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The Expert in the Civil Service.

CERTAIN important considerations in connexion with the position of the expert in the Civil Service are raised by the retirement of Sir Frank Baines from the position of Director of Works to His Majesty's Office of Works. Some months ago Sir Frank Baines was approached by a former First Commissioner of Works, Sir Alfred Mond, to undertake the construction of a headquarters on a site in Westminster for the Imperial Chemical Industries, Ltd. Sir Frank Baines applied formally for permission to add to his responsibilities in this way, and, following precedent, this permission was granted. Later, certain members of parliament discovered that the new building involved an outlay approaching one million pounds, and asked if an architect carrying out such a contract could devote his proper attention to his duties as a civil servant. The official reply to the first question, put on May 26, was to the effect that the Government had no right to interfere with the spare time activities of a civil servant, and that this particular contract would not militate against the efficient performance of Sir Frank Baines' official duties. Within a month the Government came to the conclusion that its Director of Works should either cancel his contract with Imperial Chemical Industries or retire from the Civil Service, although, as it was stated by the Government spokesman, Capt. Hacking, there was no suggestion that the work in connexion with the undertaking had so far interfered with the director's official duties.

Now it has been stated on several occasions within recent years that the professional, technical, and scientific staffs in the permanent employment of the State should have their pay and other conditions of service related to those of their professional brethren in outside practice. It was on those grounds that the Anderson Committee reported to Parliament in 1923 that no modifications in the pay or other conditions of service of professional civil servants need be made. Obviously, however, if the case of Sir Frank Baines is to be taken as a criterion, the conditions of service are not the same inside the Civil Service as in outside practice. An outside architect would feel at liberty to increase his practice to any extent, and would be the last person to suggest that he was not capable of undertaking any and every commission offered to him. London is full of monuments eloquent of the efficiency and energy of Sir Christopher Wren. Had the conditions of

our time made it possible for Imperial Chemical Industries to invite the Office of Works to undertake the contract for their new building, it is safe to say that no question would have been raised as to the capacity of the Director of Works to do the work without interfering with his other duties.

Without doubt the knowledge gained from long experience in a technical department of State, places the State servant in a position of advantage as compared with the private practitioner. Presumably, it is this knowledge which Sir Alfred Mond wished to put at the disposal of his company, just as the directors of the Bank of England have sought the services of Sir Otto Niemeyer, and the fortunes of Nobel Industries, Ltd. and later of a railway board have in turn been brought under the direction of Sir Josiah Stamp. But a nearer parallel to the case of Sir Frank Baines is to be found in the universities. At one time university professors were rarely consulted by industry or by the Government. Nowadays, largely as the result of the unique services rendered by university staffs to the country during the War, university men of science are being actively encouraged to undertake consulting and research work, for private firms and for the Government. Again, in the Report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1925–1926, special reference is made to the growing volume of work undertaken by Government scientific departments, particularly the National Physical Laboratory, on behalf of industry, and no suggestion is made that the quality of the work of the research staffs suffers in consequence of its increased responsibilities in this direction. Moreover, in the Report of the same committee for the year 1924–1925, reference is made to the increasing volume of consultative work for industrialists undertaken by the State-aided industrial research associations, work which would ordinarily have been done by private consultants.

Not only does the State encourage members of university staffs to undertake additional responsibilities, not only does it compete with the private consultant in industry, but it also appoints State servants to the boards of the State-subsidised industrial research associations in order that knowledge acquired in State departments should be made known and become available to our various industries. Within the past two or three years it has lent scientific workers to some of the great shipping companies to investigate the problems in connexion with the safe transport and storage of foodstuffs, and wholly maintains State research institutions for the primary object of assisting vital industries.

On account of an organised agitation, however, against the unique knowledge possessed by one of its principal technical experts being made available to an industrial combine, a new attitude seems to be presented to such relationships. The real objection to Sir Frank Baines undertaking a building contract for the Imperial Chemical Industries is based upon the fact that he personally was to profit by the transaction—particularly as the profit was assumed to be large. Neither of the obvious ways of dealing with the situation appear to have been considered. The Government could have suggested that the contract should be undertaken officially by its servant on behalf of the Office of Works, and incidentally made it known at the same time that the Government was prepared to tender in the open market for any similar undertaking. Alternatively, it might have given its technical expert sufficient leave of absence to enable him to complete the contract into which he had entered with the full authority of his department. Furthermore, it might carefully have considered the desirability of putting the direction of one of its most important technical departments under a man who enjoys the confidence of one at least of the foremost industrial leaders of the time, instead of abolishing his post. Under the present system, however, technical experts in Government service are usually subject to administrative officers lacking technical qualifications and experience.

Parliament has been promised that the conditions of service of members of the professional staffs of the Office of Works shall be reviewed. Presumably a Treasury Committee will undertake this task, and an attempt be made to tighten up the existing regulations regarding the nature of any work with which professional civil servants may occupy their private time. H.M. Treasury is, of course, in a position to impose what regulations it likes, but it may be suggested that in doing so great care should be taken to avoid any semblance of unfair discrimination against a particular section of the Civil Service. What is really needed is the appointment of a Royal Commission to examine and report on the present position of the professional worker in the State service, and to determine what modifications of the Civil Service system, if any, are desirable to meet the changed conditions resulting from the growing impact of the State on industry as a whole.

The Ascent of Man.

THROUGH the centuries a philosopher here and a naturalist there toyed with the notion that man was somehow linked by nature with the animal kingdom, but the notion lacked concreteness and was not taken seriously. Then came Charles Darwin, first with a theory of the evolution of organic beings which involved the ancestry of man, and sixteen years later with a cumulative study ("The Descent of Man," 1871) which clinched his argument, and could no longer be ignored. Man took his place at the summit of the tree of organic evolution, and as the topmost branch draws the lightning, so the ancestry of man became the target upon which were concentrated the thunder-bolts of a fierce opposition. Until then, the battle of evolution had been waged upon a long front, but no sooner had the 'origin of man' entered the field than the zone of fiercest combat became narrowed, and to believers in the old creed the descent of man became the salient by the fate of which the whole long front of evolution was to stand or break.

Half a century has come and gone since then; new facts have accumulated and been assimilated, and while evolution has won its battle and become part of the stock-in-trade of the world's thought, a sporadic fight still wages about the isolated salient of man. That it is no mock combat is shown by the numbers of combatants who rushed to the support of the Fundamentalist position in the United States of America a short time ago, and any one familiar with the attitude of mind of the average Briton must be aware of the latent hostility which still survives towards the idea that, in popular phrase, 'man sprang from a monkey,' and of the satisfaction with which the emergence of each new scientific squabble regarding interpretation is hailed as the rift indicating the approaching dissolution of the whole.

At the present moment the critical attitude towards the reality of human evolution is at the top of one of its periodic swings. The reason for the fresh recrudescence of opposition can be easily traced. Charles Darwin's statement of the doctrine of evolution fell upon a scientific world which had been groping for light, and after the first fierce clash with the 'die-hards' of the old order, the grandeur of his concept, its plain logic and simplicity, lulled the scientific world into a stupor of complacency. Biologists accepted the Darwinian revelation; they rushed to weave their fresh examples into its mesh, and with facile interpretation naturalists, professional and amateur, explained with satisfaction the evolutionary significance of each and every structure as it came to their notice. It must be remembered that Darwin laid the weight of his argument upon the structures of organisms, and passed lightly over the vital problems of functional adaptation and of the correlated development of structures, the prime importance of which is now becoming manifest.

However, the first inhibiting glamour of a great thesis wore off. The study, especially of variation, heredity, and the correlation of structures and activities, led to a critical examination of Darwin's conclusions; and while the doctrine of evolution has never been gainsaid, one and another has arisen to show that the course of evolution has not been determined exclusively or mainly by the natural selection or the struggle for existence upon which Darwin laid stress. Two recent works of different character may be cited as illustrating the critical attitude of scientific workers towards natural selection, both, strangely enough, founded upon the study of fishes—Berg's "Nomogenesis" (1926) and Kyle's "Biology of Fishes" (1926).

This scientific revolt against the easy acceptance of 'Darwinism' had already gained much ground when it compelled the attention of the people by the publicity given to Bateson's address to the Toronto meeting in 1921 of the American Association for the Advancement of Science, and by the directness and vigour of his attack. The disturbance of accepted theories and ideals by the long years of war had prepared the ground. The popular mind leapt to the conclusion that the apparently established belief in evolution had been shaken, and the critics of the simian origin of man rushed to the fray. Typical of their statements was the contribution of a prominent Boston pastor to an American newspaper, in which he gave the names of "some scientists who at least call in question the loudly asserted proof of evolution," and the names included those of J. P. Lotsy, W. E. Ritter, Paul Kammerer, and E. W. MacBride! Of course, the pastor and his sympathisers were mistaken. These men of science had made their declarations with clearness and in full knowledge of the implication of their words. It was only a thoughtless misinterpretation or the blindness of bias which construed their attacks and those of Bateson, Morgan, and the rest, into an onslaught upon the great truth of evolution or descent by modification, instead of, as they really were, critiques of the method — natural selection — by which Darwin supposed evolution to have worked its way.

Mistaken though the reading of scientific progress was, it is this mistake which has given new life to the present-day attacks upon evolution, and has induced doubts in many minds, unfamiliar with the trend of scientific achievement, regarding Darwin's view of man's development, and especially of the merging of human ancestry in a common stock with the forerunners of the simian apes.

A restatement of the position in the light of modern knowledge—a simple, convincing statement, unencumbered by detail and side-issues, vouched for on the word of authority—would serve a very useful purpose at the present time. We are glad, therefore, that Sir Arthur Keith has chosen the subject of "Darwin's Theory of Man's Descent as it stands to-day" as the theme of his presidential address to be delivered at the Leeds meeting of the British Association next week. No man is better qualified than Sir Arthur to meet the need of the time—by training, experience, prestige, and by the touch of fervour and imagination which he has carried from northern Scotland. Though the address will be delivered to a body of men and women familiar in the main with the scientific mood and the general conclusions of science, and, enlightening as it is sure to be, can, therefore, scarcely do more than confirm conviction, yet it will reach a wider audience through wireless and the press, and may be expected once again to focus attention throughout the English-speaking world upon the essential verities of man's ascent, and place a fresh strain upon the incredulity of unbelievers.

Language and Culture.

Die Sprachfamilien und Sprachenkreise der Erde. Von Pater W. Schmidt. (Kulturgeschichtliche Bibliothek, herausgegeben von W. Foy. Reihe 1: Ethnologische Bibliothek, Band 5.) Pp. xvi+596. Atlas von 14 Karten. (Heidelberg: Carl Winter's Universitätsbuchhandlung, 1926.) 42 gold marks.

THIS work falls into two parts, of which the first contains an enumeration of the languages of the world under more or less accepted headings, but an exception to the general rule is made for what are commonly called the Sudanic languages, for which two wholly inconsistent schemes are printed, one by Delafosse, the other by Drexel. The second part consists of a discussion of the distribution of certain features of phonetics, grammar, and syntax, followed by a reclassification of the languages on the basis of the data in question; the primitive position of the dependent genitive is then dealt with, together with the causes which brought about a change, and finally the relation of linguistic to cultural areas is discussed.

No final verdict can be passed upon the book until specialists for each area have sat in judgment and accepted or rejected, so far as they concern their own special provinces, the theories put forward; but whatever criticism in detail may be launched at the author's head, the work will remain as a great achievement, truly remarkable as the product of one man. Perhaps no one but Pater Schmidt would have had the courage to attempt it, or, if he attempted it, to bring it to a successful conclusion. For the author is far from retraversing well-trodden paths; he has opened a vista of new lines of research which cannot fail to attract many workers.

Where so much turns upon contact between different groups, it is of course essential to have a thoroughly accurate topographical basis for the theories; the linguistic data must be as complete and accurate as possible; and the conclusions must be wholly without ambiguity. To what extent these three essentials have been attained, so far as one area is concerned, will be made clear in the sequel. It is only fair to state that the author in his preface invites criticism in detail and looks forward to a second edition free from the errors which are bound to appear in a pioneer work.

Following Drexel in the main, the author groups Sudanic languages under seven heads: Wule (that is, Ubanghi group), Ngo-Nke (Mande), Manfu (Kwa and Central), Kanuri, Nilotic, Bantoid, and Hausa; in the excellent atlas are shown the areas occupied by these groups and their zones of influence. Unhappily there are serious errors in the territory ascribed to the Mande and Kanuri tongues; Hausa extends three degrees too far north, ghost languages (for example, Gogo and Kandin) appear, and the treatment of the northern provinces of Nigeria is demonstrably almost pure guesswork. Over and above this, Gola is located in the middle of the Kru tongues and Bullom north of Konakry in a Susu area; and a non-existent range of Bantoid is shown south of the Mande group.

Topographical errors are not confined to the maps; Biafada is in the text located on the Senegal instead of the Rio Jeba; Wolof is put in the Senegal group; Serer, its immediate neighbour, forms with Kisi and Fula a north-east group; but Kisi lies far to the south near Gola, and Fula stretches in a series of groups, mostly small, from a

few score miles from St. Louis in the west as far as Lake Chad. To add to the confusion, Biafada, Serer, and Fula are said to meet the Togoland and Mosi-Grusi groups in the extreme north-east on the upper Niger. But Biafada and Serer are about 1000 miles from Togoland; Fula is not in contact with Mosi on the Niger at all, and the prefixes of Tem have nothing to do with Fula, which is a suffix language. De Martonne's atlas, now in a second edition, appears to have been entirely neglected.

When we compare the linguistic data of the text with the maps, more errors and serious conflicts emerge; the Wule and eastern Manfu tongues, and all the languages of Nigeria and Kamerun, are shown as making the genitive follow the noun it qualifies, while the subject pronoun follows the verb. But at least a dozen Nigerian languages make the genitive precede; the subject pronoun is almost universally placed before the verb, as indeed the text asserts for Manfu and Wule. The text is also in disagreement with the map as to the location of two languages, Huku and Afo, to which a system of senary numeration is assigned; neither is senary in point of fact, and Huku is near the great lakes, not on the Juba, Afo on the Benue, not the Sanaga. Both text and maps wholly ignore the duodecimal systems of the Bauchi plateau.

It is clear that errors and omissions of this kind go far to compromise the author's conclusions when he proceeds on the basis of linguistic data to define the areas of primitive, primary, secondary, and tertiary speech groups; it may be remarked in passing that, singularly enough, many of the families and groups of the first part of the work have to be split up to make them conform to the new classification.

In Africa the southern primary type includes the Mande and parts of the Manfu, Wule, and Bantoid groups; the northern type includes Hausa and also Kunama, wrongly assigned to the Hamitic family; the middle type is represented by Kanuri and the Manfu group, which thus appears twice. The secondary type in Africa is regarded as a product of the southern and middle primary types; it includes Bantu and some Bantoid tongues. Singularly enough, the section on secondary and tertiary languages enumerates among the former Nama and Sandawe, which have previously figured as primitive forms of speech, while Kanuri and Hausa, elsewhere regarded as primary, are also reckoned as tertiary.

Space will not permit the citation of further points in which Pater Schmidt will probably have to make changes in another edition. It is, however, quite possible to make errors in working out the detail of a theory without invalidating fundamental principles. Attention may now be turned to some of the general principles which the author accepts as axiomatic. In the first place mention may be made of the wide use of psychological arguments in relation to linguistic facts; no doubt, if we could discover the real springs of action, psychology could be made to explain linguistics; but it is quite another matter for a European linguist to argue that because a matter presents itself to him in a certain light, therefore it must be so. The question at issue is one of fact, not of what seems likely.

A case in point occurs when Pater Schmidt is treating of different kinds of gender in nouns; he holds that a two-gender (masculine and feminine) system like that of the Hamitic languages is later than that of the Indo-European languages which have also neuter; as an explanation is given that in the two-gender system feminine and neuter have, for reasons which he sets forth, joined forces and become a single class. If we had no linguistic data on which to go this kind of argument might be admitted; but in Indo-European languages, the primary distinction is between animate and inanimate, that is, masculine and neuter, for these two alone differ in form in the noun; the masculine noun cannot be distinguished from the feminine noun in this way. The obvious conclusion is that the feminine is of late origin.

