, during which time fishing may have to be abandoned.

The special sample from the Gulf of Fiume examined by Dr. Zanon was made up chiefly of the diatoms *Nitzschia Lorenziana* var. *subtilis* Gran, *Pleurosigma lineare* Gran, and probably *Nitzschia sigmoidea* W. Sm., but different diatoms may be the cause in other parts. Some authors found dinoflagellates and various planktonic forms. These, however, may have become entangled in the floating gelatinous mass and may not be its original cause. Schreiber found chiefly the diatom *Bacillaria paradoxa*, which lives epiphytically on *Zostera*, in the masses from the waters around Venice.

Dr. Zanon shows clearly that the phenomenon is not identical with those efflorescences in the sea which among many names given to them are known as 'red water' or 'yellow water'. These are caused by an enormous outburst of growth of certain planktonic organisms. The true 'mare sporco' is definitely caused by bottom diatoms in gelatinous masses, rising to the surface in the warmth and descending in the cold.

Ceremonial Games and Social Organisation among the Creek Indians

MR. JOHN R. SWANTON during the summer of 1929 visited the Creek country with the view of obtaining further information relating to the 'square grounds' or sacred areas in which the Creek Indians celebrate their busks and other annual ceremonies. His report is now published in *Smithsonian Miscellaneous Collections*, vol. 85, No. 8. The 'square grounds' are intimately connected with Creek ceremonial, social and political organisation. According to tradition, after the formation of the Creek confederacy, the Kasihta and Coweta, the two divisions of the Muskogee element in the Lower Creeks, who

lived on the river, now the boundary between Alabama and Georgia, having defeated all their enemies, instituted periodical ball-games as a kind of moral equivalent for war. As friendly relations were established with other Indians and they were admitted to the confederacy, they joined with one side or the other and the dual system became general, the Kasihta becoming known as the 'white' side and the Coweta as the 'red'.

In the ceremonial games four towns played on either side. There was a certain aloofness of the towns of one moiety from those of the other. They did not intermarry. The people of each town were divided into clans, each with an animal name; and certain of these clans were linked into phratries which, in theory at least, were exogamous. A further division links them as 'white' people and 'people of a different speech'. These are also said to be exogamous; but the principal function of this division seems to be to determine on which side the people should play in the town games.

Every town has a ceremonial ground in which there are three elements: a community hot-house, used in bad weather and for secret ceremonies, a 'square ground', and a 'chunky yard', so called from an old pastime which consisted in rolling a disc along a level plot and throwing poles at it. In the centre of this yard is a single pole with a cow, a horse skull, or a wooden figure on it. Around this the men and women play a kind of ball-game.

In the ceremonial games, which resemble our lacrosse, and are solemn affairs, only the men play. On the 'square ground' are performed the 'stomp-dances', of which three or four take place in the spring and early summer. Only members of the town take part. They lead up to the great annual ritual, lasting four days, in which prominent features are the woman's dance and the fast and ceremonial bath of the men. This is a ceremony by which the Creeks clearly believe that they return to the state of harmony with the spirit of Nature which has been ruptured by the profane acts of the preceding year.

University and Educational Intelligence

CAMBRIDGE.—An appointment is to be made this year to a Busk studentship in aeronautics. The studentship is of the value of about £150, tenable for one year, and is open to any man or woman being a British subject and of British descent who has not attained the age of twenty-five years on Oct. 1 next. Forms of application for the studentship can be obtained from Prof. B. Melvill Jones, Engineering Laboratory, Cambridge, and must be filled up and returned to him not later than May 12.

Prof. Albert Einstein will deliver the lecture on Mr. Rouse Ball's Foundation on Friday, May 6, at noon. The subject of the lecture will be "Die Theorie der Elektrizität im Rahmen der allgemeinen Relativitätstheorie".

LONDON.—Applications are invited for the Bayliss-Starling Memorial Scholarship (value about £120 per annum and exemption from tuition fees) at University College. The successful candidate will be required to follow a course of study approved by the Jodrell professor of physiology and involving a training in the principle of and methods of research in physiology and biochemistry. Applications must be received not later than May 14 by the Secretary, University College, Gower Street, W.C.1.

