SATURDAY, NOVEMBER 14, 1925.

CONTENTS.

| | PAGE |
|---|---|
| Technical Libraries | 701 |
| Ancient Assyrian Chemistry. By E. J. Holmyard | 703 |
| The Colour Line | 705 |
| Birth-Control. By E. W. M. | 706 |
| Guide-Books for the Naturalist | 707 |
| Our Bookshelf | 707 |
| Letters to the Editor: | |
| Plotting Upper Air Temperatures.—J. S. Dines | 709 |
| Bismuth Trihydride and Silver Bismuthide.—Edward J. Weeks and Dr. J. G. F. Druce | 710 |
| Flowering Plants as Epiphytes on Willows and Alders.—H. Stuart Thompson | 710 |
| Tertiary Fossil Insects from Argentina.—Prof. T. D. A. Cockerell | 711 |
| *Opalina ranarum*: a Flagellate.—Prof. J. Brontë Gatenby and Miss S. D. King | 712 |
| The Geographo-Economic Institution at Leningrad. Prof. Boris Fedtschenko | 712 |
| Some Modern Aspects of Physical Research. By Sir Alfred Ewing, K.C.B., F.R.S. | 713 |
| The Science and Art of Map-making. By A. R. Hinks, C.B.E., F.R.S. | 715 |
| Obituary:— | |
| Mr. J. Y. Buchanan, F.R.S. By Dr. Hugh Robert Mill | 719 |
| Mr. Francis Jones. By H. B. D. | 720 |
| Current Topics and Events | 722 |
| Our Astronomical Column | 725 |
| Research Items | 726 |
| Geneva Congress of the History of Medicine | 729 |
| Economic Problems | 730 |
| The North Atlantic in Tertiary Times | 730 |
| Engineering and Shipbuilding | 731 |
| University and Educational Intelligence | 731 |
| Early Science at Oxford | 732 |
| Societies and Academies | 733 |
| Official Publications Received | 735 |
| Diary of Societies and Public Lectures | 735 |

*Editorial and Publishing Offices:*
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

Editorial communications should be addressed to the Editor.
Advertisements and business letters to the Publishers.

Telephone Number: GERRARD 8830.
Telegraphic Address: PHUSIS, WESTRAND, LONDON.



## Technical Libraries.

THE formation of the Association of Special Libraries and Information Bureaux, which held its second annual Conference at Balliol College, Oxford, in September, is a welcome sign not only that the librarians of technical and other specialist libraries are realising the need of co-ordination and co-operation amongst themselves, but also that manufacturers in Great Britain are at last seeing the vital importance of research to industry. They are realising the urgent necessity, therefore, of having ready access to existing library resources and greater facilities for ascertaining what is being done from day to day throughout the world.

The pressure behind the movement came in the main from outside and not from within the library world. The absence of the research habit in Britain, in contrast with the position in Germany, became so painfully evident after a few months of the War that the Government had no option but to undertake a Scientific Intelligence Service, which though conducted primarily for military purposes, yet necessarily covered so wide a field that it included in its survey a great deal of what in normal times would form part of the civil work of the nation. Fortunately, the necessity for a continuance after the War of similar organised efforts towards a comprehensive scheme of scientific research was clearly recognised, and numerous industrial research associations were formed, under the ægis of the Department of Scientific and Industrial Research, to act as laboratories and as feeders of up-to-date information for the benefit of the subscribing manufacturers. It is a significant fact that it was due mainly to the initiative of one or two of these research associations that the first Conference of Special Libraries was held at Hoddesdon last year, and that this was followed by the formation of an Association and the much larger Conference at Oxford this year.

At a very liberal estimate, the number of scientific and technical libraries in Great Britain may be put at about a couple of hundred. This figure, though probably not one-third of the number of similar institutions in the United States, where the Special Library Association has been in existence for more than sixteen years, may not on paper appear an unreasonable one for British needs. But when consideration is given to the fact that certainly more than one-half of this number—and of these probably the largest and most representative—would be found in London and its immediate neighbourhood, and when the nature and relative efficiency of the various collections are taken into account, it will surely be felt that the fullest advantage is not being taken even of the undoubtedly great resources we already possess.

There is, or was until quite recently, an entire lack of co-operation between the different libraries, even amongst those covering the same or closely related fields. Each shut itself in a watertight compartment, selecting and arranging its books and the still more important periodical literature without reference to its neighbours, and with the view solely of suiting the needs of its own readers—usually the members of the private or semi-private institution to which the library belonged. This involved a great deal of unnecessary duplication and a needless waste of effort, some fields being more than adequately covered, whilst others were only poorly or even not at all represented. Well-known treatises and journals could be found repeated in a number of libraries within walking distance of each other, to the entire exclusion of less well known but not always less important literature. A few fruitless efforts at reform have been made from time to time, especially in the field of engineering, but so far nothing has been accomplished that can in any way compare, for example, with the establishment of the United Engineering Societies Library in New York.

A beginning is, however, now being made in Great Britain, and one interesting experiment calls for special notice, namely, the scheme whereby, under agreement with the Carnegie United Kingdom Trust, approved special libraries are being linked up with the Central Library for Students. Already under this scheme a number of libraries—those of the Royal Aeronautical Society, the Scottish Marine Biological Association, the Rowett Research Institute, and others—have agreed to lend their books and periodicals (other than exceptional rarities) to borrowers applying through the Central Library, the latter institution becoming responsible for their proper care and return. The benefits of such a scheme are obvious. The Central Library is relieved of the necessity of purchasing a number of books, etc., already to be found in these other libraries, whilst at the same time those who avail themselves of its services will be able to borrow many books and periodicals, including back numbers, not otherwise obtainable.

Co-operation of this character is especially valuable, and the establishment of central loan libraries will be of increasing importance in connexion with the small but highly specialised libraries that are being formed by industrial establishments, research associations, and so on. As these grow, the question of the provision of shelf space for their rapidly increasing literature will undoubtedly arise and will be solvable in one of two ways, either by diverting some of the not too extravagant funds now devoted to experimental research from the laboratory to the library, or by a periodical survey of the library shelves for the purpose of weeding out the less important material.

Happily for the future prospects of research, the latter alternative, granted proper co-operation between all concerned, is not only the most practicable, but also the most desirable one. It would usually be unnecessary for the type of library now being considered, concerned as it is mainly with the results of current research, to continue to keep on its shelves copies of old editions and long runs of patent literature, or of any but the most important periodicals. At the same time, no librarian would agree to discard such material unless he could be quite sure that it would be readily and immediately accessible in some other library, if and when required. A central library to which might be sent on loan conditions all literature that could ordinarily be dispensed with would meet his needs, and would in many other ways be an invaluable adjunct to all the special libraries of a district. The increasing specialisation, and the growing interdependence of the various branches of science, render it quite impossible for any but the very largest libraries to include all the literature that might at some time or another be wanted by its readers, and reliance on other sources is the only possible solution of the difficulty.

In this the greater public libraries of Great Britain may well play an important part. Many of the municipal authorities throughout the country—notably that of Manchester—are viewing with favour the formation as part of their library system of special technical sections having particular reference to the industrial interests of the district. It would not be a difficult matter to arrange that the special libraries of the neighbourhood should each restrict its selection of literature to that relating specifically to the subject with which it is mainly concerned, leaving the public library to provide for its needs in the way of general scientific works and the literature of neighbouring fields which might be required from time to time. The public library would also serve as the reservoir, of which we have spoken, for the less important material weeded out periodically from the specialist libraries to make room for current growth. By reciprocal loan arrangements, such material would always be available when required, and the public and specialist libraries would each be able to draw on the resources of the other in case of need. Any specialist library would thus have access to a far wider range of literature than it could possibly hope to provide for itself, and would at the same time, by the elimination of the necessity to provide works on subjects outside its immediate scope, be enabled to make its own collection more fully representative of its subject than would otherwise be the case. Consolidated catalogues kept up-to-date in each of the libraries concerned would be a necessary corollary.

In London, with its varied interests, a somewhat different method might have to be introduced, and a separate loan library be formed as an auxiliary to the scientific libraries of the Metropolis, to which the rarely used volumes could be sent for the common use and benefit.

With greater co-operation between scientific institutions, we may expect to see an improvement in those indispensable tools of the research worker, abstracts and indexes of periodical literature. An enormous amount of unselfish work is being done in this field at the present moment, and unity of effort is being aimed at in more than one direction. The two leading chemical societies have since last year pooled their abstracting resources in the Bureau of Chemical Abstracts, and though two separate publications, differing in format, one for pure and one for industrial chemistry, are still being issued, it is understood that with next year the two publications will be combined into one. A much larger question arises when the actual number of journals abstracted or indexed is considered. Though we are still waiting for the second volume of the "World List of Scientific Periodicals," we shall not be far wrong in assuming that a considerable proportion of the current periodicals recorded in that invaluable work are not to be found in any British library. Dr. Chalmers Mitchell, at the Oxford Conference, made the bold suggestion that a central library should be established which should contain a copy of every current periodical issued throughout the world and publishing scientific and technical research, and keep it available for the use of indexers and abstractors for two years after publication. After that period the volumes would be distributed for permanent reference to other suitable libraries. Such a library would not be a lending library, but would be available only for abstractors and indexers from recognised organisations, and for the librarians of other libraries. A certain amount of cold water has been thrown on the proposal on the ground of the extensive nature of the work involved; but nothing is impossible unless we make it so.

Such are some of the many problems awaiting solution in the world of technical libraries, before these can render to the community that service which they alone can give, and, it may confidently be expected, will more and more be demanded of them. Improvements in the facilities provided and the growth of a healthy desire for knowledge of what others are doing in invention and research will proceed *pari passu*, for the two are mutually dependent and will stimulate each other. The newly formed Association of Special Libraries is supplying the necessary impetus. From the seriousness with which it is setting about its self-imposed task, there is distinct hope that one at least of the lessons taught by the War will not be forgotten.

## Ancient Assyrian Chemistry.

*On the Chemistry of the Ancient Assyrians.* By Dr. R. Campbell Thompson. Pp. 158+6 plates. (London: Luzac and Co., 1925.) 25*s.* net.

DR. THOMPSON'S brilliant monograph on ancient Assyrian chemistry is worthy of very careful study. To appreciate it fully one must be both an Assyriologist and a chemist, but even those who, like the present writer, have no knowledge of cuneiform, will delight in Dr. Thompson's skill in argument, lucidity of explanation, and quickness in perceiving the key to difficulties. His results and conclusions are of considerable importance, and, while one may not always agree with him entirely, he has certainly thrown a flood of light upon the chemical knowledge of one of the most talented nations of antiquity.

The texts concerned form part of the remains of the royal library of Ashurbanipal, now preserved in the British Museum. They describe in detail the processes of glass-making as practised by the Assyrians of the seventh century B.C., and give information not only on the composition of various kinds of glass but also on a variety of colouring matters used in the production of tinted glass. By subjecting these texts to a close and critical examination in the light of philology, checked at each step by appeal to chemistry and to known methods, ancient and modern, of glass-making, Dr. Thompson has succeeded in identifying a surprisingly large number of chemicals. It becomes evident, indeed, that chemistry of a practical and empirical nature must have been brought by the Assyrians to a level hitherto unsuspected.

Dr. Thompson points out that up to the present time the Assyrian words for minerals and stones have been much neglected, and that the custom has too commonly been to regard the large number of substances specified by the determinative for "stone" as (exclusively) "precious stones." He inclines to the view that "stone" in the scientific texts must have a much wider meaning; that it must, in fact, include mineral drugs and inorganic pigments. This suggestion, the fruitfulness of which is shown throughout the book, has a great deal to recommend it. Most important of all, perhaps, is the fact that in the related Semitic language of Arabia we find that the chemical writers habitually use the term *ḥajar* ("stone") for any inorganic chemical. Since the early Arabs undoubtedly derived many of their mineral-names, and possibly much of their empirical chemical knowledge, from Assyria, it is not incredible that this technical use of the word "stone" may have been handed down to them in the same way. Quite apart from this extraneous evidence, however, it is difficult for any one who follows Dr. Thompson's arguments to disagree with his view that *abnu* (determinative of *stone*) must be allowed to bear a far more extensive interpretation than that hitherto given to it.

Consideration is next devoted to the solution of the problems presented by the glass-making texts. Here the author bases his procedure upon the principles involved in the technique of modern methods. The essentials in all glass-making are silica, an alkali, and lime or less probably lead. A decolorising agent, such as manganese dioxide, is usually added. That all these substances were used so far back as A.D. 79 is proved by an analysis of window-glass from Pompeii :—*silica,* 69 ; *soda,* 17 ; *lime,* 7 ; *alumina,* 3 ; *iron oxide,* 1 per cent. ; *manganese and copper,* traces. Chemical analysis of ancient glasses has, moreover, revealed the nature of many of the colouring agents employed in the manufacture of tinted glass ; thus Assyrian blue glass has been found to contain copper, and red glass cuprous oxide. Assyrian white glass contains tin oxide, while lead antimonate has been discovered in yellow.

From data of this kind, it becomes an easier task to identify the names of the principal constituents of Assyrian glass as given in the texts. *Uḫulu, immanakku,* and *namrutu* are the basic substances. The first, *uḫulu,* has long been recognised as " alkali," and Dr. Thompson is able to show that *immanakku* probably represents a pure quartz sand. Since the word for lead (*anaku*) does not occur in any of the glass-texts, it is reasonable to assume that *namrutu* signifies a form of lime or limestone, and the author brings evidence to show that it is probably chalk. With the three main ingredients definitely settled, attention can be devoted to the rest, and it is here that Dr. Thompson's ingenuity and erudition achieve their most brilliant successes. It is here, too, that the chemist and philologist will find much to fascinate them—the first in the astonishing chemical knowledge which the texts imply, and the second in the discovery that many familiar names of minerals are of Assyrian origin.

To the chemist, one of the most interesting of the recipes is that which appears to describe a prototype of the Purple of Cassius. Dr. Thompson thinks that the aim of the operation described in this recipe is to produce an artificial pink or red coral. The ingredients of the mixture are given as 7200 parts of a glass base, 32 parts of *tuskū* (oxide of tin ?), 20 parts of *abaru* (which Dr. Thompson identifies with antimony), (?) parts of *mil'u* (a salt), and 1 part of gold. The proportion of gold here stated (0·014 per cent.) is of the usual order of magnitude in the preparation of ruby glass.

The recipe just mentioned is of much interest to the philologist also, since it necessitates the identification of no less than three constituents. One of them is the substance which is called *abaru.* Any one who has studied ancient chemical texts knows how tantalising this word is. Dr. Thompson, following Ibn Baithar, identifies the Arabic *al-abar* with antimony, and compares *al-abar* with the Assyrian *abaru.* But *abar* in Arabic chemical texts seems to have a good many different meanings, not the least common being that in which it is used for the elixir. Thus in a chemical poem attributed to Khālid ibn Yazīd the elixir is described as " that which the people of this Art (alchemy) call *Abar,*" and the same name is elsewhere applied by Khālid to the " tincture " of metals. Abu'l-Qāsim al-'Irāqī (XIIIth cent.), however, distinctly says that *abar* is another name for lead (in his book *Al-Aqālīm al-Sab'a*). According to the *Musta'īnī,* again, *abar* is tin. I am inclined to think that the most satisfactory meaning to ascribe to *abar* is " the metal extracted from collyrium," in which case it would mean either lead or antimony, between which early chemists could scarcely distinguish with accuracy. *Tuskū* Dr. Thompson tentatively identifies with oxide of tin, since (*a*) it signifies a substance used to make white (cloudy) glass, and (*b*) oxide of tin has actually been discovered in Assyrian glass. He also makes the interesting suggestion that in *tuskū* we may have the origin of the word *tutia. Mil'u* is identified temporarily with saltpetre, but it is worth pointing out that *milḥ* (salt) in Arabic chemical texts apparently never has this meaning, and that there is no reliable evidence that saltpetre was recognised as a distinct substance before the tenth century at earliest.

Other names of interest are *guḫlu* (eye-paint), whence the Arabic *kuḥl* and our *alcohol* ; *šindu arqu* (yellow paint), whence *sandarach* ; *šadanu,* whence the Arabic *shādana,* hæmatite. The Arabic *urjuwān* (purple), a title often given to the Elixir and used, too, in the description of the colours of clothes (*e.g. Mufaḍḍalīyāt,* Sir C. Lyall's edition, Oxford, 1918, ii. 249), is shown to go back to the Sumerian *argamanu,* red purple). *Sapphire* is traced back to the Assyrian *ṣipru,* and means " the scratching stone " (from *ṣapāru,* scratch), a name no doubt given to it on account of its great hardness (it is next to the diamond in Moh's scale). *Marcasite* apparently comes from *marḫaši,* which probably means " pyrites." Finally, it is thrilling to find a mineral called *kibaltu,* and one hopes that it may be possible to show a connexion between this and cobalt, though for the present Dr. Thompson refrains !

The book is clearly printed from type-written stencils, is amply indexed, and includes the cuneiform texts, which are given on six plates at the end. It is earnestly to be hoped that Dr. Thompson will continue his researches upon Assyrian chemistry, and we shall look forward with eagerness to his next volume.

E. J. HOLMYARD.

## The Colour Line.

*The Menace of Colour: a Study of the Difficulties due to the Association of White and Coloured Races, with an Account of Measures proposed for their Solution, and Special Reference to White Colonisation in the Tropics.* By Prof. J. W. Gregory. Pp. 264+4 plates. (London: Seeley, Service and Co., Ltd., 1925.) 12*s*. 6*d*. net.

HAPPILY there is as yet no sense of the colour line in Great Britain in the sinister interpretation of the term, except perhaps among a restricted few. We may have prevented by law a few coloured musicians from entering Britain; but that is trade unionism directed against foreigners in general; and only recently a coloured actor has received an ovation in the press, all the more hearty because of, and not despite, the fact that he was a member of a race which has not normally been admitted to an opportunity to excel in this field. Yet if any are in doubt of the fact that the relations of races, at different stages of culture, who live side by side in the same community constitute one of the grave problems of the future, Prof. Gregory's book may be commended to them as an antidote for short-sighted optimism.

In "The Menace of Colour" the author has surveyed the main facts bearing upon the difficulties which arise when a white and a coloured population coexist in one and the same community. He has summarised some of the more authoritative views which have been expressed upon the question, and he discusses the arguments for and against the various solutions which have been proposed. Most attention has been given to those countries of which he has first-hand knowledge—the United States, South Africa, and Australia. Of these, the first two are countries in which the conditions, even though obscured by controversy, seem to demand action most insistently of all, while in the last named, the policy of "white Australia," of which Prof. Gregory is known as a staunch supporter, has been no less heatedly debated, although the danger, if any, is not immediate.

The problem is not the same in all three cases. In the United States the negro has for long, at any rate ever since the war of 1861, been a grave social difficulty. Recently the antagonism between white and black has been accentuated by the wave of racial feeling which has overrun the country and finds expression in the popular phrase "100 per cent. American." This feeling underlies the immigration laws and is grounded in a belief in the essential superiority of certain races and the inferiority of cross-breeds. It may be noted in parenthesis that certain American anthropologists, while fully recognising the differences in races, have not hesitated to maintain that the argument is fallacious. The feeling against mixed marriages extends beyond negro blood to Indian and all non-white; and certain States have not only forbidden such marriages, but have even established bureaux to investigate pedigrees of would-be entrants into the matrimonial state to the remotest ascertainable degree. They are also carrying on a vigorous propagandist campaign on so-called eugenic lines in their schools. It is scarcely necessary to repeat what has been said so often on the mixed-breed question, that the inferiority of the cross is difficult to prove in man, when the evidence, apart from biological analogies, is almost universally vitiated by the disturbing factor of adverse social conditions.

In South Africa the problem is in part social, but to a greater degree it is economic and political. The enormously rapid increase in the black population—a feature to be observed almost invariably when white rule over African peoples puts an end to the normal checks on increase such as warfare, infanticide, or other customs of like effect—has aggravated the difficulties of adapting the native to the political and economic system, while it threatens the continued existence of South Africa as predominantly a white-man country. It has become unable to absorb the numbers of colonists required for this end, since the lower grades of labour are practically closed to any but the coloured population.

The case of Australia is in some ways the most interesting. The policy of a "white Australia" is based upon a definite political and economic theory. It is a trade union policy on a large scale. Two criticisms have been levelled against it. On one hand, it is said that it can be only partially operative, as the northern area of Australia lies within the tropics and is not, therefore, a white man's country; and, on the other hand, that it delays the filling up and development of the country. The latter point, though perhaps of more moment than is often assumed, is still perhaps not so immediately urgent as to force a decision. The former is more serious. The question of the adaptability of the white man to tropical conditions is discussed very fully by Prof. Gregory, who inclines on the whole to answer it in the affirmative. It is open to doubt, however, now that tropical disease may almost be eliminated as a factor in non-survival, whether all European races can be regarded as equally fitted for permanent settlement in such countries. Even in most favourable conditions, such as are afforded in the higher lands of East Africa, there is some evidence of a deterioration in the second generation. On *a priori* grounds the suitability of the Nordic type may be doubted. More definite evidence based on observation is needed. Up to the present the data have been obscured by the incidence of disease.

The colour problem is undoubtedly grave and difficult. It is one which affects vitally the British Empire with its vast populations of non-European culture. The solution to which Prof. Gregory inclines is that of segregation, a segregation, be it noted, in the mass, but not a segregation which excludes intercourse of individuals. Yet he is led by the tendency of European peoples during the present century to withdraw from interference with extra-European populations, notably, for example, in China and India, to the view that ultimately the whites will be confined to Europe, North America, and Australia. While, however, every one who is interested in what is called, for convenience, the native question, is convinced that it would be to the advantage of primitive populations to be protected from unrestricted contact with European civilisation, the course of events seems likely to be against the possibility of isolation. Prof. Gregory notes in his introductory chapters that at the present rate of increase the population of the world would double in sixty years. Even if that rate of increase were not fully maintained, the time for which the vacant places of the earth can be allowed to remain fallow is limited. Post-War conditions have obscured the difficulties of food-supply which were becoming apparent in 1914. They are not likely to become less acute. Their mitigation must ultimately depend upon the development of agriculture in areas in which white labour is not practicable. It therefore becomes an urgent question whether segregation would allow for the training of the primitive peoples themselves, along lines in harmony with their mentality and culture, to take their share in the development of their country and thus avert the exploitation of these lands and their inhabitants, which otherwise seems inevitable.

---

## Birth-Control.

*Population.* By A. M. Carr-Saunders. (The World's Manuals.) Pp. 112. (London: Oxford University Press, 1925.) 2*s*. 6*d*. net.

PROF. CARR-SAUNDERS has given us in this little book a most admirable discussion of the whole population question. He emphasises strongly the point that over-population is a relative term, the value of which depends entirely on the economic resources of the area under discussion. Thus, in the early Middle Ages, England with 6,000,000 inhabitants might have felt the pressure of population more severely than it does to-day with 40,000,000. He directs attention to the fact that all through human history voluntary checks on population have been practised; that in no known people was the regulation of increase left to the crude issue of natural selection. In a word, birth-control is as old as the hills. It was the Christian Church which put a stop to the methods of birth-control formerly in vogue, namely, infanticide and abortion, owing to its insistence on the value of the individual. It is not to be wondered at, therefore, that that Father of the Church, Tertullian, regarded war, pestilence, and famine as divinely appointed agencies for keeping the increase of the human race within bounds.

Prof. Carr-Saunders shows that throughout the Middle Ages the populations of the various countries either remained stationary or increased slowly, and that in the apprenticeship system we find a means of postponing marriage until economic fitness for it was attained. The extraordinary increase in population which occurred during the nineteenth century is something quite exceptional in human history and was only rendered possible by the introduction of steam power and of mass production, which constitute what is misleadingly termed the "industrial revolution."

Prof. Carr-Saunders then discusses the outlook for the future and has nothing very encouraging to suggest. He admits that the population of Great Britain is increasing by 400,000 every year, and that emigration is no remedy, for the Dominions quite rightly will only accept our very best, and the total number of emigrants whom it is feasible to induce to leave our shores every year is only a small proportion of our annual increase in numbers. He derives some comfort from Prof. Bowley's prediction, based on our diminishing birth-rate, that in fifty years the population will cease to increase and that the births will then balance the deaths. This prediction is based on the doubtful assumption that the death-rate will remain as high as it is at present, but in the meantime we shall have added 15 to 20 millions to the population and emigrated about 5 millions! Prof. Carr-Saunders wisely points out that even the fall in birth-rate is differential; that the least fit have still the largest families, and that whereas formerly this higher birth-rate was balanced by a larger death-rate, humanitarian legislation has largely abolished this distinction, so that our population is being principally recruited from our worst stocks. He indulges in a tirade against "nationalism," which he regards as the fount of "wars," and predicts a peaceful break-up of the British Empire. We utterly and completely dissent from this view; and suggest that "humanity" is too wide and vague a concept to attract the loyalty of any man, that a man's duty is first to his family and then to his country, and that it is his duty to strive to make both economically strong.