A second example of this kind of reasoning is found in the passage which explains how the prefix genitive became a suffix genitive. It is put down to the rise of matrilineal or matriarchal conditions, which resulted from the introduction of agriculture; agriculture led to a demand for more land, and this to migration and disturbance of boundaries; the meeting of heterogeneous speech forms resulted in the break-up of both, and from this issued the more logical suffixed genitive. This theory involves a good many assumptions, some of them demonstrably not in accordance with facts. Pater Schmidt's map shows matriarchy and the suffix genitive in south-east Australia, but this was not a result of the domestication of plants, which was unknown. Even more unfavourable for the author's contention is the picture presented by America, where matriarchy seems to be in a great majority of cases associated with the prefixed genitive. The major defect of the argument is, however, the assumption that domestication of plants meant land hunger; for it reduced

immensely the area needed by a given number of people for their support.

When we recall how little we know of the origins of Indo-European languages, which in some areas were reduced to writing many centuries ago, it may seem, not without reason, hazardous to survey all the speech forms of the world and explain their relations and transformations. But new ideas have a value apart from their correspondence with facts, and pioneer work like that of Pater Schmidt is deserving of all praise.

The Nitrogen Industry.

The Atmospheric Nitrogen Industry: with Special Consideration of the Production of Ammonia and Nitric Acid. By Dr. Bruno Waeser. Translated by Dr. Ernest Fyleman. Vol. 1. Pp. xxvi + 330. Vol. 2. Pp. 331-746. (London: J. and A. Churchill, 1926.) 42*s.* net.

THE original German edition of this work was published in 1923. It contained practically all the information which could be obtained from the literature up to March 1921. It has been the author's intention to make it a standard work by including a large number of economic data and a detailed survey of the literature. Vol. 1 contains a short general introduction and then a historical account of the nitrogen industry in each country of the world. Vol. 2 gives a technical description of the processes used in the nitrogen industry. The author has also included allied processes which may be important from their economic effect on the main industry. There are very complete indexes, bibliography, and list of patents.

In order to bring the first German edition up-to-date for translation, there is at the end of each chapter a supplement containing new matter covering the years 1921–1924, and a foreword of seventeen pages has been written by Dr. J. F. Crowley. The supplements consist, for the most part, of bald references to the literature and make an unsatisfactory ending to each chapter, but Dr. Crowley's foreword successfully summarises the position of the industry.

The importance of nitrogen in commerce arose during the Middle Ages from the use of saltpetre in making gunpowder. The nitrogen problem was as acute in France during the Napoleonic wars as in Germany during the late War. Prevented by the blockade from importing adequate supplies of nitre, France had resource to nitrate plantations (salt-petrières), which were administered by a State department. In these plantations heaps of animal and vegetable refuse were allowed to rot for months until covered with a layer of saltpetre. But after the Napoleonic wars, when swords were turned to ploughshares, inorganic nitrogen was not turned to agriculture. It was not until about 1840 that Liebig showed that inorganic nitrogen compounds were important soil fertilisers. From that time the use of inorganic nitrogen in agriculture has grown steadily. At first Chile nitrate was the sole source of supply; then came, in addition, ammonium sulphate obtained from coal; and within the last twenty-five years synthetic nitrogen compounds—nitrate of lime, cyanamide, and ammonia. The development of the synthetic nitrogen industry took place first where electrical power could be obtained cheaply—principally in Norway, because the arc processes absorbed much electrical energy.

Some years before the War Germany had become anxious to produce synthetic nitrogen fertilisers for her soil. A continental nation with no food-producing colonies, that country was attempting to produce all the food it required. Tariffs were put on imported food, but Germany had to import large quantities of nitrogen, and in 1913 it absorbed 27 per cent. of the total nitrate exported from Chile, as well as nitrate of lime from Norway and sulphate of ammonia from its own coal industries. During this year (1913), 32 per cent. of the world's production of inorganic nitrogen was used by German agriculturists. How different were the conditions in Great Britain with free trade, large investments abroad, food-producing colonies, and a large navy!

When the War broke out, Germany, expecting a short war, appears to have attached no importance to the supply of nitrogen for explosives. Later, when the blockade became serious, Germany looked first to her cyanamide factories for nitrogen, and only later did the German Government realise the possibilities of the Haber Bosch process of ammonia synthesis which had just been established in 1913. Two large factories were erected to provide the war requirements. Since the War the German synthetic ammonia factories have been utilised for the production of fertilisers, and works using somewhat similar processes are now active in other countries—England, America, Italy, France, and Belgium. Some of these (England and America) are well established and are already a commercial success. Others are still passing through tribulations and troubles.

The tendency of modern industry is to build large factories, because greater efficiency is obtained with large machines than with small ones, and the

cost of labour for a given output usually decreases as the size of the unit plant increases. But more important still is the advantage of better scientific and technical control of processes which can be obtained in a large factory. Dr. Crowley in his introduction seems to attach great importance to a claim of simplicity of one process (Casale), though it is difficult to find the basis of the claim. He states: "On a visit to an important synthetic ammonia plant paid some twelve months ago, the writer found that the whole plant was being operated under the direct supervision of the engineer responsible for the running of the power station, and that no chemists were employed." It does not seem probable that this plant will long survive in competition with plants controlled by the best technically trained men of to-day.

An Atlas of Rainfall.

Royal Meteorological Society. Rainfall Atlas of the British Isles. Prepared under the direction of a Committee of the Society. Pp. xii+44 maps. (London: Royal Meteorological Society, 1926.) 15*s.* net.

TWENTY years ago the collection and publication of meteorological statistics in Britain was divided between the Royal Meteorological Society, the Scottish Meteorological Society, the British Rainfall organisation, and the Meteorological Office. To-day this work is all done by the Meteorological Office, and the preparation and issue of a climatological atlas would be a natural obligation of that institution. But, as Dr. Mill explains in his admirable introduction to the volume under notice, the endowment fund of the British Rainfall Organisation was instituted for the advancement of research in rainfall, and no application of that fund could have reflected more honour on the memory of Symons and Salter (and, one may add, of Dr. Mill himself) than its utilisation for the preparation of an atlas of rainfall. Incidentally it enabled the atlas to appear at an earlier date than would otherwise have been likely.

The preparation of a rainfall atlas for a country where the variations are so marked as they are in the British Isles, presupposes the collection and analysis of an enormous number of observations; and above and before all others, credit must be given to the 10,000 observers whose work, for the most part entirely voluntary, during the past sixty-six years provided the material.

The frontispiece of the atlas is a good orographic map of the British Isles, a chart essential for the right understanding of the maps of rainfall which follow; and to meet a very natural desire, three full-page maps are given showing the average annual rainfall, the rainfall of the wettest year, 1872, and the rainfall of the driest year, 1887. Nearly every patch of colour (high ground) on the orographic map has its corresponding patch of deeper blue (heavy rainfall) on the chart of average rainfall.

There are two main series of maps. The first comprises small maps (scale 1 in 8,000,000) of annual rainfall for each individual year for the fifty-six years, 1868–1923, expressed as a percentage of the average for the standard period of thirty-five years, 1881–1915. An examination of these maps shows that though there were three years (1872, 1877, 1903) in the period with rainfall everywhere above the average; there was only one year, 1887, with rainfall everywhere below the average.

The maps show, too, how frequently the regions with the greatest percentage excess of rainfall are not the wet mountainous western districts but the plains and lowlands where the normal rainfall is moderate or low. This series of charts presents a historical summary which cannot fail to interest the student of rainfall, the economist, the water engineer and the reminiscent citizen.

The second series includes twelve full-page maps of average monthly rainfall. Though these are of much greater practical importance than the series of annual maps for individual years, they do not make quite the same appeal to the imagination: averages never do. So it is good that the committee included the annual maps, and it would have been even better, had space permitted, to have had a map for each of the 700 individual months of the period. The reader naturally wants to see if 1872 was as thoroughly disastrous for the farmers of Cheshire, Stafford, Derby, and York as the annual map suggests: that depends on the months in which the 70 per cent. excess in those counties was accumulated, but no information can be derived from the atlas on this point. Actually, 1879 was far worse for agriculture than 1872, though the rainfall for the whole year in 1879 was generally much less than in 1872.

The monthly maps reveal many unexpected and interesting features: for example, Norfolk has more rain in July than any part of east and south-east England except the high ground of the Downs. September has a larger dry area than any of the months May to August, but is nevertheless appreciably wetter in the mountainous districts of the west than the months of May to July.

The winter months are relatively very dry in

Cambridge, December being drier than June: in this connexion it is of interest to note that Paris lies in a relatively dry area in France as Cambridge and Oxford do in England.

The Table V. of normal monthly rainfall, which Dr. Mill quotes from Mr. Salter's book, reveals that though October is the wettest month in England, December is the wettest month in Scotland, Ireland, and Wales. In Ireland, indeed, August is wetter than October. Similarly though April is the driest month in England, May is the driest month in Wales and Ireland, and June the driest month in Scotland.

This atlas, which surpasses expectation and arouses admiration the more it is examined, is really as indispensable a part of the ordinary household reference library as a common topographical atlas; but the price is too high: it ought to be reduced to 7*s*. 6*d*. or even to 5*s*., and the book advertised and sold in tens of thousands, instead of in tens. E. GOLD.

Alpine Studies and Pictures.

(1) *The Natural History of Ice and Snow: Illustrated from the Alps.* By Dr. A. E. H. Tutton. Pp. xvi + 319 + 48 plates. (London: Kegan Paul and Co., Ltd., 1927.) 21*s*. net.

(2) *The Art and Sport of Alpine Photography.* Described and Illustrated by Arthur Gardner. Pp. 224 + 150 plates. (London: H. F. and G. Witherby, 1927.) 21*s*. net.

(1) DR. TUTTON'S work on the Alps is a valuable contribution to the literature on ice and snow. It will appeal in particular to those alpinists who have at least a fair general knowledge of physical science and to those others who visit the Alps of Europe with but the common desire to enjoy a holiday there, and at the same time to see and understand the most striking of the developments of snow, ice, and stream in that marvellous country.

For the latter, the chapter to be read as introductory is Chap. viii., "The Call of the Alps," for there the author sets out the attractiveness of his subject with the enthusiasm of a devotee who has himself spent many holidays in the enjoyment of the physical, mental, and artistic pleasures available in the central area of Europe. These are the lure the reader must have in view when he tackles Part I. of the work, for Part I. is for arm-chair evening reading in advance of a spell of freedom.

Part I. (pp. 1-74) gives a very useful résumé of all the major researches which have gone to build up our present knowledge of the chemistry and physics of water, ice, and snow. Successive chapters deal in detail with the chemical and physical relation of water and ice; the crystal structure of ice and snow; the optical, thermal, and electrical properties of ice; its plasticity, viscosity, and elasticity. Throughout this section Dr. Tutton has treated the subject historically, giving the names of successive workers in the direct line of progress, with dates of their work and an outline of their researches and results. This section of the book thus affords the scientific reader an interesting study of the history of the subject from Cavendish in 1783 to the present day.

Referring to Part I. in his preface, the author hopes that it "will be readable by any ordinarily educated person." He is, it is to be feared, too sanguine. The person who has to be taught on p. 12 the meaning of $2H_2 + O_2 = 2H_2O$ is not likely to learn by the time he reaches p. 42 enough of physical and chemical science to qualify for the study of Sir William Bragg's 1926 work which is there summarised. Yet the matter of Part I. is well selected and carefully written. It gives honour to whom honour is due, and should be read attentively by those who have a fair knowledge of physical science. Taken as a whole it is an interesting study in the record of advance in science.

Part II. (pp. 75-146) has a short chapter on the geology of the Alps and a longer one on their topography. The latter should be read in company with a good map. The map given is quite unworthy of the book; in fact it is unworthy of this century. Coolidge's "Alps in Nature and History" (1908) had an admirable map (by Bartholomew), and there are now many excellent maps of the region.

Most of the readers of Dr. Tutton's comprehensive work will find its kernel in Chaps. xi. and xii., snowcaps, glaciers and their movements; crevasses, bergschrunds, and séracs; dirt-bands and veins; moraines and glacier lakes. These give descriptions and explanations of the phenomena which most arrest the interest of travellers in the Alps, and they are freely and well illustrated by photographs which have been carefully selected from a great store. Chap. xiii. outlines the history of the "Conquest of the Summits." It affords answers to many questions which every visitor puts to his friends or his guide-book, and its answers are well and fully stated in an interesting manner.

Part III. (pp. 147-304) presents examples of snow and ice forms discussed in earlier chapters. Here, however, they appear as incidentals to a typical set of expeditions. The expeditions selected were chosen for record as affording the most in-

teresting illustration of the facts described in the earlier parts of the book, and as being expeditions which the author could describe and recommend from personal knowledge. They are illustrated by 145 pictures on 33 half-tone plates, all being reproductions of the author's own photographs.

These pictures are admirable as illustrations. Some are of full-page size, others half-page, but the great majority are six on a page, each of these being about 2 in. × 2 in. Selected with good judgment, they illustrate point after point of interest in the forms of snow and of ice, in the work of frost and of glaciers, and in the scenery produced in the course of prolonged ice action. Each bears definite relation to the text, and the text references to them are complete. Small in size though they are, each makes its point to the eye clearly, yet the execution is such that every one of them stands well the test of detailed examination under a reading lens.

The arrangement of matter in the chapters that deal with definite expeditions is a happy one. It emphasises the individuality of each of the areas traversed and it presents in various settings examples of the different phenomena which in Part II. are discussed as types. It is replete with human interest.

(2) In his "Art and Sport of Alpine Photography," Mr. Gardner presents an arresting series of fine photographs—150 plates, six of which have two pictures each, the others are single full-page photographs. These show what can be achieved by skill in the selection of subjects as to each of the many conditions upon which success depends. The author does not, however, leave the pictures—and they *are* pictures—to speak entirely for themselves. In a light and pleasant running commentary he points to the main factors upon which success depends, and in illustration of the influence of these he refers to the examples in this real album of the Alps which his series of photographs forms. Thus, under "Composition and Foreground" he deals successively with water, trees, rocks, ice, and snow in varied forms. In the following section he deals with weather, lighting, and seasons. In all such matters his work shows that he is exceptionally well qualified to advise those who would produce photographs that are pictures as well as mementoes. In his chapter on mountain portraits, Mr. Gardner points to twenty excellent pictures of the Matterhorn and thirteen of Mont Blanc in illustration of the aspects and moods that go to form what the lovers of a mountain feel as its individuality.

F. G. OGILVIE.

Our Bookshelf.

Stars and Atoms. By Prof. A. S. Eddington. Pp. 127 + 6 plates. (Oxford: Clarendon Press; London: Oxford University Press, 1927.) 7*s.* 6*d.* net.

THIS new volume from Prof. Eddington bears the same relation to his "Internal Constitution of the Stars" as does his "Space, Time, and Gravitation" to his "Mathematical Theory of Relativity." It is in the form of three lectures, "The Interior of a Star," "Some Recent Investigations," and "The Age of the Stars," with an appendix on the ultimate fate of 'white dwarfs.'

The modern theory of the stars and the way it fits in with and makes use of the modern theory of the atom is a fascinating story, however told. But Prof. Eddington tells it with the full vigour of a powerful and gifted imagination. "Stars and Atoms" is sheer enjoyment in the reading. It is difficult to do justice to the liveliness of his style—the atoms fairly dance before one's eyes; in his own phrase, we see them "riding sunbeams." His wealth of metaphor is apparently inexhaustible—we have Daedalus and his flying equipment, ball-rooms and crinolines, detectives and finger-prints, larders and mousetraps.

Extensive trains of argument are followed through without a mathematical symbol. Prof. Eddington is never content with a merely mathematical deduction. He insists that we shall see for ourselves the inwardness of the matter—that we shall not only acquiesce but also give joyful assent. For this reason, and for inspiration's sake, the professional astronomer will profit from this work as much as the general reader. One illustration will suffice. Though not connected particularly with atomic physics, the principle of the Michelson stellar interferometer is described in a way which illumines the whole of optics.

The prospective reader may rest assured that he is not asked to listen to vague speculations. A charm of the book is the author's candidness. Problems are discussed from which present theories are shown to be inadequate. Prof. Eddington, a great theorist, shows himself also a disciplined one.

E. A. M.

Aluminium: the Metal and its Alloys. (A Critical Descriptive Treatise.) By M. G. Corson. Including Chapter on 'Structurography,' prepared in co-operation with J. R. Vilella. Pp. xx + 291 + 122 plates. (London: Chapman and Hall, Ltd., 1926.) 36*s.* net.