MANCHESTER.—The Manchester City Council is again offering a number of scholarships tenable in the Faculty of Technology of the University. Successful candidates are required to follow a full-time course leading to the degree of bachelor of technical science in the College of Technology, and matriculation or its equivalent is an essential qualification. For students who have been engaged in industry, and who have attended part-time day or evening classes, the scholarships are of the value of £100 a year, while for students leaving secondary or central schools the value is £60.

Calendar of Geographical Exploration

May 1, 1607.—Hudson's Voyages

Henry Hudson left Gravesend on his first voyage of arctic exploration, hoping that it might be possible to find a passage right across the polar area. He sighted the east coast of Greenland north of any previous point reached, and by following the ice barrier which extends between Greenland and Spitsbergen, proved that there was little chance of finding a passage through. On a second voyage he reached Novaya Zemlya and made several landings, but failed to penetrate to the Kara Sea. In his next voyage (1609), the ice proving unfavourable for the Novaya Zemlya region, he decided to search for a passage on the American coast, and there discovered the Hudson river. In 1610 he set out in the *Discovery* and passed through Hudson Strait to Hudson Bay. In the latter the ship was frozen in, and the party passed the winter in great distress and scarcity of food. A mutiny broke out, and Hudson and those who supported him were put in an open boat and left to their fate, the mutineers sailing home in the *Discovery*. The strait and bay named after him were probably known to the Portuguese in the second half of the sixteenth century, and Frobisher and Davis also visited the strait.

May 1, 1769.—Opening up Kentucky

Daniel Boon, a typical backwoodsman, keen on hunting and exploration, left his home in North California, crossed the Alleghenies and the Cumberland Mountains, and reached the fertile but forest-clad plain of Kentucky. He was captured by Indians, but made his escape, and later settled with his family in the region, which was soon visited by other surveying parties.

May 2, 1497.—John Cabot

The *Matthew*, commanded by John Cabot, a Genoese who became a naturalised citizen of Venice and later settled in England, sailed from Bristol. With a crew of 18 he crossed the North Atlantic and discovered land thought by some to be Cape Breton Island, by others to be southern Labrador or Newfoundland or Nova Scotia. In any event, Cabot did not realise that he had approached the shores of America, but thought that the land was part of the coast of north-east Asia. His son, Sebastian, after sailing in a Spanish expedition from Seville which reached the river La Plata in 1527, returned to England. He afterwards became director of the Company of Merchant Venturers, incorporated on Dec. 18, 1551, and in that capacity helped to organise the expedition of Willoughby and Chancellor.

May 3, 1850.—Sledge Travel in the Arctic

Capt. H. Austin sailed with two ships to search for Sir John Franklin via the Barrow Strait. Austin and Penny, a whaling captain, entered Barrow Strait and discovered Franklin's winter quarters of 1845–46, but no record of the direction taken by the ships. Austin and M'Clintock advanced to Melville Island, marching more than 770 miles in 80 days. Austin also examined the entrance to Jones Sound. The expedition is

notable for the excellent way in which M'Clintock conducted the sledge travelling. M'Clintock went out again with Kellet's expedition, which passed the winter of 1852–53 at Melville Island. M'Clintock travelled with a sledge party for 105 days, covering 1328 miles, Mecham and Vesey Hamilton travelling for 94 and 97 days respectively. They completed the exploration of the north and west of Melville Island and of the coast-line of Prince Patrick Island.

May 5, 1255.—An Early Journey to Mongolia

William of Rubruck, or Rubruquis, reached Cilicia after his journey to the court of the Grand Khan. He was sent by Louis IX. of France as an envoy and left Acre in 1252. He went by sea to Constantinople, whence he sailed in May 1253 to the Crimea. He travelled by land to the Talas valley, penetrated to Lake Balkhash, passed the Ala Kul, entered Mongolia, and arrived at the court of the Khan on Dec. 25, later accompanying the court to the Karakoram. His narrative supplemented that of John de Plano Carpini, 1245–47. He gives interesting descriptions of the salt trade via the Don, and notes that the Caspian Sea is an inland sea and not a bay of the ocean, as was then believed.

May 6, 1788.—The Marshall and Gilbert Islands

Capt. Marshall left Port Jackson and was later joined by Capt. Gilbert, the two ships keeping together for most of the voyage. After passing Norfolk Island and sighting Matthew's Island in 22° 22′ S., 170° 41′ E., the two captains navigated the little-known part of the Pacific in which they discovered the groups of islands which now bear their names.