The immediate need of Great Britain is a wider spread of the knowledge of the means of birth-control amongst the poorer classes, and when that is accomplished, a system of sterilisation enforced against all those who produce children in the absence of the means to support them. These measures will meet with a great amount of opposition on the part of those of our population who are swayed by vague sentiment, but it is our conviction that they will ultimately be forced on us by economic pressure. E. W. M.

## Guide-Books for the Naturalist.

(1) *Salzburg.* Von Prof. Dr. Max Hoffer und Prof. Dr. Ludwig Lämmermayr. (Junk's Natur-Führer.) Pp. xvi+406. (Berlin: W. Junk, 1925.) 6 gold marks.

(2) *Sächsische Schweiz.* Von Dr. Walther Friese. (Junk's Natur-Führer.) Pp. x + 354 + 3 Karten. (Berlin: W. Junk, 1925.) 6 gold marks.

THE geologist has long been indebted to the enterprise of German publishers for several excellent series of guide-books. Junk's "Natur-Führer," previous volumes of which have dealt with Tirol, the Riviera, Switzerland, South Bavaria, and Steiermark, are guides not only to the geology, but also to all subjects likely to interest the naturalist in the field. Attractively produced, and of convenient size, they contain numerous photographic illustrations, but maps have been omitted, owing to their prohibitive cost.

Primarily a guide-book of this nature must consist of a collection of local details arranged for ready reference. A mere collection of facts will, however, only bewilder the visitor unless he has sufficient general knowledge to collate them. It is, therefore, very necessary that a naturalist's guide-book should contain a few introductory chapters, generalising on such subjects as the physical geography, the geology, the botany, and the animal-life.

(1) It is a pity that some such plan has not been adopted in the guide to Salzburg. The authors have brought together a large number of facts, but insufficient attention has been given to their arrangement for reference. Paragraphs are often three or four pages long, and sub-headings are completely absent. The type is of monotonous uniformity, and lists of species are printed in continuity with the rest of the text. Two introductory chapters deal with the geography and the early history, but the former is mainly statistical. The rest of the book is a detailed local guide, traversing the country roughly in the order adopted in the corresponding Baedeker. Floral lists, often filling a whole page, are given at frequent intervals. If these had been replaced by an introductory chapter dealing with the botany as a whole, with especial reference to the altitude-zones of Alpine vegetation, it would have been sufficient to direct attention to exceptional local occurrences. In Salzburg the geological facts can only be presented by the aid of numerous sections. There is not one in the whole book; hence the details given are usually very lacking in precision.

(2) Saxon Switzerland, the hilly district through which the river Elbe flows where it leaves German soil, is probably little visited by British travellers, although a favourite retreat for the holiday-making German. To geologists it was long ago made familiar by the works of Geinitz, and it is to the hard Cretaceous sandstones, eroded into many picturesque crags and precipices, that it owes its particular charm.

Being only one-ninth of the area of Salzburg, and of infinitely simpler geological structure, its description in a guide-book must have presented a much easier task. On the whole, Dr. Friese has arranged his facts very well. A number of interesting chapters, dealing with particular aspects of the natural history, occupy two-thirds of the book, the remaining third being a detailed guide traversing most of the area in twenty-four excursions. There are maps of the river-system, a simplified geological map, and numerous diagrams and sections.

## Our Bookshelf.

(1) *A Student's Manual of Organic Chemical Analysis: Qualitative and Quantitative.* By Prof. Jocelyn Field Thorpe and Prof. Martha Annie Whiteley. Pp. x+250. (London: Longmans, Green and Co., 1925.) 9*s.* net.

(2) *Introduction to Qualitative Organic Analysis.* By Prof. Hermann Staudinger. Authorised translation by Dr. Walter T. K. Braunholtz. Pp. xvi+112. (London: Gurney and Jackson; Edinburgh: Oliver and Boyd, 1925.) 6*s.* 6*d.* net.

THE difficulty with which qualitative organic analysis can be systematised, and the fact that the properties of the various organic groupings can be learnt best by experience, has rendered the literature on this subject very meagre in comparison with the comprehensive works published on inorganic analysis. The two books under review are welcome additions to the literature, treating the subject, as they do, from different points of view.

(1) Profs. Thorpe and Whiteley's book, as the title indicates, is intended for the student. Those who have worked under the direction of the authors will recognise in it the substance of their advanced practical organic course, amplified and arranged suitably for use as a work of reference. It is intended that a student with an elementary knowledge of organic chemistry will be able, after steadily working through the tests, to recognise and estimate the more common compounds and groupings and will be competent, with a little specialised experience, to undertake any type of organic analysis. The book includes detailed descriptions of both historical and modern methods of elementary analysis, and also gives a most comprehensive and up-to-date compilation of the methods used in estimating the more common types of organic substances. The

qualitative reactions of the important organic compounds are tabulated with full experimental details in a form which will be found very convenient for reference. The book will be found invaluable to all students and lecturers of practical organic chemistry by reason of its completeness of experimental detail and excellent manner of treatment. The type and illustrations are excellent.

(2) Prof. Staudinger's book gives no experimental details. It presumes that the student has already a good acquaintance with both theoretical and practical organic chemistry and is only concerned with the methods of separating the constituents of organic mixtures and identifying the class to which they belong. It gives no specific tests for individual substances or experimental details in performing the operations. The book is more a theoretical discussion of the methods employed than a practical aid in the laboratory. While it will prove useful in showing a student the way to deal with difficult problems, the methods given are too elaborate for ordinary use when the student has obtained practical experience; for example, many pages are used in discussing how to separate liquid mixtures which can be identified by their odour in a few minutes. The book has been translated into idiomatic English very ably, the only outstanding peculiarity being the expression "mixed melt test."

*An Introduction to Physical Geology: with Special Reference to North America.* By Prof. William J. Miller. Pp. xvi + 435. (London: Chapman and Hall, Ltd., 1925.) 13*s*. 6*d*. net.

SEVERAL books on physical geology, with special reference to North America, are already available, but Prof. Miller's contribution to the existing literature is sufficiently attractive to justify its choice as a college text-book. Although no new ground is broken, the order of treatment differs somewhat from that usually adopted. River work, for example, is not touched upon until rocks, weathering, earth-movements, and structural features have been dealt with. Underground waters, again, are considered only after volcanic action has been discussed. The effort after logical treatment in geology can, however, never be wholly successful, whatever the arrangement. Since the study of processes includes that of the alteration and origin of rocks, and that of the concomitant development of land-forms, the aspects of physical geology fall into at least three dimensions, and a written account, which is of necessity unidimensional, must therefore involve both anticipation and repetition.

Like all recent books of its kind, Prof. Miller's is weak on the theoretical side, perhaps deliberately in view of the variety of hypotheses now under discussion. But some mention might have been made of the controlling importance of radioactivity in contributing to the heat of the earth and to crustal disturbances. The grouping of weathering with metamorphism is an example of placing the logical significance of words before that of the processes they connote. Familiarity with Crook's important paper on classification, a paper that has been strangely overlooked in the United States, would have prevented such an error of judgment. The ideal text on physical geology, even relative to existing knowledge, has yet to be written, but of its class, Prof. Miller's work is thoroughly good, and its exceptionally full illustration by photograph and diagram is an added virtue which should ensure success.

*Roman Folkestone: a Record of Excavation of Roman Villas at East Wear Bay, with Speculations and Historical Sketches on related Subjects.* By S. E. Winbolt. Pp. xiv + 199 + 21 plates. (London: Methuen and Co., Ltd., 1925.) 8*s*. 6*d*. net.

IN this volume Mr. Winbolt describes his excavation of the Roman site discovered at Folkestone in August 1923. He suggests, with good ground, that we have here the remains of the official residence of the Roman Commander of the British Fleet, which came into being somewhere about A.D. 43, with headquarters at Gessoriacum (Boulogne) and stations at Dover, Lympne, and at times Newcastle, and was probably disbanded about A.D. 290. The size of the villa testifies to its importance, and strategic considerations make it improbable that it was a purely private residence, especially as there is no other private building known along this coast. Mr. Winbolt has made a very careful record of the finds and describes them in detail. Having the interest of the general public in archæological matters in mind, he takes his readers into his confidence, and not only gives for their benefit extracts from his diary so that they may follow the progress of the excavation day by day and share his enthusiasm, but he also explains with great lucidity how each type of find bears upon the solution of the problems of the excavator. His book, therefore, may be commended to those who have no technical knowledge of Romano-British antiquities as well as to the expert.

*Non-Metallic Minerals: Occurrence, Preparation, Utilization.* By Raymond B. Ladoo. Pp. viii + 686. (New York: McGraw-Hill Book Co. Inc.; London: McGraw-Hill Publishing Co., Ltd., 1925.) 30*s*. net.

THE technology of the non-metallic minerals has not before been treated so systematically and comprehensively as in this book. Merrill's well-known book is essentially geological and mineralogical, but Mr. Ladoo gives us not only the physical properties and mode of occurrence, but also methods of mining, uses, and market values, together with much miscellaneous commercial information. The materials discussed are listed under nearly ninety headings, arranged in alphabetical order, and to each section a bibliography is appended. The volume closes with a more general bibliography and an excellent index, so that as a work of reference it is both a valuable compilation and an admirable guide to a literature that is comparatively little known.

The author has covered a wide field, and to keep the book within reasonable limits of size and scope he has properly omitted all fuels such as coal and petroleum, and all other "minerals" of organic origin. These, like the metallic ores, have an extensive literature of their own, and the remaining minerals, hitherto somewhat neglected, have now for the first time received really adequate attention.

## 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.*]

### Plotting Upper Air Temperatures.

SIR NAPIER SHAW has recently devised a method of plotting upper air temperatures in the form of a curve which he has named a tephigram (T-$\phi$-gram). The curve is plotted on squared paper on which the abscissæ represent absolute temperature and the ordinates entropy or log potential temperature. The condition of a mass of dry air can be described as well by its temperature and potential temperature as by its temperature and pressure, and the tephigram in utilising this method has an advantage over the older form of pressure-temperature diagram in that the work which will be done by a sample of air in rising through any given environment when conditions are unstable is shown directly on the diagram as an area which may readily be measured by planimeter. Tephigrams are

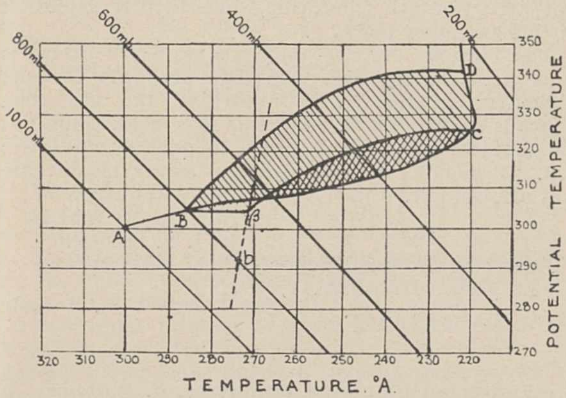



FIG. 1.

unfortunately somewhat difficult to comprehend at first sight, and are therefore unsuitable for presenting the results of upper air work to those who are not in close touch with the subject; but workers in this field of meteorology find that the graphs possess most of the advantages of the older pressure- (or height-) temperature diagram with the added advantage that, as explained above, they show the energy available from a sample of air placed in unstable surroundings at a glance.

If moisture did not exist in the atmosphere, the technique of plotting upper air data in the new manner might be regarded as fully worked out, but in all considerations of stability, moisture is of as great importance as lapse rate, and it is essential to indicate the water contents of the air by means of dew point or otherwise if the diagrams are to be of practical value.

To illustrate the following remarks a tephigram is sketched in Fig. 1. Potential temperatures are on the right of the diagram on a logarithmic scale, temperatures at the foot on a linear scale increasing from *right* to *left*, while lines of equal pressure slope down from left to right. Certain details have been omitted for the sake of clearness, only essential lines being shown.

The changes of temperature and potential temperature from the surface to the stratosphere are shown by the curve ABCD, the portion ABC where potential temperature changes but slowly being in the troposphere, while CD with its almost constant absolute temperature is in the stratosphere. If the air at the point marked B were saturated, the energy which would be liberated as one kilogram of the air rose from B to D is indicated by the whole area shaded on the diagram. The upper boundary of the area is an adiabatic line for saturated air, and it will be seen that as between B and D this line is everywhere to the left of the environment line ABCD, the rising air will throughout be warmer than its environment and will therefore have buoyancy and be capable of doing work as it rises.

The method of plotting humidities on the diagram which has been suggested by Sir Napier Shaw is to plot the dew point as well as the air temperature on each pressure line. Thus in the diagram B shows the temperature (286° A) at 800 mb. pressure and $b$ the dew point (274° A). (See Q.J. Royal Meteorological Society, vol. 51, p. 206, footnote.) The length of the line B$b$ gives an indication of the dryness of the air. This method is probably the best that can be devised for showing the variations of humidity throughout an ascent, but it does not seem to be the most suitable for a study of the energy available in a mass of air rising from any particular layer. An alternative plan which appears to have advantages is to calculate the weight of water vapour per kilogram of dry air present in the air at B, and to mark the temperature $\beta$ on the horizontal through B at which this weight of water vapour is the saturated content of air. Lines showing the number of grams of water vapour which will saturate one kilogram of dry air are printed on the tephigram paper (one is shown in the figure passing through $b$ and $\beta$) and render plotting the point $\beta$ easy. By this means the energy available in the actual non-saturated air at B is shown at once on the diagram, being the double shaded area which lies between the environment curve ABC and the saturated adiabatic through $\beta$.

This is easily seen, for if a sample of air from B is raised in the atmosphere its temperature-potential temperature curve will run horizontally from B to $\beta$, where the sample will become saturated; thereafter it will follow the curved saturated line from $\beta$ to C. During the first stage the air will be colder than its environment and work will be needed to raise it. During the last part of the course it will be warmer than its environment and will do work, as indicated by the double-shaded area. This method of plotting appears likely to have value in the study of instability in the atmosphere. It will make it plain that in many cases where large quantities of energy would be available if the air were saturated, in the conditions actually existing there is no energy available at all.

One criticism may be raised. On some few days the lapse rate reaches the dry adiabatic, and the environment curve ABC becomes for part of its course a horizontal line. Thus several successive points $\beta$ may also fall on the same horizontal line, and it will be difficult to say which of the $\beta$'s corresponds with any one B. If, however, each point on the temperature curve is denoted by a separate letter, and each corresponding point on the moisture curve by a corresponding letter (B$\beta$, C$\gamma$, etc.), it will be easy to relate the two. It appears that if paper of a sufficiently open scale is used this objection need not be given too much weight.

J. S. DINES.

78 Denbigh Street, S.W.1,
October 15.

### Bismuth Trihydride and Silver Bismuthide.

GASEOUS bismuth hydride was first prepared by Paneth (*Ber.*, 1918, 51, 1704), who obtained it by treating an alloy of magnesium and thorium C or radium C with 0·2 normal hydrochloric sulphuric acid. He afterwards (*ibid.* p. 1728) prepared somewhat larger quantities of the gas by the action of either of the above acids (but of four times normal strength) upon an alloy of bismuth and magnesium, carrying out the reaction in a heated iron crucible and in a stream of hydrogen. A mirror of bismuth was obtained when the issuing gas was heated as it passed through a glass tube. The gas was, however, never obtained in large quantities, and we have endeavoured to make a considerable amount of this hydride and from this substance to isolate the silver bismuthide, analogous to silver antimonide (*vide* Weeks, *Chem. News*, 1923, 127, 319; Weeks and Lloyd, *ibid.* p. 362).

In view of our results with the solid hydrides of arsenic and antimony (Weeks and Druce, Trans. Chem. Soc., 1925, 127, 1069 and 1790) it seemed likely that bismuth trihydride could be obtained by reduction of bismuth dihydride with hydrogen.

Thus, when the dihydride was heated *in vacuo*, it decomposed evolving bismuthine:

$$3Bi_2H_2 = 4Bi + 2BiH_3,$$

which could be decomposed on heating, with the formation of a mirror of bismuth. The gas was also drawn through solutions of silver nitrate to produce silver bismuthide, $Ag_3Bi$. The apparatus used in these experiments has been described in our communication to the Chemical Society on bismuth dihydride (*loc. cit.*). The most suitable reagent for absorbing bismuthine is ammoniacal silver nitrate solution, with which it forms a precipitate which was proved to contain only silver and bismuth. Analysis indicated that the composition of this compound corresponded closely with that demanded by the formula $Ag_3Bi$. The reaction is probably similar to the case of stibine and silver nitrate, namely:

$$BiH_3 + 3AgNO_3 = 3HNO_3 + BiAg_3.$$

Since the gas could never be obtained in large quantities by this method, we directed our attention to the reduction of the dihydride with hot hydrogen. For this purpose hydrogen was generated in the usual way and was purified by passing through solutions of lead nitrate, silver sulphate, potassium hydroxide, and potassium permanganate, and before being dried with concentrated sulphuric acid, it was passed through bulbs containing silver nitrate solution. These were inserted to ensure that the hydrogen contained nothing that would cause a precipitate to form with the silver nitrate used to react with the bismuthine which was obtained on heating the dihydride in this purified hydrogen. The gas issuing from the silver nitrate bulbs was ignited, and when the silver nitrate was largely decomposed, the flame assumed a steely grey colour and thin clouds of bismuth oxide were produced. Meanwhile, the silver nitrate slowly darkened with the formation of an almost black precipitate of silver bismuthide. It may be noted here that the bismuth dihydride must be free from traces of chloride, or silver chloride might be precipitated along with the bismuthide. This led us to prepare the dihydride by reducing a solution of a bismuth salt with aluminium and potassium hydroxide instead of the method described by us previously (Weeks and Druce, Trans. Chem. Soc., 1925, 127, 1790). This product gave us a precipitate of silver bismuthide uncontaminated with any silver chloride. The dihydride was reduced in accordance with the equation:

$$2Bi_2H_2 + H_2 = 2BiH_3 + 2Bi.$$

Paneth has pointed out that the yields of bismuthine prepared from his alloys were very variable, and he concluded that the action of acids upon the alloys cannot be one of simple decomposition, since the best yields were obtained from magnesium which was merely coated with fused metallic bismuth. A possible explanation of this is that Paneth made a coating of bismuth dihydride upon the magnesium as soon as the acid acted upon the alloy. This view is supported by the work of one of us (E. J. W., *Chem. News*, 1923, 127, 87), in which it was shown that the yields of stibine from alloys of antimony and zinc appear to be independent of the composition of the alloy. It appears that the first action of the acid upon the alloy is the formation of the solid antimony hydride, which then decomposes in the following manner:

$$2Sb_2H_2 + H_2 = 2SbH_3 + 2Sb.$$

Silver bismuthide is an almost black crystalline compound, similar in appearance and properties to silver antimonide. It can be melted in a bunsen flame, and is unaffected by water or hydrochloric acid. It dissolves in warm dilute nitric acid giving but little bismuth trihydride, since further oxidation of this gas takes place.

The action $Ag_3Bi + 3HNO_3 = 3AgNO_3 + BiH_3$ is thus a reversible one, and this accounts for the difficulty experienced in absorbing the gas with aqueous silver nitrate. For this reason we employed ammoniacal solutions in order to remove the nitric acid as soon as it was formed. Silver bismuthide was also soluble in fairly strong hot sulphuric acid.

EDWARD J. WEEKS.
J. G. F. DRUCE.

Battersea Grammar School,
St. John's Hill, S.W.11,
October 20.

---

### Flowering Plants as Epiphytes on Willows and Alders.

SINCE April, when trout fishing on many occasions in the river Chew, which enters the Avon between Bristol and Bath, I have been impressed with the large number of flowering plants, or Phanerogams, growing as epiphytes on pollard willows and alders by the river-side. I have listed about 103 species, in addition to the common Polypody fern. Some of these are of considerable interest in their strange habitat; and a single plant of *Lysimachia vulgaris* and two of *Nasturtium sylvestre* appear to be unrecorded species from the whole valley. The latter was also seen in the bed of the river during the drought of June.

The Chew extends from Chewton Mendip and East Harptree, Somerset, to Keynsham, a distance of about nineteen miles, or ten as the crow flies, and with a fall of about 400 ft. It is subject to heavy floods, and the average rainfall in the upper region is several inches greater than that at Clifton (35 inches) or Bath (30·84). The river rises rapidly, and occasionally to a height of eight or even ten feet above the normal summer level.

Doubtless the majority of the plants have been brought down and left stranded by floods; but not a few have been brought by birds, which are frequent in the valley, and several by wind dispersal of the seed. Cows, drinking and wading in some of the shallows, may be responsible for others. Many of the trees have a considerable accumulation of humus, so that some of this vegetation may be regarded as well established.

Weeds of cultivated ground are few, for there is very little arable land in the valley, it being chiefly meadow or pasture. There are several mixed plantations near Compton Dando, three or four miles from Keynsham, but few woodlands in the upper part, except near the source of the stream. The number of woodland as distinct from hedgerow plants hitherto seen is extremely small. Ninety per cent. of the total plants have been noted between Keynsham and Compton Dando.

There is an apparent absence of any Leguminosæ—not even a vetch, clover or Lotus was observed. Many of the leguminous seeds would sink in water. Seeds (even from herbarium specimens) of practically all the British vetches and many others of that family sink in water, as experiment this autumn has proved. Compositæ is only moderately represented; but the comparatively large number of umbellifers is noticeable. The fact that no monocotyledons were seen, save *Juncus bufonius* and *Luzula campestris* (once) and a few grasses, is not surprising, except the paucity of grasses.

At least a dozen kinds of woody plants and shrubs have got established, namely, dog-rose, ivy, blackthorn, hawthorn, gooseberry, sycamore, elder, a small elm, ash, alder on two willows, and two or more species of Rubus in many places. No holly has been seen, nor maple with its winged samaras.

On April 30 I counted twenty-three Phanerogams, three mosses and two liverworts on a single old willow fallen half across the stream. These include *Ranunculus Ficaria, Arenaria trinervia, Rosa canina, Angelica, Conium, Anthriscus sylvestris, Torilis Anthriscus, Tussilago Farfara, Petasites ovatus, Symphytum officinale, Scrophularia nodosa, Stachys sylvatica, Nepeta hederacea, Plantago lanceolata* and three grasses, one of which proved later to be *Deschampsia cæspitosa* in two fair-sized clumps.

There are a number of quite handsome plants in these lists, such, for example, as the comfrey, meadow cranesbill, hemlock, angelica, teasel, meadow-sweet, hemp agrimony, purple loosestrife, great mullein, and the picturesque woolly-headed thistle (*Cirsium eriophorum*), of which one poor specimen appeared. This most handsome thistle is very abundant on a steep bank overlying the Lower Lias, which descends in a great tongue-shaped mass almost to the river near Chewton Keynsham. It was from numerous dried specimens from this locality sent in 1922 to Dr. Petrak in Czecho-Slovakia, when monographing the genus, that his belief was confirmed that the English form differs slightly from the Continental. He has therefore called it sub-sp. *britannicum*. It is frequent in Somerset on the Lias, Keuper marls and Oolite, and was first noted in the county and for Britain by Lobelius in 1570.

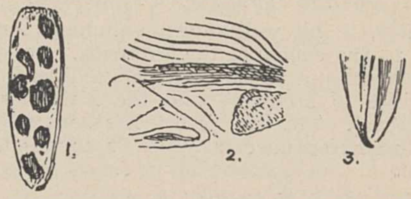
Among the other plants growing upon some of the trees are *Thalictrum flavum, Ranunculus auricomus, R. acris, Nasturtium officinale, Brassica Rapa* (abundant and possibly native by the Chew), *Barbarea vulgaris, Cardamine pratensis, Viola Riviniana, Stellaria aquatica, S. neglecta, Lychnis dioica, L. Flos-cuculi, Geranium Robertianum, Geum urbanum, Adoxa Moschatellina* (once), *Galium Cruciata, Valeriana officinalis, Bidens tripartita, Lactuca muralis, Lysimachia Nummularia, Solanum Dulcamara, Prunella vulgaris* and *Ajuga reptans*. From these abridged lists most of the smaller plants and a few annuals have been omitted. H. STUART THOMPSON.