ALUMINIUM and its alloys are now used very extensively in almost all branches of engineering, and new uses for them are found every year, even in competition with steel. A trustworthy compilation of knowledge concerning them would therefore be of value to the engineer as well as to the metallurgist. This has been attempted by the author of the present work, unfortunately with imperfect success. He has shown great patience and industry in collecting data, but the treatment of

the subject is unsatisfactory, and when information on some point of known technical importance is sought, the statements are too often found to be vague or inaccurate. More information as to manufacturing processes would have been welcomed, for such is now to be found scattered through the technical journals, although not as yet systematically collected and reviewed. Die-casting, for example, is used to a far greater extent than would be supposed from the references to it here, and the original difficulties in casting aluminium alloys under pressure have been largely overcome. The 'imaginary' equilibrium diagrams are scarcely a substitute for accurate knowledge, and in fact much more is known of the more important systems than is here indicated. There is much that is of value in the book, and the experienced metallurgist will make critical use of the tables of physical and mechanical data. The photo-micrographs at the end of the volume are of excellent quality, and illustrate the immense improvement in the technique of preparing these rather difficult alloys for the microscope which has occurred in the last year or two.

Primitive Man: his Essential Quest. By Dr. John Murphy. Pp. xiv + 342. (London: Oxford University Press, 1927.) 15*s*. net.

THE primitive in man in Dr. Murphy's definition is that which characterises him near to his origin as man, that is, when he began to be human, and includes the mind of the savage of the present day who is at a low stage of culture, probably at the intellectual level occupied by early man. His viewpoint in analysing the development of human society from its beginnings in primitive customs and belief to higher manifestations is evolutionary and psychological. In his view, man has progressed by integration through differentiation from the lower to the higher on a line which in a sense is parallel to the evolution of the brain. This, as has been shown by the study of the brain in the anthropoids and fossil man, has been a process of development in the frontal area and a resulting improvement in the powers of co-ordination which have been largely responsible for man's intellectual advancement. Dr. Murphy therefore has a sound physical basis upon which to rest his interpretation of the facts; but it needs no great discernment to see that from the outset he is at odds both with the diffusionist school of Prof. Elliot Smith and with the recently enunciated theories of Prof. Levy Bruhl.

A Treatise on Light. By Dr. R. A. Houstoun. Fifth Edition. Pp. xi + 489. (London: Longmans, Green and Co., Ltd., 1927.) 12*s*. 6*d*. net.

THE fact that this book has had a new impression or new edition every two years since 1919 is sufficient evidence of its use to teachers and students and of their appreciation of it. The author is to be congratulated in that he has not burdened the student by the introduction of accounts of recent advances in kindred branches of the subject. His final chapter might well have been omitted, the one valuable addition on the angular diameter of stars being inserted in the chapter on interference. The rest is out of place in the book and in any case could not fail to be inadequate.

An account of modern apparatus for the determination of indices of refraction would have improved the chapter on that subject, and in the chapter on diffraction the accounts of the Lummer-Gehrcke and Fabry-Perot interferometers should have been given in more detail both in theory and practice. The theory would follow very readily from the excellent treatment of diffraction given in this chapter. These are, however, slight criticisms of an excellent treatment of the subject. The reader cannot fail to appreciate the careful mathematical presentation, which is well exemplified in the chapters on lenses, diffraction, and on the nature of light.

The Autobiography of Kingsley Fairbridge. With a Preface by the Rt. Hon. L. S. Amery and an Epilogue by Sir Arthur Lawley. Pp. x + 188. (London: Oxford University Press, 1927.) 6*s*. net.

KINGSLEY FAIRBRIDGE had an active and adventurous life before he went to Oxford as a Rhodes scholar. Most of the book consists of those early experiences, and gives an admirable picture of Rhodesia in the making. But the importance of the book lies in his scheme of Imperial settlement. Fairbridge was convinced that the solution of the unemployment and emigration problems of Great Britain were to be found in taking children from the large towns and training them in schools in the Dominions to become farmers. His enthusiasm led to the foundation at Oxford of the Child Emigration Society. In 1912 he started his farm school in Western Australia. There were many difficulties to be contended with, of which the financial was not the least, but before Fairbridge died in 1924 the scheme was on a sound footing. The book is a worthy record of a man of far-seeing vision.

The Student's Handbook of British Hepatics. By Symers M. Macvicar. Second edition, revised and enlarged. Pp. xxxi + 464 + viii. (Eastbourne: V. V. Sumfield; London: Wheldon and Wesley, Ltd., 1926.) 24*s*. net.

THE value of an accurate systematic treatise in stimulating interest in a group is evidenced in the call within a comparatively short time for new editions. Lister's "Mycetozoa," Dixon's "Mosses," and Lorrain Smith's "Lichens" are familiar examples, and to these have now been added Macvicar's "Hepaticæ." The accurate descriptions, useful keys, and excellent illustrations for every species at once made the work invaluable to students, and after fourteen years the stock has been exhausted. The new edition includes only minor changes; a few additional species, changes in rank of certain forms, and a full glossary being the most important.

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.*]

The 'Forbidden' Line of Mercury at λ2270 in Absorption.

IN a letter to NATURE of May 28, p. 778, I stated that the line λ2270 which is 'forbidden' by the selection principle for inner quantum numbers, could not be observed in absorption. I have now repeated the attempt with a more powerful instrument, which has been placed at my disposal by a grant from the Council of the Royal Society. A definite positive result has been obtained, the line showing up clearly in absorption by a column of mercury vapour 45 cm. long boiling at a pressure of 95 cm. It is well seen on several different negatives. The range of conditions for observing it is very limited. Too much vapour blots out the continuous background; too little fails to show the line absorption.

The observation seems of considerable theoretical interest, as showing that direct transition from the normal to the metastable excited state of the mercury atom can sometimes occur, even though very rarely. The resonance line of mercury, λ2537, would, I believe, show up in comparable intensity with the same column of mercury vapour at the atmospheric temperature; thus at about one millionth of the density used for λ2270.

RAYLEIGH.

Terling Place, Chelmsford,
Aug. 10.

Prof. Labbé's Copepod 'Allomorphs.'

PROF. LABBÉ, in the succession of papers in which he has expounded his theory of allelogenesis, claims to have established as a fact that, in the salines of Croisic and in the aquaria of his laboratory, an evolution of Copepoda has been observed, leading through a series of eight stages from Canthocamptus to Cyclops. According to his theory, the eggs laid by one species of Harpacticid may produce 'allomorphs' which, according to accepted standards of classification, would be considered to represent distinct genera or even families. If such were indeed the case, and it were possible in seven years to observe the transformation of Canthocamptus into Cyclops, it would indeed be necessary for systematists to abandon their task in despair.

Those who are not specially conversant with the detailed systematics of the Copepoda will appreciate the position more clearly if it were stated in terms of a more familiar group. One may, I think, quite fairly say that it would be much less surprising if the egg of a sparrow were to produce a robin, and the robin's egg a swallow, than if the eggs of a Canthocamptus gave rise to Wolterstorffia and those of the latter to Copepods having the characters ascribed to Ferroniera. Such revolutionary results are obviously inacceptable, and should not even be considered, unless supported by the most scrupulously exact descriptions and experimental evidence. Prof. Labbé in his most recent paper (*Arch. Zool. Exp. et Gen.*, **66**, pp. 135-290; 1927) states (p. 246), "Nous avons maintenant une sériation complète de stades qui donne la preuve de l'arbre généalogique. C'est cette preuve qu'apporte le présent travail," so that we may suppose that he has now offered all the evidence which he is prepared to give. I have already (NATURE, Sept. 4, 1926) given some reasons why such evidence as he has previously offered is insufficient, and it is only necessary to consider that which is now brought forward.

First, with regard to the descriptions of the 'species' with which Prof. Labbé deals. A detailed discussion of each of these would be a long and tedious business and, for reasons which I shall give, it is scarcely practicable or necessary, but one or two cases must suffice.

Prof. Labbé does not appear to have availed himself of the most indispensable systematic work on Copepods, Prof. Sars's "Crustacea of Norway." Had he done so he would scarcely have redescribed *Metis ignea* Philippi under the new name of *Parametis sanguinea*. That the two are identical there can be no doubt, and a comparison of his figures with those of Sars will give some gauge of the accuracy of Labbé's figures in general.

The original parent form of the experimental cultures from which were derived in "huit étapes successives" *Wolterstorffia croisicensis*, *Ferroniera mirabilis*, *F. cyclopoides*, *Regis servus*, *Herouardia paradoxus*, *Cyclops phaleroides* and *C. serrulatoides*, is called *Canthocamptus salinus*. This is the species named in previous papers *C. minutus* O. F. M., but Labbé has recognised that the original identification was unfounded (p. 209). A short description and some figures of this parent form are given which require comment. In the first place, the 1st antenna of the female is stated to be of seven "très courtes" joints, but it is figured (Fig. 41) as of seven unusually long joints, the fifth of which bears an æsthete. It may safely be said that this is not the antenna of a Canthocamptus, and indeed I am not aware of any genus or family of Copepod to which it could possibly be referred. Secondly, the first leg of the male and female are shown entirely unlike, and in neither case with an inner seta on the 2nd joint of the exopod. I do not know of any Harpacticid showing such an extraordinary sexual difference, and, if the figures are correct, it is quite clear that the animal is not a Canthocamptus, and that two species have been confounded in one description. What these may have been it is impossible to suggest. There is reason also to suppose that the same error, namely, that of giving figures and drawing up descriptions from different species and uniting them under one name, has given rise to others of the remarkable forms here dealt with. It would not be difficult to produce some very striking new creatures by such combinations!

If Fig. 103 of the 2nd antenna of *Ferroniera cyclopoides* male be compared with Fig. 117 of the same appendage of *Rhynchoceras rota*, a strong suspicion is aroused that in this case the same male has been attached to both species. The appendage as figured is so extraordinary that it could scarcely be identical in two species of different genera. The sexual difference in this appendage is, so far as I know, a new discovery by Prof. Labbé.

It is possible, in some cases, to suggest or to affirm the identity of some of these new species with others already known, but it is not worth while discussing them all in detail:

(1) The genus Portierella is very extraordinary, and the two species of it in some respects so unlike that they cannot possibly be congeneric if the figures are correct. It seems probable that there is a mixture here too, and that some species of Tisbe forms part of it.

(2) *Rhynchoceras rota* may, in part, be *Tachidius*

brevicornis. *R. elongatus* is certainly *Euterpina acutifrons*, but the "1st gnathopod" does not seem to belong to it.

(3) *Regis servus* is *Wolterstorffia confluens* Schmeil. It is possible that *R. racovitzai* may be *W. blanchardi*.

(4) *Herouardia paradoxus* certainly includes *Halicyclops magniceps*, but some of the figures cannot be correct. For example, in no known Copepod is there an exopod on joint 3 of the 2nd antenna, and leg 1 (Fig. 176) has some quite unique characters. Labbé lays great stress on the presence of a spiny operculum in his new species, and, if it actually existed, it is, of course, impossible that he could have been dealing with *H. magniceps*. On the other hand, he figures it (Fig. 174) on the ventral side and attached to the fourth abdominal somite—a quite impossible situation.

(5) *Mesquieria cœrulescens* is *Acartia latisetosa* Kric.

It appears, then, that reliance cannot be placed on the accuracy of Labbé's descriptions and figures. Further, if he has in some cases confounded two or more species in one description, it seems that the whole edifice of theory which he has built on his facts must crumble, for the succession of forms on which it is based disappears.

With regard to the reliability of the experimental methods, it does not seem necessary to say much since (p. 211) Labbé himself admits that no attempt has been made to prevent contamination of the cultures by the introduction of extraneous nauplii. He disposes of this difficulty simply by saying that his interpretation is more probable than that species should always have been introduced in the same order, and by the statement that the allomorphs always appeared in his cultures long before they were "generated" in the salines. On the other hand, we are not told anything about the number of cultures in which this order of succession was observed, or indeed anything whatever about these observations, so that it is impossible to weigh the probabilities. It is very necessary to know more about them. For example, these Harpacticids are minute creatures creeping about in mud and vegetation, and in any culture in which they would be able to thrive it would be most difficult to remove and examine the whole population. They can seldom be recognised except under high powers of the microscope, and without examining the whole, or at least a large part, of the population of an aquarium, it would be rash indeed to say that all the individuals belonged to one species. A very small aquarium stocked as Labbé's seem to have been stocked might readily contain half a dozen species, and it might involve a lengthy examination before all of them were discovered. The Harpacticids provide peculiarly bad material for an investigation of this kind.

It is most remarkable that the salines of Croisic should contain only an assemblage of new species and genera and lack so many that are characteristic of such places. For example, no species of Amphiascus is mentioned; no Tachidius; no Mesochra and no Stenhelia. Labbé's identification of *Nitocra hibernica* is obviously wrong, and there can be little doubt that other species of this genus actually occur. As I have pointed out above, some of these genera were probably actually present and have been described under other names.

Almost every page and paragraph of this paper provokes criticism, but it seems scarcely worth while to pursue the subject further or to deal with Labbé's views on the systematics and comparative morphology of the Copepoda. They need not be taken seriously. The only question which concerns zoologists is whether or not species at Croisic are giving rise by allelogenesis to new species or genera. If this paper contains all the proof which Labbé is prepared to offer, one can say with complete certainty that there is no substantial evidence that such is the case.

ROBERT GURNEY.

Ingham, Norwich, Aug. 3.

Ectoplasmic Matter.

A PROTEST should surely be made against the statement of the reviewer on page 111 of NATURE for July 23 that "various kinds of . . . ectoplasmic formation are facts of experience." The number of persons, among those competent to form an opinion, who are of this belief, must be a very small minority, and the supposed existence of ectoplasm is no more proved than that of any other psychic phenomenon.

One of the proofs of the existence of ectoplasm relied upon by Dr. Geley in the book to which the review refers are wax masks of spirit hands. As has recently been shown by Sir Arthur Keith and others, these can easily be counterfeited, wax being a substance that readily becomes plastic and capable of fraudulent manipulation at quite low temperatures.

I have, therefore, elsewhere recently made the suggestion that these masks would be more conclusive if made, say, in cast-iron or some other metal which is rigid and nonplastic at ordinary temperatures, but I fear that ectoplasm would frizzle just as easily as the living hands of the mediums or of their confederates, which, I am convinced, are the real agents involved.

A. A. CAMPBELL SWINTON.

THE complete sentence in my review was: "It must now be admitted that the various kinds of lucidity and of ectoplasmic formation are facts of experience as actual, though as sporadic, as hypnotism, insanity, or physical deformity." Mr. Campbell Swinton's protest is interesting, because it seems to imply that all *facts of experience* must be *scientific facts* and, inversely, that all scientific facts are common facts of experience. The gist of the review, as well as my previous communications on psychic phenomena (Oct. 23, p. 588, and Nov. 13, 1926, p. 693), is to the effect that no 'proof,' in the strictly scientific sense, has been obtained of any supersensible phenomenon. Many 'facts of experience' cannot be explained as yet by exact science, which requires a formula so that the experience may be repeated or prevented at will. Again, much of the phenomena of scientific laboratories are not general facts of experience and are accepted credulously and without understanding by the lay majority. Such common facts of experience, known to the majority as disease, deformity, dreams, and insanity, are admitted to be actual, but they do not, therefore, come under *exact* science, since the laws underlying these states of matter have not been clearly, that is scientifically, defined. Science has advanced and will continue to advance by discovering the laws underlying all facts of experience, thus bringing the latter under self-conscious control.

Uncommon facts of experience, known only to the minority, are not readily admitted by the majority, for the very good reason that experience is an individual matter. To 'believe' in the reality of another's experience one must have had an analogous experience unless one understands the laws behind or is an undeveloped, credulous person. This is a beneficent law of individual development, and a protection against superstition and charlatanism. On the other hand, we cannot believe that all those who have had experiences unknown to ourselves are fools or knaves.

The man who never dreams does not deny that others have had such experiences.

It seems to me the duty of science either to show that, in the nature of things, there is no inherent possibility for the existence of ectoplasmic matter, or to attempt a tentative explanation of the phenomena. Blank denial is a foolish policy in the face of rapidly spreading superstitions—spiritistic and religious—amongst the people, many of whom are reacting against the materialistic attractions science has brought within easy reach of the democracy. If the human race is to advance in self-knowledge, science must maintain its authority. What is now termed ectoplasmic matter has always been a concomitant of mediumistic materialisations, and tests suggested to prove its existence are unscientific, for the function of science is not to prove the existence of phenomena, but, when admitted, to investigate and explain it. The first step toward the scientific elucidation of psychic phenomena (and the exposure of superstitious beliefs) is to admit them as facts of experience amongst certain peculiarly organised human beings. W. W. L.

Occurrence of Extensor Rigidity in Quadrupeds as a Result of Cortical Injury.

PERMANENT contraction of certain muscle groups occurs in apes, following the removal of the cortical motor centres of the limbs. Hermann Munk (1895) stated that 'contractures' do not occur in rabbits, cats, and dogs following similar operations. Recent workers are of the opinion that extirpation of the gyrus proreus of the cat results in an exaggerated extensor tonus in the contralateral limbs, but removal of the motor cortex fails to influence the tonus of the corresponding limbs.