Societies and Academies

LONDON

Royal Society, April 21.—**H. W. McKenny Hughes**: Induced melanism in Lepidoptera. Females of the Geometrid moth *Selenia bilunaria*, Esper, were collected in three different areas in southern and eastern England, as far as possible away from industrial areas. Two generations were fed upon pure untreated hawthorn, after which four subsequent generations were fed upon hawthorn treated with lead and manganese salts respectively. Brother and sister matings were adopted throughout the experiment. Adequate control broods were kept, and in all 3265 moths were reared. No melanic individuals appeared at any time, either in the control or treated broods.—**S. Adler** and **O. Theodor**: Investigations on Mediterranean kala azar (6). Canine visceral leishmaniasis. Eleven out of 100 dogs examined in Malta between June and November were found to be naturally infected with kala azar. Seborrhea and partial depilation are the most frequent signs of canine kala azar and were found in nine out of eleven cases. The skin condition is due to infiltration of macrophages round hair follicles. Infected macrophages are found throughout all parts of the skin, both in the areas of infiltration round the hair follicles and in normal dermis. Sandflies, *P. perniciosus*, were infected with *Leishmania* by feeding on the unbroken skin of three dogs. The infection rates were 62·5 per cent, 65·4 per cent, and 32 per cent respectively.—**R. H. Stoughton**: The morphology and cytology of *Bacterium malvacearum*, E.F.S. (2). Reproduction and cell-fusion. New morphological forms have been observed. The production of coccoid bodies, their liberation, and subsequent germination to form apparently normal rods, is described. The formation of densely-staining spherical bodies, apparently arising from the point of fusion of two cells, is described. These bodies are apparently liberated by the degeneration of the parent cell.

PARIS

Academy of Sciences, March 14.—**Ernest Esclangon**: Talking clocks designed for the telephonic distribution of the time. Two types of apparatus are described, both depending on the use of a photoelectric cell with amplifiers. It is proposed to instal these at the Paris Observatory for telephonic distribution of time through the Post Office.—**A. Cotton** and **H. Mouton**: The optical properties of a thin layer of nitrobenzene submitted to electrostatic stress. A thin layer of nitrobenzene, submitted to alternating current (1000 to 2500 volts), shows double refraction. It differs from the Kerr effect in that the double refraction develops slowly (2-3 minutes) and takes a similar time to disappear after suppression of the field.—**L. Cayeux**: The interpretation of the deposits of calcium phosphate dredged on the Agulhas Bank, to the south of the Cape of Good Hope. The Agulhas Bank phosphate deposit is formed of materials foreign to the green sand on which it rests. The nodules of phosphate are derived from deposits formed at greater depths than those where it is now found. The current formation of phosphatic deposits on the sea floor cannot be proved.—**V. Grignard** and **J. Colonge**: A new general method for the condensation of ketones.—**Henri Logatu** and **Louis Maume**: Can the leaf accept an excess of mineral food without benefiting the development of the plant? The leaf of the potato can show a marked excess of potash without benefit to the plant.—**Louis Lapicque**: The verification of decease by a medico-scientific test clearly proving death with certainty.—**Jean Cantacuzène** was elected *correspondant* for the Section of Medicine and Surgery, and Émile Guyénot *correspondant* for the Section of Anatomy and Zoology.—**Jean Mascart**: Remarks on logarithms.—**Georges Durand**: The application of the conception of contingent to the research on the characters of planeity for a simple arc.—**S. Mazur** and **S. Ulam**: The isometric transformations of vectorial spaces, *normés*.—**A. Marchaud**: The limiting demisecant and semi-tangents.—**Karol Borsuk**: The conception of local contractibility of ensembles.—**Edouard Callandreau**: The close connexion between Coulomb's and Boussinesq's theories of the thrust of soil.—**Paul Santo Rini**: A high frequency method for the study of vibrations both at the surface and in the interior of a solid, especially the framework of a bridge.—**Nicolas Kryloff** and **Nicolas Bogoliuboff**: Some examples of non-linear vibrations.—**P. Lambert** and **J. Lecomte**: The infra-red absorption spectra of hydrocarbons with nucleus. Results of the application of the recording spectrometer described in a previous paper to the infra-red absorption of derivatives of cyclohexane, cyclohexene, and naphthalene.—**R. Freymann** and **S. Takvorian**: The absorption spectra of the rare earths in the infra-red. The spectra were studied in the region $0{\cdot}82\mu$–$1{\cdot}16\mu$. Some new absorption bands have been detected, and these are of interest from the point of view of analysis.—**Maurice Robert**: A new method of study and of regulation of a television transmitter.—**S. Rosenblum** and **M. Valadares**: The fine structure of the α-rays of thorium-C. Utilising the large electromagnet of the Academy of Sciences, a new faint line (α_5) has been detected: the line α_4, noted as doubtful in an earlier note, is confirmed.—**P. Reiss**: The intervention of equilibria of oxidation-reduction in the permeability of a membrane.—**W. Broniewski** and **S. Koslacz**: The silver-copper alloys.—**A. Perret**: The action of primary amines on dicyandiamidine sulphate. Under