33 Southleigh Road, Clifton,
October 20.

## Tertiary Fossil Insects from Argentina.

A FEW years ago Mr. Geo. L. Harrington, of Buenos Aires, was prospecting in the Santa Barbara district of the Province of Jujuy, Argentina. In this region we find deep gulches with good exposures of the geological formations. A very conspicuous and important formation consists of green rock, easily breaking up into small angular fragments, commonly with conchoidal fracture. In its upper part it shows streaks of red, increasing until we reach an entirely red deposit. We interpret this as indicating increasing aridity, culminating in desert conditions with wind-blown sands. The red rock appears to be without fossils, and above it is a great mass (possibly 2000 feet) of yellowish deposit of more recent date. Dr. G. Bonarelli (1921) placed the green rock in the upper division of his Calcareo-Dolomitic horizon, but owing to the absence of fossils the age remained unknown. Mr. Harrington, following up the gulch which runs west from Sunchal, came upon a little deposit of fossil insects, and collected a number of specimens. Most of these were eventually transmitted to the U.S. National Museum, whence they were sent to me for study. They were found to consist of seven species of beetles and a caddis fly, almost certainly of Tertiary age. The horizon was in the typical portion of the green formation, where it is interbedded at intervals with heavy limestone.

This discovery was of quite extraordinary interest, as these were the first Tertiary insects ever found in South America, if we exclude a couple of small flies in amber of unknown age. My wife and I decided




1, *Cerambycites wilmattæ*; 2, *Gryllus vociferans*; 3, *Psalis pachyura*.

that we could not spend the summer of 1925 better than by visiting the spot where there was a reasonable hope of further discoveries. Accordingly, after various adventures which it is not necessary to relate, the month of July saw us established in a small tent at Sunchal, within half an hour's walk of the insect beds. The locality proved interesting in many ways; the neighbouring slopes showed large columnar cacti, *Trichocereus terschekii* (Parmentier) and *T. pasacana* (Weber), while the gulches were full of splendid trees, among which were flocks of green parrots. Sunchal proved to consist of a single, very poor ranch, with a few suburban sheds. We soon found Mr. Harrington's locality, as well as another not far away. In the course of several days we obtained a considerable collection of insects, mostly elytra of beetles. We also got a well-preserved fish, a species of Corydoras, a cat-fish of the family Callichthyidæ. This represented a family of fishes not before found fossil. The general outcome is that the deposit is unquestionably fresh-water Tertiary, but the more exact position will have to be considered when the collections have all been gone over. The general impression is that the fauna is not very ancient, yet in some respects it recalls the Upper Eocene fauna of North America.

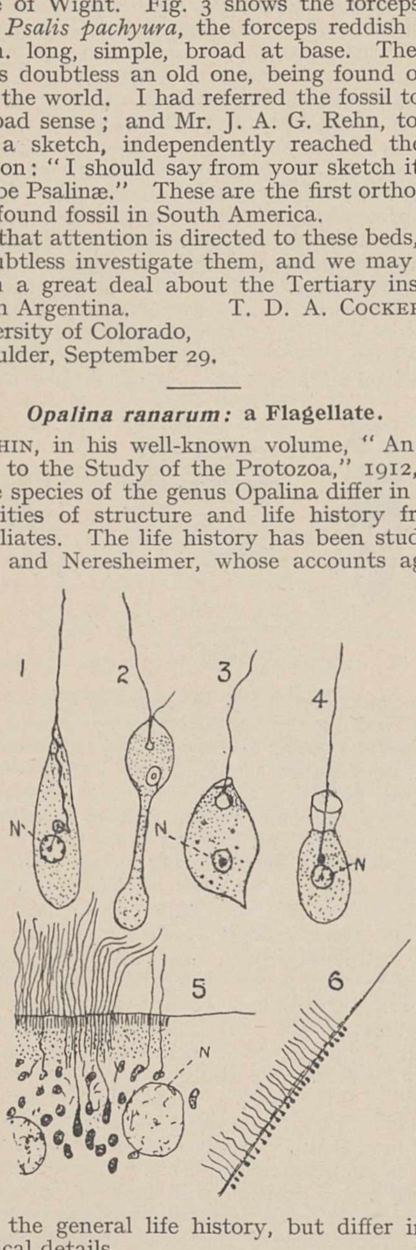
So far, we have only relatively small species of insects, with nothing specially characteristic of the tropics. I give figures of three of the most interesting. Fig. 1 is a cerambycid elytron, 9·5 mm. long and 3 mm. broad, with large brown spots, the edges of which are darkened as in Eburia. It was found by my wife at our Station 2. I call it *Cerambycites wilmattæ*, placing it in the blanket-genus Cerambycites because it cannot be definitely referred to a modern genus known to me. Fig. 2, which I call *Gryllus vociferans*, is part of the tegmen of a small male cricket, the part shown being only 4 mm. long, the veins sepia brown. It is probably not a Gryllus in the strictest sense, but it is of particular interest as showing the male vocal organs fully developed, as in modern forms. This does not necessarily indicate a very recent age for the deposit, as similar specimens (three species) have been found in the Oligocene of the Isle of Wight. Fig. 3 shows the forceps of an earwig, *Psalis pachyura*, the forceps reddish brown, 3·3 mm. long, simple, broad at base. The genus Psalis is doubtless an old one, being found on both sides of the world. I had referred the fossil to Psalis in a broad sense; and Mr. J. A. G. Rehn, to whom I sent a sketch, independently reached the same conclusion: "I should say from your sketch it would clearly be Psalinæ." These are the first orthopteroid insects found fossil in South America.

Now that attention is directed to these beds, others will doubtless investigate them, and we may expect to learn a great deal about the Tertiary insects of northern Argentina. T. D. A. COCKERELL.

University of Colorado,
Boulder, September 29.

### *Opalina ranarum*: a Flagellate.

MINCHIN, in his well-known volume, "An Introduction to the Study of the Protozoa," 1912, states that the species of the genus Opalina differ in certain peculiarities of structure and life history from all other ciliates. The life history has been studied by Metcalf and Neresheimer, whose accounts agree as




regards the general life history, but differ in some cytological details.

Neresheimer considers that the life-cycle of Opalina proves its affinities are with the Flagellata rather than with the Ciliata. This view did not find favour with Minchin, who placed Opalina in its usual position.

Recently we have carried out some work on Opalina, and have obtained results which we believe show conclusively that this protozoon is really a flagellate, as Neresheimer suggested from his study of the life history.

In a flagellate (Figs. 1-3, from Minchin) the flagellum nearly always passes into the substance of the organism and ends in a bead, vacuole, cyst or special granule of some kind. In various flagellates the granule may be specially well marked as a "solid," well-defined structure; in others it is apparently associated with a cyst of some sort.

In the typical ciliate, the cilia are almost invariably short structures arising from cortical granules which are nearly always quite small (Fig. 6). We know, however, of cases where the cilia have been described as entering right into the substance of the organism, and even impinging upon the nucleus, but such cases are rare, and unlike typical flagella.

Now, in *Opalina ranarum*, the "cilia" enter right into the substance of the organism, and take their origin from the peculiar granules which exist in very large numbers in the protoplasm of Opalina (Fig. 5).

This system exactly resembles the arrangement in the choanocytes of *Grantia compressa* and Spongilla (Fig. 4) as described by Hirschler and Gatenby. We claim, therefore, that the motile organs of Opalina are flagellar in nature, and that this protozoon should be classified among the Flagellata.

J. BRONTË GATENBY.
S. D. KING.

Trinity College, Dublin,
October 28.

### The Geographo-Economic Institution at Leningrad.

IN 1919 the leading professors of the Geographical Institution, Leningrad, conceived the idea of creating a scientific institution for research upon geographical questions in which young men and women students of the Geographical Institution were to co-operate. From this sprang a "Scientific Collegium," which in 1923 was reorganised and named the "Geographo-Economic Institution."

This Institution is now under the direction of Prof. S. Sovietov and has eight departments: (1) Plant Geography, (2) Soil Science, (3) Zoo-geography, (4) Geophysics, (5) Economic Geography, (6) Geology, (7) Geography, (8) Ethnography. There are about thirty fellows and forty assistants now working in all departments. The principal work of the Institution is field studies. All the fellows and assistants are engaged during the summer in different parts of Russia, and during the winter the results of their work are discussed at the meetings of the Institution. This makes a very valuable training for young scientific workers in preparing them for responsible scientific positions. As Russian literature is very poor in good field manuals, the Institution has just published a handbook entitled "How can the Country be Studied?" Another large publication, a Geographical and Economic Atlas of the Leningrad country, is in preparation. This work will contain maps showing the distribution of different climatic and soil factors as well as of the various organisms — plants and animals, and of different peoples and their cultures.

The Institution has its own publication, "The Phyto-Geographical Atlas of the World," and would be glad to establish scientific relations with other similar Institutions of the world. The address is: Leningrad, Mramornyi Dvoretz (Marble Palace), Geographo-Economic Institution.

BORIS FEDTSCHENKO.

## Some Modern Aspects of Physical Research.[1]

By Sir ALFRED EWING, K.C.B., F.R.S.

IN this ancient and honourable Royal Society, we have an association of persons with a common motive, namely, to assist the advance of natural knowledge. The chief functions of such a society are (1) to provide facilities for intercourse, personal and formal; (2) to provide a library—and we have a great library of ever-increasing value; (3) to provide the means of publication. Records of scientific research are not a readily marketable commodity. They would fare badly if left to the mercy of the ordinary laws of supply and demand. So we meet the cost of publication, and they go out, after some winnowing of chaff from wheat, with our imprimatur. The published volumes of our Proceedings and Transactions contain papers by Kelvin and other fellows which may be said without exaggeration to mark epochs in the development of scientific thought.

The urge which we feel towards research—that urge which is our bond of fellowship—is not mainly utilitarian; it arises rather from a special type of intellectual curiosity. Often indeed the results of research undertaken with no utilitarian purpose have been found to possess a utility that was not in the mind of the discoverer. For example, Kelvin's theory of the oscillatory discharge of electricity, followed by Maxwell's recognition of electromagnetic waves in the ether, and by the detection of such waves by Hertz, though matters of purely scientific interest at the time, led in due course to wireless telegraphy and broadcasting. Again and again in the history of discovery an abstract research has turned out of quite unlooked-for practical value.

We may recognise, I think, two general types of research, both of which it is the business of a scientific society to foster. There is the inspired type—the flash of genius, of intuition, of imagination, which breaks new ground or brings the old into a new harmony by some far-reaching generalisation. There is also the plodding everyday systematic spade-work of research; a kind which goes on in a hundred laboratories; not inspired, not spectacular, not in the least intoxicating; but we should make a grave error if we were to underrate its importance.

Such a society as ours is, consciously or not, in some degree propagandist. One of its effects is to spread an interest in science beyond the bounds of the scientific workers. There is already a changed attitude on the part of the public towards scientific ideas and the scientific method. Formerly the voice of the specialist was that of one crying in the wilderness; now he commands the attention of the man in the street. In the training of engineers, in the carrying on of manufactures, in many different fields of social activity, we trace the permeating influence of science. Young men leaving the universities with a knowledge of scientific principles and able to manipulate scientific instruments are quickly absorbed into industry. One sees great industrial concerns setting up their own research laboratories, and finding that it pays them to do so. Research has found a place not only in manufacture and industry, but also in the budgets of the politician. The Government endows individual researchers and encourages corporate efforts in various administrative departments, notably through its Department of Scientific and Industrial Research. The activities of that department are perhaps not so well known as they ought to be. Such an organisation can successfully undertake researches of a kind impossible for isolated workers. I have some personal knowledge of its work, for I am at present chairman of two of its scientific committees. One of these deals with the effects of moving loads in producing stress in railway bridges. This is an investigation which no private individual could conceivably have carried out: it needed, and has in fact received, the active co-operation of the railway companies. It is a long and costly inquiry, but I am able to say with confidence that the results already secured are such as to justify the expenditure, by the influence they will have on the future design of bridges and locomotives.

Looking back, it is curious to note the progress in pure and applied science that has come about within the period of my personal recollection. I am old enough to recall the very beginnings of electrical engineering, the first use of electric lamps, the first transformers and storage batteries, the first attempt to produce and distribute electric power. In student days I exhibited at a bazaar the first telephones of Graham Bell's invention, which had been brought across the Atlantic by Lord Kelvin. It happened too that, guided by a brief description in the *Times*, I made the first Edison phonograph ever made on British soil, an invention which has given us the advantages (if you so regard them) of the gramophone. I remember too the earliest form of motion pictures, from which has come the ubiquitous cinema. My memory goes back to the most primitive type of internal-combustion engine, the development of which has given us motor cars, and has made flying possible. It goes back also to the earliest application of refrigeration, which is now playing so large a part in bringing our food from overseas.

It was my privilege while a young professor at Cambridge to test for Parsons his earliest condensing steam turbine, and a little later his first turbine-driven steamboat. The invention of the steam turbine, which we owe to Sir Charles Parsons, has been applied on a gigantic scale not only for ship propulsion, but also for the distribution of electric power from central stations. I recollect vividly hearing, in the early 'seventies, Lord Lister describe to this society his antiseptic method in surgery, and seeing him take from a sterilised flask its plug of cotton wool and drink down the milk it contained—milk which he had drawn from the cow three months before. Later came the two cardinal discoveries of radioactivity and the X-rays. Both of these soon became handmaids of surgery; but apart from that, they put novel instruments of unparalleled effectiveness into the hands of the physicist. Think of what all this discovery and invention has meant in making Nature more man's servant, in prolonging his life, in giving him more of comfort, of interest, of power.

[1] Presidential address delivered before the Royal Society of Edinburgh at the annual meeting on October 26.

Younger men, who have been born into a world where these things are already familiar, cannot realise the excitement and delight of an earlier generation in seeing them spring, new and strange, from the brains of their creators.

> Bliss was it in that dawn to be alive,
> But to be young was very heaven!

I was really in middle life when, in the last decade of the nineteenth century, the great physical renaissance began, of which radioactivity and X-rays were the two chief starting-points, opening up as they did new vistas of thought as well as furnishing new tools for research. J. J. Thomson had shown in 1881 that a charged body derives additional inertia from the existence of the charge, but it was not until after his discovery (in 1897) of the electron as a disembodied atom of electricity, an indivisibly small unit, that it became apparent that all mass is electrical in origin. We used in older days to aim at explaining electricity in terms of matter; now we have come to regard matter as one of the manifestations of electricity. We recognise that the atoms of all substances are complex structures, which are built up out of only two kinds of brickbats, positive and negative units of electricity, called respectively protons and electrons. The positive brickbats, the protons, contribute nearly the whole mass, and it comes from the concentration of electricity into a very minute space. We may perhaps think of the protons and electrons as being electrified holes in the ether, imagining the proton hole to be about eighteen hundred times smaller in diameter than the electron hole in order that it may have a sufficiently bigger mass. But I must admit that to suggest a definition of the ultimate particles of matter as electrified holes in a medium which perhaps does not exist, is more stimulating to the imagination than satisfying to the intelligence. Whatever the protons and electrons may be, they build up the atom in what Rutherford has taught us to regard as a sort of planetary system. There is a nucleus which contributes nearly all the mass. It is positively charged because it contains all the protons and only some of the electrons. The remainder of the electrons, in number equal to the positive charge, are disposed outside, much as the planets are disposed around the sun.

This conception of an atomic structure has led to the grouping of the elements in a systematic series, rising in regular steps by one unit of positive nuclear charge as we pass from one element to the next. The number of units of nuclear charge gives the atomic number of the element, and it goes progressively up from hydrogen = 1, helium = 2, lithium = 3, and so on, up to uranium = 92, forming a continuous series in which there are only two or three gaps still waiting to be filled. Towards this idea the way was paved by Barkla's discovery of the characteristic radiation of substances under bombardment by X-rays. The splendid generalisation of the atomic series was itself reached through the inspiration of Moseley. It justifies Prout's old hypothesis, the objection that the atomic weights of the elements do not come out as whole numbers having been completely removed by the discovery of isotopes, the discovery, namely, that some elements are mixtures of two or more substances having the same chemical properties, but with integral differences in their atomic weights.

More or less concurrently with these developments of atomic theory came the recognition of series in the lines of optical spectra, initiated in 1885 by Balmer, a teacher in a secondary school at Bâle. His work was followed up by Lyman and Rydberg, and is now interpreted, thanks to the genius of Bohr, in a manner which connects the spectral lines with the complex atomic architecture of Rutherford. In this interpretation the quantum theory, which had been framed by Planck in 1900 to account for other and quite different phenomena, has received so complete a confirmation that we are forced to accept it as a rule in Nature's operations, although at present it is a rule we cannot understand.

In the hands of the Braggs, father and son, X-rays have served to show exactly how the atoms take their places in the tactical groups which constitute crystals. The whole development of modern atomic theory is a chain of discovery connecting phenomena that were previously separate, stretching link by link into regions that had seemed hopelessly outside the pale of exact knowledge. No one surely foresaw that it would be possible to weigh and measure the constituent particles which make up an atom.

Other romances of science are to be found in the recent progress of astronomy. A new departure was taken by Michelson in 1920 in the success of his device for measuring the sizes of certain stars. He found, for example, that in Betelgeuse we have a celestial giant two hundred million miles in diameter, big enough to take in the whole orbit of the earth, and more. This diameter had been foreseen by theory. In particular, Eddington has applied his imagination and his mathematics to the question. He shows that the surface temperature of a star is no criterion of the fervent heat within, where a temperature of perhaps twenty million degrees may be reached. Under such conditions the energy of the star is about equally divided between the energy of waves of radiation and that of the motion of particles. The radiation causes a disruptive pressure which acts against gravitation so strongly that the balance between those two forces is the factor which determines how much mass is condensed to form a single star. This explains why it is that all stars are roughly of the same order of magnitude.

Eddington pictures the radiant energy within the star as trying to escape into surrounding space but caged in by the material. It is tossed to and fro from atom to atom as the ball is tossed in a Rugby match, and only little by little does it reach the surface and find itself free. He shows how at the enormous temperature of the interior the atoms are stripped of their outer electrons, which then mingle in the throng as free particles. Deprived in this way of the crinoline or fender of electrons that would normally keep them apart, the nuclei may approach one another far more closely than they could otherwise do, and the star may therefore contract to a density which vastly exceeds that of any substance known in our laboratories. But in contracting from a giant to a dwarf, the substance of the star preserves the essential features of a gas, for the particles have still a relatively large mean free path of movement in the intervals between their encounters. Owing to the removal of their crinoline, stellar atoms have only something like one-hundred thousandth the bulk of ordinary atoms, and so may be brought immensely closer to one another before the properties of a nearly perfect gas are lost. Finally, Eddington gives us reasons for imagining that in the course of its life history the star maintains its power of emitting radiation not simply by virtue of its contraction, but by converting into energy a portion of its own mass. His remarkable prediction as to the density of dwarf "white" stars has, during the past summer, been verified by Adams at Mount Wilson, who, by measuring the "relativity" displacement of lines in the spectrum of the companion of Sirius, has proved that star to have a density some two thousand times greater than that of platinum, and has directly confirmed the validity of the spectral shift as a test of Einstein's general theory of relativity.

Yet another romance is the story of helium, first inferred as an element in the sun by Lockyer in 1868 from observations of the spectrum of a solar prominence. It was not known to be a constituent of the earth until Ramsay found it in 1895 as a gas in the mineral cleveite. It takes an important place as the second member of the atomic series, the lightest of the group of inert elements which includes neon, argon, krypton, and xenon. It is found in small quantity in the atmosphere and in nearly all natural gases and spring waters. We now recognise it as a product of the disintegration of radioactive substances. Each alpha particle they shoot out is essentially an atom of helium. It is the nucleus of such an atom, which only requires to associate itself (as it can readily do) with two planetary electrons in order to become a complete electrically neutral atom of helium. The lightness and inertness of helium make it an ideal substance for the filling of airships, for it has a lifting power in the atmosphere not far short of that of hydrogen, along with the immense advantage of being completely uninflammable. Helium is now assiduously collected from its natural sources for this practical purpose. From the point of view of theory it is also particularly interesting. As an agent for producing the extremest degree of cold it has been used by Onnes, who, by vaporising liquefied helium, has reached a temperature only about two degrees short of absolute zero. One may remark in passing that the absolute zero of temperature is almost the only absolute thing that is left to us in a universe given over to relativity.

Rutherford has put helium to another scientific use. He employs the alpha particle, which is the nucleus of helium, projected from a heavy radioactive substance with a velocity of ten or twelve thousand miles per second, as a projectile with which to knock chips off the nuclei of nitrogen and certain other elements. In this way he produces hydrogen, for the chips which are knocked off are single protons, each of which forms the nucleus of a hydrogen atom. Thus in the hands of Rutherford the alpha particle is a veritable philosopher's stone by which the transmutation of elements, so long the dream of the alchemist, has become an accomplished fact. Quite lately we were told of laboratory experiments in which gold was reported to have been made by the removal of part of the nucleus of the element next above it in the list, namely mercury. The news was received with perfect calm by the scientific world, and even, I fancy, by the Governor of the Bank of England. For if you want gold it will doubtless be cheaper to find it by digging than to make it in that way.

There have been so many surprises in physics that the faculty of wonder is almost exhausted. Things have happened which a little while ago would have seemed to be miracles. We may think of Kelvin or of Tait as turning in his grave when an occupant of this chair speaks of there being no strict conservation either of matter or of energy, and accepts the possibility of transforming the one into the other. The foundations of the older physics have been rudely shaken, and the effect of such upheavals has been to alter the temper of the scientific mind. The old positiveness has gone. No longer are we positive about anything. The complacency, the facile dogmatism, which here and there showed itself in the last century, is now a rather absurd memory.

We are confronted by dilemmas and find no way out. We are obliged, one may say, to take the dilemma by the horns, boldly grasping both. The electromagnetic theory of light, established as we believed by Maxwell, is confronted with the view that there is no ether, nothing which will serve, in the words of the late Lord Salisbury, as a nominative to the verb to undulate; and, worse still, while the wave theory is amply supported by the facts of interference and diffraction, it is apparently inconsistent with the equally well-established facts of absorption and photo-electricity. How to reconcile these seeming contradictions we simply do not know. So while we may justly feel pride in all this progress and achievement, it is mingled with a consciousness of mystery, with a spirit of question. In a special sense is it true to-day that the widening of the circle of light has widened the circumference of darkness, and for the moment at least the darkness seems strangely impenetrable.

## The Science and Art of Map-making.[1]

By A. R. HINKS, C.B.E., F.R.S.

THE progress of invention has placed in the hands of surveyors a number of beautiful new methods, and some we have not yet scientifically explored. Would you measure a base? So far from painfully seeking a dead-level plain and clearing it of every petty obstruction, you will gaily take the suspended invar tapes across country, and by preference run them up a hill at each end to get a better view for the base extension. Would you equip a party for primary triangulation? Look thankfully at Ramsden's 36-inch theodolite reposing in the museum of the Ordnance Survey; look doubtfully at the fashionable 10-inch; and before you take it any more into the field, examine whether the instrument of the future is not a 5-inch

[1] From the presidential address delivered at Southampton on August 27 before Section E (Geography) of the British Association.

constructed on the new principles of Mr. Henry Wild, with circles etched on glass, and parallel plate micrometer that reads opposite points of the circle from the eye-end and takes the mean for you. When you lay out the triangulation, consider well the recent opinion of the U.S. Coast and Geodetic Survey, that it is better to be content with small triangles easily accessible, with automatic electric beacons tended by a party in a car, than to make enormous efforts at rays longer than Nature easily allows. Bear in mind also a remark which our lamented friend Col. Edmund Grove-Hills made to me not long before his death. I was saying how necessary it was to complete as soon as possible the late Sir David Gill's great arc of meridian in Africa; and to my horror Hills referred contemptuously to the meridian arc as an "obsolete method." He did not pursue the idea; but I think we can see what was in his mind, and that he was right. The old-fashioned arc stuck to the meridian or the parallel with a sublime disregard of the topographer's convenience. It had infrequent bases measured with pomp and ceremony. It had occasional astronomical latitudes and azimuths observed with an almost painful degree of internal precision by heavy instruments and prolonged sojourn on uncomfortable heights.