I observed that removal of the cortical limb areas in cats results in extensor rigidity in the contralateral fore- and hind-leg. If the foreleg area alone is removed the rigidity is confined to the contralateral foreleg; also if the hindleg area alone is removed the rigidity is confined to the contralateral hindleg. In chronic preparations the rigidity has been observed six weeks after the operation. Injury to or removal of the gyrus proreus in cats, in my experiments, does not result in an increased extensor tonus in the contralateral limb muscles, but there is a definite stiffness in the neck muscles.

Extirpation of the foreleg area in rabbits and guinea-pigs results in a marked extensor rigidity in the contralateral foreleg. In chronic rabbit preparations, rigidity has been observed two weeks after the operation.

The rigidity observed in the animals studied has certain definite properties. It appears very quickly following the operation on the cortex, in the limb muscles which oppose gravity. It can be temporarily inhibited by stimulating reflex movement (flexion reflex and progression). In certain positions (dorsal decubitus) the rigidity exists over long periods of time with no apparent fatigue. In rabbits and cats, labyrinthine and neck reflexes, as described by Magnus and De Kleijn, influence the rigidity in a manner similar to that observed in decerebrate preparations.

It would appear, then, that the rigidity observed in these experiments is due to a release from cortical control and that it is similar to the decerebrate rigidity as described by Sherrington.

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Etiology of European Foul-brood of Bees.

SINCE Cheshire and Cheyne investigated the cause of foul-brood of bees in England and attributed the etiology of the disease to *B. alvei*, which is almost invariably found in large numbers in infected larvæ, much work has been done to corroborate their results. In no case, however, has an isolated culture of *B. alvei* been known to produce the disease. On the other hand, G. F. White and others have refuted the claim of Cheshire and Cheyne and ascribed infection in this disease to *B. pluton*. Owing to their inability to cultivate and isolate the organism, however, their claim has remained hypothetical; for it could not be determined whether this organism was itself merely a secondary invader—as they said was *B. alvei*—or whether the infection was mixed, or whether, indeed, these organisms played any pathological rôle in the disease.

It has been my good fortune, however, to develop a medium admirably suitable for the growth of *B. pluton* (White). A 0·15 per cent. concentration of agar, together with certain nutrients, is employed as an enrichment medium; and a concentration of 1·5 per cent. agar for the isolation of the organism at 37° C. By this method pure cultures of *B. pluton* can be readily obtained, provided the larvæ used contain a preponderance of this organism.

I have obtained infection in a healthy colony of black bees in four days, using as inoculum cultures of the organism derived from isolated colonies. The symptoms of the diseased larvæ accorded with those observed in naturally infected larvæ, and the microscopical picture was typical—*B. alvei* forms being also present, though only in small numbers. The organism has been re-isolated successfully.

Morphological studies thus far suggest the identity of the two organisms. While the results in this are not yet complete, cultures of *B. pluton* have been observed to change to *B. alvei* form, resembling biologically the *B. alvei* isolated from infected larvæ. This further corresponds very closely with the changes observed in brood naturally infected, where the ratio of *B. alvei* to *B. pluton* generally increases as the putrefaction of the larvæ progresses, so that *B. pluton* is almost eliminated. The more conclusive substantiation of this is anticipated, and its accomplishment should lead to the demonstration of important relations between the pathogenicity of micro-organisms and their life stages. DENIS R. A. WHARTON.

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Ottawa, Ontario, Canada.

Mediterranean Oligochæts.

As our knowledge of the Oligochæta of the Mediterranean is far from being exhaustive, the following records of finds made in Corsica and the Maritime Alps in April last may be of service to future investigators.

1. *Microscolex phosphoreus* (A. Dugès). Stiff loam, Ville-franche, about 200 ft. Already found in Sardinia.

2. *Enchytræus* sp. ? Peira Cava, 5000 ft., among the snow; species not yet determined.

3. *Eiseniella tetrædra* (Sav.). The typical form taken at Thouët (Touët), April 20, and Calacuccia, Corsica (height, 847 m.), April 27.

4. *Eisenia alpina* (Rosa). Peira Cava, as before, in perfect condition. On April 2, 1910, I received one specimen from Mr. Wm. Evans, collected in Perthshire. This is at present the only British record; previously reported as occurring in Switzerland, the Piedmontese Alps, Armenia, and Syria.

5. *Dendrobœna rubida* (Sav.). Peira Cava; one beautiful specimen of this well-known tree-worm.

6. *Allolobophora caliginosa* (Sav.). Thouët, in a streamlet with Eiseniella as above. The same species as the next, but with modifications in the girdle.

7. *Allolobophora trapezoides* (A. Dugès). In the stream at Calacuccia with Eiseniella.

8. *Lumbricus castaneus* (Sav.). By stream at Thouët, April 20. All the foregoing are British.

I found a worm (probably *A. caliginosa*) at Lucéram, but it retreated into a rock-crevice before I could secure it, and so was lost. As my object was to explore the Alps, no time was devoted to the examination of the lowlands and seashore, where, doubtless, a considerable number of species might be discovered, both in Corsica and in the Riviera. Worms are used for angling in Corsica, but no one has determined the species ("The Impossible Island," 82).

HILDERIC FRIEND.

Solihull,
July 25.

The Tetrad Difference Criterion.

IN recent years the quantity F, called the 'tetrad-difference', has become very important in psychological investigations as to the possible nature of the underlying causes of mental activities. If there are four such activities, and r_{13}, r_{24}, etc., the six correlation coefficients, F is defined by the equation $F = r_{13}r_{24} - r_{14}r_{23}$. The value of F, in practice, approximates to zero.

On the assumption that the activities are due to the operation of a number N of 'all or none' factors, and that the four activities in question involve the operation of the fractions p_1, p_2, p_3, p_4 of these factors respectively, the most probable value of F is zero, but it is important to know how far we may, *a priori*, expect it to deviate from zero. In other words, if every possible arrangement of the p_1N, p_2N, p_3N, p_4N factors out of the universe of N factors be considered, and the tetrad-differences F calculated, we require the standard deviation of F. In the course of investigation the following results have been arrived at theoretically, and without approximations:

(1) The mean value of F is zero.

(2) The standard deviation of $F = r_{13}r_{24} - r_{14}r_{23}$, calculated on the above assumptions, is given by

$$\sigma_F^2 = \frac{1}{N-1}\Big[4p_1p_2p_3p_4 - 2(p_1p_2p_3 + p_1p_2p_4 + p_1p_3p_4 + p_2p_3p_4) + p_1p_3 + p_2p_4 + p_1p_4 + p_2p_3 + \frac{2(N-2)(p_1-1)(p_2-1)(p_3-1)(p_4-1)}{(N-1)^2}\Big].$$

If N be supposed large, and we put the p's each equal to their average p, we have, as an approximation,

$$\sigma_F^2 = \frac{1}{N} \cdot 4p^2(1-p)^2.$$

JOHN MACKIE.

The University, Edinburgh,
July 16.

The Spectrum of Gold Chloride.

VAPOUR from auric chloride ($AuCl_3$) was introduced into a stream of active nitrogen. The observed spectrum consisted of intermingled green bands, shaded toward the red. The strongest band heads were measured and found to comprise two systems given by the formulæ:

$$A: \nu = 19113{\cdot}8 + 312{\cdot}0(n' + \tfrac{1}{2}) - 382{\cdot}8(n'' + \tfrac{1}{2}) - 0{\cdot}70(n' + \tfrac{1}{2})^2 + 1{\cdot}30(n'' + \tfrac{1}{2})^2.$$

$$B: \nu = 19238{\cdot}3 + 316{\cdot}3(n' + \tfrac{1}{2}) - 382{\cdot}8(n'' + \tfrac{1}{2}) - 1{\cdot}45(n' + \tfrac{1}{2})^2 + 1{\cdot}30(n'' + \tfrac{1}{2})^2.$$

(Half-quanta were not required for the accuracy of these data, but were used in view of the latest developments.) The identity of the coefficients of terms in n'' shows a common final vibrational level which is probably the normal state of the aurous chloride (AuCl) molecule.

Associated with each of the strong heads in the two systems were weaker heads corresponding to $AuCl^{37}$, taking the stronger heads to be due to $AuCl^{35}$. In this molecule, for the isotopes of chlorine, $\rho = 0{\cdot}9768$. With the dispersion employed (around 28 Å.U. per millimetre), the isotopes of gold were not evident, ρ for this case being 0·9992. Gold lines at wave-lengths 4792·6, 3122·8, 3029·2, 2748·3, 2676·0, 2641·5, 2428·0, and 2352·7 Å.U. also appeared from excitation of this salt by active nitrogen. The intensities of the band heads in each system follow the usual distribution with changes in n' and n''. In the region 7000 to 2000 Å.U., no other spectrum from gold chloride appeared.

W. F. C. FERGUSON.

New York University,
Washington Square College,
Washington Square, New York.

'Oertling' Balances.

IT is generally admitted that there are few finer craftsmen than the London instrument maker. As employers, therefore, we regret to find a continental origin ascribed to any of his products.

Since 1849, when the late Mr. L. Oertling settled in London and commenced business as a builder of precision balances, instruments have borne the mark 'L. Oertling—London,' which has, in fact, become known throughout the world as denoting the highest grade of workmanship in this very specialised field.

It is easily understood that the name might suggest to some a foreign origin; but the truth is that this has never been a foreign firm with a London address, or a firm importing foreign balances, or parts for erection here.

Every 'Oertling' balance has been built throughout in London; and, since we find misapprehensions on this point, we wish to stress that our output is entirely British—the product of British brains, British craftsmen, and British capital.

MALCOLM DUNBAR,
(Director).

L. Oertling, Ltd.,
Turnmill Street,
London, E.C.1, Aug. 6.

Petrified Forests.

THE interesting note in your number for August 13, p. 239, arising out of Miss Winifred Goldring's article on the Upper Devonian Forest of Gilboa, N.Y., suggests that readers of NATURE may like to know of the stump of one of these Pteridosperm trees, *Eospermatopteris textilis*, which was very kindly presented to the British Museum by Mr. Hugh Nawn, president of the Hugh Nawn Contracting Company, and found during the company's work of building the Gilboa Dam. Mr. Nawn informs me that this specimen, and one that he has sent to the National Museum of Ireland, are the only specimens outside the United States.

F. A. BATHER.

British Museum (Natural History),
S.W.7, Aug. 13.

Canadian Hydro-Electric Power Development.

By Dr. BRYSSON CUNNINGHAM.

I.

DURING a recent tour in Canada the writer, who had on a previous occasion seen Niagara and the Chippewa-Queenston installation, was able to investigate more widely, though admittedly in a superficial manner, the present stage of hydro-electric power development in the province of Quebec, where he visited power-sites and waterfalls at Shawinigan, Grandmère, La Gabelle, and Montmorency. He also took the opportunity of discussing the situation with officials of the Shawinigan Water and Power Company at Montreal and of the Water Power Branch of the Department of the Interior at Ottawa. The following notes of his observations, combined with information obtained from official sources, may be of interest to readers of NATURE.

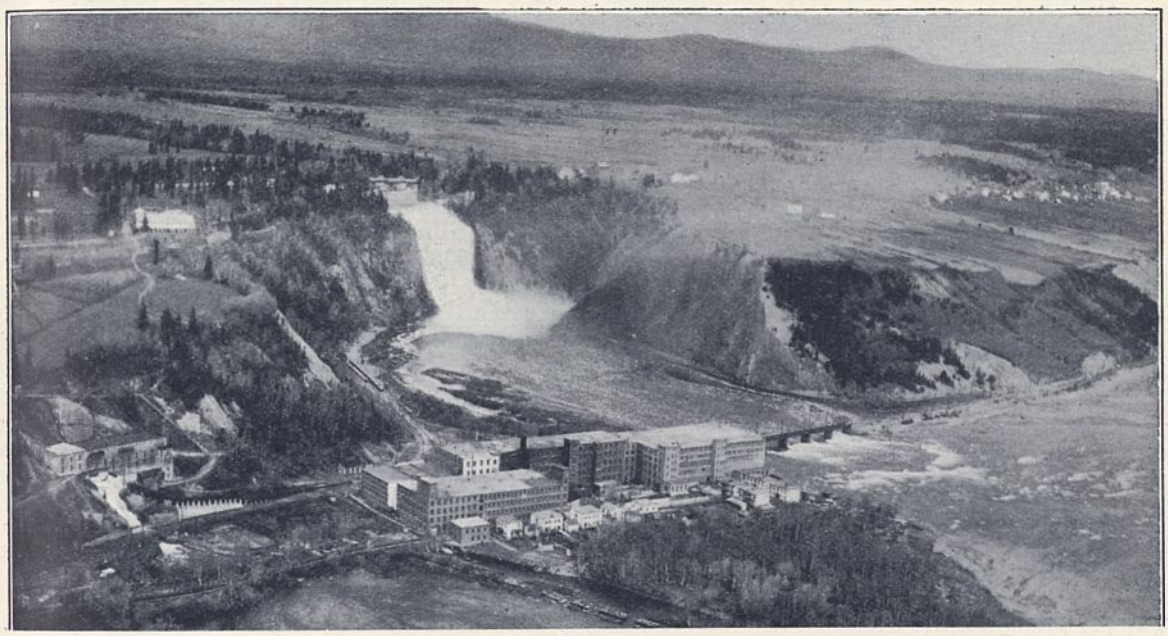

Photo.] [*Fairchild Aerial Survey Co. (of Canada), Ltd.*

FIG. 1.—Montmorency Falls and Power Station. The Falls are 274 ft. high; 114 ft. more than Niagara. Reproduced by permission of the Shawinigan Water and Power Co.

The vital importance of water power to Canada in the development of its industries is a fact not readily appreciated in Great Britain, where water power supplies are relatively of negligible proportions and an abundance of coal for steam driven plant fully compensates for the deficiency. In Canada, the reverse is the case; or rather, to speak with greater precision, it is the case in the more highly developed and most populous provinces of the Dominion, namely, Quebec and Ontario. Neither of the provinces in question is favoured with coal deposits; at any rate, none of economic value has been found, or seems likely to be found: on the other hand, both have numerous waterfalls, most of them capable of development as sources of power at a reasonable and remunerative outlay.

It has been computed that there is some eighteen and a quarter million horse-power of 24 hours availability, and 80 per cent. efficiency, at ordinary minimum flow, in the whole of Canada. Of this, nearly twelve million h.p., or say two-thirds, is located in the provinces of Quebec and Ontario, the former having the preponderant share of seven million h.p. If the figures be referred to the basis of ordinary six months flow, the total for the Dominion is raised to 32 million h.p., and the proportions of Quebec and Ontario are 11,640,000 h.p. and 6,808,000 h.p. respectively. The actual water-wheel realisation is fully thirty per cent. in excess of this. These figures give some idea of the vastness of the resources available, especially when compared with the mere million h.p. which represents the total estimated resources of the British Isles. It must not be assumed that the figures, however, are in any sense complete. Indeed, they represent the minimum possibilities. Many rapids and falls in Canada, of greater or lesser power capacity, are scattered over rivers and streams which are not yet recorded and can only become available for classification as detailed survey work is extended and carried out. This is particularly true of the less explored northern districts of the Dominion. Moreover, full consideration has not yet been given to those power concentrations which may be feasible in rivers and streams of moderate gradient with the aid of dams and impounding works. Altogether, it must be admitted that the natural water resources of Canada are of a very high and even stupendous order, amounting on a

conservative estimate to fully forty million horse-power.

Out of the impressive total, whatever it may be, so far the actual utilisable turbine installations established at the present time yield only 4½ million h.p.—a very small proportion, barely eleven per cent. of the total.

It may be of interest here to insert a full table of the estimated provincial distribution of water power as corrected up to Jan. 1 last, and issued by the Water Powers Branch of the Canadian Department of the Interior.

AVAILABLE AND DEVELOPED WATER POWER IN CANADA (JAN. 1, 1927).