certain conditions detailed, a primary amine $R.NH_2$ reacts with the acid sulphate of dicyandiamidine—giving guanidine sulphate and the symmetrical urea $CO(NH.R)_2$.—**P. Weill** and **Mlle. Madeleine Darmon**: The isomerisation of phenylglycide. The affinity capacity of the primary alcohol group.—**J. Bougault** and **Mlle. Pinguet**: The combinations of allantoxanic acid and of allantoxaidine with the alkaline bisulphites. Crystalline compounds are formed, slightly soluble in water and hence useful from the analytical point of view.—**R. Marcel Godchot** and **Max Mousseron**: The resolution of *o*-aminocyclohexanol into its optical antipodes.—**Mlle. D. Biquard**: The preparation of the cyanhydrins of the formula $C_6H_5(CH_2)_n.CH(OH).CN$, $C_6H_5.(CH_2)_nCH(CH_3).CH(OH).CN$ and the corresponding α-acid-alcohols.—**Ch. Courtot** and **P. Chiffert**: The aryl thioniums with strictly hydrocarbon radicals.—**M. Battegay** and **H. Silbermann**: The aryl ethers of pseudo-urea.—**J. P. Arend**: The constitution of oolitic minerals and its relation with the facies of the deposits.—**André Demay** and **Henri Longchambon**: The antistephanian tectonic of the Cevennes at the height of Largentière.—**Raymond Furon**: The extension of the marine Devonian in western Africa.—**Antonin Lanquine**: The dislocations of the secondary strata of the valley of Caramy, below its confluent with the Issole (Var).—**L. Dubertret, A. Keller,** and **H. Vautrin**: Contribution to the study of the Syrian desert region.—**Henri Erhart**: The types of soils in the loess district in Alsace.—**L. Cagniard**: The reflection of a spherical and isotropic seismic wave at the surface of the soil.—**L. Eblé** and **G. Gibault**: The values of the magnetic elements at the station of Val-Joyeux (Seine-et-Oise) on Jan. 1, 1932.—**R. Hickel**: The two layers of tertiary plants in the Bas-Rhin.—**J. Szymanek**: Supplementary caryological observations on *Gossypium*.—**Paul Wintrebert**: The preservation in paraffin sections of the vital marks in Bismarck brown and Nile blue, made on the living eggs of Amphibians.—**A. Policard** and **A. Morel**: The comparative utilisation of a spark or of an arc in the spectrography of sections (histospectrography).—**Maurice Lecamp**: Grafts of fragments of the posterior limbs in *Alytes obstetricans*.—**A. Girard, G. Sandulesco, A. Fridenson, C. Gaudefroy,** and **Ir. J. J. Rutgers**: The crystallised sexual hormones extracted from the urine of pregnant mares. Detailed crystallographic study of folliculine and equiline. The composition of the latter is probably $C_{18}H_{20}O_2$: its physical, chemical, and physiological characters are described. A third crystalline hormone isomeric with equiline (hippuline) has been isolated.—**Mmes. Eudoxie Bachrach** and **Jeanne Roche**: The prolonged action of potassium chloride produces a displacement of the thermal optimum of yeasts.—**Ph. Lasseur, M. Pierret, A. Dupaix,** and **C. Maguitot**: Remarks on the bactericidal power of metallic silver.—**Michel Faguet**: Contribution to the study of microbial multiplication (*Bacterium coli*). The opacity of a broth culture is taken as measuring the number of micro-organisms. The variations in the opacity have been measured and recorded by means of a photoelectric cell. A reproduction of a 12-hour record is given.—**C. Jonesco-Mihaiesti, D. Noica,** and **B. Wisner**: The experimental transmission to the ape of a disseminated human encephalomyelitis.—**G. Mouriquand, A. Leulier,** and **Mlle. Weill**: Age and substances preventing the assimilation of lime.