We can see now how mistaken it all was. The purpose of these astronomical observations was to compare the geodetic with the astronomical latitudes, as a contribution to the Figure of the Earth. But what use to aim at single tenths of seconds in the latter, when on the average they were divergent by several seconds owing to local deviations of the vertical? Our real need is for a latitude at every triangulation point, and those points thick upon the ground. "Obsolete" was Hills' word for the meridian arc; and I think we shall not find it too strong, when we look at a graphical plot of the contribution to our problem which Gill's arc in South Africa can make.

It seems that we shall be driven back to the old network stretching far and wide across the country like the triangulation of Great Britain; and that raises problems which can scarcely be discussed here. But let me not for one moment be taken as disparaging the practical value of Gill's great achievement. It has proved invaluable as a framework on which to hang boundary surveys. It stretches a long skeleton from Port Elizabeth to near Tanganyika—ready to be clothed with topographical maps; and still lying in stark nakedness, for there is something in self-government that is antipathetic to map-making. Our Crown Colonies are getting fairly well provided with maps, thanks in great measure to the work of that Colonial Survey Committee which was so active early in the century, and which we hope was not a casualty in the War. But our self-governing Dominions have not always much to boast of.

This is a well-worn subject, and geographers are getting tired of asking whether there is yet a single topographical sheet to be bought in Australia. I believe that the answer is still, No: though there are some thirty sheets for official use produced by the Department of Defence as an earnest of the thousands that are wanted to cover the continent. Canada has now a first-rate geodetic survey and the beginning of a good topographical map; but it is a big country that began survey very late, and its settlement is marching faster than its maps. Thanks to the labours of Mr. Wallace, we do know at last, what Lord Southesk never did, where he went on his journey of 1859 in the Rockies, but there is still no published map good enough upon which to show the route.

It is a commonplace of books that the surveyor in the field can always find latitude or azimuth, but is in difficulty with his longitude. That is no longer true. The rapid establishment of powerful time signals has made it possible to get longitude as exactly as latitude, and this must have a profound effect on further survey, exalting the astronomical at the expense of the trigonometrical; facilitating marvellously the rapid reconnaissance survey; putting off the drastic remedy of triangulation; but heaping up trouble in the future. On the other hand, the method of wireless longitudes will tend to the solution of two great problems, one of respectable position and one a little parvenu. Is the equator a circle? No one has yet certainly challenged it, though Clarke and others have done their best with inadequate means. Are the continents floating, or rather sliding about slowly on a sima-slide? We are generally agreed that Wegener has not proved his case, because he had a naïve trust in astronomical longitudes palpably weak. Yet the question has been deemed worthy of a serious and costly enterprise, warmly advocated by General Ferrié, and gradually assuming, I think we may say, without offence to that great enthusiast, a much more acceptable shape than the rather hard and unadaptable outline that was a little criticised by British geodesists and astronomers two years ago.

The need of a strong central authority is as evident in wireless time signalling as it is in the organisation of broadcast. Happily for geographers, the astronomers have organised themselves well since the War into a Union with thirty-two Commissions. The Union spends half its whole income on the sustenance of the Bureau International de l'Heure, over which one of the Commissions exercises a general control. The prodigality of the Union, stated thus, is impressive. In cold fact, its contributions, fixed unfortunately in French francs, do not go very far to pay the cost of the service, which can be carried on only because the Director of the Paris Observatory has not hesitated to place the instrumental resources and the magnificent house-room of his Observatory at the disposal of the Bureau; while the keen interest of General Ferrié has secured the benevolent and beneficent co-operation of the French radio-telegraphic services, military and civil. Geographers owe a great debt of gratitude to the French in this matter. But we hope that the British Government will not rest content with the modest part which Great Britain has played up to the present in this great development. We have—or shall have soon—an "Imperial Wireless Chain" stretched out from the new station at Rugby to the farthest Dominions; and we shall miss a great dramatic opportunity if from the opening of this service we do not insist that time signals from Greenwich shall be sent from Rugby and retransmitted in each link of the chain, that all Britain's Dominions beyond the seas, her ships on the ocean, and her travellers wherever they may be, shall be able to take Greenwich Mean Time direct from the source. The technique of time transmission has been so greatly improved in these last years that there is no serious difficulty about it; and of the Imperial services for which the Rugby station is built, there can be none, I think, more really, if modestly, useful than the propagation of Greenwich Mean Time throughout the Empire.

The science of cartography is based upon the sciences of precise survey, and I make no apology for having dwelt for some time on the methods of securing the foundations. But when these are well and truly laid, it is time to press forward the visible building—the maps—and a problem we share with the larger world is that of building with speed and economy, not regarding too closely the interests vested in the old methods, but prepared if it seems wise to reinforce the ancient crafts with new. Two new powers have been added to the cartographer in these last years: flight to give him range of vision, and the stereoscopic plotter to give his photographic vision a new sense. For I do not exaggerate when I use those words—a new sense—to describe the power which the stereoscopic measurement of pairs of photographs has given the surveyor of topographical detail. The brilliant idea that this could be done automatically was due to Capt. Vivian Thompson. The credit of extending and perfecting the beautiful but marvellously simple geometry belongs to an Austrian, Lieut. von Orel; and of translating the geometry into sweetly working mechanism to the German firm of Zeiss. No more beautiful piece of optical machinery has ever been made, I willingly believe, than the stereoautograph of von Orel and Zeiss. But they made a sad mistake in marketing it, granting exclusive rights over a territory to an individual, and demanding from him not only a heavy price for the outfit, but also a large and perpetual royalty on his gross receipts as a stereoautographer. So strange a method of selling a scientific instrument was never known before.

Happily there is more than one mechanical and optical solution of the problem, and at least four different machines are now in the field abroad, while a fifth is under construction in Great Britain to the order of the Air Survey Committee. We are thus fortunately saved from the reproach that nothing has been done in this our country to develop a method first devised by an Englishman. But we may feel that our instrument-makers and our surveyors have been a little unenterprising; and there is nothing I would like to see more than a real effort, with adequate means, to try out stereographic surveying on geographical scales.

We know well enough that the stereoautograph can deal marvellously with a small piece of country on a large scale; but what has never yet been shown is that it can deal with a large piece of country on a small scale. It will contour for you an inaccessible cliff at 1-metre intervals on the scale 1/5000; but can it or a rival be made to tackle 100-metre intervals on the scale 1/250,000? That is a question which has never yet been answered, and I believe that it is our duty to answer it. Along the northern frontiers of India in the ranges of the Himalaya are at least 10,000 permanently snow-clad peaks. So long as the inch-to-the-mile map is incomplete in the plains, we can scarcely expect it in the mountains. Yet a really accurate map on the scale, say, 1/250,000 cannot be deemed superfluous for defence; and even the poor geographer or traveller is entitled to ask for it. How is it to be obtained? Will stereoscopic survey do anything for us?

I feel certain that the answer is Yes; but much less certain that the photographs should, at least in the first instance, be taken from the air, which seems to be contemplated by the advanced school, and taken for granted by the newspapers. Air photography made a brilliant success in the War, when the cost was not too severely scrutinised. In peace we have to approach the problem with the fear of the Treasury in our hearts, and with more respect for that sort of precision which lets one go on in an orderly way for ever, without leaving accumulations of errors "to be absorbed in the desert," as they say in the Sudan.

Now, photographs taken with axis vertical cover a surprisingly small ground, even from extreme heights. With a lens of 6 in. focal length, about the minimum, you must go to 25,000 ft. to get a result on the scale 1/50,000, and then you can photograph only about three miles square on each plate. Flying at 90 miles an hour you must take plates every few seconds to avoid getting too much stereoscopic relief. It looks as if vertical photographs combined stereoscopically will fail in mountainous country.

I turn to obliques. The photographs taken in the air are taken from unknown points, and the first thing to do is to determine the position of the camera at the instant of exposure. The geometry of the method is none too strong, anyhow, and we could not expect to find the resulting place of the aeroplane with anything like the accuracy of a ground station. This leads me to think that stereographic survey from ground stations will be found to play an indispensable part in the future survey of mountainous country.

Suppose, for example, that political difficulties did not exist, and that we were able to survey the country south of Mount Everest. I think I would rather start out with a series of camera stations along the Singalela ridge, and fix all the visible crests stereographically with horizontal axes and vertical plates. A large part of the ground would be dead ground; but quite a good deal could be put in. Would this not solve the question of providing a fixed framework for the obliques from the air, perhaps combining each with a plate from a ground station, rather than in pairs of obliques? It will at any rate be worth the trial; and therefore I am anxious that we should not fail to exploit the relatively easy and inexpensive ground stations, while we are perfecting the vastly more difficult process of the oblique air photograph.

I suppose there never was a time when it was more difficult than now to forecast the future in surveying. We have seen already that geodesy is in a state of flux; we are not even allowed to believe that the pole or the continents stand fast in their right places. The methods that were canonical in field astronomy a few years ago are being rapidly displaced by new. The prismatic astrolabe is threatening to oust the theodolite; and Mr. Reeves has retaliated by inventing a small attachment to the theodolite that does the work of the astrolabe to perfection, and makes a separate instrument unnecessary. Sound-ranging and flash-spotting may yet be turned to the arts of peace, and there is something suspiciously like the latter in the method proposed for connecting Egypt with Crete or Alaska with Siberia. Sound-ranging in air is perhaps not so likely to be useful to geographers as sound-ranging in water. But there is a post-War invention the future of which is brilliant. Who would have dreamed in the *Challenger* that her modern counterpart, the Royal Research Ship *Discovery*, would be equipped with deep-sounding gear on the method of echoes, that takes soundings in no time, or very nearly? It has become suddenly vastly more simple to measure the depth of the sea than the height of the land. There is much more sea than land, and a disproportionate part of it is very deep. Yet now for the first time we can begin to think of ocean contours drawn less by imagination and more by soundings in the new sense of the word.

If there was twenty years ago one branch of cartography that seemed stereotyped and unlikely to develop, it was surely the subject of map projections—a subject with a large and rather unprofitable literature; a science in which pure mathematics disported itself to the little advantage of maps; a science with a misleading title, since scarcely more than one of the useful projections is really a projection at all, the rest being only constructions; a science in which guiding principles were hard to find.

But in recent years the subject has taken on a new aspect. Tissot, and Jordan, and especially A. E. Young, have developed the expressions in infinite series —a process which sounds terrifying to those whose intelligences automatically shut up when they scent mathematics, but it is really an enormous simplification, because it reveals at once how much alike all these projections are in the first few terms, and precisely by how much they begin to diverge from one another when the sheet is extended. Moreover, this way of dealing with the subject allows the conscientious cartographer to distribute the errors judiciously by a process of cooking the projection, producing a flavour much appreciated by the connoisseur, though a taste not yet acquired by the common map-maker. But these refinements must not be looked at askance, as over-elaboration tending to preciosity. They have real practical advantages in the computing office.

This branch of our venerable science is therefore very much alive. It has even produced of late two new families—the retro-azimuthal projections which are the offspring of the Survey of Egypt, and the doubly-zenithal the father of which is Sir Charles Close. The former guides the Muslim in his prostration towards Mecca; the latter serves wireless direction-finding and other devices of the twentieth century. Could a student desire a subject of wider scope in which to exercise his powers?

The thought of the very charming modification of the polyconic projection devised by M. Charles Lallemand for the International Map on the scale of one in a million, leads us naturally to consider the outcome of that ambitious programme which was launched at the London Conference of 1909. Difficult as it was to secure enthusiastic co-operation before 1914 in producing sheets the marginal lines of which were necessarily drawn on a hard geometrical convention regardless of frontiers, it is trebly difficult now.

But I think it is fair to inquire if the original scheme was sound. There is an old proverb that if you want a thing well done you must do it yourself, and with suitable modification this seems to me to apply especially to map-making. It is difficult enough for a single office to produce at intervals sheets that will absolutely match their neighbours. To expect uniformity from twenty or thirty reproduction offices is to expect altogether too much. One might indeed overlook slight differences in layer tints if one could only get the maps; but that is just the difficulty. Some countries are keen to meet their obligations, and some are not. India has produced a fine block of sheets; the North American Continent—I will not particularise—has produced three. I think we should find if we took a census that the majority of the Powers represented at Paris in 1913 have produced none, and show few signs of doing so.

With some trepidation I suggest, therefore, that the scheme for an International Map was bound to fail, because it required that each of many different countries should do its share, after a preliminary wrangle with its neighbours as to what that share was. Successful international co-operations have never worked that way. What has been the guiding principle of the successful enterprises? Surely that the reputed cost should be contributed by the nations in rough proportion to their populations, and that the work should be done by one. The Bureau International des Poids et Mesures, the old International Geodetic Association's Institute, the modern Bureau International de l'Heure, all these work or worked on that plan, with great success. The contributing nations get a great deal for a very small payment, and the nation which has the energy to take on the responsibility, and gets the credit, naturally contributes from its own resources, directly or indirectly, a large and essential part of the total cost.

The Survey of India has set us an admirable example in its map of India and Adjacent Countries, with a liberal interpretation of what adjacent means. Is it beyond hope that even in these hard times the Geographical Section of the General Staff might be given means to produce a map of the "British Empire and Adjacent Countries"—again without too much regard to the niceties of language?

Such a map of the world is indeed an almost necessary outcome of the P.C.G.N.'s work on names for British official use, for if unity of style could be achieved by miracle in an international map, there is no hope whatever for unity of spelling, or even of nomenclature. A sheet bears inevitably in its methods of transliteration the mark of its origin. We are all agreed that names in countries using the Roman alphabet should be spelled as in that country; the difficulty comes in transliteration from the non-Roman, and in descriptive names. The International Hydrographic Bureau at Monaco seems to me to have entered on a hopeless quest when it tries to obtain international agreement for the names of international waters. The French must surely always call Pas de Calais and La Manche what we call the Straits of Dover and the English Channel. The Germans will doubtless continue to speak of the Ost See, even though the bishop's wife protested to Elizabeth in Rügen that "the Baltic exactly describes it." Much can be done, no doubt, to eliminate superfluous variants and modern corruptions; but I do believe that the names for "British Official Use" must always have a certain British flavour, however much we try to be scrupulous or even pedantic.

It will be agreed, I trust, that the science of map-making is healthily active and growing. Let us turn now to the art, which is twofold: the art of the convention by which the outline and the relief are reduced to the compilation, and the personal art of drawing the detail, the lettering, the divided margins, the ornaments, so that the finished map shall be clear, harmonious, and beautiful.

During the last thirty years we have seen the convention profoundly modified by the rapid improvement of colour lithography. Colour has, it is true, been used on engraved maps from the very first, and in my opinion the most agreeably coloured atlas ever published was the Rome edition of Ptolemy of 1486. But this was hand colouring, and no two copies are alike. In the years that followed the colour became more elaborate, but it was largely in the ornament, and the essential outline of the map was in black, from the single engraved plate. The great extension of possibilities came with the quite modern use of colour to distinguish the outlines of different classes: blue for rivers, brown for contours, red for roads, and so on. The enormous resulting improvement was conspicuously in the representation of relief. Layer colouring in particular, first employed on a large scale by the celebrated firm of Bartholomew, has given our maps all the advantages of a relief model without the inconveniences. It is a method in which the British have always excelled; and the supreme example of skill in layer colour-printing is the "Gamme" or colour scale attached to the report of the Paris Conference of the 1/Million Map in 1913: a scale which we may be proud to think was printed in England, at the War Office. There are infinite possibilities in the combination of layer colouring with contours, hachure, vertical and oblique hill shading; many of them have already been realised by the Ordnance Survey, particularly in their special maps of holiday districts, and in a map of South Devon which I regretfully remember in proof only, because it was found too expensive for issue. For we must note that a modern map passes through the press eight or ten or twelve times, and the cost of the machine work, apart from all the plates, is multiplied in the same ratio. The wonder is not that maps are expensive, but that in the circumstances they are so cheap. We should wish to believe, however, that the progress of invention may some day give us back that richness of tone that distinguishes the old engraved maps.

## Obituary.

### MR. J. Y. BUCHANAN, F.R.S.

THE last member of the original scientific staff of H.M.S. *Challenger* on her famous voyage of discovery in the great oceans has passed away by the death, on October 16, at eighty-one years of age, of Mr. John Young Buchanan. He holds an assured place as one of the founders of modern oceanography, and if his personal share in the fundamental researches is not more conspicuous in the text-books, it is largely because of his loyalty to the spirit of the expedition which gave the glory to the *Challenger* group rather than to individuals. He was in the most literal sense an original worker, always preferring to settle a point by observation or experiment rather than by books, and when reference to recorded work was necessary, always going direct to the fountain-head, never to a compilation. He paid no regard to authority or scientific orthodoxy, and did not get on comfortably with those who did. Censorship of research, even the reference to experts of papers submitted to a learned society, was obnoxious to him, and he spoke very plainly on this subject in communications to NATURE and elsewhere. So far as he allowed his singularly restrained and reserved nature to express itself in warm terms, he showed a passion for the freedom of research. He said: "To standardise research is to limit its freedom and to impede discovery. Originality and independence are the characteristics of genuine research, and it is stultified by the acceptance of standards and by the recognition of authority" (Preface to his "Comptes Rendus," 1917).

Buchanan was born in Glasgow in 1844, the second son of Mr. John Buchanan of Dowanhill, and was educated at the High School and University of his native city, where he graduated as M.A. Having decided to follow chemistry as a profession, he proceeded to study on the Continent, where he spent some time at the Universities of Marburg, Bonn, and Leipzig, and under Wurtz in Paris. On returning to Scotland he acted for a short time as assistant to Prof. Crum Brown in the University of Edinburgh. His leaning was always towards practical work rather than theoretical study, and he had little liking for teaching or lecturing. He excelled in manipulation, and especially in glass-blowing, a fact which weighed in his appointment as chemist and physicist on the *Challenger* expedition, where it was desirable that a scientific man should be able to make his own apparatus in case of need. The voyage of the *Challenger* lasted from December 1872 to May 1876, and most of Buchanan's time was occupied by routine work in measuring density of sea-water, collecting gas contents, and making qualitative analysis of all manner of natural deposits. He found time for several pieces of research which he afterwards developed in the private laboratory which his ample means allowed him to maintain, first in Edinburgh and latterly in London. The most important of these involved the thermal relations of sea-water and of salt-solutions generally, especially with regard to the formation of ice and steam.

A picturesque incident in the *Challenger* was his determination of the true nature of *Bathybius Hæckeli*, which Huxley believed from microscopic examination of preserved deposits to be a primitive organism covering the bottom of the sea. Buchanan proved it to be a gelatinous precipitate of calcium sulphate thrown down by alcohol, a fact which was very reluctantly accepted by the biologists on board, who were unwilling to think that Huxley, the highest authority, could possibly have made a mistake. Huxley himself at once accepted the correction in the frankest manner. A less dramatic but more constructive piece of work was the analysis of deep-sea deposits, especially of the red clay and the nodules of manganese peroxide embedded in it, on which Sir John Murray based his theory of the formation of oceanic deposits and coral islands. Buchanan championed the hydrometer against chlorine titration as the measure of salinity, and he held to this view, although later work has convinced the oceanographers of to-day of the superior accuracy and convenience of the titration method. He made important experiments on the compressibility of substances at pressures existing in the depths of the sea, and the water and mercury piezometers which he made on board the *Challenger* yielded remarkable results in his hands, enabling him to measure depths and bottom temperatures irrespective of the length of line paid out. He pursued these investigations in later years, and read several papers to the Royal Society and the Royal Society of Edinburgh on the compressibility of solids.

The researches on sea-water initiated from the chemical or physical side were continued with the object of studying the conditions and movements of water in the sea and in lakes, thus leading their author from chemistry into physical geography. Buchanan made many scientific cruises in his steam-yacht *Mallard* on the west coast of Scotland and the lochs connected by the Caledonian Canal. Later he made a series of voyages on the cable-laying ships of the Silvertown Company along the west coast of Africa, and during the later years of his active life he was closely associated with the oceanographical researches of Prince Albert I. of Monaco. The Prince had a very great regard for him and consulted him in all details of his work on board the *Princesse Alice*, as well as in the organisation of the Monaco Oceanographical Museum and of the Oceanographical Institute in Paris.

During the 'eighties of last century the *Challenger* Office made Edinburgh a focus of activity in all branches of science, and Buchanan took his share in the intellectual revival, doing much to infuse new life into the flagging University Chemical Society, which he invited to hold its meetings in his laboratory. He helped in founding the Ben Nevis Observatory, and joined the Council of the Scottish Geographical Society soon after its formation. Above all, he furthered the work of the Scottish Marine Station which was opened at Granton in 1884. He fitted up his old chemical bench from the *Challenger* on board the floating laboratory *The Ark*, and when I was appointed chemist and physicist at the Granton station he proved a most helpful and kindly instructor. He was an exceptionally tidy worker, and planned a system of laboratory books for recording all observations, experiments and calculations, with scrupulous regard to dates and hours.

In 1889 Buchanan was appointed lecturer on geography in the University of Cambridge, and although he only occupied the position for four years, he found the social life of Cambridge so congenial that for twenty years he made Christ's College his home. This was probably the happiest period of his life, and he revealed more of his inner self in intercourse with his friends in the Combination Room than he was wont to do elsewhere. The coldness of his manner was probably due in part to shyness, in part to an extreme sensitiveness to the opinions of others, which he concealed by an assumption of indifference. He was never idle, and accumulated a mass of recorded observations, only a fraction of which was ever brought into shape for publication. He had no freedom in writing, but he took immense pains to verify every statement and to make his meaning perfectly clear. His chief pleasure was in travelling, and he was an insatiate observer of things and men in all parts of the world. He had friends in every country in Europe, and was greatly affected by the outbreak of the War, during the course of which he resided in America and the West Indies.

Had Buchanan been a poor man, or bound to some permanent scientific position, he would probably have cut a deeper niche for himself in the Hall of Memory. As it is, he left no formal book behind him, though he long cherished the idea of producing a treatise on oceanography. After returning to England, he collected his more important and some of his slighter published papers in three volumes, which were brought out by the Cambridge University Press under the respective titles "Scientific Papers, Vol. I.," 1913, "Comptes Rendus of Observation and Reasoning," 1917, and "Accounts Rendered of Work done and Things Seen," 1919. In the remarkable synoptical tables of contents prefixed to these volumes, he gives notes and criticisms which throw an interesting light on his methods of work and modes of thought.

HUGH ROBERT MILL.

---

## MR. FRANCIS JONES.

AMONG chemists the name of Francis Jones is always associated—almost identified—with boron hydride. When Humphry Davy in 1809 heated the amorphous boron he had isolated with metallic potassium, and treated the grey mass with water, he found the hydrogen gas given off had a peculiar smell and took up more oxygen on explosion than did pure hydrogen. This observation was for seventy years the chief evidence of the existence of a hydride of boron, and after the researches of Wöhler and Deville, who doubted its existence, chemical text-books and dictionaries maintained a strict silence on the subject. The discovery of the spontaneously inflammable silicon hydride by Buff and Wöhler in 1857 left boron the one exception to the rule that all the non-metallic elements combined with hydrogen, and the methods adopted by these chemists—as well as the experience he himself had gained in determining the composition of the hydride of antimony—led Francis Jones to plan his research on boron.

Born in Edinburgh in 1845 and educated at the Edinburgh Institute and University, Jones decided at an early age to take up chemistry as a career and proceeded to Heidelberg to work in Bunsen's laboratory. It was his work here that led to his introduction to Roscoe, who brought him to Manchester in 1866 as research-assistant in his private laboratory. The years ahead were strenuous with Roscoe's great work on vanadium, whereby this element was first placed in its true order: and the young assistant could have had no better training-ground in chemical method or in manipulation. Four years later he was appointed demonstrator, and after two years' teaching at the Owens College, was chosen by the high master of the Manchester Grammar School to fill the place left vacant by Dr. Marshall Watts. His science work at the school soon won for it an almost unchallenged position among the large schools of England: the writer remembers well the succession of brilliant candidates he sent up for the Brackenbury science scholarships at Balliol between 1879 and 1886. For forty-seven years he continued to direct the chemical laboratories and to take his full share of teaching in the school.

Francis Jones must be placed in that small class of science masters who, in spite of incessant calls on their time and energy, have advanced chemistry in England. His first important paper on the properties and composition of stibine appeared in 1876 (J. Chem. Soc.). The composition of the hydride of antimony had previously been based on the analysis of the black compound thrown down when the gas mixed with hydrogen was passed through silver nitrate solution—presumed to be pure $SbAg_3$. But metallic silver is also deposited in this reaction, and the substance is really a mixture, as Jones showed by his analyses. His next attempts were to measure the increase in volume when 2 litres of the hydrogen and stibine were sparked, but the proportion of the stibine was too small to enable its composition to be determined from the increase in volume and the weight of antimony formed. He discovered, however, that stibine was decomposed by sulphur at ordinary temperatures in bright light:

$$2SbH_3 + 6S = Sb_2S_3 + 3H_2S.$$

By passing the mixed gases through weighed sulphur-tubes and absorbing the hydrogen sulphide, he showed that one atom of antimony was combined with three of hydrogen. The orange colour imparted by stibine to sulphur gives us a very delicate test for antimony.