Province.	Available 24-hour power at 80 per cent. efficiency.		Turbine Installation (h.p.).
	At ordinary min. flow (h.p.).	At ordinary 6 months flow (h.p.).	
British Columbia	1,931,142	5,103,460	460,562
Alberta . .	475,281	1,137,505	34,107
Saskatchewan .	513,481	1,087,756	35
Manitoba . .	3,270,491	5,769,444	227,125
Ontario . .	4,950,300	6,808,190	1,790,588
Quebec . .	6,915,244	11,640,052	1,915,443
New Brunswick .	50,406	120,807	47,231
Nova Scotia .	20,751	128,264	65,702
Prince Edward Island . .	3,000	5,270	2,274
Yukon and North-west Territories	125,220	275,250	13,199
CANADA . .	18,255,316	32,075,998	4,556,266

The value of the 4½ million h.p. already developed may be gauged from the fact that it is found that each installed h.p. is capable of effecting an annual saving of 6 tons of coal, or a total of 27 million tons of coal per annum. With the increasing economies which are taking place in the production of power from coal, this valuation of 6 tons per h.p. will no doubt require adjustment from time to time, but at present it represents a fair and reasonable equivalent. To the provinces which have to import their coal for industrial purposes, the economy is of significant proportions.

It is scarcely to be wondered at, in these circumstances, that the exploitation of available water power sites in Canada is proceeding steadily and even rapidly. To give one example only, five years ago (on the occasion of the writer's previous visit to Canada) the River Saguenay, running from Lake St. John to the River St. Lawrence, was a natural, unregulated stream, flowing through a remote and primitive district. In the interval, some 450,000 h.p. has been developed at Isle Maligne, a station on the river where a fall of about 100 ft. has been utilised, and preparations are now in hand to instal a second power house at Chute-à-Caron, where the fall is 200 ft., with a corresponding availability of power. Works and mills are springing up along the banks, and a new industrial town is projected at Arvida.

During last year (1926) the total horse-power installed throughout the whole of the Dominion was 265,838, but while this is a substantial figure in itself, it fails to take into account many constructional activities which had not reached their final stage. A number of these are nearing completion and will shortly add 1,700,000 h.p. to the Dominion total, while others in active prospect indicate a further addition of at least one million h.p. The capital invested, or involved, in these undertakings cannot be put at a less figure than 270,000,000 dollars.

That progress in the future is likely to be accentuated may be inferred from the consideration that,

DEVELOPED WATER POWER IN CANADA.

Province.	Turbine Installation in H.P.			Total.	Population, June 1, 1926.	Total Installation per 1000 population.
	In central electric stations.	In pulp and paper mills.	In other industries.			
1	2	3	4	5	6	7
	H.P.	H.P.	H.P.	H.P.		H.P.
British Columbia . .	318,179	80,500	61,883	460,562	568,400	810
Alberta	33,520	..	587	34,107	607,000	56
Saskatchewan . . .	..	..	35	35	823,000	0·04
Manitoba	210,725	..	16,400	227,125	638,000	356
Ontario	1,508,266	174,548	107,774	1,790,588	3,145,600	569
Quebec	1,546,692	242,044	126,707	1,915,443	2,561,800	748
New Brunswick . .	25,325	13,003	8,403	47,231	407,200	116
Nova Scotia . . .	31,942	16,636	17,124	65,702	540,000	122
Prince Edward Island .	279	..	1,995	2,274	87,000	26
Yukon and North-west Territory . . .	10,000	..	3,199	13,199	12,300	1,073
CANADA	3,684,928	526,731	344,107	4,556,266	9,390,300	485

Column 2 includes only hydro-electric stations which develop power for sale.
Column 3 includes only water power *actually developed* by pulp and paper companies. In addition to this total, pulp and paper companies purchase from the hydro power central stations totalled in Column 2, horse power estimated at about 425,000 h.p., making a total of about 951,000 h.p. actually used in the manufacture of pulp and paper.
Column 4 includes only water power *actually developed* in connexion with industries other than the central station and pulp and paper industries. These industries also purchase blocks of power from the central stations totalled in Column 2.
Column 5 totals all turbines and water wheels installed in Canada.
Column 6, population at June 1, 1926, as estimated by the Dominion Bureau of Statistics.
Column 7 averages the developed water power per 1000 population.

as stated in the Government Report dated Mar. 1 last, the consistent earning power of the various hydro-electric organisations, coupled with the fact that the output of new stations is absorbed almost as soon as it comes on the market, has created a favourable impression in capitalist circles and established a public confidence which is demonstrating itself in the inception of wider and more expansive undertakings. Of the 265,837 h.p. installed during 1926, more than 219,000 h.p. was destined for public distribution through the medium of central electric stations. Pulp and paper mill organisations installed 44,760 h.p. during the year, mainly connected to electric generators, and they will purchase a considerable portion of the additional installation of the central electric stations. Installations other than for central electric station purposes and in pulp and paper mills, totalled only 2072 h.p., of which 2000 h.p. was for electro-chemical reduction.

The uses to which the existing installations throughout Canada are put, indeed, continue to follow on general lines the apportionment in the foregoing paragraph. Preponderant, and of growing importance, is the distribution of hydro-electricity through the medium of central electric stations, which account for fully 80 or 81 per cent. of the total. Next comes the pulp and paper mill industry, absorbing about 11½ per cent. of the total power, apart from the large purchases which the mills make from the central stations themselves. General industrial enterprises, such as electro-chemical reduction, lumber manufacturing, flour milling, grain grinding, water pumping, etc., account for the balance of 7½ per cent.

The table above from the Government report is of interest in showing these allocations, and also the total hydraulic installation per thousand of the population, a feature which bears on the capacity for industrial output of the workers of the Dominion. The high average of 485 h.p. per 1000 population enables Canada to assume a position of importance among the nations of the world in *per capita* utilisation of water power.

Some Colouring Agents in Glasses and Glazes.[1]

By Sir HERBERT JACKSON, K.B.E., F.R.S.,
Director of Research, British Scientific Instrument Research Association.

BEFORE dealing with the colours and effects produced by ferric oxide in glasses and glazes, let me direct attention first to the different shades of colour which can be seen in varieties of the oxide itself. These range from a reddish yellow through brick reds, bright reds, to a rich brown red and almost to a black. Some specimens also have almost a bronze-like appearance. The range of colours produced when ferric oxide is used as a colouring agent for glasses and glazes is practically as great. It is doubtful if the colours produced by ferric oxide are due to compounds of this oxide with the other constituents of the glass. Without going into elaborate detail it is somewhat difficult to give adequate support to this statement. Perhaps the simplest way of dealing with it is to take the behaviour of ferric oxide in lead glasses, frequently described as flint glasses. There are light flints and dense flints. In the light flints there is always a notable quantity of an alkali such as potash or soda along with the lead oxide. In the dense flints the proportion of alkali is decreased and the proportion of lead oxide is increased.

Now, taking three such glasses as examples, having specific gravities of 3·2, 3·8, and 4·8, it is possible to add a known, but small, quantity of ferric oxide to the first glass and still to produce a glass having no detectable yellow colour to the eye. The same amount of iron added to the second glass will give a noticeable yellow colour, and added to the third glass will give a marked yellow colour. The glass of specific gravity 3·2 contains a notable proportion of alkali, and there is reason to believe that this either promotes the formation of a compound of ferric oxide with the alkali or the formation of a double silicate, either sodium ferric silicate or potassium ferric silicate; such compounds appear to be colourless. If the quantity of iron be increased, then a colour can be produced in the light flint, and, by increasing the percentage of ferric oxide to 5 per cent., a fairly strong yellow colour is produced. With 10 per cent. of ferric oxide in the same glass the colour is a deep brownish red when looking through a thickness of about 3 mm. With 20 per cent. of ferric oxide an even richer red colour can be seen when looking through a thickness of ½ mm.; but in thicknesses of 1 mm. or more the glass is practically opaque. When the percentage of iron is raised much higher, some ferric oxide crystallises out from the glass on cooling, and with 40 per cent. of ferric oxide the small crystals dispersed through the glass can be seen with a hand lens. With the denser flints, containing a lower percentage of alkali, colours similar to those described above are produced with much smaller proportions of ferric oxide.

A reasonable explanation of this would be on the same lines as the suggestions made in dealing with cuprous oxide and metallic copper, namely, that the light yellow colour is due to a small amount of free ferric oxide dispersed in the glass as extremely fine particles; the transparent deep yellows and brownish reds would represent a greater concentration of ferric oxide similarly dispersed, possibly also, as the percentage of ferric oxide gets higher, as somewhat larger particles. In the 20 per cent. glass mentioned the particles are still too small to be seen, but in specimens of lead glass containing nearly 30 per cent. of ferric oxide, fine clouds of almost irresolvable particles can be seen in the microscope.

Leaving the subject of lead glasses coloured with

[1] Continued from p. 266.

ferric oxide, I would first mention the behaviour of ferric oxide in a glass containing a large proportion of phosphoric acid, an acid which in glasses may be described as a much stronger acid than silica. Ferric phosphate is a definite compound and is colourless; in this phosphoric acid glass, quite a notable proportion of ferric iron may be present without showing any colour. Evidence that the iron is in the ferric state is obtained by heating the glass in a highly reducing atmosphere; this reduces the ferric iron to the ferrous state, and the glass is found to have developed a marked indigo blue colour, due, possibly, to ferrous phosphate, or to ferrous phosphate along with a very small proportion of unreduced ferric phosphate.

In such glasses as ordinary sodium calcium silicates, it is rather difficult to obtain light pure yellow colours with ferric oxide. Much use has been made of ferric oxide in producing glazes which are of a deep colour: practically black in moderately thick layers, though of a fine golden brown in thinner layers. These glazes are frequently described as felspathic glazes, and their composition may be given as sodium or potassium calcium aluminium silicates. To get the deep colour of these glazes, amounts of ferric oxide of the order of about 12 per cent. are required. If the percentage of ferric oxide is raised to about 15-20 per cent. some of the ferric oxide separates out on cooling and, according to the concentration of the ferric oxide, so may be seen a fine brown red colour on the surface of the glazes or bronze-like spangles of ferric oxide, or rosettes, or tree-like crystals, or even more massive crystals which to the eye look black. The Chinese made much use of this behaviour of ferric oxide. As the result of a close microscopic study of certain Chinese glazes owing their colour to ferric oxide, which I undertook in collaboration with Mr. A. L. Hetherington, he was able to explain how the varied and beautiful effects seen on certain specimens of Chinese porcelain could be obtained, and to show many similar glazes produced in the laboratory to support the explanation put forward.

Ferroso-ferric oxide, magnetic oxide of iron, gives in certain glasses neutral tints of various depths, but with high concentration of this oxide a black glass can be obtained. If the concentration of the ferroso-ferric oxide be high enough, some of this oxide will come out on cooling so as to be dispersed through the glass in very minute aggregations, which are, however, presumably crystalline, since the resulting glass is appreciably magnetic. The above remarks refer to glasses containing the whole of the iron in the ferroso-ferric form. If a ferrous iron glass or glaze contains some ferric iron, the green colour due to the ferrous iron will be modified and various olive green tints can be obtained. There are many such coloured glazes in which the iron is principally in the ferrous state, but there is sufficient of the ferric iron present to produce the olive green tint. In a similar way small quantities of ferrous iron in a glass which contains appreciable quantities of ferric iron will modify the yellow or brown colours due to the ferric iron and give somewhat dusky hues.

Before leaving the subject of iron I am tempted to hazard a guess at the nature of the colouring matter in lapis lazuli. In almost all the specimens which I have seen, here and there crystals of iron pyrites (ferric sulphide) can be seen. An examination of these specimens under the microscope reminds me very strongly, except for the difference of colour, of the appearances of many of the glazes very deeply coloured with ferric oxide, in which also crystals of ferric oxide can be seen. The colouring of lapis lazuli is very intense, so much so that very thin portions of it make equally thin portions of the deepest blue glass obtainable look almost white by comparison. Let me for a moment direct attention to a simple experiment with solutions. If to an aqueous solution of ferric chloride, as free as possible from free hydrochloric acid, there be added quickly an aqueous solution of hydrogen sulphide, there is the production of a transient intense lapis lazuli colour. It has been suggested that this colour is due to the formation of a ferric sulphide which, in the solution, rapidly breaks down to a ferrous salt with the separation of free sulphur. My guess in respect of lapis lazuli is that the beautiful blue colour is due to minute particles of ferric sulphide, altogether too small to be seen by the microscope, dispersed through the mineral. Different concentrations of the dispersed ferric sulphide would account for the various lighter blues, full blues, and dark, almost black, blues which can be seen in specimens of lapis lazuli. I hope to be able to find a specimen of lapis lazuli of the very blackest blue colour obtainable and to examine it critically by the microscope; I also hope to be able to test the suggestion made by synthetic experiments.

In the process of making artificial ultramarine by heating together clay, sodium carbonate, sulphur, and charcoal, or some other substance rich in carbon, it has been stated, I believe, by a number of experimenters, that small amounts of iron must be present in the materials. I need scarcely mention that almost every clay contains small, but appreciable, quantities of iron.

A few points about the third colouring agent already referred to may now be described. It is quite a common thing to see glass in windows which by long exposure to sunlight has developed colour ranging from a pink, through various depths of rose-violet almost to a marked blue-violet. Some window glasses also become coloured with a brownish-yellow tint by long exposure to sunlight, but the colour is not usually noticeable. In a glass sphere taken from a sunshine recorder, kindly lent me by Dr. G. C. Simpson, the originally colourless or slightly green glass has become a pronounced yellow-brown; the colour of this sphere is very marked in comparison with the usual colourless sphere.

The colour developed in a glass by exposure to sunlight is partly determined by the composition of the glass. Similar discoloration can also be produced in glasses by exposing them to ultra-

violet rays of shorter wave-length than those present in sunlight, to X-rays and to the radiations from radium, but the colour developed by these agencies is not, in every instance, the same as that which can be produced in the same glass by exposure to sunlight. There can be little doubt that the radiations are the cause of the colour, though what is the nature of the material which is separated out by the action of the radiations and produces the colour is not fully known. In purpled window glass, manganese has been frequently mentioned as the colouring material, it being sometimes assumed that under the influence of the radiations the colourless manganous oxide in the glass becomes oxidised to a purple manganese peroxide. In a similar way it has been suggested that the brown colour such as is seen in the sunshine sphere is to be explained by the oxidation of the ferrous iron to the ferric state. There are certain difficulties in accepting these explanations of the colours. The colourless sunshine sphere mentioned above was, a few weeks ago, a much darker yellow-brown than its companion which shows the marked brownish-yellow colour. Both spheres were colourless when new, and the present colourless one has been rendered so by heating it to a temperature of 500° C. All the varieties of coloured glass with which I have been able to experiment, and which owe their colour to the action of radiations, can similarly be decolorised by heating to an appropriate temperature; but of all the glasses I have tried which have been purposely coloured by ferric oxide, or by manganese dioxide, I know of no example which can be decolorised by heating, even if it is heated up to a temperature sufficiently high to re-melt it. This is not to say that these observations refute the suggestions of the nature of the colour mentioned above, but they certainly introduce difficulties which it would take too long to elaborate on this occasion.

Just as glasses can become discoloured by radiations, so have many minerals apparently been similarly affected, and in all examples which I have tried, and in which the colours were produced presumably by radiations, the colouring could be discharged by heat. Highly coloured fluorspar is a typical example; purple amethyst, smoky quartz, rose quartz, yellow quartz, and various coloured zircons, known in the gem trade as jargons, are others. All of these can be decolorised when heated to an appropriate temperature. A fine purple amethyst, for example, became clear colourless quartz at a temperature of about 400° C. A rather browner purple amethyst lost its purple at the same temperature, but had a yellow colour left, which was discharged, however, at 700° C., and the resulting quartz was white but not clear; it was opalescent.

In all the cases mentioned above it is found that when the colour of the glass or mineral is discharged by heat, the apparently colourless material shows a marked absorption in some part or other of the ultra-violet spectrum.

In the instances of glasses and fluorspar it is generally found that the decolorised specimens exhibit marked fluorescence under the influence of ultra-violet light. I have not seen examples of crystalline quartz which show similar fluorescence, but if the decolorised amethyst be fused, the vitreous silica so obtained shows marked fluorescence. Either the decolorised amethystine quartz or the same substance fused can be coloured again by exposure to radiations, the colour being developed most readily by exposure to the gamma-rays of radium. It is not possible, with pure crystalline quartz, which shows the highest transparency to ultra-violet radiations, to produce any coloration by submitting it to the action of the gamma-rays from radium over a period sufficient to produce marked coloration in the decolorised amethyst or in decolorised rose, yellow, or smoky quartz. Similarly, I have not found it possible with fluorspar of the highest transparency to ultra-violet light to colour it by gamma-rays, but there are many specimens of fluorspar colourless to the eye which fluoresce in the ultra-violet light, and these can be coloured by exposure to the gamma-rays from radium.