LENINGRAD

Academy of Sciences—*Comptes rendus*, No. 11, 1931.—**V. Vernadsky**: The field of stability of the liquid carbonic acid in the biosphere. Carbonic acid in liquid form exists in microscopic pores of many minerals and must play an important part, but the problem has never been studied. Still more important is the fact that the low average temperature of water in oceans, coupled with great pressure in oceanic depths, make the existence in deep waters of liquid carbonic acid a certainty, and this cannot be without an effect on the life of organisms. It is possible, for example, that the absence of planktonic organisms at relatively small depths, where there is still light, is due to peculiar conditions for respiration owing to a certain part of the carbonic acid being in liquid state (see also NATURE, April 23, p. 607).—**V. Chlopin**: Geochemistry of noble gases.—**E. Krinov**: A bolide meteor of Nov. 23, 1930, in the Nijny-Novgorod region. Observations by eye-witnesses are quoted and a sketch-map of its track is presented.—**A. Reichardt**: On a new representative of the genus *Philotis*, Rchdt. Description of *Philotis atavus*, sp. n., from Buchara.

SYDNEY

Linnean Society of New South Wales, Nov. 25.—**W. W. Froggatt**: A classification of the gall-making coccids of the genus *Apiomorpha*. The male and female galls are described and the range of each species, together with the name of the host eucalypt, is given. The species of the genus are classified into groups based on the form and disposition of the hairs and spines on the dorsal surface and the structure of the anal appendages.—**Ida A. Brown**: The stratigraphical and structural geology of the Devonian rocks of the south coast of New South Wales. The formations found in the south coast district are correlated with a number of other occurrences of Devonian rocks in south-eastern Australia, and the palæogeography of the Devonian era is considered.—**H. M. R. Rupp**: Notes on New South Wales orchids. A description is given of a teratological specimen of *Caladenia testacea* from the South Maitland coalfields, and a distinctive form of *Dendrobium teretifolium* var. *Fairfaxii* is recorded.—**Gladys Carey**: Note on the leaf-buds of *Angophora*. More detailed examination of the leaf bud of species of *Angophora*, previously described by the author as "an ill-defined axillary swelling", shows that this swelling is in reality a deep-seated bud of peculiar type in which the primordia are well differentiated.—**Lilian R. Fraser**: An investigation of *Lobelia gibbosa* and *Lobelia dentata*. Mycorrhiza, latex system, and general biology. The root is infected from the first by the fungus, which remains in an intercellular position in the cortex. The fungus infects the younger parts of the root and all lateral roots by growing down from the older region, and goes through a series of changes, being finally almost crushed out by the cortical cells of the root. Reinfection of roots takes place at intervals from the soil, rhizomorph-like strands of the fungus coming into contact with the root and penetrating into the cortex. The latex system of the two species is briefly described.

Forthcoming Events

FRIDAY, APRIL 29

ASSOCIATION OF ECONOMIC BIOLOGISTS (in Botany Department, Imperial College of Science and Technology), at 2.30.—Dr. S. G. Paine: The Relationship of Micro-organisms to the Decay of Stone.—Dr. E. S. Moore: Virus Disease Problems in Tobacco Cultivation in South Africa.

ROYAL ASTRONOMICAL SOCIETY, at 4.30.—Geophysical Discussion: The Maintenance of the Earth's Electric Field. To be opened by Dr. F. J. W. Whipple, and continued by Dr. G. C. Simpson and others.

INSTITUTION OF ELECTRICAL ENGINEERS (Meter and Instrument Section), at 7.—Dr. C. V. Drysdale: Future Progress in Electrical Measuring Instruments (Lecture).

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. H. Hartridge: The Rival Theories of Hearing.

MONDAY, MAY 2

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.—Annual Meeting.

UNIVERSITY COLLEGE, LONDON, at 5.15.—Prof. O. Grosser: Human and Comparative Placentation, including the Early Stages of Human Development (1). (Succeeding Lectures on May 5 and 6.)