In 1879 appeared the preliminary note on boron hydride. In his first experiments Jones attempted to make magnesium boride by the action of sodium on a mixture of magnesium chloride and potassium borofluoride—following the method for making silicon hydride. The reaction was violent, but no hydride resulted from acidifying the product. Then he tried with success the direct heating of magnesium powder with boron trioxide:

$$B_2O_3 + 6Mg = B_2Mg_3 + 3MgO.$$

When hydrochloric acid was dropped on to the grey friable product a gas was evolved which burnt with a bright green flame and had a most disagreeable odour. He had obtained the hydride mixed with hydrogen.

Two years later a fuller paper was published (J. Chem. Soc., 1891) by Francis Jones and R. L. Taylor. Other methods of preparing the hydride were given, but the simplest was that described above—which always contained a large excess of hydrogen. The hydride was decomposed by passage through a red-hot tube leaving a brown deposit of boron; when bubbled through silver nitrate it formed a black precipitate containing silver and boron. Combustion of the mixed gases by means of copper oxide showed the hydride molecule to contain more hydrogen than the molecule $H_2$, and to approximate to $H_3$. Twenty years later, Ramsay, by cooling the mixed gas with liquid air, extracted another hydride from it, to which he assigned the formula $B_3H_3$.

In 1884 Francis Jones published a simple method for detecting a chloride, bromide, and iodide when the three salts are mixed together. By the addition of dilute sulphuric acid drop by drop to the salts in the presence of manganese dioxide and water the iodine can be boiled off, then the bromine, the residue with strong sulphuric giving the chlorine. His other published work dealt chiefly with the effect of different modes of heating and lighting on the air of living-rooms: he took an active interest in the crusade against air pollution.

For many years he acted on the council of the Manchester Literary and Philosophical Society, and was president for the two years 1909–11: he gave his services freely to the last, and his kindly and sage counsel was always appreciated. H. B. D.

---

MR. G. L. SMITH, who died at Chertsey on September 25, was head of the Instrument Research and Design Department of the Royal Aircraft Establishment. As such he was responsible for a large number of instruments used on aircraft. His remarkable genius for this type of work enabled him to accomplish much work of great importance, though his share in it is little known outside the circle of a few associates. Born at Aberdeen about 1870, Mr. Smith followed a number of scientific pursuits—among which may be mentioned the design and application of the aero fire alarm, which was extensively used in England and the United States. At the outbreak of the War, he offered his services to the Royal Aircraft Establishment, where he remained until illness compelled him to resign a few months before his death. While of a somewhat retiring and unobtrusive disposition, his kindly and sympathetic nature made him beloved and respected by every one.

G. M. B. D.

---

WE regret to announce the following deaths:

Dr. E. J. Babcock, professor of industrial chemistry, metallurgy and mining and dean of the College of Mining Engineering in the University of North Dakota, on September 3, aged sixty years.

Dr. H. R. Carter, assistant surgeon-general of the United States Public Health Service and a distinguished authority on yellow fever and malaria, on September 14, aged seventy-three years.

Prof. T. Case, formerly president of Corpus Christi College and Waynflete professor of moral and metaphysical philosophy in the University of Oxford, on October 31, aged eighty-one years.

Dr. Paul Héger, honorary professor of physiology in the Faculty of Medicine at the University of Brussels, aged seventy-nine years.

Dr. J. R. Henderson, C.I.E., formerly professor of zoology in Madras Christian College, and Superintendent of the Government Museum and Aquarium in Madras, on October 26, aged sixty-two years.

Prof. J. N. Langley, F.R.S., professor of physiology since 1903 in the University of Cambridge, on November 5, aged seventy-three years.

Prof. J. Massart, professor of botany in the University of Brussels, corresponding member of the Paris Academy of Sciences and foreign associate of the Royal Academy of the Lincei, aged sixty years.

Rev. E. F. Russell, of St. Alban's, Holborn, one of Huxley's early students, who contributed to our issue of May 9, p. 751, his recollections of Huxley and of the course of biology being given in 1875 at South Kensington, on November 7, aged eighty-two years.

## Current Topics and Events.

HIS Majesty the King has approved of the following awards this year by the president and council of the Royal Society :—A Royal Medal to Prof. W. H Perkin, for his work on the constitution of the alkaloids ; a Royal Medal to Prof. A. C. Seward, for his researches on the palæobotany of Gondwanaland. The following awards have also been made by the president and council :—The Copley Medal to Prof. A. Einstein, for his theory of relativity and his contributions to the quantum theory ; the Davy Medal to Sir James Irvine, for his work on the constitution of the sugars ; the Sylvester Medal to Prof. A. N. Whitehead, for his researches on the foundations of mathematics ; the Hughes Medal to Mr. F. E. Smith, for his determination of fundamental electrical units and for researches in technical electricity.

THE following is a list of those recommended by the president and council of the Royal Society for election to the council at the anniversary meeting on November 30 :—*President*, Sir Ernest Rutherford ; *Treasurer*, Sir David Prain ; *Secretaries*, Mr. J. H. Jeans and Dr. H. H. Dale ; *Foreign Secretary*, Sir Richard Glazebrook ; *Other Members of Council*, Prof. J. H Ashworth, Prof. L. Bairstow, Prof. F. O. Bower, Prof. S. Chapman, Sir Dugald Clerk, Prof. F. G. Donnan, Prof. E. J. Garwood, Prof. J. P. Hill, Prof. J. B. Leathes, Prof. J. C. G. Ledingham, Sir Thomas Lewis, Prof. F. A. Lindemann, Sir Robert Robertson, Sir Charles Sherrington, Dr. G. C. Simpson, and Mr. W. C. D. Whetham.

SIR ERNEST RUTHERFORD, O.M., who has been nominated to succeed Sir Charles Sherrington as president of the Royal Society, was born at Nelson, New Zealand, on August 30, 1871. Educated at Nelson College and Canterbury College, New Zealand, he proceeded to the University of Cambridge, entering Trinity College. He occupied the post of Macdonald professor of physics, McGill College, Montreal, from 1898 until 1907, when he left to become Director of the Physical Laboratories in the University of Manchester. From thence he went to Cambridge to take up the duties of Cavendish professor of physics, a post which he still occupies and adorns. Nobel Laureate in chemistry in 1908, Sir Ernest was Copley medallist of the Royal Society in 1922. In 1923 he was president of the British Association at its Liverpool meeting, and he remarked that it was in Liverpool in 1896 that he first attended any gathering of the kind, and that there he read his initial scientific paper. Sir Ernest's address was entitled "The Electrical Structure of Matter." The unknown appears, he said, as a dense mist before the eyes of man. In penetrating the obscurity we cannot invoke the aid of supermen, but must depend on the combined efforts of a number of adequately trained ordinary men of scientific imagination. It may be recalled that Sir Ernest Rutherford was the recipient, in 1908, of the Bressa quadrennial prize of 9600 lire (say 400*l.*) at the disposal of the Turin Academy of Sciences, instituted to recompense the most notable scientific achievement during the particular period. We believe that no other Englishman has received this award.

DR. HENRY H. DALE, C.B.E., who has been nominated for the secretaryship of the Royal Society in succession to Sir William Hardy, is a Londoner, and was born in 1875. Educated at Tollington Park School and the Leys School, Cambridge, he graduated at Trinity College, Cambridge, taking up afterwards his medical career at St. Bartholomew's Hospital, London. At the present time Dr. Dale is head of the Department of Biochemistry and Pharmacology under the Medical Research Council. He gave a series of lectures in Johns Hopkins University, Baltimore, in 1919. Croonian lecturer at the Royal Society in 1919, he was last year awarded a Royal Medal of the Society in recognition of his researches in pharmacology and physiology.

MR. BALDWIN, Prime Minister, in his Rectorial address to the students of the University of Edinburgh on November 6, made a comparison between the aims of university study and the practice of politics. The student learns to acquire "habits of accuracy in measurement, precision in statement, honesty in handling statement, fairness in presenting a cause—in a word, to be true in word and deed." The politician, on the other hand, is concerned with persuading people to support his cause, so that truthfulness has often to be sacrificed to expediency. The result "is inevitably to place a veto on complete frankness, and to tempt recourse to words which are nebulous, hesitating, ambiguous, or misleading." While the discovery of truth is the purpose of scientific investigation, in the political field the truth may be tempered to the minds of an audience if a favourable impression is thereby secured. Mr. Baldwin did not for a moment suggest that such methods of political sophistry were worthy of an educated people, but he excused them as a consequence of a democratic constitution, and he urged that it was the business of universities to change the conditions which enable a modern demagogue to mislead the public. It will be a long time before the voters who decide how the State shall be governed will be able to distinguish between the special pleading of an advocate and the summing up of a judge when political questions are under discussion, and meanwhile they have the power to decide matters upon which they have no actual knowledge. The duty of those who object to this penalty of democratic control is to take an active part in enlightening the public and in securing the entrance into Parliament of members who not only know how to search for truth but also how to use scientific methods in its application to social life.

THE disaster in the valley of the Conway in North Wales on the night of November 2 adds another to the melancholy list of failures of dams, or retaining embankments, which have been constructed to the best of human knowledge and ability, and yet have developed some unsuspected source of weakness resulting in collapse, unfortunately attended in so many cases by sad loss of human life and much destruction of property. The dam at Llyn Eigiau, North Wales, was constructed in 1908 for the purpose of impounding water to supply hydro-electric power for the aluminium works at Dolgarrog. It is a concrete embankment, shaped in plan like the letter L, with the angle, which, in reality, is slightly curved, jutting into the lake. The enclosure is estimated to have contained, before the collapse, about one thousand million gallons of water. A breach, which occurred near the junction of the two arms of the dam, apparently below the concrete work, allowed the whole or greater part of this mass of water to escape. For a distance of more than two miles, it traversed the relatively level bed of the stream which carries the normal overflow, and then precipitated itself down the mountain side in an almost perpendicular descent of nearly 1000 feet into the Conway valley below. Great boulders of rock, blocks of concrete, a girder bridge, a temporary iron church and a number of buildings were swept away and piled into a mass of débris and ruin along its course. The disaster is said to be the greatest of its kind which has occurred in Great Britain since the catastrophe at Bradfield, near Sheffield, more than sixty years ago, though more notable and devastating failures have been recorded in other countries.

COMMENTING on our note (NATURE, October 24, p. 620) concerning his recent article on the position of the classics, Prof. J. P. Postgate writes that although it was not unfair to mention that the committee of the British Association had unanimously rejected the claims of Latin to be chosen as the international auxiliary language, it must not be forgotten that the committee, with one dissentient, also rejected the claims of English; and that although reporting in favour of the adoption of an artificial language, namely, Esperanto or Ido, the committee was unable to decide between them. "Their conclusion, then," he says, "was a purely negative one, and in present circumstances it could hardly have been otherwise." We thank Prof. Postgate for reminding us of the further decisions of this committee, but we cannot agree with him that the recommendation of Esperanto or Ido was a "purely negative" conclusion. Esperanto, in particular, is showing much vitality as an auxiliary language, "a special tool for a special purpose"; and we do not think that the position of the classics as a means of culture would in any way suffer if an easier, synthetic language were adopted for scientific and commercial purposes, or even as the medium for the exchange of international thought generally. Did not Mr. John Galsworthy declare recently that such exchange was the only possible salvation of the world?

THE work of M. Léon Guillet is well known to British metallurgists as well as to his compatriots, and many will be interested to know that his recent election to the Paris Academy of Sciences has been made the occasion of a proposal to raise a fund for a testimonial to M. Guillet, in recognition of the services rendered by him to education, science, and industry. His work has covered a wide range, but his name is best known in connexion with researches on the alloy steels and on bronzes and other alloys of copper, particularly in regard to the changes brought about in them by quenching and other forms of heat treatment. A circular containing an appeal for subscriptions for this purpose has been issued, and is signed by many metallurgists, England, Belgium, Sweden, Italy, Denmark, and the United States being represented as well as France. Subscriptions should be sent to M. Roszak, 8 Rue Jean-Goujon, Paris VIII$^{e}$.

IT is a gratifying indication of the position of scientific metallurgy in Great Britain that the two principal metallurgical societies, the Iron and Steel Institute and the Institute of Metals, have practically become international organisations, numbering a large foreign membership, and serving as the medium of publication for a mass of important work from foreign countries. We have received from the Institute of Metals a booklet addressed to metallurgists in the United States, containing a list of the two hundred members of the Institute resident in that country, and giving particulars of its activities. Recent volumes of the Journal of the Institute have contained many important papers from foreign sources, whilst its abstracts are much more complete than anything published elsewhere. There are obviously great advantages in a common medium of publication and a common source of reference to metallurgical literature, serving the whole of the metallurgical world acquainted with the English language, and the growth of American membership is a healthy sign.

IN the *Forum* for September several articles deal with China. Of these the more important are "China in Ferment," by Walter Littlefield, an attempt to analyse the present political situation in its bearing upon the covenants of Washington of 1921–1922, and "The Foreign Devil in Young China," by John Brailsford, in which the author seeks to define the relation of western industrialism and western revolutionary thought in China. Neither writer offers much ground for optimism. The former, while crediting Washington with sincerity in forming the covenants through which China was to preserve her territorial and political entity, considers that both China and the other Powers signatory to the convention who are interested in the exploiting of China have proved indifferent to Washington's solicitude. The author fails to see that his naïve conclusion that not only is it difficult to gauge the real attitude of the individual Tuchuns but also that any one of these who may hold Pekin is prepared to assent to measures which he is unable to guarantee will be carried out, and his still more naïve confession that Washington does not appear to have grasped this fact, are not only a criticism of the United States diplomacy, but also an endorsement of the attitude of Great Britain that China must first place her house in order before anything can be done in regard to treaty rights. Of this attitude he is both critical and suspicious. In the second article, Mr. Brailsford shows that the intellectuals and students, whether Christian or heathen, have eagerly embraced revolutionary ideas out of sympathy with labour in opposition to western industrialism. They favour, on the whole, a class struggle rather than peaceful reform by development of the Chinese guild and social systems. As the adverse conditions of western industrialism have had as yet little or no opportunity to develop in China, the revolutionary attitude seems unreal and doctrinaire as well as misdirected. The need for political and administrative reform is real enough.

MR. R. A. CHATTOCK, the electrical engineer to the City of Birmingham, gave a short but interesting presidential address to the Institution of Electrical Engineers on October 22. He pointed out that the new processes being introduced for the production of steam enable us to obtain more perfect combustion and higher temperatures. The difficulties with regard to furnace linings have been overcome by screening the furnace walls with water tubes which form part of the boiler itself. He then pointed out some of the advantages of pulverised fuel. He reminded his hearers that if the distillation of coal proves to be commercially feasible, from 30 to 70 per cent. more weight of coal will have to be handled so as to get a given electrical output. Hence although in some cases it will be profitable to adopt this process, the number of pounds of coal for a given output will compare very unfavourably with that required by a station burning coal to destruction. There is also, as in the case of the gas industry at the present time, a serious financial risk of finding it impossible to dispose of the by-products at a remunerative price. Mr. Chattock laid stress on the importance to a power station of having the ratio of the average output to the total output, that is, the load factor, as large as possible. A residential neighbourhood has only a power factor of about 10 per cent. If prices to the consumer are to be reduced, it is necessary to foster the use of electricity for heating and cooking by an attractive two-price tariff. He is opposed to the political agitation for constructing a few large power stations and distributing over considerable distances to many substations. In his opinion the cost of distribution would in general be so great that no appreciable reduction in the price would be possible. It will be remembered, however, that the main reason for Mr. Snowden making the suggestion in 1924 was that it would reduce the number of unemployed. Mr. Chattock is also strongly opposed to having a single standard frequency for alternating current supply. He pointed out the great convenience of having mercury arc rectifiers in order to convert alternating to direct current supply. Most engineers are in favour of standardisation, but if it be adopted too soon, it will only hamper progress.

ON Saturday, November 7, the Marchese de Pinedo landed at Rome, after having completed a flight in a Savoia 16 flying boat of about 35,000 miles to Australia and Japan and back again. This remarkable journey commenced on April 21 last, and the route followed was via Baghdad, India, Burma, Singapore, and the Dutch East Indies, to Australia. Leaving Australia and turning north, Japan was reached, and here a new engine was fixed. Thus some 20,000 miles were covered by the first engine, and the second sufficed to bring the seaplane home via the coast of China to Burma, and then along the usual airway to Europe. Throughout the journey, which took 370 flying hours, the Marchese de Pinedo was accompanied only by one mechanic. The achievement was noteworthy as regards both the skill and endurance shown by the airmen and the general trustworthiness for transcontinental and transoceanic travel which the seaplane has shown itself to possess.

THE hundredth annual course of Christmas Lectures for Juveniles at the Royal Institution will be delivered this year by Sir William Bragg on "Old Trades and New Knowledge." The trade of the sailor is the title of the first lecture, to be given on Tuesday, December 29, and the following five lectures will be on the trades of the smith, the weaver, the dyer, the potter and the miner.

THE president of the Executive Committee of the International Research Council has summoned a meeting of the General Assembly of that body to be held at Brussels on June 29, 1926. The object of the meeting will be to discuss the advisability of removing from the statutes the restrictions which have hitherto stood in the way of admitting the Central Powers of Europe to the Research Council.

APPLICATIONS for the Royal Society Government Grant for Scientific Investigations for 1926 must be received by, at latest, January 1 at the offices of the Royal Society, Burlington House, Piccadilly, W.1. They must be made on a printed form obtainable from the clerk to the Government Grant Committee, Royal Society.

AN informal lecture will be delivered before the Chemical Society at Burlington House on Thursday, November 26, by Prof. R. Robinson, professor of organic chemistry in the University of Manchester, who has chosen as his subject "Recent Researches on the Structural Relationships of some Plant Products." The lecture will be given at 6 o'clock, and not at 8 o'clock as originally announced.

THE first broadcasting station in the Irish Free State has been erected by Marconi's Wireless Telegraph Company, Ltd., in the McKee Barracks in the outskirts of Dublin. The studio will be in Denmark Street, off Henry Street. The transmitter, which will operate on a wave-length of 390 metres and will use the call sign 2RN, is a Marconi 6 kw. type Q set. This is the same type as that used at the majority of British broadcasting main stations, and also at a large number of foreign stations. It is expected that tests will begin shortly, and that the service will be inaugurated during December.

AN exhibit of winter-flowering begonias, showing the wild species from which these winter-flowering begonias have been derived, has been arranged at the Royal Botanic Gardens, Kew, in the house which is devoted to objects of special and current interest. The two wild species which are particularly concerned are *Begonia socotrana*, from the Island of Socotra, and *Begonia Dregei*, from South Africa. *B. socotrana* was introduced in 1880 by the late Sir Isaac Bayley Balfour, Regius Keeper of the Royal Botanic Garden, Edinburgh. This, in itself a beautiful winter-flowering species, has proved of immense importance as the progenitor of our present-day race of winter-flowering Begonias. From 1883 onwards Messrs. J. Veitch and Sons produced many fine winter-flowering varieties by inter-crossing it with various tuberous-rooted varieties of begonia from the Andes of South America. Some of the most recent hybrids resulting from these crosses are "Exquisite," "Fascination," and "Optima," which are shown in this group. The leaves tend to resemble those of the Andean species rather than those of *B. socotrana*. Though they are very beautiful plants, as can be seen from the display in the Kew Conservatory, they are not very generally grown as their cultivation presents some difficulties. M. Lemoine, of Nancy, in 1892 crossed *B. socotrana* with the South African species, *B. Dregei*. The resulting hybrid was *B. Gloire de Lorraine*, of which there are now several varieties, including some of American origin, such as "Glory of Cincinnati" and "Mrs. Petersen." These are now some of the most popular and easily grown plants for winter decoration. There are now four additional sets of picture postcards in colour on sale at the Royal Botanic Gardens. These comprise a set of stove and greenhouse plants, two series of rock garden and hardy herbaceous plants, and a set of Himalayan rhododendrons.

Applications are invited for the following appointments, on or before the dates mentioned:—A professor of materia medica at the Royal Veterinary College, Camden Town, N.W.1—The Secretary (November 21). A lecturer in the department of electrical engineering of Bradford Technical College—The Principal (November 24). The professorship of physics at University College, Nottingham—The Registrar (November 28). A county analyst under the Lancashire County Council—Clerk of the Lancashire County Council, County Offices, Preston (November 28). An assistant lecturer in mechanical engineering at the Manchester Municipal College of Technology—The Registrar (November 30). A lecturer in pathology and bacteriology in the Welsh National School of Medicine, Cardiff—The Secretary (December 4). An assistant lecturer in physics at Natal University College, Pietermaritzburg—The Registrar (December 31). A part-time assistant in the department of zoology and geology of University College, Southampton—Dr. W. Rae Sherriffs. A lecturer in education in the University College of Wales, Aberystwyth—The Secretary. A professor of biology and a professor of bio-chemistry in the College of Medicine, Singapore—The Private Secretary (Appointments), Colonial Office, 38 Old Queen Street, S.W.1. A laboratory assistant in the physics department of the Liverpool Collegiate School for Boys—Director of Education, 14 Sir Thomas Street, Liverpool. A male junior assistant in the Research Department, Woolwich, for computing work in connexion with ballistic observations—Chief Superintendent, Research Department, Woolwich.

## Our Astronomical Column.

November Meteors.—Mr. W. F. Denning writes: "The return of these meteors is due on the mornings of November 15 and 16, but they are not expected to be unusually abundant. In certain years, however, when the display was not anticipated, it came with special activity.

The orbit of the stream extends out to beyond the path of Uranus, and the cometary system, to which it owes its parentage, has a period of about 33¼ years. All along this lengthy ellipse the meteoritic particles are distributed, and they are certainly clustered more abundantly in certain sections of the orbit than in others. Hence the annual displays vary in their character, some being much richer than others.

This year there will be no moonlight to interfere with observation. The radiant point does not rise until nearly 10.30 p.m., and the meteors cannot be seen before that time; in fact, the most promising period at which to watch for them lies between 1 and 5 in the morning. The splendid display of 1866 reached its maximum at about 1.10 a.m., when one observer counted about two hundred meteors per minute.

The meteors of this system are generally bright, very swift, and leave luminous trails which often linger for several seconds and, in the case of very bright objects, may endure for 10 or 15 minutes. The directions of the meteoric flights are from the well-known "sickle" of stars in the western part of Leo.

The comet associated with this shower was last seen in 1866. It will return in 1933, and for several years before and after that time showers of these mid-November meteors should be as abundant as they are attractive.

Though one of the richer sections of the stream which gave us the display of 1866 was sufficiently disturbed by the attraction of Jupiter to enable it to pass outside the earth's orbit in about 1899, there are other regions of the system capable of inducing rich displays, as in 1867, 1868, and 1869. There were also fairly abundant exhibitions of meteors in 1901 and 1903."

The Masses and Colours of the Stars.—*Astr. Nach.* No. 5394 contains two papers on these subjects by G. Shain and Miss V. Hase, of the Simeis Observatory, Crimea.

The former contains arguments favouring Eddington's masses, deduced on the assumption that absolute luminosity is a function of mass, rather than those of Seares, deduced from the principle of equipartition of energy (*i.e.* assuming that $Mv^2$ is constant for all stars). The latter principle is shown to fail for the brighter giant stars, notably those of type B, though for the dwarfs it agrees fairly with Eddington.

In the other paper it is argued that there is a correlation between colour and absolute magnitude, the giants of a given spectral class being redder than the dwarfs, and the dwarfs having the higher temperature for a given intensity of spectral lines.