From all the observations it certainly seems that the substances I have mentioned owe their colour to the action of radiations, and become coloured only when they contain a small quantity of a suitable impurity. There is no conclusive evidence of the exact nature of the material which, separated out by the action of the radiations, imparts colour to the glass or mineral. Finely dispersed metal such as calcium has been thought possible as accounting for the colouring of glass, fluorspar, and Iceland spar, but glasses which contain no calcium become coloured by radiations, and it is not impossible to imagine finely dispersed potassium or sodium as the colouring material. Silicon itself has been suggested as producing the colour of some quartz, and so has titanium, and so has carbon. It is difficult to see why silicon, which is made to go back as silica by heating, should render the quartz opaque to some ultra-violet radiations. There is no suggestion which has been made which is not open to some objection or other.

In the production of these colours, there appears to be some analogy with the ordinary changes which are observed in silver salts on exposure to light. A pure silver halide (chloride, bromide, iodide) is apparently unaffected by light. That the well-known action of light on these compounds as they are generally prepared is ascribable to the presence of small quantities of some other material or materials is generally accepted; but no one would suggest with our present knowledge that the dark material which develops in the silver salt when exposed to radiation consists of the impurity. The darkening is ascribed to decomposition of the silver salt, which decomposition is rendered possible by the presence of the impurity.

Taking into account all the observations which have been made on the effect of exposing various glasses and minerals to radiations and to cathode discharge, it would appear not unlikely that the colours produced in these experiments are

ascribable to the separation from the material of one or other of its constituents by the action of the radiation, which separation is only possible provided there is present in the material a suitable impurity; but change the line of argument a little, and there are facts which would appear strongly to support the view that it is the impurity itself, in many instances, which becomes separated out in a fine state of division by the radiations and imparts the colour to the glass or mineral. We do not know. There is a mass of evidence to be considered, but much more experimental work is needed before that evidence can be dealt with and properly assessed.

Hæmolysis.

THE discussion at the recent meeting of the British Medical Association in Edinburgh, opened by Dr. Eric Ponder, afforded much information as to the nature of hæmolysis, and was particularly fruitful in clearing up the apparently contradictory data concerning the structure of the erythrocyte or red blood corpuscle.

On one hand, it has been held that the red blood corpuscle, although to all appearance homogeneous, in reality consists of an external envelope of colourless material which forms a thin film enclosing the dissolved coloured material or hæmoglobin. Thus this envelope would be controlled by the laws of osmotic pressure. When water reaches the corpuscle it passes through the film and swells the corpuscle, causing it to become globular; eventually the envelope will burst or become sufficiently distended to allow the fluid to escape through its pores, the envelope being left. The loss of water from the cell causes shrinking and corrugation of the surface, the wrinkled or crenated form being produced. On the other hand, it has been supposed that the corpuscle is formed of a homogeneous porous material, in the pores of which the hæmoglobin is contained.

A few years ago a reversal effect was described by Brinkman, but the reaction is only apparent. After hæmolysing the cells, the solution was centrifuged and the supernatent fluid subjected to cataphoresis. This treatment resulted in the appearance of the ghosts at one pole and of the hæmoglobin at the other; on mixing the ghosts and hæmoglobin together the cells were apparently reformed, but on analysis only 50 per cent. of the hæmoglobin could be accounted for. Further, it can be shown that the isoelectric point of the normal cell and that of hæmoglobin are different, whereas the isoelectric point of the re-formed cell and hæmoglobin are the same, which is evidence that in this phenomena the cell is not re-formed as was originally thought, but that the hæmoglobin is merely adsorbed on to the surface of the ghost.

The further evidence advanced by Brinkman, that section of the red cell does not result in the exudation of fluid, is by no means contradictory to the theory of the envelope-like structure of the cell, for indeed, as Schafer pointed out, it is possible to cut a soap bubble in a similar manner, the razor reuniting the edges of the cut membrane.

The changes in size and shape which the cell undergoes both in hypotonic solutions and in solutions containing hæmolysins afford considerable evidence that the red cell of mammals is a balloon-like structure possessed of an envelope of considerable strength. The work of Seifriz offers direct information. This observer has actually micro-dissected the human red cell, stretched its envelope, and observed the escape of fluid containing hæmoglobin from the cell. The membrane is probably similar to that suggested by Beehold, namely, that it has a protein frame-work in the interstices of which lipoids are contained. It is probably inaccurate to describe the lipoids as a constituent of the cell membrane; for recent work goes to show that the lipoids are mainly if not entirely within the cell. Mellanby, in the discussion, raised the objection that the cell membrane could scarcely be of a protein and lipoid structure, as the enzymes lipase and trypsin are without hæmolytic action upon the red cell. In this instance the specificity of enzyme action must be remembered; and, further, Ponder has shown that certain proteolytic enzymes of bacterial origin are capable of producing hæmolysis.

The ingenious method devised by Mellanby has afforded a means of making rapid and accurate observations on hæmolysis. A beam of light passes through a system of lenses, the emerging parallel rays being incident upon one of the parallel faces of the glass cell containing the suspension of corpuscles. The beam of light, after passing through the suspension, falls upon a selenium cell which is connected in circuit with a galvanometer. Variations in the intensity of light passing through the suspension of corpuscles produce variation in the deflexion of the galvanometer. The galvanometer scale is calibrated so that the readings may be made direct in terms of hæmolysis. To keep the experimental conditions constant, the parallel-faced dish is surrounded by a water bath, the temperature of which is kept constant by an electric thermo-regulator.

Using this method, Ponder has shown that a large number of lysins fall into what might be called the class of simple hæmolysins. With this class of lysins, hæmolysis results in the using up of the lysin due to its union with some protein component of the cell envelope, the reaction being of the first order. Among this simple class of hæmolysins are the majority of the hæmolytic glucosides, the soaps, salts, and acids allied to the bile salts; while recently McLachlan and Ponder have shown that the majority of the lysins of bacterial origin fall into this class. It is very interesting to note that two of these bacterial lysins, namely, that of *B. histolyticus* and that of *Streptococcus pyogenes*, are definitely known to be proteolytic.

With the lysins of the saponin class, the reaction which results in hæmolysis appears to be one between the lysin and the protein of the cell envelope, and it is possible to demonstrate that these lysins will unite with other proteins to form non-hæmolytic compounds. Further, the results indicate that the combination takes place as an adsorption process. An interesting point arises with regard to the action of bile salts, as it has been shown that the serum proteins may either inhibit or accelerate the action of the bile salts according to the order in which the components of the hæmolytic system are added. The inhibitory action may be explained in the same manner as the saponin series, but the manner in which acceleration is brought about is far more difficult.

Mackie's experiments on brilliant green are of interest in this respect. 'Brilliant green' in high concentrations is a hæmolysin, but in lower concentrations it acts by 'sensitising' the cells so that the subsequent addition of small quantities of serum produce rapid lysis. Further, as in the bile salt system, if the components are mixed together in the reverse order, no hæmolysis occurs. Although the sensitised cells are apparently free from 'brilliant green,' in reality they contain large quantities of the dye, as is evidenced by extraction with alcohol and acetone. Experiments have shown that the dye is united to the hæmoglobin as well as to the cell envelope, and that the amount taken up is nearly proportional to the amount used in bringing about the sensitivity. The reaction between the 'brilliant green' and the cells is divisible into at least two distinct changes:

(1) The adsorption of the dye by the cell envelope and contents.

(2) A reaction, which results in hæmolysis, occurring between the adsorbed dye and the cell envelopes.

The amount of lysin formed will depend on the amount of dye adsorbed to the cell and the amount of protein added. If one unit of 'brilliant green' is adsorbed to the cells, this unit will unite with one unit of serum to form one unit of the new lysin. If only half a unit of protein is added, there will be insufficient protein present for the combination and one half unit of lysin will be formed. The phenomena observed with the bile salts can be shown to be identical with those observed with 'brilliant green,' the taurocholate replacing the dye as a 'sensitising agent.'

The Leeds Meeting of the British Association

LOCAL ARRANGEMENTS.

LEEDS, in these days of railway amalgamations, is supplied with railway termini in confusing profusion, the L.M.S. trains arriving at no less than three different stations. All the stations are close together, however, and convenient for the reception rooms. At all stations members will be met by guides wearing armlets, and those proceeding to hostels can, if they wish, entrust their luggage to these officials for despatch to the hostels.

The inaugural meeting, where the presidential address will be delivered, is to be held in the Majestic Cinema, which lies between these main stations, and faces on City Square.

The abundance of restaurants near the city has obviated the need for extensive provision for meals in the Reception Room, but lunch or tea can be obtained there, whilst at the University, in addition to the usual refectories, a buffet luncheon will be served in the elementary physics laboratory throughout the week.

The local handbook is now ready for distribution to members. Under the editorship of Dr. C. B. Fawcett, this handbook is more on the lines of modern regional geographic studies than has been customary. A special feature of the meeting is the series of guides to the various excursions, which are gathered into a neat cloth folder making another volume equal in size to the handbook. Under the editorship of Mr. H. E. Wroot, these excursion handbooks have been done with unusual thoroughness, and will be found of permanent value.

Members will also receive a guide to the extensive exhibition of scientific apparatus in the Crypt of the Town Hall, whilst the local handbook contains brief descriptions of the special exhibits by the Air Ministry and Meteorological Office, and the British Broadcasting Corporation, which are also in the Town Hall, and of the demonstration of television, noctovision, and the phonoscope which is to be given by Mr. J. L. Baird in a room at the Education Offices next door to the Town Hall.

The General Committee, the Committee of Recommendations, and the Council will meet in the Crown Court of the Town Hall—in close proximity, therefore, to the Reception Room.

Badges are prepared for issue to members, which, by resolution of the City Council, will frank members over the Corporation tramways during the week.

Excursions are rapidly booking up. Those to Gaping Ghyll, the St. Leger at Doncaster, Farnley Hall, and Rievaulx Abbey, and Ampleforth are already over-applied for. When possible, early applicants will receive their excursion tickets through the post before the commencement of the meeting. But in some cases their issue will, of necessity, be delayed until the meeting starts. In these cases the tickets will be awaiting members at the excursion counter in the Reception Room.

The Leeds Art Theatre announces the performance of the "Cradle Song," translated from the Spanish of G. Martini Sierra by John Garret Underhill, which will be given on the evenings of Monday, Tuesday, and Wednesday, Sept. 5-7, at 8.30 P.M.

Citizen's lectures in Leeds have been arranged as follows:

Sir Oliver Lodge. "Energy." In the Albert Hall.

Dr. MacGregor Skene. "By-Products of Plant Activity." In the Philosophical Hall.

Children's Lectures:

Mr. Kingdon Ward. "Plant Hunting on the Roof of the World." In the Albert Hall.

Dr. Clarence Tierney. "Nature's Secrets," with cinematograph illustrations. In the Majestic Cinema.

Citizen's lectures have also been arranged in Pontefract, Batley, Harrogate, Huddersfield, Otley, Keighley, Wakefield, Shipley, Castleford, Guiseley, and Brighouse.

Obituary.

Sir Bryan Donkin.

BY the death, on July 26, at the ripe age of eighty-two years, of Sir Horatio Bryan Donkin, the world has lost a sane psychologist and a clear and rational thinker. My first meeting with him was in the middle 'eighties, when he was dean of the Westminster Hospital, and I learned to appreciate his sterling qualities when, in my third year, I became his ward clerk. This was during what may be termed the first half of a life spent in the useful service of mankind, for he not long after forsook the practice of physic for a Government official position. As a teacher of medicine Donkin was not only clear and precise in his methods, but also possessed a broad outlook upon the duties of a physician which was in strong contrast with that of some of his colleagues on the hospital staff. To one who was mindful of the limitations imposed by medical tradition, this made work under his guidance a pleasure as well as a duty. It was my privilege in later life to realise still further the value of his friendship. The second part of his life was fully occupied by his duties as H.M. Commissioner of Prisons, duties which he took very seriously. Bringing to the post his deep knowledge of medicine and his very kindly nature, he succeeded in introducing more than one salutary reform in prison organisation. He was not one to whom the prisoner was merely a 'bad lot'; he regarded him rather as a patient, and he was, with the late Dr. Mercier, one of the pioneers of the valuable work which has been done in the psychology of crime. He was medical adviser to the Prison Commission, and in 1910 delivered the Harveian oration of the Royal College of Physicians upon the subject of the inheritance of mental characters.

A well-deserved knighthood honoured Donkin's retirement at an age when many men prefer to rush out in such quiet enjoyments as, in their consideration, their remaining years permit. He, however, possessed the mind which refuses to become hide-bound with age. He knew how to keep young in mind and body, and he elected to do fighting work for what he considered to be the right. To his straightforward mental outlook and his uncompromising rationalism, everything which savoured of charlatanism and humbug, or was the result of inaccurate and loose thinking was anathema, and he never hesitated to speak and write exactly as he thought. Possessed of a ready pen, his trenchant criticisms upon such subjects as psycho-analysis and various hasty and irrational reforms were characterised by a clearness of argument that made them difficult to controvert. To young writers he was ready of help, and his kindly advice was always acceptable. His loss to the cause of rationalism (he was a member of the Rationalist Press Association) is one which will be felt, and his name will be remembered by all with whom the quest of truth is a thing that matters.

Macleod Yearsley.

The issue of the *Physikalische Zeitschrift* for June 1 contains an account of the life and work of the late Prof. F. Exner of Vienna from the pen of his pupil and colleague Prof. H. Benndorf. Franz Exner was the youngest of the five children of F. Exner, professor of philosophy at Prague, who was called to co-operate with Count Thun in the reform of Austrian education in 1848. He was born in Vienna in 1849 and lost both his parents at an early age. He was a pupil at the gymnasium at Vienna from 1860 until 1867, when he entered the University under Stefan, who although director of the physical institute had no assistants and only a miserable supply of instruments. After two years at Vienna he spent a year under Kündt at Zürich, where his brother was lecturer on Roman law. On his return to Vienna he graduated as doctor in 1871. After acting for two years as assistant to Kündt at Strasbourg, he became lecturer and assistant to von Lang at Vienna and in 1879 professor extraordinary. In 1891, on the death of Loschmidt, he became ordinary professor, and in 1907 Rector of the University. The new physical institute he designed was opened in 1913. He retired at the age limit in 1920 and died in Vienna on Nov. 15, 1926, aged seventy-seven years. During his tenure of the professorship the University of Vienna produced a large number of physicists, who now occupy most of the chairs of physics at Austrian universities and the lectureships at high schools. Of his own researches, those on atmospheric electricity are probably best known; but he also did valuable work on spectroscopy, on colour vision, and on the voltaic cell.

We regret to announce the following deaths:

Prof. B. B. Boltwood, professor of radio-chemistry at Yale University since 1910, who did noteworthy work on radium and radio-activity, aged fifty-seven years.

Dr. William Burnside, F.R.S., late professor of mathematics at the Royal Naval College, Greenwich, on Aug. 21, aged seventy-five years.

Prof. E. B. Titchener, Sage professor of psychology in the Graduate School at Cornell, New York, editor for many years of the *American Journal of Psychology* and American editor of *Mind*, on Aug. 3, aged sixty years.

News and Views.

Two esteemed veterans of science—Sir Oliver Lodge and Prof. Henry E. Armstrong—celebrate their golden weddings within a few days of one another, and on behalf of scientific workers everywhere we offer them most cordial congratulations and best wishes for further happy years. Sir Oliver and Lady Lodge were married on Aug. 22, 1877, and Prof. and Mrs. Armstrong on Aug. 30, 1877. There is a distinctive quality in the personalities of the wives as well as of the partners of their triumphs and troubles for fifty years. Both Sir Oliver and Prof. Armstrong are distinguished by their originality of thought and independence of action; and both are held in affectionate regard by all who have come under their influence. Their different natures—or rather certain factors which characterise them—are represented to some extent in their eldest sons, Sir Oliver's being a life-long student of art and full of imaginative insight, while Prof. Armstrong's is devoted to industrial chemistry, and is managing director of the British Dyestuffs Corporation, Ltd. Heine said that a man should be careful in the choice of his parents, and with the Lodges and Armstrongs the children have had the advantage of both wise nurture and noble nature. Well may they say, in spirit and in truth: "Let us now praise famous men, and our fathers that begat us."