SCHOOL OF ORIENTAL STUDIES, at 5.30.—Prof. G. Morgenstierne: The Káfirs of the Hindu Kush (1). (Succeeding Lectures on May 4 and 6.)

ROYAL SOCIETY OF ARTS, at 8.—Prof. J. C. Drummond: Recent Researches on the Nature and Function of Vitamins (Cantor Lectures) (3).

SOCIETY OF CHEMICAL INDUSTRY (London Section) (Annual Meeting) (at Chemical Society), at 8, followed by a General Discussion on Smoke Abatement in Industry.

TUESDAY, MAY 3

ROYAL ANTHROPOLOGICAL INSTITUTE (African Research Committee), at 4.30.—Methods of Study of Culture Distribution in Africa.

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 5.—Dr. Harriette Chick: The Relation of Light to Nutrition (Oliver-Sharpey Lectures) (1).

ROYAL SOCIETY OF MEDICINE (Orthopædics Section), at 5.30.—Annual General Meeting.

UNIVERSITY COLLEGE, LONDON, at 5.30.—Dr. W. A. Shewhart: The Rôle of Statistical Method in Industrial Standardisation (1). (Succeeding Lectures on May 5 and 6.)

GOLDSMITHS' COLLEGE (New Cross), at 5.45.—Exhibition in connexion with the Teaching of Geography.—At 5.45.—Sir Halford Mackinder: Inaugural Address.

WEDNESDAY, MAY 4

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, at 5.30.—Aldous Huxley: Huxley as a Literary Man (Huxley Memorial Lecture).

NATIONAL INSTITUTE OF INDUSTRIAL PSYCHOLOGY (at London School of Economics), at 5.30.—Dr. C. S. Myers: Psychological and Social Factors in Business Rationalisation (1): The Significance of Rationalisation.

GOLDSMITHS' COLLEGE (New Cross), at 5.45.—L. Brooks: The Teaching of Geography—The Modern Approach.

EUGENICS SOCIETY (at Royal Society).—Annual General Meeting.

THURSDAY, MAY 5

IRON AND STEEL INSTITUTE (at Institution of Civil Engineers), at 10 A.M.—Annual Meeting.

ROYAL SOCIETY, at 4.—Election of Fellows.

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 5.—Dr. Harriette Chick: The Relation of Light to Nutrition (Oliver-Sharpey Lectures) (2).

LONDON SCHOOL OF ECONOMICS, at 5.—Dr. R. R. Marett: Covenant in Primitive Economics, Law, and Religion (1). (Succeeding Lecture on May 12.)

GOLDSMITHS' COLLEGE (New Cross), at 5.45.—Prof. E. G. R. Taylor: First Ventures on the Atlantic—A Study in the Relations of Human and Physical Geography.

INSTITUTION OF ELECTRICAL ENGINEERS (Varley Centenary Meeting), at 6.—Lt.-Col. A. G. Lee: The Lives and Work of Cromwell Fleetwood Varley (April 6, 1828) and Samuel Alfred Varley (March 22, 1832).—Annual General Meeting, at 6.45.

SIR JOHN CASS TECHNICAL INSTITUTE (31 Jewry Street, E.C.), at 7.—Prof. C. O. Bannister: Ancient and Modern Metallurgy (Armourers and Brasiers' Company Lectures) (1). (Succeeding Lectures on May 12 and 19.)

FRIDAY, MAY 6

IRON AND STEEL INSTITUTE (at Institution of Civil Engineers), at 10 A.M.—Annual Meeting.

ROYAL SOCIETY OF MEDICINE (Otology Section) (Annual General Meeting), at 10.30 A.M.—Discussion on Labyrinthitis.

CAMBRIDGE UNIVERSITY (in Senate House), at noon.—Prof. A. Einstein: Die Theorie der Elektrizität im Rahmen der allgemeinen Relativitäts-theorie (Rouse Ball Lecture).

INSTITUTION OF MECHANICAL ENGINEERS (London Spring Meeting), at 2.30.—A. Binns: Recent Developments in the Mechanical Equipment of the Port of London Authority.

ROYAL SOCIETY OF ARTS (Indian Meeting), at 4.30.—Miss B. M. le P. Power: Indian Labour Conditions.