## Research Items.

THE ROYAL MAGICIAN IN ANCIENT EGYPT.—Attention has frequently been directed to parallels in the customs of the ancient Egyptians and of African races. Such a parallel has been suggested by Sir Flinders Petrie as an explanation of a frequent scene in the royal functions of ancient Egypt in which a king is seen rapidly striding or running and bearing certain objects. This performance has been termed by Hermann Kees *Opfertanz*; but, as Sir Flinders Petrie points out in *Ancient Egypt* for September, the action is that of running, not dancing. Nor is the purpose to sacrifice or make an offering. He suggests that these scenes represent a ceremony analogous to the rain-making ceremonies of the African chief. They are usually found at the ends of the lintels in great temples, but occasionally elsewhere. The general meaning is indicated by certain signs such as the three *adeb* signs signifying cultivated land, which connect the ceremony with the cultivated fields, a small female figure frequently accompanying the king, with the plant of Lower or Upper Egypt on her head, and inviting him to come and bring the inundation, and, frequently, a galloping bull representing the Nile. This invocation begins as early as the sixth dynasty. The origin of the ceremony is indicated by the flail which is shown. This appears to have been derived from the bull's tail, which was used as a fertilising lash before the artificial form took its place. Thus it appears that the king went round the fields ceremonially to drive away evil influences, fertilising them with the lash and leaving blessings behind him. Fans are also shown. These are divine symbols, and are the regular adjunct of African rulers down to the present day. Later ceremonies (eleventh dynasty) show the oar, and (eighteenth dynasty) two vases for pouring water in the hands of the king. It would therefore seem clear that Egypt had a king of that African type of which the principal function is to act as a magician who controls the rain. In Egypt, as there was no rain, it was his duty to bring the inundation which made fertile the cultivated lands.

FAMILY NAMES IN FRANCE.—Dr. Albert Dauzat in *La Nature* for October 3, discusses the origin of French family names. After the disappearance of the Roman system of nomenclature, surnames only reappear with the stabilising of the feudal system in the ninth and tenth centuries. Between the eleventh and fifteenth centuries the individual name is followed to an increasing degree by a surname which tends to become the family name by passing from father to son. This tendency is particularly apparent from the time of Philip Augustus, beginning in the south and spreading rapidly to the north and the Rhine area. With the establishment of registers in certain parishes at the end of the fifteenth century, these surnames began to be fixed. Jewish family names, however, were not legally established until 1808. French family names fall into four principal categories. First are individual names which have been perpetuated without modification, such as Henri, Louis, or with modification: Jacques, Jacoton, Cottin. Many are individual names no longer in use, mostly of Germanic origin, *e.g.* Aymon, Rambaud, Arnaud. These are also modified in various ways. A second category includes names derived from location or habitation (Caseneuve, Dubois, Delaval, Delarue) or origin (Le Breton, Paris, Le Normand, Langlais). Thirdly come names of profession or occupation—Chausselier, Feuvre, Fournier. The fourth class, which is very large, consists of soubriquets and includes such names as Le Grand, Le Gros, Poincaré, Roussel, Rousseau, Bossu, Bossuet, Chappedelaine, Legendre, and the like. In addition to patronymics, a number of matronymics, such as Marguerite, Collette, and so on, also occur.

CLIMATE AND HUMAN ENERGY.—In an interesting analysis of the results of the Olympic Games of 1920 (Antwerp) and 1924 (Paris), which Dr. Guillermo Hoxmark, of the Weather Bureau, Buenos Aires, has published in *Ecology* (New York), vol. 6, No. 3, July 1925, success in the competition is correlated with mean temperature as a suggested index of the relation of energy and climate. This study follows the lines taken by Huntingdon and others in establishing zones of human energy and civilisation. Twenty-six countries were represented, and the number of inhabitants of each is here divided by the number of points gained, thus giving the number of thousands of inhabitants per point. The countries are then ranged in the resulting order. An index number is assigned to each, the smallest number of thousands per point being 1·00. When brought into relation with mean annual temperature, it appears that a low index number, *i.e.* high average athletic ability, and a low average temperature go together. The figures of the two competitions, taken separately and together, give approximately the same result. In each case, Norway, Finland, and Sweden head the list in the order named. Great Britain stands twelfth; Spain, Czecho-Slovakia, Japan and Egypt are among those at the bottom of the list.

WARM FEBRUARY OF 1925 IN THE UNITED STATES.—The *Monthly Weather Review* for May contains a discussion by Mr. Alfred J. Henry which shows that February 1925 in the continental United States was the warmest February during the last forty years. No other February has averaged so much as 5°·8 F. above the normal for the country as a whole. The monthly departures ranged from a minimum of 1°·2 above the normal in the Florida peninsula to 10°·1 above in the region embraced by the States of Montana, Wyoming, and the western parts of South Dakota and Nebraska. An attempt is made to ascertain the cause of the temperature departure. Both primary and secondary cyclones lacked in intensity during the month, and naturally strong pressure gradients were absent. The anticyclones experienced were not associated with an indraught of cold air. A detailed examination was made by the author of the pressure conditions existing over the Pacific and elsewhere with the object of tracing, if possible, the relation between these varying conditions and the exceptionally warm weather experienced in the United States. The author concludes that the explanation of the warm weather experienced must be referred to the presence of an oceanic cyclone over the Gulf of Alaska which occasioned suitable atmospheric conditions for ill-defined cyclonic systems to be detached from the primary oceanic cyclone and to pass along the northern boundary towards the Atlantic, inducing on their fronts an unusual frequency of southerly winds. Attention is directed to the growing belief on the part of meteorologists that the cause of unusual seasonal variations is associated with conditions prevailing in the Arctic and Antarctic regions, and reference is made to the difficulties of verifying this supposition.

CARBONIFEROUS FOSSILS FROM CHITRAL.—Dr. F. R. Cowper Reed has completed the sixth volume of the new series of the *Palæontologia Indica* with a well-illustrated memoir on the Upper Carboniferous fossils collected by the late Sir H. H. Hayden in Chitral and the Pamirs in 1914. Most exhaustive comparisons are made, and the fauna is shown to be distinct from any hitherto found in India or Kashmir. It is specially characterised by the abundance of the foraminifer Fusulina. The whole fauna resembles that found in the Upper Carboniferous of the Ural mountains, and it may be inferred that the late Carboniferous Eurasiatic Mediterranean Sea extended across Chitral into Turkestan and Central Asia.

MIOCENE ANTHRACOTHERES FROM BALUCHISTAN.—In 1909 and 1910 Mr. C. Forster Cooper made an important collection of mammalian remains from a Lower Miocene deposit at Dera Bugti in Baluchistan. The specimens were prepared for study at the British Museum, where they are now preserved, and most of them have been described by Mr. Forster Cooper in a valuable series of papers and memoirs. The latest of these contributions is an exhaustive study of the primitive hoofed mammals known as Anthracotheriidæ, published as a memoir in the *Palæontologia Indica* (new series, vol. 8, No. 2). Most of the fossils representing this group are fragmentary jaws and teeth, but they suffice to indicate great diversity both in size and form. They make known a remarkable assemblage of mammals, all of one family, living side by side and presumably fighting together to some extent for the means of subsistence, some of them closely allied to one another and some evolving on marked lines of their own. They remind us of some of the assemblages of antelopes still or until recently existing in Africa.

RÖNTGEN RAYS AND PALÆONTOLOGY.—In the Geological Museum of the Russian Academy of Sciences, Drs. A. Hartmann-Weinberg and S. A. Reinberg have been experimenting on the detection, by means of X-rays, of fossils enclosed in pieces of rock, and they have just published their results in the Bulletin of the Academy. They have been especially successful in finding pieces of bone in sandstone, and a little less successful in detecting similar fossils in shale. They have used pieces of concretions containing reptilian bones collected by the late Prof. Amalitzky in the Permian sandstone of the Northern Dwina, and their radiograms of several specimens are sufficiently clear to guide the preparator in uncovering the various fragments. They have also been successful with an ammonite in sandstone. They find that, for the purpose, no piece of sandstone should be more than 30 to 40 cm. in thickness. The authors, however, point out that buried fossils can only be detected by X-rays when they differ considerably in constitution from the enclosing rock. Bones impregnated with calcite, for example, are not shown in the radiograms when the surrounding rock is limestone. The latter result accords with the experience of the British Museum when an attempt was made some years ago to examine the skeleton of Archæopteryx by the same method.

MOUNT LOGAN.—An account of the first ascent of Mount Logan, the loftiest summit in Canada, appears in the *Dominion Land Surveyors' Journal* for October. Mount Logan, which lies some forty miles to the north-east of Mount St. Elias, was photographed from the south by the Duke of the Abruzzi's expedition to Mount St. Elias in 1897, and its great height was not established until the survey of the Alaska-Yukon boundary in 1913. The ascent was made this year by a small party of Canadians under the leadership of Mr. A. H. MacCarthy, who was accompanied by Mr. H. J. Lambert of the Geodetic Survey department, The climb was made from the west up the Ogilvie glacier and the King glacier. Above 14,500 ft. the reduced pressure hampered the climbers. Progress was very slow, and it was difficult to get a restful sleep. However, on June 23 the summit was reached at 19,850 ft. Mr. Lambert's article is illustrated with several photographs.

EARTHQUAKES IN THE UNITED STATES.—How numerous are the earthquakes in the United States is evident from a short article published in the *Volcano Letter* for September 17 of the Hawaiian Volcano Research Association. During the nine years 1915–23, the total number of earthquakes was 955, or more than a hundred a year, felt in as many as 42 States. Had the record been continued up to February 1925, every State would have been represented except Delaware, Florida, and Louisiana. The most frequently disturbed State is California, with 594 earthquakes. In the eastern States, the most active regions lie along the middle part of the Mississippi River, and it is noteworthy that some of the earthquakes there affected areas nearly as great as that disturbed by the San Francisco earthquake of 1906, though at the surface the damage caused was slight. This shows that the foci in the east of the country are more deeply-seated than those in the west. During the first part of the period considered, several earthquakes were experienced at or near Charleston, the scene of the great earthquake of 1886.

NEWER MAGNETIC PHENOMENA.—In the November issue of *Conquest*, Prof. J. A. Fleming gives a short account of some of the recent discoveries in magnetism. Many of them depend on the fact that iron can exist in two allotropic forms, $\alpha$ below 780° C., and $\gamma$ above. The former is magnetic and the latter not. A steel containing 12 per cent. of manganese and a cast iron containing 6 per cent. of manganese and 9 per cent. of nickel are non-magnetic at low temperatures. On the other hand, iron alloyed with 78·5 per cent. of nickel is in weak fields more magnetisable than wrought iron, and Heusler's alloy, $MnAlCu_2$, is as magnetisable as cast iron. The effects of alternating fields on feebly magnetic iron ores, discovered by Mr. Mordey and used for the separation of ores, are traced to the lag of the magnetisation behind the field as shown in the hysteresis curves.

THE ISOTOPE EFFECT IN THE SPECTRUM OF SILICON NITRIDE.—The spectrum of silicon nitride can be produced by introducing silicon chloride vapour into active nitrogen, and in the *Physical Review* for September, Dr. R. S. Mulliken describes the structure of the bands, in the fourth paper of a series dealing with the isotope effect in band spectra. The structure is of a simple type, resembling in some respects the spectrum of cyanogen (CN), and it is shown that the bands are due to a diatomic emitter, both the chemical evidence and the isotope effect indicating that this is SiN. A striking feature is the unusual prominence of the null line, or missing line, in each band; this is also the case in the cyanogen bands. Weak satellite band heads due to $Si^{29}N$, and slightly weaker ones due to $Si^{30}N$, accompany the stronger $Si^{28}N$ bands, as reported by Mulliken in NATURE, March 22, 1924, p. 423, and in agreement with Aston's positive ray work on the isotopes of silicon. Equations have been worked out for the positions of the band heads and for the band structure; from these it is deduced that the distance between the atomic nuclei is $1{\cdot}56 \times 10^{-8}$ cm. in the vibrationless molecule. In a paper in the July number of the *Physical Review* the isotope effect in the band spectra of copper iodide (CuI) is dealt with in detail, the spectra of copper fluoride, chloride and bromide having also been partially investigated. The effects of the two isotopes $Cu^{63}$ and $Cu^{65}$ are clearly shown in the spectra.

THE STRUCTURE AND DISTRIBUTION OF BAND SPECTRA.—In a series of papers in the *Comptes rendus Acad. Sci.*, Paris, ending with one on October 5, M. H. Deslandres puts forward the following formula for the distribution of the principal and secondary bands in the infra-red spectra of simple chemical structures:

$$\nu = qd_1/rs \pm q'd_1/r's',$$

where $\nu$ is the frequency, $d_1$ a universal constant or fundamental frequency = 1062·5, $s$ the number of atoms or of large rings of electrons in the molecule, $s'$ the number of exterior electrons of an atom and $q$, $r$, $q'$, $r'$ whole numbers; $r$ in the examples given in the paper of September 28, which relate to the first term, *i.e.* to the principal bands, being 1, 2, 3, 4 and in some cases 6 for different bands. The second term in the equation represents the secondary bands which appear in the principal band with sufficient dispersion. The first term has been verified with twenty absorption spectra of substances of very simple structure. The author found in 1919, in 11 infra-red and 29 luminous or ultraviolet spectra, that the most intense band frequency is almost exactly a multiple of $d_1$, which follows from the above formula in the case of the infra-red bands. The line spectra emitted by single atoms are connected with the constant $d_1$ by the same simple law. The author considers that the facts imply the existence of a new series of vibrations intimately connected with the fundamental frequency $d_1$; he supposes that they originate in the nucleus of the atom or in a "protective" sphere connected with the nucleus.

THEORY OF THE PHENOMENA AT THE CATHODE IN GLOW DISCHARGE.—A large amount of work has recently been carried out by Dr. A. Güntherschulze on the glow discharge, and in the *Zeitschrift für Physik* of August 31 he develops the theory of the phenomena observed at the cathode in terms of recent developments in the determination of the behaviour of electrons accelerated in an electric field through a gas at low pressure. He makes use of the results of Brose, who has determined the field intensity in the space between the edge of the negative glow and the cathode, the "fall space," in the case of the abnormal cathode fall; and assumes that the curve of field intensity has the same form in normal cathode fall. The dark space observed by Aston in the case of hydrogen and helium, between the cathode and the thin luminous layer of the cathode glow, is ascribed to the fact that here the electrons given out by the cathode have not acquired the velocity necessary for the excitation of the atoms. In the cathode glow the excitation velocity is reached, and the excited atoms give out light; but Seeliger has shown that when the velocity becomes still higher excitation diminishes, and this is why the Crookes space is nearly dark. Ionisation takes place here, free secondary electrons being split off from the atoms and positive ions being formed, which move towards the cathode, and colliding with it produce a further supply of electrons from its surface. The above secondary electrons are accelerated by the field in the Crookes space, and a large number of them reach excitation velocity at the edge of the negative glow, where the luminosity rises very quickly, falling off again farther on when, owing to the continued acceleration, the number of electrons with the exciting velocity has diminished. A number of relations between the length of the fall space, the voltage drop in it, the current density and other variables are worked out.

THE POLARISATION OF THE ZODIACAL LIGHT.—Visual observations have given contradictory results as to the polarisation of the zodiacal light. M. J. Dufay has recently carried out a series of measurements photographically, using first a nicol prism and then a doubly refracting analyser, which gave two images of the opening in a diaphragm illuminated by a small region in the zodiacal light (*C.R. Acad. Sci.*, Paris, September 28). In this way it was possible to photograph simultaneously two components the vibrations of which were at right angles to one another, and to study the relative intensities with the microphotometer on the photographic plate. Thus the depolarisation, $\rho$, of the original light, that is, the ratio of the intensity $i$; of the beam the vibrations of which are in the plane passing through the line of sight and the sun, to that, I, of the beam the vibrations of which are perpendicular to this plane ($I > i$), can be determined, and from this the proportion, $p$, of the light which is polarised in the above plane. A number of measurements have been made of small regions near the plane of the ecliptic and distant from 30° to 95° from the sun; $\rho$ appears to diminish from 30° to 60°, passing through a minimum and then increasing much more rapidly. The values obtained for the same angle differ, however, from night to night according to the state of the atmosphere. Further observation is necessary to obtain results which will give full information as to the nature and distribution of the material which causes the zodiacal light; the measurements made, however, make it clear that the light is diffused sunlight, and that it cannot be due to gaseous molecules, since in that case, while the curve for $\rho$ would be of the form observed, the values of $\rho$ would only be from half to one-third as large. The particles must have dimensions which are not negligible as compared with the wave-lengths concerned.

CARBONISATION OF COAL.—In pursuance of a policy mentioned in NATURE (September 20, 1924, p. 441) the Fuel Research Board has tested the carbonisation plant of Midland Coal Products Ltd., Netherfield, Nottingham, and the results have been published (H.M. Stationery Office, 9*d.* net). The coal treated is a poorly caking local slack which is first briquetted. Carbonisation is effected by internal heating in a tall brick-lined shaft, water-jacketed at the base, a portion of the fuel being gasified by the air-steam mixture injected. The producer gas so generated reduces the calorific value of the gas to 190 B.T.U. per cubic foot —a figure too low for public supply. The yields of products obtained were: coke 7·5 cwt., gas 58,300 cubic feet or 112·5 therms, tar 21 gallons. The ammonia liquor was too dilute for profitable recovery. The coke was well carbonised with 2 per cent. only of volatile matter, and though suited for use in stoves, it was unsuitable for open grates. Its ash content was 9-13 per cent. The temperature reached in the charge was 1200° C., and the process cannot be classed as a low temperature carbonisation in the sense commonly understood. The tar yield was high, but the proportion of light oil was small. The pitch obtained was used for the briquetting. It was considered that the grade of coke might be improved by the use of more suitable elevating plant. No attempt is made to assess the commercial success, but the results do not suggest that the process is one which will prove a general solution to the problem of providing smokeless fuel.

## Geneva Congress of the History of Medicine.

THE Fifth International Congress of the History of Medicine was held at Geneva on Monday, July 20–Friday, July 24, under the presidency of Dr. Charles Greene Cumston, lecturer in the history of medicine at the University of Geneva, with Sir D'Arcy Power as president of honour. The meetings, which were held at the Athenée, where the conference leading to the formation of the Red Cross took place in 1863, were well attended, representatives being present from Belgium, Cuba, Denmark, France, Great Britain, Holland, Italy, Morocco, Poland, Spain, Switzerland, and the United States.

At the opening meeting the president gave an account of the medical celebrities of Geneva, including Daniel Le Clerc (1652–1728), whose history of medicine was published twenty-nine years before Freind's "History of Physick"; Jean Antoine Sarasin (1547–1598), the author of a treatise on plague; and Théophile Bonet (1620–1689), who wrote a work on morbid anatomy entitled *Sepulchretum*, which secured him a European reputation. Dr. André Patry, president of the Medical Society of Geneva, then gave a sketch of ophthalmology in Switzerland from Roman times. Addresses were next delivered by M. André Oltramare, Chief of the Department of Public Instruction, representing the Council of State; M. Georges Werner, Rector of the University of Geneva; Dr. Hugues Oltramare, representative of the City of Geneva; and Dr. Tricot-Royer, of Antwerp, president of the International Society of the History of Medicine. Prof. Eugène Pittard, of the University of Geneva, then delivered a lecture on the prehistoric period of medicine, illustrated by skulls and implements from French and Swiss burial mounds. He showed that trephining of the skull was fairly frequent among prehistoric peoples, being usually performed in the parietal and rarely in the occipital or frontal regions.

On Tuesday papers were read at the morning session by Dr. J. D. Rolleston, on Voltaire and English doctors; by Sir D'Arcy Power, on Albert von Haller and the *Disputationes Chirurgicae Selectae*, *i.e.* M.D. theses written in various European universities between 1699 and 1742 and edited by Haller; by Dr. John Comrie, of Edinburgh, on Robert Whytt, an eighteenth-century neurologist; by Dr. A. Guisan, of Lausanne, on the life of Fabricius Hildanus, a Basel practitioner of the sixteenth century; by Dr. J. G. de Lint, on Tronchin and the Suttons' method of inoculation; by Dr. E. Wickersheimer, on syphilis in Geneva at the end of the fifteenth century, who combated the view that the disease had been imported for the first time by Columbus from America; by Prof. Wiki, on Dr. Karl Niclaus Lang, who described the epidemics of ergotism at Lucerne in 1709 and 1717; by Dr. Maillart, on abdominal ex-votos found in the Museo delle Terme at Rome; and by Mlle. Eugénie Droz, on a plague tractate of the thirteenth century.

The afternoon session was taken up by papers by Dr. Paul Delaunay, on the doctors of Le Mans in Switzerland during the sixteenth century; by Dr. J. W. S. Johnsson, of Copenhagen, on an autograph letter of Fracastor in which poetry is described as a kind of disease; by Prof. F. M. Messerli, on three sanitary edicts at Lausanne in the fifteenth and sixteenth centuries; by Mr. C. J. Thompson, on hygiene and public health in early civilisations; and by Prof. P. Capparoni, on anatomical instruction at Rome during the sixteenth century.

After the close of the session the members of the Congress were entertained by Dr. and Madame Rilliet at Vengeron, where they were able to inspect the library of the pædiatrist, Dr. Frédéric Rilliet.

On Wednesday morning papers were read by Dr. R. O. Moon, on Paracelsus and medicine; by Dr. E. B. Krumbhaar, on the medical literature of the seventeenth century as exemplified in the Elzevir press; by Dr. H. Renaud, on some recent discoveries bearing on the history of Arabian medicine in Morocco; by Prof. Jeanselme, on the Germanic conceptions of surgical anatomy at the time of the barbaric invasions; by Dr. Tricot-Royer, on the history of lepers at Antwerp and Louvain; and by Dr. M. A. van Andel, on medicine and architecture.

In the afternoon session papers were read by Mrs. Lilian Lindsay, on the growth of dentistry in England from the earliest times to the beginning of the nineteenth century; by Prof. Wrzosek, on Remak and Polish science, showing that Remak published several scientific works in Polish before he settled in Berlin, and on Emmanuel Gilibert, who organised the medical school at Grodno (1776–1780), at a time when numerous French doctors were practising in Poland; by Dr. E. Wickersheimer, on Jean Gispaden, a fifteenth-century surgeon of Annecy and Grenoble; by Dr. Tricot-Royer, on Isaac Ammon, otherwise known as Palatino Chaldaico, a physician and astrologer; by Dr. de Metz, on the barber-surgeons of Antwerp; by Dr. Dubreuil-Chambardel, on the houses of refuge on the pilgrim routes in the tenth, eleventh, and twelfth centuries; by Dr. Laignel-Lavastine, on his ancestor, the oculist Jacques Dariel, who performed the first operation for cataract on April 8, 1785, at Marseilles; and by the same speaker, in collaboration with Dr. Jean Vinchon, on demoniacal possession in the sixteenth century.

After the meeting a visit was paid to the public library, where a special exhibition of manuscripts, incunabula, and other works bearing on the history of medicine, had been arranged, and portraits of Geneva physicians from the sixteenth to the eighteenth century were on view. In the evening there was a reception by the Administrative Council of the City of Geneva at the Palais Eynard.

Thursday was devoted to a tour on the Lake of Geneva, a visit being first paid to the Château de Chillon, and then to Evian-les-Bains.

On Friday morning, when the Congress was brought to a close, Dr. Wierzbicki read a paper by Prof. A. Wrzosek and himself on auscultation in Poland in the first half of the nineteenth century; Dr. J. W. Courtney, of Boston, dealt with Benjamin Waterhouse, who introduced vaccination into the United States; Dr. De Alcalde, of Madrid, showed an iron crown found in a Spanish cloister which was credited with the power of curing diseases of the head and mental disorders; Dr. Bugiel described the life of the Polish students at the Paris Faculty of Medicine in the thirteenth, fourteenth, and fifteenth centuries; Dr. J. B. Hurry contributed a paper on J-Em-Hetep, Prime Minister to King Zoser and afterwards the medical god of Egypt; Dr. A. De Peyer, the general secretary of the Congress, read a communication from Prof. Pierre Gautier on the history of typhoid fever in the child, and himself contributed a paper on his ancestor, Johann Conrad Peyer, a seventeenth-century physician of Schaffhausen, who has given his name to the patches of lymph follicles in the small intestine.

The next Congress of the History of Medicine will be held in July 1927 at Leyden, under the presidency of Dr. J. G. de Lint.

## Economic Problems.

THE proceedings of Section F (Economic Science and Statistics) of the British Association were marked this year by the variety and the number of the topics discussed. They were noticeable also in that a lady economist, Miss Lynda Grier, occupied the presidential chair of the Section. Taking "The Meaning of Wages" as the subject of her address, Miss Grier stated that it was not her intention to put forward a new theory of wages but rather to analyse and restate certain aspects of the wages problem under the three headings: (1) the distributive or competitive aspect, (2) wages as the product of the worker, and (3) the effect of the wages paid on the work and the supply of workers. We are being forced increasingly to discuss, she remarked, those measures which attempt to add to the normal wage rate or to "stretch" the rate so that it will pay for things that it did not previously pay for. Such measures include schemes for fixing minimum wage rates which do not increase productivity; cost of living sliding scales; systems of family allowances; compulsory insurance schemes, and schemes for subsidising certain sections of the wage-earners of the community.