ALTHOUGH young in years, the Institution of Chemical Engineers has so firmly established itself in the professions both of chemistry and of engineering as to make the appearance of a volume of its *Transactions* an occasion of some significance. The season has passed when a self-styled chemical engineer was merely a chemist who knew how to screw a pipe, or a young engineer who could make himself generally useful, and in particular could manipulate caustic soda with safety. Familiarity with specific industrial plant and works practice is far from being a negligible accomplishment in a chemist, but the qualifications demanded for associate-membership of the Institution go beyond this; they can best be realised by a glance at the examination papers which are reprinted in vol. 4 (1926) of the *Transactions*, and the examiners' report in connexion therewith. The test, the first public examination in chemical engineering held in Great Britain, was based on the requirement of a thorough general knowledge of chemical reactions and physical laws and a sound grasp of the principles of engineering; it attempted to estimate fundamental knowledge and the mental attitude brought to bear on industrial problems. The *Transactions*, of which Mr. S. G. M. Ure is the editor, include a report of the fourth annual corporate meeting, with Sir Frederic L. Nathan's presidential address on "Industrial Efficiency", four papers on corrosion, two on statistical methods, and one each on filtration, grinding, the saccharification of wood, alcohol motor fuels, a plant for fat extraction by solvents, a recording torsion dynamometer, refrigeration, and the laws of air elutriation, together with reports of discussions on each of the papers.

THE reader of the *Transactions of the Institution of Chemical Engineers* is left with a strong impression of the importance of the results both accruing and to be anticipated from the type of investigation fostered by the Institution. The chemical industries, despite, and at the same time because of, their remarkable progress, have accumulated a considerable store of problems concerning which the need for prolonged and systematic research is evident. For example, although the conversion of sawdust into alcohol (with intermediate production of sugar) has long been possible, even on a considerable scale, the process is still unsatisfactory from the point of view of its economics, both in regard to the actual saccharification and to the subsequent fermentation. The present price of petrol, although contributory, is not the only difficulty. The papers on statistical methods are, perhaps, of more than ordinary interest in times when the difference between cost and receipts is so often dangerously small. Works managers in factories other than chemical might well study the scheme of recording which is described. Although they may differ concerning the nature of the information which they require day by day in order to control and maintain production, efficiency, and economy, they may find themselves in substantial agreement as to the best means of obtaining it.

FROM the Second Circular of the tenth International Congress of Zoology, to be held at Budapest on Sept. 4-9 (incorrectly described in our issue of Aug. 6 as the ninth Congress), we learn that the 146 authors have already announced their intention of reading 162 papers between them. Many of these papers, while doubtless useful additions to knowledge, appear from their titles scarcely to possess that general or fundamental character which might warrant their public reading to a gathering of zoologists from all parts of the civilised world. The subject of general interest that has attracted a large number is tissue-culture, and communications dealing with it are promised by Carrel of New York; Centanni of Modena; Demuth and van Riesen, A. Fischer, Kimura, and Laser of Berlin; Gassul of Kazan; Haan of Groningen; Harrison of New Haven; Krontowsky of Kiev; Küster of Giessen; Levi and Olivo of Turin; Timofejewsky of Tomsk, and Zweibaum of Warsaw. Tissue-culture may perhaps pass, but when one finds several titles like "Zur Physiologie der Tumorzellen" and "Immunity in relation to Implanted Malignant Tumours," or others on white blood corpuscles, one begins to inquire what is meant by 'zoology.' Fortunately the old-fashioned zoologist will find a few papers of broad interest, such as Racovitza "Espèce et lignée," Van Bemmelen "Organismen-Begriff und Zellenlehre," Fedotov "On the Relations between the Classes of Echinoderma," and L. O. Howard "On the International Aspects of Entomology." Or if his tastes

are more sporting, he may hear the unwearied Stiles stand up to the irrepressible Poche on the rules of nomenclature.

THE part of the chain of Mont Blanc recently christened "Monte Mussolini" is one of the many peaks comprised in the *massif* dominated by and generally known as Mont Blanc, but it is wholly in Italian territory. There are at least fifteen high peaks in the chain, from Mont Joli, 2670 metres high, to the Aiguille du Tour, 3542 metres, the highest peak, Mont Blanc, being 4810 metres. Monte Rosa, its Italian sister, rises to 4683 metres, while the highest summit in the Pyrenees, the Nethou, attains only to 3404 metres. The Franco-Italian frontier runs (in theory) along the summits of the high peaks of Mont Blanc, but in one place the Italian line lies on the wrong side. It happened that when Savoy was ceded to France, in 1860, Victor Emanuel expressly reserved a little *enclave* on the other side, as that spot was the haunt of the chamois he so dearly loved to hunt. It was in a somewhat similar way that the ex-Emperor of Germany, when the frontier was delineated between British, and German East Africa, persuaded the British Government to deflect the otherwise straight line so as to include Kilimanjaro, as he wished Germany to possess the highest mountain in Africa.

AN account of the work of the *Discovery* Expedition up till Aug. 18, 1926, has already appeared in these pages (NATURE, Oct. 20, 1926, p. 628). In the recently published first annual Report of the expedition (London: H.M. Stationery Office. 1*s*. 6*d*. net) an outline of the work carried out for the remainder of that year is given. The R.R.S. *Discovery*, together with the additional Research Steam Ship *William Scoresby*, which arrived at Cape Town on Aug. 1, embarked on the programme originally arranged. Leaving Simon's Town on Sept. 21, the *Discovery* proceeded on two short cruises off the African coast for work off the Saldanha Bay whaling grounds. On Oct. 27 she left Africa for South Georgia, arriving there on Dec. 5, after having to change the route originally chosen—south from the Cape to about Lat. 58°—owing to exceptional ice conditions. Meanwhile the *William Scoresby* had been employed in whale marking and taking plankton collections off the African coast until Oct. 21, after which she sailed for South Georgia. Arriving before the *Discovery*, on Nov. 8, a line of plankton stations was run by her along the north-west coast, and whale hunting was undertaken for marking purposes. Afterwards the two ships combined in a plankton survey of the whaling grounds. Observations were resumed by the staff of the Marine Station at Grytviken, in South Georgia, early in November. Amongst other valuable data obtained by them during their previous stay at Saldanha Bay was an embryo of a Sei whale, only 2-3 mm. long, believed to be the youngest embryo which has ever been found in a whale. The *Discovery* left Simon's Town for Portsmouth on July 18 via the west coast of Africa and is expected to arrive in October. Before further sea work is undertaken, the scientific staff will spend two or three months working up the results of their collections, which are housed in the Natural History Museum.

THE reports of the electrical engineers of the Brighton and Bradford Corporations who have independently visited the United States to inspect American power stations and transmission lines are of interest. Abstracts of them have been published recently in various technical journals. In their opinion, the Americans are in advance of Great Britain in boiler-house practice. The use of pulverised fuel is becoming common. In New York the Steam Corporation supplies its consumers directly with 5000 million pounds of steam every year for heating purposes. The high-pressure steam pipes, covered with heat-resisting material and provided with valves and expansion joints, have been admirably designed. If we except the large size of the steam turbines, there was little in the power stations themselves that was found to be novel. Many of the new capital stations have very much higher load factors than any in Great Britain, being loaded in some cases up to 80 per cent. of their maximum capacity. The price of electricity, however, is not cheap. In the opinion of these British engineers the overhead transmission lines, worked at very high pressures which convey large supplies of power from one station to another, instead of marring the beauty of the landscape, give an added interest to it. In Chicago the Commonwealth Edison Company has constructed a very large new generating station. There is an underground ring main which will be operated at 132,000 volts and will inter-connect all the power plants and substations of the company. This is a new departure, and its operation will be studied with great interest by electricians. The sign lighting in Broadway and Times Square, New York, is marvellous, and greatly improves the somewhat meagre direct lighting from street lamps. Some of the smaller cities and towns visited had better street lighting than New York. We agree with the statement that it would be a great boon to all road users in Brighton if the candle power of all the street lamps was doubled.

THE rapid improvement which is taking place in the thermal efficiency of electric generating stations is very satisfactory, as it shows that old-fashioned apparatus is being scrapped. In the July number of *World Power*, H. Quigley gives statistics which indicate some of the economies which have been effected by this increased efficiency. During the last five years the average fuel consumption per electric unit generated in British generating stations has diminished from 3·11 lb. to 2·40 lb. If this diminution had not taken place, about two and a half million tons of coal in addition would have been consumed. The average of 2·4 lb. per unit is not much greater than the average of 2·1 lb. per unit obtained in America. The author, taking the average of the twenty-five largest and most efficient stations in Great Britain, finds that since 1922 the average consumption per

unit generated has fallen from 2·05 lb. to 1·80 lb. Twenty-five per cent. of the national output of electricity is generated by these stations. The Barton station at Manchester achieved in 1925-26 the record efficiency, generating a unit for every 1·36 lb. of coal consumed. Practically all the modern generating plant in these stations has been manufactured by British firms. Provided that trade is prosperous, so that the load factor of the generating stations continues to increase, there is every prospect of much better results being attained in the immediate future. The new Government schemes will help in this direction.

THE first issue has appeared of the *Journal of the Ministry of Agriculture for Northern Ireland* (Belfast: H.M. Stationery Office, price 2*s.* 6*d.*), its object being to provide a medium for the publication of the results obtained by the different agricultural research divisions of Northern Ireland. The articles are intended to be in a form which should render them easily understood by the farmer, while in no way affecting their scientific value. One of the chief problems is to discover a phosphatic fertiliser which will be suitable to the crops and soils of the district, and also an efficient substitute for the high grade basic slag now rapidly disappearing from the market. Experiments are recorded which show that North African rock phosphates can be successfully used, with the further advantage of reduction in cost. Investigations in connexion with the loss of vigour in stocks of potatoes are of special importance in view of the efforts being made to develop a seed potato trade in Northern Ireland. Deterioration is much more rapid in early than late districts, thus enabling the latter to provide healthy stocks for the former when change of seed is needed. The practice of cutting potatoes is quite successful on light, dry soils, provided it is done at the time of planting. With regard to plant diseases, American gooseberry mildew is one of the most serious problems confronting the fruit growers in Ireland, but it can be successfully controlled by suitable spray mixtures. Silage investigations are of particular importance owing to the prominent part played by live stock in the farming of this district. The yield from a mixture of oats, beans, vetches, and peas, though less than the average yield of turnips, is more certain, and further, the crop has a considerably higher dry matter and feeding value than roots. In addition to the main articles, bibliographical reviews and short notices of recent important agricultural publications are appended, which should prove of the greatest value to both farmer and agricultural instructor.

IN 1928, on Sept. 24-Oct. 6, it is proposed to hold a Fuel Conference at the Imperial Institute, London. This will be a sectional meeting under the auspices of the International Council for the Organisation of World Power Conferences—the first of which was held at Wembley in 1924. Lord Balfour has accepted the honorary presidentship, and Sir Alfred Mond the presidentship, while the chief participating industries, including coal, oil, gas, and chemicals, are strongly represented in the organising committees. The technical programme covers solid, liquid, and gaseous fuels, utilisation of fuel, and the general aspects of the fuel question, including training. The programme will include questions of composition and classification of fuel, preparation, storage, handling, and transmission. Evidently the scope of the conference is extremely wide. To shorten proceedings, it is proposed to accept normally only authoritative reports from representative bodies of the participating countries. A preliminary announcement has been issued from the central office, 36 Kingsway, London, W.C.2. The secretariat consists of Messrs. Sholto S. Ogilvie and M. W. Burt (general secretaries) and Dr. E. W. Smith and E. J. Fottrell (joint technical secretaries).

THE chief interest of the annual report for 1925–1926 of Bergens Museum (*Bergens Museum Aaresberetning*, 1925–1926) drawn up by the Director, Prof. Carl Frederic Kolderup, lies in the large amount of original research forthcoming from all departments, which shows a very flourishing state of affairs. Amongst the many well-known and valuable publications of the Museum is included Vol. 9, parts 11 and 12, of the late G. O. Sars's "An Account of the Crustacea of Norway," continuing the Ostracoda. Attached to the Museum is the Biological Station at Herdla, and here many visitors have availed themselves of the opportunities offered to workers, where the Director, Prof. Aug. Brinkmann, and his assistants are themselves engaged in investigating marine problems. At the Geophysics Institute hydrographical work under the direction of Prof. Helland-Hansen is being carried out, observations being undertaken on temperature, salinity, and carbon dioxide content of the fjords round Bergen, with direct registry of the density of the upper water layers by means of the 'pycnosonde,' an apparatus recently constructed by Dr. D. la Cour, Director of the Danish Meteorological Institute.

ALTHOUGH historically unimportant, Tut-ankh-amon will no doubt long continue to occupy a prominent place in popular regard and an added interest be taken in any historical details concerning him or his entourage which can be brought to light. Prof. Forrer has now published in full a corrected and amended copy of the Hittite cuneiform texts relating to the negotiations between Tut-ankh-amon's widow and the Hittite king Subbiluliumas for her remarriage, which has been translated by Prof. Sayce in *Ancient Egypt* for June. While the king was at Carchemish, the queen sent him an envoy asking for one of his sons in marriage as "My husband is dead and I have no son." With characteristic caution the king sent the Chief Secretary, his High Chamberlain, to Egypt "to bring back an accurate report as to whether she is in any way deceiving me and what has become of the son of their (late) master," a proceeding which seems to have aroused the queen to some indignation, which she expresses in a subsequent despatch. This text raises an interesting question

as to the method of making and filing these official records. Apparently there were two copies, one on clay and one on bronze, one of which was a draft, though which is not quite clear. Sir Flinders Petrie adds a figure of the Princess from the tomb of Panehesy at Tell el Amarna.

THE need for scientific research in the fishing industries is concisely stated by Maurice Holland in a short paper which has been issued by the U.S. National Research Council (No. 74, Reprint and Circular Series of the National Research Council, Dec. 1926). His remarks indicate the indifference with which the fisheries have, in the past, supported a rational research programme. Whilst dealing only with the specific problems presented by the United States, his remarks are generally applicable. Fisheries products, in spite of their importance, make up no more than 3 per cent. of the world's food supply; this only represents 40 per cent. of the total catch, and the remainder gives but a small return. The author gives a summary of future commercial possibilities in which the 60 per cent. by-products might be profitably utilised. A comparison is made with other industries, particularly with the meat-packing industry; it appears that out of 115 industries, less than ten have a higher number of wage earners, though the value of the annual product per person is very low. It is suggested that the formation of a fisheries bureau similar in scope to the Conseil Permanent International of Atlantic countries, but dealing particularly with the Pacific countries, would be of great help in future developments.

UNDER the title of "Flottierende Stationen," Dr. H. C. Redeke, in "Abderhalden's Handbuch der biologischen Arbeitsmethoden" (Abt. 9, Teil 2/2, pp. 1249-1257, 1927), gives particulars of a houseboat used for inland fishery research on the Dutch waterways. This well-equipped laboratory, built on a barge 81 ft. × 19 ft., is illustrated by a photograph, where it is seen moored in a placid Dutch waterway—an ideal laboratory and summer residence which can be towed from place to place at small expense as occasion demands. The relative advantages of wood over iron construction, equipment, and accommodation are discussed. Three other floating biological laboratories exist, on Lough Derg, in Illinois, and in Quebec.

IN a note entitled "Non-Marine Mollusca of the Belgian Congo" in our issue of Aug. 6, p. 204, reference was made to the lack of an index to the collections. A correspondent informs us that, in answer to an inquiry, the Librarian of the American Museum of Natural History stated that an index to "The Aquatic Mullusks . . ." will be ready very shortly.

THE April issue of the *Proceedings of the Imperial Academy* of Japan contains a list of the grants to be made out of the research funds of the Academy for the fiscal year 1927–28. Of the seventy-one grants made, eighteen are for religious, historical, literary, and economic studies, and fifty-three for scientific and medical work. In the latter group may be mentioned investigations on asteroids, earthquakes, Japanese coal and petroleum, air movements, synthesis of paraffins, soil and its organisms, crops, genetics of insects, nutriments, effects of poisons on the nervous system, metabolism, and cancer. Further grants recommended by the Academy were made out of the Toshogu Memorial Fund by the Board of Directors of that Fund.

THE British Museum (Natural History) has recently issued a "Guide to the Crustacea," by Dr. W. T. Calman, which forms an excellent handbook to the study of the specimens of the class Crustacea exhibited in the galleries of the Museum. Brief accounts are added of the Trilobita and the Pycnogonida. The guide is well illustrated by fifty-three drawings and photographs.

A CATALOGUE (No. 499) of second-hand books—some 341 in number—on British and foreign birds has just been issued by Mr. F. Edwards, 83A High Street, Marylebone, W.1. It can be had from the bookseller upon application.

A CATALOGUE (No. 1, New Series) of second-hand books, pamphlets, and serials relating to natural history has reached us from Mr. A. J. Bateman, "Tintern," Hampden Park, Eastbourne. Some 850 works are listed. The prices asked appear to be reasonable.