SOCIETY OF CHEMICAL INDUSTRY AND INSTITUTE OF CHEMISTRY (Joint Scottish Meeting) (at University, St. Andrews), at 5.—Prof. J. Read: Alchemical Literature and Iconography (Lecture).

ROYAL SOCIETY OF MEDICINE (Laryngology Section), at 5.—Annual General Meeting.

PHYSICAL SOCIETY (in Physiological Laboratory, University College), at 5.—Prof. A. V. Hill: The Measurement and Analysis of the Heat Production of Nerve (Lecture).

UNIVERSITY COLLEGE, at 5.30.—Sir Bernard Pares: Russia and the West (Lecture).

GOLDSMITHS' COLLEGE (New Cross), at 5.45.—Prof. J. F. Unstead: Recent Developments of the Regional Method—as applied to Teaching.

ROYAL INSTITUTION OF GREAT BRITAIN, at 8.30.—Conversazione.

ROYAL SOCIETY OF MEDICINE (Anæsthetics Section), at 8.30.—Annual General Meeting.

CAMBRIDGE UNIVERSITY (in Anatomy Lecture Room, New Museum).—Prof. J. J. R. Macleod: Linacre Lecture.

SATURDAY, MAY 7

GOLDSMITHS' COLLEGE (New Cross), at 3.30.—Prof. H. J. Fleure: Social and National Ideals in their Geographical Settings—A Study of Some European Problems.

Official Publications Received

BRITISH

The West of Scotland Agricultural College. Research Bulletin No. 2: A Nematode Disease of Potatoes caused by Heterodera Schachtii (Schmidt). By Dr. D. G. O'Brien and E. G. Prentice. Pp. 63+23 plates. (Glasgow.)

Proceedings of the Royal Irish Academy. Vol. 40, Section B, No. 14: Observations on the Reproduction of *Nyctiphanes couchii* (Bell) and *Meganyctiphanes norvegica* (Sars) off the South Coast of Ireland. By Winifred E. Frost. Pp. 193-232. 1s. 6d. Vol. 40, Section A. No. 6: A Characteristic Property of Systems of Paths. By Charles H. Rowe. Pp. 99-106. 6d. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.)

Reports of the Council and Auditors of the Zoological Society of London for the Year 1931, prepared for the Annual General Meeting to be held on Friday, April 29th, 1932, at 4 p.m. Pp. 99. (London.)

Dominion of Canada. Fourteenth Annual Report of the National Research Council containing the Report of the President and Financial Statement, 1930-1931. Pp. 210. (Ottawa.)

Tanganyika Territory: Geological Survey Department. Bulletin No. 2: Report on the Geology of the Ruhuhu Coalfields, Njombe—Songea Districts; being a Preliminary Geological Survey of the Karroo Rocks, East of Lake Nyasa, by G. M. Stockley, and Technical Report on the Coal Samples, by F. Oates. Pp. vi+68+7 plates. (Dar es Salaam: Government Printer.) 5s.

FOREIGN

Carnegie Institution of Washington. Annual Report of the Director of the Department of Terrestrial Magnetism. (Reprinted from Year Book No. 30, for the Year 1930-31.) Pp. ii+281-375. (Washington, D.C.: Carnegie Institution.)

Bulletin of the Earthquake Research Institute: Tokyo Imperial University. Vol. 10, Part 1, March. Pp. 272+38 plates. (Tōkyō: Iwanami Shoten.) 4.45 yen.

Académie Tchèque des Sciences (Česká Akademie Věd a Umění.) Bulletin International. Résumés des travaux présentés, Classe des sciences mathématiques, naturelles et de la médecine. 29e année (1928). Pp. iv+556. 30e année (1929.) Pp. v+475. (Prague.)

Proceedings of the Imperial Academy. Vol. 8, No. 2, February. Pp. iii-iv+27-57. (Tokyo.)

Methods and Problems of Medical Education. (Twentieth Series.) Pp. iv+250. (New York City: The Rockefeller Foundation.)

CATALOGUES

General Catalogue of Books and Prints, 1932. (No. 547.) Pp. 96 (London: Francis Edwards, Ltd.)

Important and Rare Books on Gardening (including Herbals), Agriculture and Husbandry (1481-1800). (New Series, No. 27.) Pp. 52. (London; Wheldon and Wesley, Ltd.)

A Catalogue of Book Bargains. (No. 535.) Pp. 16. (London: William Glaisher, Ltd.)