In opening a joint discussion with the Agricultural Section on the "Marketing of Agricultural Products" Mr. R. B. Forrester said that in Britain very little serious attention has as yet been directed to the examination and analysis of marketing methods. Recent developments in other countries seem to show that a widespread tendency has set in towards improvement of marketing methods by means of control of quality and the setting up of grades or standards. So far, this has been especially associated with the efforts of the farmers themselves, though government action has been of great help in providing scientific assistance and impartial inspection. It would seem that the British producer will also be compelled to give attention to marketing developments, which so closely affect competition in the home market. No alterations of a radical character are, however, to be expected in Great Britain unless they have the support of the farmers themselves, since changes in marketing are bound to involve important modifications in the system of production.

A young Swedish economist, Mr. Fabian v. Koch, gave an interesting account of unemployment relief in Sweden. The abnormal conditions of the post-War period are now practically at an end in that country. No insurance scheme has been initiated, though a provisional and restricted system of unemployment relief has been organised. The available funds have gone for the most part to State relief work, and only a small fraction has been devoted to the granting of doles or unemployment benefit. The principle has been accepted that relief work wages shall in all cases and localities be less than the ordinary wages that are paid.

Dealing with "The Economics of Family Endowment," Mrs. Stocks asserted that inadequate attention has been given by theoretical economists to the problem of the family and its place in the economic structure. But, from recent statistical and social investigations, the fact has emerged that current output is insufficient to ensure the payment of a living wage so long as wages are paid at a flat rate without respect to the family responsibilities of the wage-earner. This is the basis of the plea for family endowment and the argument on which its advocates base their case.

## The North Atlantic in Tertiary Times.

THE resemblances between the Tertiary faunas of the West Indies and those of the Mediterranean region have long been noticed and have been taken to indicate the former existence of shallow water across the Atlantic from the West Indies to Northern Africa, along which the migration of animals could take place. This subject, so far as the Miocene and Pliocene periods are concerned, has been more fully investigated by W. P. Woodring (Bull. Geol. Soc. America, 35, 1924, pp. 425, 867), who finds that the resemblance of the Miocene mollusks of the West Indies to those of the Mediterranean area is even closer than was formerly supposed—the resemblance being particularly striking to the fauna of the Piedmont basin of Italy. The similarity reached its maximum in the Helvetian period, when the Miocene transgression of the sea was at its greatest in both regions.

The Miocene faunas of the east coastal part fo North America give clear evidence of the existence of climatic regions; in fact the distinction between tropical, sub-tropical, and temperate faunas is almost as striking as at the present day. It is therefore only natural that some differences should be found between the Miocene faunas of the Mediterranean and those of the West Indies; the former include temperate elements which are unknown in the latter and give them a sub-tropical aspect. The Mediterranean faunas are also characterised by the large number of exotic genera. The fact that so many genera, belonging to many different families, are common to both regions can scarcely be explained except by migration.

It is evident that this migration of tropical or sub-tropical genera could not have taken place along the northern border of the Atlantic; and Woodring concludes that there must have been series of shoal-water banks or islands extending across the southern part of the North Atlantic in Miocene times, but that these disappeared in late Miocene or Pliocene times, when the resemblances between the faunas of the two regions diminish. The present configuration of this part of the Atlantic floor, however, shows no sign of the former existence of shallow water or islands. In the Mediterranean region the sub-tropical faunas of the Miocene and Pliocene periods were replaced in Quaternary time by a temperate fauna coming from the North Atlantic.

In a later memoir, Woodring (Carnegie Institution, Publ. 366, 1925) describes the Miocene lamellibranchs and scaphopods from Bowden, Jamaica, and expects in a subsequent part to discuss the character and significance of the fauna. Dr. T. Wayland Vaughan has on more than one occasion pointed out resemblances between the coral faunas of the western side of the Atlantic and those of the Mediterranean region in Eocene, Oligocene, and Miocene times. In a short paper (Bull. Geol. Soc. America, 35, 1924, p. 823) he recurs to this subject and states that in the West Indies the resemblance is greatest (1) between the Upper Eocene of St. Bartholomew and the Priabonian of Northern Italy, and (2) between the Oligocene of Antigua and the Rupelian of Northern Italy.

## Engineering and Shipbuilding.

THE causes of the present depression in engineering and shipbuilding and ways and means of mitigating the results formed the subject of the address delivered by Sir Eustace H. Tennyson d'Eyncourt on October 16, as president of the North-east Coast Institution of Engineers and Shipbuilders. Employers and employees, manufacturers and owners must pull together and not attempt to row the boat in opposite directions; this is especially necessary now, since there has never before been a time when such strenuous efforts were being made to stir up strife. One of the chief causes of the present trouble is the over-production which took place in the later years of the War and immediately following. There is little doubt that many of the vessels laid up at present are old, or becoming obsolete, and probably will never be put in service again.

Improvements in machinery and other features of ships are so rapid that older vessels soon have to give way to more up-to-date craft which can be run more economically. Higher steam pressures will come, and we shall soon see boilers and turbines with at least double the usual present-day pressure—one vessel is now being built on the Clyde, for passenger traffic there, with high-pressure boilers and turbines. Our knowledge of the best dimensions for propellers has been considerably added to, as has also the improvement in the form of the hull, on both of which important work has been done at the Froude Tank at the National Physical Laboratory, and at other tanks.

In the construction of the hull there is room for considerable improvement in steel. The ordinary mild steel has remained practically unchanged in quality during this century. Special attention has been given to high-tensile steel in the Navy, and Sir Eustace thinks that steel of improved quality could be made and adopted at any rate for the more important portions of the structure of merchant ships.

Labour questions, including that of the loss of many of our highly skilled men who have gone to other countries, were also touched upon. The present conditions are jeopardising the supremacy of our industries, and Sir Eustace thinks that the whole position is more clearly understood by other nations, both on the Continent and in the United States. He has made a close study of relative costs, and thinks that the low prices which can be accepted abroad are due to a combination of factors—longer hours and slightly lower wages; lower rates and taxes; more elasticity allowed to workmen doing various kinds of work; full advantage taken of labour-saving appliances; many of the materials used are somewhat less costly; less elaborate and expensive ship's fittings are accepted by owners. In fact, a somewhat lower standard of living is accepted by the workers, and a lower standard of article by the purchasers.

---

## University and Educational Intelligence.

BIRMINGHAM.—Prof. F. W. Burstall, for some time Dean of the Faculty of Science, has been appointed Vice-Principal, in succession to Sir William Ashley, who resigned at the end of last session.

The Walter Myers Travelling Studentship (value 300*l*. for one year) has been awarded to Miss Edythe Milne Bankier.

The date of the celebration of the Centenary of the Medical School is fixed for December 8 next, but arrangements for the celebration are not yet complete.

CAMBRIDGE.—On November 3 the Senate discussed some of the statutes proposed by the Royal Commission, and many points were raised. Among them was the suggestion that the Forestry Department should be made a part of the Faculty of Agriculture. Some speakers felt that it was unfair to place a limit on the period of tenure of demonstratorships.

The Council of the Senate has presented a report in which it is pointed out that whereas the possession of a Cambridge degree is supposed to signify that the bearer has participated in the life of the University, it is now possible in certain circumstances for research students to obtain degrees after only three terms of residence. It is proposed that the new statutes shall require at least five terms of residence, a scheme which would undoubtedly enhance the value of research degrees. Concessions would be made to graduates of Oxford and Dublin.

It is proposed that a committee of management shall be set up to deal with the Polar Research Institute, for which 13,000*l*. was provided from the Captain Scott Memorial Fund.

Dr. Dean, professor of pathology, and Mr. T. Knox Shaw, tutor and mathematical lecturer of Sidney Sussex College, have been elected members of the Council of the Senate.

Among the fellows recently elected at St. John's College were Dr. F. H. Constable (biochemistry) and Messrs. E. G. Dymond and T. G. Room (mathematics).

Mr. H. Godwin has been elected to a fellowship at Clare College. Mr. Godwin was formerly a scholar of the College and is now junior (University) demonstrator in botany; he is carrying on research work on the respiration of leaves.

Queens' College now elects its entrance scholars on the results of the Higher School Certificate Examinations; of the five elections recently announced, one is for science and one for science with mathematics. At Pembroke College, of eight 80*l*. exhibitions announced last week, two were for mathematics and two for science.

Applications are invited for the Pinsent-Darwin Studentship in Mental Pathology. The studentship is of the annual value of about 200*l*. and is tenable for three years. Further particulars may be obtained from the Registrary of the University of Cambridge, and applications for appointment should be sent before December 1 to the Secretary, Pinsent-Darwin Studentship, Psychological Laboratory, Cambridge.

LONDON.—Applications are invited for the Rogers prize for 1926 for the best essay on "The Value of the Various Methods of investigating Diseases of the Pancreas." The value of the prize is 100*l*., and the competition is open to all whose names appear on the Medical Register of the United Kingdom. Information can be obtained from the Academic Registrar, University of London, South Kensington, S.W.7.

ST. ANDREWS.—Dr. F. Nansen has been elected Rector of the University to succeed Dr. Rudyard Kipling. The following appointments have been made by the University Court: Mr. H. J. R. Kirkpatrick to be lecturer in regional anatomy and assistant to the Bute professor of anatomy in the United College; Mr. D. L. Pritchard to be assistant in mathematics, and Dr. Margaret Scott Dickson, assistant in public health.

The degree of D.Sc. has been conferred on Mr. R. S. Vaidyanathaswamy, of Madras, for a mathematical thesis entitled "Studies in Form-Theory."

---

THE British Research Association for the Woollen and Worsted Industries announces the following awards for the year 1925–26 :—Research fellowships to Mr. J. R. Nichols, to enable him to continue his reaearches at the animal Breeding Research Department of the University of Edinburgh, on the fibres of various breeds of sheep ; and to Miss J. S. S. Blyth, to conduct research at the Animal Breeding Research Department, Edinburgh, on the microscopical examination of the fleeces of British breeds of sheep ; advanced scholarships to Mr. H. S. Bell, at the University College, Nottingham, and to Mr. W. Riddle. at the Scottish Woollen Technical College, Galashiels.

FOR the sixth year in succession, Trinity College, Cambridge, announces the offer of a Research Studentship open to graduates of other universities who propose to come to Cambridge in October next as candidates for the degree of Ph.D. The value of the studentship may be so much as 200*l.* a year. Applications must reach the Senior Tutor by July 25, 1926. The College is also offering, as usual, Dominion and Colonial Exhibitions of 40*l.* or (in cases of special need) about 72*l.* to students of Dominion and Colonial universities who wish to come to Cambridge next October as candidates for the degree of B.A., M.Litt., M.Sc., or Ph.D. Candidates must apply through the principal authority of their university, and applications should reach the Senior Tutor (from whom further particulars may be obtained) by July 1, 1926.

TRAVELLING studentships for university graduates are provided on a remarkably liberal scale by the National University of Ireland. In the new Calendar, particulars are given of five such studentships of the value of 200*l.* each, open to graduates of the University, offered in the following subjects for competition in 1926: economics, experimental physics, agriculture, physiology, and modern languages (two of—English, French, and German). Reference is still made in the Calendar to the Royal College of Science, Dublin, as an institution at which may be taken the practical course required to be pursued in the second year of the course for the bachelorship in engineering. We understand, however, that the buildings and equipment are being transferred to University College, Dublin.

THE Charles' University (Universita Karlova) of Prague has published in English a prospectus, specially prepared for foreign students, of its Faculty of Science. It offers a doctorate in science (Rerum Naturalium Doctor) on conditions which do not necessarily involve a knowledge of the Czech language or a prolonged stay in the country. Any part of the required four or five years of university work may be taken at any university of recognised standing, the thesis may be in English, French, German, or Russian, and the two (oral) examinations may be conducted in any of these languages. The thesis must embody the results of original research constituting a distinct advancement of science. Among the departments in which facilities for specialist study and research are offered are those of meteorology, pharmaceutical botany, anthropology and demography, photography and photochemistry, methodology and history of the natural sciences and of the exact sciences. The University maintains a Department of Athletics and Physical Training which offers, free of charge to students, facilities for football, swimming, rowing, tennis, ski-ing, skating, etc., and the Faculty of Science arranges ski-ing parties for which special reduced student rates for railway journeys and hotel accommodation are obtainable. Special arrangements are made by the student body for welcoming foreign students and helping them to find suitable accommodation.

## Early Science at Oxford.

**November 15, 1687.** A letter was read from Dr. Garden concerning the formation of animals. In which he reconciles the opinions concerning the formation ex Animalculis and ex Ovo, in these positions : first animals are formed ex Animalculis, 2d that these Animalculà are in semine Marium et non in fæminis ; 3dly that the ovum fæminarum is this nidus requisite to the production of the animals.

There was also read a relation of a dismall tempest at Hullavington, communicated by Mr. Cole of Bristoll.

**November 16, 1683.** Dr. Plot shewed us ye two peices of a magnet, which he had lately cut *secundum Æquatorem* ; they were now two Magnets, and referred to one another, as when they were one whole ; contrary to what was found in ye division *secundum Meridianum.*—And, with Dr. Tyson, he gave an account of Hair-balls. 'Twas observed that ye grain of ye hair, was all one way, which was caused (possibly) by ye motion of ye ball in ye stomach.

Mr. Piggot read an account of Chylification, which was put into his hands by a freind of his, who desires to be anonymous to us : the Author says, he has a liquor, some few drops of which will turn spittle, ye broths of beef, mutton, and veal, as also ye flesh it self, to a white color ; arguing from thence, that probably ye great menstruum of ye stomach, may be of ye same nature, with his liquor ; Mr. Piggot says he saw these experiments tried with success.

**November 16, 1686.** An account of one Mrs. Brown in Oxford who dyed of a *dropsie*, out of whose body was taken by measure 16 gallons of water wanting a quart, all contained in one great bag which was continued with the ovarium.

An account was received from Mr. Halley of a *little man*, lately presented to the French king, being 37 years old, and with a great beard, and yet but 16 inches high. Likewise of a transparent substance lately invented in France, made out of Hogs *bladders*, fit to be used instead of coach glasses because it will not break.

An account of an experiment made at the spire of the Cathedral in new Sarum, Nov. 1684, with the *Baroscope* by Colonel Windham and Mr. Warner.

**November 17, 1685.** Mr. Bobart presented a catalogue of ye leaves and seeds of plants lately brought from St. Christopher's and shewn us ye last meeting.

Mr. Pigot junior informed ye Society, that not long since he opened a dog by entering ye abdomen a little above ye Os Pubis according to Dr. Lister's direction ; ye dog was kept above a fortnight after this, (in which time he recovered gradually) and then ran away. Mr. Pigot farther informs ye Society that in a late dissection of a dog he observ'd Lacteals to rise from ye bottom of the stomach, contrary to the opinion of some late anatomists.

Dr. Plot comunicated ye *Byssus marinus* of a *Pinna marina* mentioned by Rondelet.

**November 18, 1684.** A letter from Mr. Aston was read, giving an account of severall experiments mentioned in a book lately written by Kunckell, being sent over by ye Elector of Brandenburg, these experiments were ordered to be tried : Mr. Desmastres took ye trouble upon him.

A letter from Mr. Packer, Physitian at Reading, mentions a hollow oak, not far from Early Court in Berk-shire, which, as he is inform'd, is 18 yards in compass at ye bottom, but lessens apace from ye ground. He promises a full account of this thing as soon as his occasions will suffer him.

## Societies and Academies.

### LONDON.

Royal Society, November 5.—L. **Ballif**, J. F. **Fulton**, and E. G. T. **Liddell**: Observations on spinal and decerebrate knee-jerks, with special reference to their inhibition by single break-shocks. Simultaneous mechanical torsion-wire myograph and electrical records have been obtained of knee-jerks in decerebrate and spinal preparations. The spinal knee-jerk differs from the decerebrate: the mechanical response of the spinal jerk is two to three times longer in duration than that of the decerebrate jerk (or the motor twitch); the curve of relaxation of the spinal jerk is different; the electrical response tends to be more prolonged in the spinal knee-jerk; the interval between the tap and the electrical response is greater in the spinal preparations; and the spinal jerk is more difficult to elicit. The shortest spinal knee-jerk observed seems to be produced by a repetitive discharge of at least 4 to 8 volleys of impulses recurring somewhat asynchronously at 100 to 200 per sec. Both spinal and decerebrate knee-jerks may be inhibited by a single appropriately timed break-shock applied to an ipsilateral afferent nerve, the former much more readily than the latter. When recovering from an inhibition, the spinal knee-jerk has the same duration as a twitch or a decerebrate knee-jerk.—K. **Furusawa**: (1) Muscular exercise, lactic acid, and the supply and utilisation of oxygen. Pt. xiii. The gaseous exchanges of restricted muscular exercise in man. A simple ergometer, capable of being worked at any speed by the arms, has been constructed. As regards oxygen requirement, there is a marked optimal speed but no optimal load. Oxygen intake rises much more slowly to its maximum value than it does in the case of exercise involving most of the muscles of the body. It seems that lactic acid produced in excess by violent activity of a localised group of muscles may diffuse from them into the blood, and thence to other parts of the body (particularly resting muscles and liver), and there be removed or restored to glycogen under the influence of oxidation occurring in those tissues. There appears, therefore, to be possibility of an exhaustion due to complete using up of lactic-acid precursor, when the exercise involved is localised in a small group of muscles. (2) A spirometer method of studying continuously the gaseous metabolism of man during and after exercise. A new method is described of studying continuously the rapidly altering gaseous metabolism of man during and after muscular exercise. A spirometer of large capacity is used, the gases inside it being kept continuously stirred, the total ventilation being measured every 10 litres, and samples being abstracted at intervals for analysis.—D. T. **Harris**: The effect of light on the circulation. Irradiation of a localised area of skin with ultra-violet energy causes a widespread peripheral vaso-dilation. Consequently, only a very slight transitory rise of blood-pressure results from the small increase in pulse rate of from two to five per minute in dark and white subjects respectively. The reaction was always less in pigmented subjects. The vaso-dilator response to ultra-violet radiation is enhanced by a previous exposure; this is not the case with radiant heat. The vascular response appears to be a nervous reflex initiated by a nocuous stimulus; the whole phenomenon is one of incipient injury.—A. V. **Hill**: The surface tension theory of muscular contraction. The amount of lactic acid liberated when a muscle fibre 1 cm. long develops a force of 1 dyne is $1{\cdot}46 \times 10^{-11}$ gm. This is very nearly $10^{11}$ molecules. Spread out in a continuous mono-molecular film these would occupy about $2{\cdot}1 \times 10^{-4}$ sq. cm. If the mechanical response of muscle were due to a change of surface tension caused by such a film, the coefficient of surface tension required would be about 4800 dynes per centimetre. This is about 230 times the tension of a water—olive-oil interface, clearly an impossible value. Reckoned per gm. of muscle, the amount of lactic acid liberated in a maximal contraction of a frog's muscle is about 0·033 mgm., which would occupy an area of about 470 sq. cm.; *i.e.* about the surface area of the fibres composing the muscle.—J. F. **Fulton** and E. G. T. **Liddell**: Electrical responses of extensor muscles during postural (myotatic) contraction. Simultaneous mechanical and electrical records have been obtained of the responses of quadriceps femoris and rectus femoris of decerebrate cats to various forms of postural (myotatic) reflex. The knee-jerk seems to be produced by a somewhat asynchronous volley of impulses. The comparative absence of electrical responses in stretch reflex is due to complete asynchronism of afferent stimuli, for when a large number are recruited synchronously an action current invariably occurs. Since the exaggerated stretch reflex characteristic of the decerebrate condition is in large measure responsible for rigidity of extensor muscles in the decerebrate animal, we have inferred that these sustained postural reactions are produced by asynchronous all-or-nothing contractions of individual muscle fibres rather than by hypothetical fixing mechanisms.—L. N. **Katz**: On the supposed pluri-segmental innervation of muscle fibres. In the frog, when the two components of the sciatic nerve are stimulated in succession in an isometric tetanus, the sum of the tension developed is considerably greater than the tension produced when both components are stimulated simultaneously. The total heat developed on stimulating the two components of the sciatic nerve separately is, however, the same as that produced when they are stimulated simultaneously. This indicates that there is no pluri-segmental innervation of frog's muscle fibres apart from possible infrequent chance variations.—L. N. **Katz** and C. N. H. **Long**: Lactic acid in mammalian cardiac muscle. Pt. i. The stimulation maximum. The mammalian heart is dependent on its contemporary oxygen supply, and fails rapidly in its absence; the skeletal muscle, on the other hand, is independent at first of its contemporary oxygen supply. The data obtained from cats and rabbits show that the mean lactic-acid stimulation maximum of the heart is approximately one-third that of the skeletal muscle. The maximum "oxygen-debts" of these two tissues should therefore be in the same ratio.—H. J. G. **Hines**, L. N. **Katz**, and C. N. H. **Long**: Lactic acid in mammalian cardiac muscle. Pt. ii. The rigor mortis maximum and the normal glycogen content. The rigor mortis maximum, or the caffeine rigor maximum, of lactic acid in the heart is only half that in the skeletal muscle. A lack of lactic-acid precursor is not the cause of the relatively low stimulation maximum in the heart. The glycogen content of the heart is much smaller than that of skeletal muscle in well-fed cats. There is in the heart a greater discrepancy between resting glycogen content and the lactic acid produced in rigor mortis, than there is in skeletal muscle. It indicates that a greater portion of the lactic-acid precursor of the heart is in some other form than glycogen.—Phyllis **Kerridge**, L. N. **Katz**, and C. N. H. **Long**: Lactic acid in mammalian cardiac muscle. Pt. iii. Changes in hydrogen-ion concentration. The hydrogen-ion concentration of cardiac and of skeletal muscles stimulated to fatigue are different; the difference is of the order of 0·2$p$H, the skeletal muscle being the more acid. In rigor mortis the difference is of the order of 0·4$p$H, the skeletal muscle being the more acid. Cardiac and skeletal muscle have different buffering powers which vary at different $p$H's. The maximum difference is at approximately 6·3$p$H, when the ratio of the buffering power of skeletal to that of cardiac muscle is about 2 : 1.—W. E. **Garner**: The mechanism of muscular contraction. It is suggested that the tension generated on applying a stimulus to a muscle fibre is due to the formation of a solid film on the surfaces of the ultimate fibrils of the muscle. Liquid crystals composed of long-chain carbon compounds are present in the anisotropic segments of the muscle, and the molecules of the long-chain carbon compounds are orientated with their chains in a direction parallel to the axis of the fibre. It is suggested that glycogen is converted into sodium lactate according to the series of reversible reactions

$$A \rightleftharpoons B \rightleftharpoons \text{lactic acid},$$

where A is a product formed from glycogen and B is an intermediate active form of both A and lactic acid. The direction of the chemical reaction may be influenced by alteration of the surface energy of the membranes during movements of the muscle. When the energy liberated during the conversion of glycogen into lactic acid is not utilised in doing external work, it may be stored, in part, by a reversal of the reactions.—R. W. **Riding** and E. C. C. **Baly**: The occurrence of helium and neon in vacuum tubes. [Proc. A 749 (September), pp. 186-193.]—O. W. **Richardson**: Structure in the secondary hydrogen spectrum (iii.). [Proc. A 750 (October), pp. 239-266.]—T. R. **Merton** and J. G. **Pilley**: On the excitation of the band spectrum of helium. [Proc. A 750 (October), pp. 267-272.]—H. **Hartley** and J. E. **Fraser**: The conductivity of uni-univalent salts in methyl alcohol at 25° C. [Proc. A 750 (October), pp. 351-368.]—C. S. **Beals**: The arc spectrum of palladium. Its Zeeman effect and spectral type. [Proc. A 750 (October), pp. 369-384.]—N. **Ahmad**: Further experiments on the absorption and scattering of $\gamma$-rays. [Proc. A 749 (September), pp. 206-223.]—R. A. R. **Tricker**: A determination of the variation of the mass of the electron with velocity, using homogeneous $\beta$-rays. [Proc. A 750 (October), pp. 384-396.]—E. H. **Boomer**: Experiments on the chemical activity of helium. [Proc. A 749 (September), pp. 198-205.]—R. M. **Wilmotte**: On the construction of a standard high-frequency inductive resistance and its measurement by a thermal method. [Proc. A 751 (November), pp. 508-522.]—R. B. **Brode**: The absorption coefficient for slow electrons in the vapours of mercury, cadmium, and zinc. [Proc. A 750 (October), pp. 397-405.]—P. **Kapitza** and H. W. B. **Skinner**: The Zeeman effect in strong magnetic fields. [Proc. A 749 (September), pp. 224-239.]—F. R. **Weston**: The flame spectra of carbon monoxide and water gas. Pt. ii. [Proc. A 751 (November), pp. 523-526.]—H. S. **Hirst** and E. K. **Rideal**: The thermal decomposition of nitrogen pentoxide at low pressures. [Proc. A 751 (November), pp. 526-540.]—R. W. **Gurney**: The number of particles in the beta-ray spectra of radium B and radium C. [Proc. A 751 (November), pp. 540-561.]

### MANCHESTER.

**Literary and Philosophical Society**, October 27.—S. J. **Hickson**: The life and work of Georg E. Rumphius (1627–1702). Among the early pioneers of the sciences of botany and zoology, Georg Everard Rumph (or Rumphius) occupies a prominent if not an outstanding position. His work was done in the remote island of Amboyna in the Malay Archipelago, but owing to a series of calamities only his two books, "Het Amboinsche Kruidboek" and "D'Amboinsche Rariteitkamer," were preserved in a form sufficiently complete for publication. His three books on the land, air and water animals of Amboyna were lost, as were also the greater part of his books on the history of the island and the description of the country. Rumphius was born and educated in Hanau, a German city, but there is reason to believe that his family was of Dutch descent. The date of his birth must have been either 1627 or 1628. He arrived eventually in Amboyna in 1653, at the age of about twenty-six years. He exchanged from the Dutch army into the Civil Service and settled down as a Resident in the northern province of Hitoe of the island of Amboyna, and it was in the capital town, Hila, on the sea coast of this beautiful island, that the greater part of his work was done. For some years his life appears to have been happy and uneventful, but in 1670, when he was forty-three years of age, he became totally blind by cataract in both his eyes. He was removed to Amboyna, but with the help of his son Paul continued his work until his death in 1702. In 1674 his wife and youngest daughter were killed in the terrible earthquake that ravaged the island in that year. In 1687 many of his books, manuscripts and drawings were destroyed in a disastrous fire that burned down his house, and to complete the misfortunes of this most unfortunate man, the whole of the original manuscripts and drawings of the first six books of his Amboyna Herbarium were lost when the ship *Waterland*, in which they were being conveyed to Holland, was captured by the French and destroyed. Fortunately, by the order of the Governor-General a complete copy of this work was made before it left Java, and this copy reached Holland in safety.

### PARIS.

**Academy of Sciences**, September 28.—F. E. **Fournier**: The prevention of collisions at sea. The international rules at present in force are insufficient to prevent collisions between vessels during fog. A scheme of wireless signals giving greater security is suggested.—H. **Deslandres**: Complementary researches on the structure and distribution of band spectra. On the basis of the data of Coblentz on infra-red spectra, the author finds confirmation of his general formula given in earlier communications.—E. **Bataillon**: The first parthenogenesic kineses in *Bufo vulgaris* and the mechanism of the regulation.—A. S. **Besicovitch**: Some points in the theory of nearly periodic functions.—F. **Carlson**: Some mean values of an analytical function.—Jean **Dufay**: The polarisation of the zodiacal light. Visual observations have given contradictory results regarding the polarisation of the zodiacal light. The author has made use of a photographic method, details of which are given, and finds that his results confirm the view generally held, that the zodiacal light is only diffused solar light.— — **Arabu**: The tectonic of the field of faults of Ribeauvillé (Haut-Rhin) to the north of Strengbach.

### WASHINGTON, D.C.

**National Academy of Sciences** (Proc. Vol. 11, No. 9, September).—C. Dale **Beers**: Encystment and the life cycle in the ciliate *Didinium nasutum*. Under favourable and adequate conditions, there is no definite life cycle, and encystment does not occur periodically. Scarcity of food causes the formation of cysts which are all considered to be protective in nature. Excretion products of Paramœcium inhibit encystment: excretion products of Didinium promote it.—Sophia **Satina** and A. F. **Blakeslee**: Studies on biochemical differences between (+) and (−) sexes in Mucors: tellurium salts as indicators of the reduction reaction. Of the 264 heterothallic races of Mucor examined, the (+) races show a higher average power of reducing certain tellurites and selenites than the (−) races. This reducing power seems to be influenced by the sex differential, but other non-sexual factors exert an influence which varies from race to race.—Howard B. **Frost**: Tetraploidy in Citrus. "Thick-leaved" citrus appears to be tetraploid (18 chromosomes, but the number is very variable), the doubling of the chromosome number taking place in the nucellus or in the very young embryo.—C. E. **Seashore** and Milton **Metfessel**: Deviation from the regular as an art principle. Emotion in music is expressed by slight deviation from the exact and can be analysed by photographing the sound waves. These records show the character of the vibrato used to express emotion in singing, and indicate how various singers obtain their effects by gliding to a note, attacking it, correcting for illusions of hearing by singing what is actually a wrong note, and making slight deviations from exact time.—C. E. **Seashore**: The rôle of mental measurement in the discovery and motivation of the gifted student. A new type of senior high school examination testing training and aptitude gives a forecast of probable success in college. This is followed by a freshman examination in each subject, which makes possible the immediate organisation of sections on the basis of fitness. These records give a trustworthy measure of each student's capacity.—G. A. **Miller**: Arithmetisation in the history of mathematics.—Francis G. **Benedict**: Skin temperature and heat loss. Skin temperature surveys are made rapidly under various conditions by thermo-junction; heat loss is measured by pyranometer (for radiation) and calorimeter chamber (total). Generally there is distinct correlation for all parts of the body, for skin temperature and temperature of the environment. As regards radiation of heat, the human skin seems to act as a true "black-body." Except under exceptional conditions, heat production and heat loss are essentially independent processes.—A. J. **Dempster**: The passage of slow canal rays through hydrogen. Protons of velocity $4 \cdot 16 \times 10^7$ cm. per sec. (900 volts) pass through many molecules without causing ionisation or exciting light.—George Porter **Paine**: Energy transformations in an unobstructed air current, in an air current containing a dry obstacle, and in an air current containing an evaporating surface; with applications to an aerodynamic psychrometer and to the measurement of atmospheric humidity.—Samuel K. **Allison** and Alice H. **Armstrong**: Note on the experimental determination of the relative intensities of some of the molybdenum and copper $K$ series lines and the tungsten $L$ series lines.—P. A. **Ross**: (1) X-rays scattered by molybdenum. The radiation scattered from the molybdenum shield of the cathode of a standard tungsten tube and of a water-cooled molybdenum tube was examined by an ionisation spectrometer. In each case the measured change of wave-length agreed well with that calculated from Compton's theory of scattering. (2) Ratio of intensities of unmodified and modified lines in scattered X-rays. A photometric study was made of numerous spectrograms and some of Compton's results were incorporated. There is roughly a linear relation between atomic number and the ratio of the intensities.—Ernest **Merritt**: The effect of light on the behaviour of selenium contact rectifiers. The high resistance of the selenium contact and the tendency of the surface to deteriorate make it unlikely that it will prove of value in radio work. Illuminating the contact has different effects on the rectified current according to the contact pressure and other circumstances.—Carl **Barus**: The acoustic pressure in tubes capped by high resistance telephones, vibrating in different phases.

## Official Publications Received.

Department of Commerce: U.S. Coast and Geodetic Survey. Serial No. 269: Geographic Dictionary of the Virgin Islands of the United States. By James William McGuire. (Special Publication No. 103.) Pp. iii+211. 25 cents. Serial No. 311: Tides and Currents in San Francisco Bay. By L. P. Disney and W. H. Overshiner. (Special Publication No. 115.) Pp. iv+125. 20 cents. (Washington: Government Publishing Office.)

The Indian Forest Records. Silviculture Series, Vol. 12, Part 1: Volume and Outturn Tables for *Sal* (*Shorea robusta*). By S. H. Howard. Pp. iv+87+7 plates. (Calcutta: Government of India Central Publication Branch.) 1.2 rupees; 2*s*.

Peradeniya Manuals, 3: Bibliography of Books and Papers relating to Agriculture and Botany to the end of the Year 1915. By T. Petch. Pp. ii+256. (Peradeniya: Department of Agriculture.) 2.25 rupees; 3*s*.

University College of Swansea. Prospectus of the Department of Engineering for the Session 1925–26. Pp. 68+2 plates. (Swansea.)

Proceedings of the United States National Museum. Vol. 66, Art. 33: Notes on the Fishes of Hawaii, with Descriptions of Six new Species. By Eric Knight Jordan. Pp. 43+2 plates. (Washington: Government Printing Office.)

Report of the Aeronautical Research Institute of Tôkyô Imperial University. Vol. 1, No. 11: On the Valve Method of Measuring small Motion, with Special Reference to the Precise Recording of Sounds, Pressure-Variations and Vibrations. By Jûichi Obata and Yahei Yoshida. Pp. 305-319+4 plates. (Tokyo: Maruzen Kabushiki-Kaisha.) 80 sen.

Canada. Department of Mines: Geological Survey. Memoir 145, No. 125 Geological Series: The Palæozoic Outlier of Lake Timiskaming, Ontario and Quebec. By G. S. Hume. Pp. ii+129+16 plates. (Ottawa: F. A. Acland.) 35 cents.

Canada. Department of Mines: Geological Survey. Summary Report, 1924, Part A. Pp. 159A. (Ottawa: F. A. Acland.)

Ministry of Finance, Egypt: Survey of Egypt. Survey of Egypt Paper No. 39: Determination of the Exact Size and Orientation of the Great Pyramid of Giza. By J. H. Cole. Pp. 9+1 plate. (Cairo: Government Publications Office.) 10 P.T.

Battersea Polytechnic. Report of the Principal for the Session, 1924–25. Pp. 35. (London.)

Journal of the Marine Biological Association of the United Kingdom. New Series, Vol. 13, No. 4, October. Pp. 755-1021. (Plymouth.) 8*s*. net.

Experiment Station of the Hawaiian Sugar Planters' Association. Red-Stripe Disease Studies. By the Staff of the Department of Pathology. Pp. v+99. (Honolulu, Hawaii.)

## Diary of Societies.

*FRIDAY*, NOVEMBER 13.

ROYAL ASTRONOMICAL SOCIETY, at 5.—B. P. Gerasimovic: On the Masses of Stars of Spectral Types F to K.—W. M. H. Greaves: The Solar Motion from Stars of Spectral Types F to M.—W. J. Luyten: A List of Dwarf M Stars.—Prof. E. A. Milne: The Equilibrium of the Calcium Chromosphere (Second Paper).—W. M. H. Greaves and C. R. Davidson: Preliminary Note on the Determination of Effective Stellar Temperatures by the "Prism-across-Grating" Methods.—K. Lundmark and W. J. Luyten: The Relation between Mass and Luminosity.—K. Lundmark: Double Spiral Nebulæ.—Prof. A. S. Eddington: Electrostatic Forces in a Star and the Deviation from the Laws of a Perfect Gas.—W. M. Smart: A Comparison of Schlesinger's Proper Motions of the Harvard A.G. Zones with Proper Motions Photographically Determined at Cambridge.—Dr. H. Jeffreys: On the Surface Waves of Earthquakes.

*SATURDAY*, NOVEMBER 14.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS (North of England Branch) (at Newcastle-upon-Tyne), at 3.—J. A. B. Horsley: The Selection, Lay-out, and Maintenance of Electrical Equipments at Collieries.

INSTITUTE OF TRANSPORT (North-East Centre) (at Newcastle-upon-Tyne), at 3.—C. J. Allen: British Main Line Passenger Train Services.

INSTITUTE OF CHEMISTRY AND SOCIETY OF CHEMICAL INDUSTRY (Bristol and S.W. Section) (at University College, Exeter), at 7.30.—Dr. S. Glasstone: The Measurement of Over-Voltage.

PHYSIOLOGICAL SOCIETY (at Cardiff).

*MONDAY*, NOVEMBER 16.

ROYAL GEOGRAPHICAL SOCIETY (at Lowther Lodge), at 5.—F. Rodd: The Origin of the Tuaregs.

ROYAL SOCIETY OF MEDICINE, at 5.30.—Sir Arthur Keith: Man's Structural Defects (Lloyd-Roberts Lecture).

ROYAL AERONAUTICAL SOCIETY, at 6.—Informal Discussion on The Autogyro.

INSTITUTION OF ELECTRICAL ENGINEERS (Mersey and North Wales (Liverpool) Centre) (at Liverpool University), at 7.—T. Carter: The Engineer: his Due and his Duty in Life (Lecture).

INSTITUTION OF AUTOMOBILE ENGINEERS (Scottish Centre) (at Royal Technical College, Glasgow), at 7.30.—Capt. R. K. Hubbard: The Requirements of the Military Motor Vehicle.

ARISTOTELIAN SOCIETY (at University of London Club), at 8.—Dr. L. A. Reid: The Nature of Beauty.

FARADAY SOCIETY (at Chemical Society), at 8.—E. D. Campbell: A Chemical Theory of Remanent Magnetism.—Prof. J. R. Partington and N. L. Anfilogoff: An Improved Form of Electric Vacuum Furnace. —J. R. H. Coutts and E. M. Crowther: A Source of Error in the Mechanical Analysis of Sediments by Continuous Weighing.—D. Werner: A Simple Method of obtaining the Size Distribution of Particles in Soils and Precipitates.—J. A. V. Butler: Co-ordination and Co-valence.—F. G. Tryhorn and W. F. Wyatt: Adsorption by Charcoal from Alcohol-Benzene and Acetone-Benzene Mixtures.—F. L. Usher: The Nature of the Interfacial Layer between an Aqueous and a non-Aqueous Phase.

*TUESDAY*, NOVEMBER 17.

ROYAL STATISTICAL SOCIETY (at Royal Society of Arts), at 5.15.—G. Udny Yule: Why do we sometimes get Nonsense-Correlations before Time Series? A Study in Sampling and the Nature of Time Series (Presidential Address).

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—Secretary: Report on the Additions made to the Society's Menagerie during the month of October 1925.—Dr. G. D. Hale Carpenter: Speke's Tragelaph on the Sese Isles of Lake Victoria.—Dr. P. R. Lowe: On the Classification of the Tubinares or Petrels.—S. Hirst: On some New Genera and Species of Arachnida.—H. C. Wilkie: The Auditory Apparatus of the Common Mole (*Talpa europæa*).—J. R. Kinghorn: A New Genus of Sea Snake and other Reptiles collected by H.M.A.S. *Geranium* during a Cruise to North Australia.

INSTITUTION OF CIVIL ENGINEERS, at 6.—Prof. W. E. Dalby: The Mechanical Properties of Steel.

INSTITUTION OF ELECTRICAL ENGINEERS (East Midland Sub-Centre) (at the College, Loughborough), at 6.45.—J. A. Aiton: Steam Pipes for Extra High Pressure and Temperature.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Western Centre) (at 17 Albert Square, Manchester), at 7.—P. Dunsheath: Dielectric Problems in High-Voltage Cables.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—J. C. Dollman: Specialisation and Versatility.

INSTITUTION OF AUTOMOBILE ENGINEERS (Coventry Graduates Section) (at Broadgate Café, Coventry), at 7.15.—C. A. Gosling, C. Ballard, and others: Discussion on Traffic Control and Organisation.

INSTITUTION OF AUTOMOBILE ENGINEERS (Wolverhampton Centre) (at Wolverhampton), at 7.30.—Capt. R. K. Hubbard: The Requirements of the Military Motor Vehicle.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND (Glasgow), at 7.30.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Middlesbrough Branch) (at Cleveland Scientific and Technical Institution, Middlesbrough), at 7.30.—W. T. Butterwick: Tonnage.

ROYAL ANTHROPOLOGICAL INSTITUTE (Indian Section), at 8.15.—Dr. E. H. Hunt: Recent Work on Hyderabad Cairn Burials.

*WEDNESDAY*, NOVEMBER 18.

ROYAL METEOROLOGICAL SOCIETY, at 5.—Sir Gilbert Walker and E. W. Bliss: On Correlation Coefficients: their Calculation and Use.—Miss Catharine O. Stevens: Note on the Variations in Transparency of the Atmosphere observed by Means of a Projected Telescopic Image of the Sun.—N. L. Silvester: Notes on the Behaviour of certain Plants in relation to the Weather.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Prof. W. Wright: The Medieval Conception of the Anatomy and Physiology of the Central Nervous System (Thomas Vicary Lecture).

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—W. L. F. Nuttall: A Revision of the Orbitoides of Christmas Island (Indian Ocean).—W. Campbell Smith: The Volcanic Rocks of Christmas Island (Indian Ocean).

INSTITUTION OF CIVIL ENGINEERS (Students' Meeting), at 6.—J. Kennard: Address.

GLASGOW UNIVERSITY ALCHEMISTS' CLUB, at 7.30.—Dr. F. W. Aston: Isotopes.

INSTITUTION OF ELECTRICAL ENGINEERS (Sheffield Sub-Centre) (at Royal Victoria Hotel, Sheffield), at 7.30.

ROYAL MICROSCOPICAL SOCIETY, at 7.45.—M. T. Denne: A New Microscope.—S. Dickinson: A Simple Method of Isolating and Handling Individual Spores and Bacteria.—Dr. R. S. Clay and T. H. Court: Two Microscopes made by G. Adams for King George III.

ROYAL SOCIETY OF ARTS, at 8.—J. C. Goodison: The Furniture of Hampton Court.

ENTOMOLOGICAL SOCIETY OF LONDON, at 8.

INSTITUTE OF CHEMISTRY (Annual General Meeting).

SOCIETY OF GLASS TECHNOLOGY (at Leeds).

*THURSDAY*, NOVEMBER 19.

ROYAL SOCIETY, at 4.30.—J. W. Pickering and R. J. Gladstone: The Development of Blood Plasma. Part I. The Genesis of Coagulable Material in Embryo Chicks.—D. J. Scourfield: On a new Type of Crustacean from the Old Red Sandstone (Rhynie Chert Bed, Aberdeenshire), *Lepidocaris Rhyniensis*.—J. R. Norman: The Development of the Chondrocranium of the Eel (*Anguilla vulgaris*) with Observations on the Comparative Morphology and Development of the Chondrocranium in Bony Fishes.—J. Needham and Dorothy Needham: The Hydrogen-Ion Concentration and Oxidation-Reduction Potential of the Cell-Interior before and after Fertilisation: a Micro-Injection Study of Marine Eggs.—R. R. Armstrong: Studies on the Nature of the Immunity Reaction.—R. J. Ludford: The Cytology of Tar Tumours.—E. Ponder: The Inhibitory Effect of Blood Serum on Hæmolysis.—L. Brull and F. Eichholz: (*a*) The Effects of Calcium and Potassium Ions on Urine Secretion as studied in the whole Animal; (*b*) The Secretion of Inorganic Phosphate by the Kidney.—F. Eichholz, R. Robison, and L. Brull: Hydrolysis of Phosphoric Esters by the Kidney *in vivo*.

LINNEAN SOCIETY OF LONDON, at 5.—Dr. H. G. Holden and S. H. Clarke: On the Seedling Structure of *Tilia europæa* L.—L. R. Crawshay: On Sponge Fishery.—Dr. G. Claridge Druce: Recent Additions to the British Flora.

INSTITUTION OF MINING AND METALLURGY (at Geological Society), at 5.30.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—T. Carter: The Engineer: his Due and his Duty in Life (Lecture).

INSTITUTION OF AUTOMOBILE ENGINEERS (London Graduates Meeting) (at Watergate House, Adelphi), at 7.30.—S. C. Vince and C. F. Gifford: Modern Methods of Omnibus Chassis Overhaul.

CHEMICAL SOCIETY, at 8.—Prof. E. C. C. Baly and R. W. Riding: The Constitution of the Metallic Ozonides.—Prof. T. M. Lowry and I. J. Faulkner: Studies of Dynamic Isomerism. Part XX. Amphoteric Solvents as Catalysts for the Mutarotation of the Sugars.—Prof. T. M. Lowry and G. Owen: Studies of Valency. Part V. Absorption-Spectra of Halogen and Sulphonic Derivatives of Camphor. Origin of the Ketonic Absorption-Band.—Prof. T. M. Lowry and R. R. Sass: Studies of Valency. Part VI. General and Selective Absorption of Halogen-Derivatives of Methane. The Origin of General Absorption. —R. G. W. Norrish and G. G. Jones: Studies of Valency. Part VII. Surface Polarity and the Reaction of Ethylene and Chlorine. The Effect of the Adsorbed Water Layer.

ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE (Laboratory Meeting) (at London School of Hygiene and Tropical Medicine), at 8.15. —Demonstrations by Col. A. Alcock, Dr. A. Balfour, Dr. H. A. Baylis, Major K. K. Chatterji, Dr. A. Castellani, Dr. J. T. Duncan, Dr. T. Jeekes, Prof. R. T. Leiper, Dr. H. B. Newham, Dr. H. H. Scott, Lt.-Col. H. Marrian Perry, Dr. N. A. D. Sharp, Dr. J. G. Thomson, and Dr. C. M. Wenyon.

INSTITUTION OF MECHANICAL ENGINEERS (Birmingham Branch).—H. W. Coultas: Some Hydraulic Problems.

INSTITUTION OF MECHANICAL ENGINEERS (Glasgow Branch, jointly with Association of British Foundrymen (Scottish Section)).—Discussion on Cast Iron for Diesel Engines.

INSTITUTION OF MECHANICAL ENGINEERS (North-Western Branch, Graduates Section) (at Manchester).—Lt.-Col. E. Kitson Clark: Archæological Engineering (Annual Lecture).

*FRIDAY*, NOVEMBER 20.

ROYAL SOCIETY OF ARTS (Indian Section), at 4.30.—Prof. E. P. Stebbing: Recent Progress in Indian Forestry.

SOCIETY OF CHEMICAL INDUSTRY (Liverpool Section) (at Liverpool University), at 6.—Dr. A. Holt and others: Discussion on Chemical Journals and Chemical Societies.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—H. F. L. Orcutt: Characteristics and Uses of Ground Gears.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—A. C. Banfield: Honest Photography.

PHOTOMICROGRAPHIC SOCIETY (at 4 Fetter Lane), at 7.—Members' Evening.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—G. E. Wills: Dehydration of Tar.

*SATURDAY*, NOVEMBER 21.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Graduate Section) (jointly with Institute of Mining and Mechanical Engineers) (at Neville Hall, Newcastle-upon-Tyne), at 3.

BRITISH MYCOLOGICAL SOCIETY (at University College).

## PUBLIC LECTURES.

*SATURDAY*, NOVEMBER 14.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—R. A. Smith: Aspects of Roman London. II.

*MONDAY*, NOVEMBER 16.

GOLDSMITHS' HALL (E.C.2), at 4.—Sir Oliver Lodge: The Link between Matter and Matter (Norman Lockyer Lecture).

UNIVERSITY OF LEEDS, at 5.15.—Sir Charles F. Close: Some International Aspects of Geography.

*TUESDAY*, NOVEMBER 17.

KING'S COLLEGE, at 5.30.—Miss Hilda D. Oakeley: The Philosophy of Aristotle: Philosophy of the Universe: Nature: The First Mover.

GRESHAM COLLEGE (Basinghall Street), at 6.—A. R. Hinks: Meteorites and Meteors. (Succeeding Lectures on November 18, 19, and 20.)

*WEDNESDAY*, NOVEMBER 18.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Dr. C. W. Saleeby: The Rôle of Clothing in the Prevention and Arrest of Disease.

ROYAL SOCIETY OF MEDICINE, at 5.15.—Sir Wilfred Beveridge: Insects in Relation to Public Health (Chadwick Lecture).

*THURSDAY*, NOVEMBER 19.

BEDFORD COLLEGE FOR WOMEN, at 5.15.—Sir Robert Witt: Eighteenth-Century Art.

DYERS' HALL (Dowgate Hill), at 6.—Dr. E. F. Ehrhardt: The Patent Law as it affects the Dye-making and Dye-using Industries.

*FRIDAY*, NOVEMBER 20.

ROYAL SOCIETY OF MEDICINE, at 5.30.—Dr. Howarth: The Slaughtering of Animals for Human Consumption (Benjamin Ward Richardson Memorial Lecture).

*SATURDAY*, NOVEMBER 21.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—G. C. Robson: Animal Life in the Depths of the Sea.