MESSRS. W. Heffer and Sons, Ltd., 4 Petty Cury, Cambridge, announce for early publication a new book by Dr. H. Martin Leake, entitled "Land Tenure and Agricultural Production in the Tropics," being a discussion on the influence of the land policy on development in tropical countries.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A lecturer in physics and electrical engineering at the Leigh Municipal College—The Director of Education, Town Hall, Leigh, Lancs. (Sept. 3). An assistant in the Records Bureau of the Department of Scientific and Industrial Research—The Secretary, Department of Scientific and Industrial Research, 16 Old Queen Street, S.W.1 (Sept. 12). A specialist in medical entomology in the Ankylostoma and Bilharsia Research Section of the Public Health Laboratories of the Egyptian Government—The Under-Secretary of State, Department of Public Health, Cairo, Egypt (Sept. 15—particulars from the Egyptian Legation, 75 South Audley Street, W.1). An assistant bacteriologist in the East African Medical Service—The Private Secretary (Appointments), Colonial Office (38 Old Queen Street, S.W.1 (Sept. 17). A lecturer in engineering at the Cape Technical College, Cape Town—Chalmers and Guthrie, Ltd., 9 Idol Lane, E.C.3 (Sept. 19). An assistant lecturer in electrical engineering at the Manchester Municipal College of

Technology—The Registrar, Municipal College of Technology, Manchester (Sept. 19). A demonstrator in agricultural botany in the University of Reading—The Registrar, The University, Reading (Sept. 24). A senior lecturer in physiology in the University of the Witwatersrand, Johannesburg—The Secretary, Office of the High Commissioner for the Union of South Africa, Trafalgar Square, W.C.2 (Sept. 26). Research appointments, as follow, under the Ministry of Agriculture, Cairo, Egypt—a chief entomologist, an entomologist for entomological research, a mycologist, and another entomologist, each in the Plant Protection Section; two botanists in the Botanical Section; and a chief chemist, a soil physicist, and a soil bacteriologist in the Chemical Section—The Under-Secretary of State, Ministry of Agriculture, Cairo, Egypt (Oct. 1). A director of tobacco investigations under the Commonwealth Government and the States of Australia—The Official Secretary, Commonwealth of Australia, Australia House, Strand, W.C.2 (Oct. 17). A physics specialist at the Liverpool Collegiate School—The Director of Education, 14 Sir Thomas Street, Liverpool. A lecturer in estate management (including farm machinery) at the Harper Adams Agricultural College—The Principal, Harper Adams Agricultural College, Newport, Shropshire. A chemical laboratory assistant in the experimental department of the Fine Cotton Spinners' and Doublers' Association, Ltd.—The Chief of the Department, Rock Bank, Bollington, Macclesfield.

Our Astronomical Column.

NAKED-EYE SUNSPOT.—A recent spot of considerable size is the eighth to be observed this year as a naked-eye object on the sun's disc. The growth of the spot was rapid, and it originated in a place immediately in front of the disappearing fragments of a group which was near the east limb on Aug. 9. The following table shows the rate of growth, the area being measured in the customary units of millionths of the sun's hemisphere:

Date	Aug. 12	Aug. 13	Aug. 14	Aug. 15	Aug. 16	Aug. 17
Area	25	160	550	900	1150	1300
Long. from central meridian	25°E	12°E	2°W	15°W	28°W	41°W

On Aug. 16 the spot was approximately 40,000 miles in length and 30,000 miles broad. Its structure was complex with several umbræ. In appearance it resembled those spots the magnetic polarities of which are found to be irregular and are, according to the Mt. Wilson observers, most likely to be associated with terrestrial magnetic disturbances. In the present instance no disturbance has been reported, but as the spot, when near the central meridian, had not reached its maximum growth, it will be of interest to await its second transit about Sept. 10. The duration of large irregular spots is not proportionate to their size, a smaller spot of regular outline often lasting much longer, but the return of the recent spot may well be expected on Sept. 4 at position angle 122° from the north point on the sun's east limb. Other details of the spot are as follows:

No.	Date on Disc.	Central Meridian Passage.	Latitude.	Max. Area.
8	Aug. 11-20	Aug. 14·2	10° S	1/750 of hemisphere.

THE TEMPERATURE OF MARS.—Prof. H. N. Russell gives in *The Scientific American* for July a simple description of the work of Drs. Coblentz and Lampland on the heat received from Mars (see also NATURE, Sept. 19, 1925, p. 439). They used a very delicate thermocouple, and screens of glass, quartz, fluorspar, or cells containing water to isolate different wave-lengths of the heat spectrum. The chief difficulties were the effects of the atmospheres of the two planets; that of the terrestrial atmosphere was minimised by the high altitude and dry climate of Flagstaff. It is noted that a moist, slightly hazy atmosphere tends to increase the surface temperature of a planet since it retards the escape of radiation of long wave-length: but for this very reason observations made from another planet are likely to give too low a value for the surface temperature, since they are derived largely from reflection from the upper surface of the haze. It is thus explained why the temperature at the melting edge of the polar cap was measured as −75° F. in 1924, when it must have been in the neighbourhood of 30° F.

Taking the necessary corrections into consideration, Dr. Coblentz gives the following estimates of the noon temperatures of different zones of Mars in the late summer of the southern hemisphere:

Zone.	Temperature (F.).
South polar region	15° to 50°
South temperate zone	65 ,, 75
Tropics	65 ,, 85
North temperate zone	30 ,, 60
North polar region (southern part)	−40 ,, +10

The nights are probably very cold, even at the equator.

The above values are stated to be in good agreement with those found by Messrs. Pettit and Nicholson at Mt. Wilson in 1924. For example, they gave the noon temperature in the tropics as 80°, after correcting for the effects of cloud and haze.

The temperatures as a whole are much higher than was previously thought probable, and this is obviously a point in favour of the planet's habitability.

THE MASS OF VENUS.—The issue for June of *Mon. Not. R.A.S.* contains two papers on this subject. Dr. H. Spencer Jones rediscusses the observations of Mars made with the Cape heliometer at each opposition from 1899 to 1924, applying some necessary corrections to a former discussion. His new value for the mass of Venus in terms of the sun is 1/411,300, with a probable error of 1 part in 300. This is 1 per cent. smaller than Newcomb's mass and 3 per cent. smaller than Le Verrier's.

The other paper, by Dr. J. K. Fotheringham, deals with all determinations of the mass of Venus from 1750 to the present time, and shows that they may be divided into three groups. The observations from 1750 to 1846 give a small mass, those from 1846 to 1888 a large one, the remainder an intermediate value, nearer the first than the second. Dr. Fotheringham regards the change in the mass as real, but most people will consider this as improbable as that the length of the seconds pendulum should change by an inch or so. It is, however, very useful to have all this material rediscussed, though the apparent change remains a puzzle.

Research Items.

AINU NEOLITHIC IMPLEMENTS.—We have received a communication from Dr. N. Gordon Munro of Karuizawa, Japan, in reference to our comments on the Rev. F. Smith's book, "Prehistoric Man and the Cambridge Gravels" (*see* NATURE, April 9, p. 523), and directing attention to the question of the derivation of certain types of palæolithic implements from shell forms. Dr. Munro states that among his collection of Ainu neolithic implements, now unfortunately destroyed by the earthquake, were a considerable number commonly called *Tengu no meshi kai*, or rice-spoons of the Tengu, Tengu possibly meaning spirits of the wild or soil. Inspection suggested that these were copies of shells, and as they were made of igneous rock, obsidian, or chert, rarely agate, there could be no question of the conchoidal fracture being responsible for the form. Conventionalism had resulted in a notched or button-shaped survival of the umbo, but of the attempted representation of the convexity and concavity of the shell there could be no doubt. *Kai* stands for both spoon and shell, and in the ancient Chinese pictographs the spoon is represented by a shell, and shells are still in use in Japan as spoons. This may be in part responsible for the survival of the name quoted. Dr. Munro has examined a large number of specimens from the Thames gravels, and among them has recognised many as similar to his Ainu specimens,—a resemblance based upon the ensemble rather than the conchoidal fracture. He suggests that the palæolithic artisan noted the resemblance and was influenced thereby to transfer the functional form of the shell to the flint.

CONSANGUINEOUS MARRIAGE IN ANCIENT EGYPT.—In *Ancient Egypt* for June, Miss M. A. Murray examines a number of genealogies recorded on stelæ of the Middle Kingdom with the view of extracting the relationships of those who are mentioned as married or whose marriage can be inferred. Consanguineous marriages occur, though infrequently; but occasionally the names suggest that the custom had been more general. Such a name, for example, as "My mother is my sister" indicates a father-daughter marriage and "My father is my brother" a mother-son union. Particularity of definition is such in some cases as to preclude the argument against these types of marriage that terms of relationship were then used more loosely and must not be construed literally. It is to be noted that these marriages occur in all classes of society, and there are those of small officials not necessarily connected with the royal house or the families of great nobles. It is, no doubt, also significant that these marriages are usually found in families where the name Wah-ka, Bebu, or Beby, and names compounded with Khnum and Sebek are used. In the genealogy of Wah-ka is a father-daughter marriage, his grandfather having married his two daughters, one of whom was Wah-ka's mother. Another father-daughter marriage and an aunt-nephew marriage is shown in the stele of Horzeruy. A mother-son union is probable in the case of Nefer-rud, whose mother and wife Hetept were possibly one and the same. The genealogy of Sen-mry Kheper-ka-ra can be explained only as the marriage of one man with three women, two of whom were his own daughters. Mother-son marriages occur also on the stelæ of Sebek-dedu, the scribe of the stone-masons, Pa-unt, and the goldsmith, Sebek-hetep. The marriage of Se-hetep-ib shows the union of brother and sister, while an aunt-nephew union of the kind familiar from the parentage of Moses occurs in the genealogy of Ptah-sankh-en.

PUJA.—In the *Indian Antiquary* for May and July is a study in two instalments of certain elements in Hinduism by Prof. Jarl Charpentier of Upsala. The religion of the Aryans, as set forth in the Rig-Veda, was the religion of the upper classes; it was too complicated and its ritual too expensive for the masses. All its gods were males and there were no temples and no images. Among the aboriginal subject races the religion of the Munda-speaking tribes was a crude form of animism including human sacrifice to an earth goddess; while the Dravidian religion included the worship of she-devils and the spirits of the dead, the female element was predominant and crude idols were put up either in the open air or under the shelter of small temples. Sacrifices were characterised by the use of blood which was smeared on the idol or the worshippers and was used when poured on cooked rice as a common meal. These forms of religion were totally opposed to that of the Aryans, which, however, at an early date compromised by incorporating godlings and taking in idols and temples. These gods and godlings are now adored by a number of ceremonies comprised under the name *puja*, which takes a central place in the daily routine followed in Hindu temples, in which the god is treated as a living monarch. In this routine the characteristic element is the washing of the idol or the sprinkling of the *linga* with water or with honey, curds, honeyed water, etc., or the smearing of it with certain ointments, powders, or oily substances which are generally of a brilliant red or yellow colour. Of the various derivations, few in number, offered for the term puja, the most likely seems the Dravidian root *pûçu*, Kanarese *pûsu*, meaning to smear, put on sticky substances, to daub, to paint. Now in all the more primitive cults of India the most common way of adoring the various gods is to smear the wooden logs, uncarved stones or idols representing them with oil or lac, cinnabar, turmeric, or other red or yellow dyestuffs; and this practice is even extended to the tools of certain castes at various seasons, *e.g.* the Rajput guns, the Thug pick-axe, the agricultural implements of the Deccan. The rite thus has its origin in very primitive conditions as it is practised among low-caste peoples, and in advanced Hinduism it is now most frequent in the case of such gods as Ganesa and Hanuman who are of low origin.

THE FEEDING MECHANISM OF NEBALIA.—Prof. H. G. Cannon (*Trans. R. Soc. Edin.*, **55**, No. 15, 1927) describes the feeding mechanism of *Nebalia bipes*—a mud-dwelling form which feeds on particles filtered from a food stream produced by its foliaceous trunk limbs. The food stream enters at the anterior end and makes its exit at the posterior end of the carapace. The current is produced by the oscillatory movements of the trunk limbs, and a detailed account is given of the movements and of the setal armature of these appendages. The mouth parts, structurally and in their method of functioning, closely resemble those of a mysid. From a comparison with Paranebalia it is suggested that Nebalia evolved from a mysid, or from some other primitive malacostracan possessing a feeding mechanism similar to that of Hemimysis, that took to living in mud. The foliaceous limbs are in no way primitive, but have evolved from typical biramous malacostracan limbs in connexion with the new method of filter feeding.

EEL LARVÆ.—In a recent issue (vol. 2, No. 1, p. 38) of the *Journal du Conseil Permanent Inter-*

national pour l'Exploration de la Mer; Prof. Johs. Schmidt supplies a new record of the capture of the larvæ of the common eel in the Faroe-Shetland Channel. Previous to 1926, only four specimens of metamorphosing eel larvæ not yet at the elver stage had been taken east of Long. 5° W., but on Aug. 11, 1926, the *Dana*, under the supervision of Å. V. Tåning, made a capture of 297 larvæ in the southern part of the Faroe-Shetland Channel—60° 35′ N., 3° 45′ W.—over soundings of 366 and 470 metres. The great majority were in the metamorphosis Stages II and III, although 9 per cent were in Stage I and had not commenced metamorphosis. Most of the larvæ were found at a depth of 20-30 metres below the surface. The average lengths for the various stages in the retrograde metamorphosis were, Stage III, 75·46 mm.; Stage II, 74·33 mm.; and Stage IV (of which there were only 11 specimens), 72·46 mm.

GRASSES OF THE CENTRAL ANDES.—The Smithsonian Institution has just issued a work on the grasses of the Central Andes—Ecuador, Peru, and Bolivia, by that eminent agrostologist, Dr. A. S. Hitchcock (*Con. U.S. Nat. Herb.*, vol. 24, part 8). Most of the region is mountainous, and although lying under the equator, many ranges and peaks are capped with snow. The flora is mainly temperate and alpine, but becomes tropical on the coastal plain and on the eastern slope. There are wide variations in rainfall over the region, and because of the extremes of altitude and precipitation the grass flora is large and varied. While the very detailed information in the book has been collated from many herbaria, and every available source of information has been laid under contribution, the list of grasses is based primarily upon the specimens in the United States National Herbarium. The descriptive lists and keys include 124 genera and 605 species, of which 29 species are new.

GROWTH OF POLLEN TUBES.—P. O'Conner, experimenting on the growth of pollen grains, finds that malic acid has no directive influence on the growth of pollen tubes of Angiosperms (*Scientific Proceedings, Royal Dublin Society*, vol. 18 (N.S.), No. 40, July 1927). By adding watery extract of stigmas to a medium consisting of gelatine and cane sugar, he was able to inhibit growth of all pollen except that of species from which extract was made. Thus a medium containing extract of tulip stigmas which had been inseminated with a mixture of crocus, daffodil, and wallflower pollen, permitted the development of the tulip pollen tubes only. As the hydrogen ion concentrations of the various stigma extracts were of much the same order, he rules out the possibility of acidity as a determining factor. Osmotic concentration is similarly eliminated. The inhibiting substances are diffusible through permeable membranes and are not destroyed by boiling, which tends rather to accentuate their inhibitory effects, probably through a reduction of oxygen tension. Where growth of pollen tubes did occur in an inhibiting medium, the tubes produced were frequently of a monstrous type. On "general biological considerations" the inhibiting substances are supposed to be of an amino compound nature. Extracts from other parts of the plant were found equally inhibitive of the growth of foreign pollen grains, and the author suggests a specificity of the sap, and considers that possibly the 'sap' may be the source of mutation, and the protoplasm largely its instrument.

SIZE OF THE GENE.—The conceptions connected with dominant and recessive genes are closely analysed by Dr. A. S. Serebrovsky (*Jour. Genetics*, vol. 18, No. 2) in a paper on the influence of the 'purple' gene on crossing over in the middle part of chromosome II. in Drosophila. The experiments were carried out in a thermostat owing to the well-known effect of temperature on crossing-over, and 120,000 flies were bred and examined in three months. Since the age of the female also affects the crossing-over, the eggs laid during the first and second six-day periods of life were kept separate. The records of females which hatch on successive days were also kept separate, as the later emerging flies become progressively smaller until the last are dwarfs. Flies which hatched late showed diminished crossing-over, although this was not very regular. A new method is worked out for determining the approximate size of the 'purple' gene from the data of crossing-over. It is suggested that genes may vary in size, and that the presence-absence theory may be revived if divisibility of the genes is admitted. There is a certain periodicity in the occurrence of cross-overs, but the coefficient of variation in their frequency is of the same order as other biological co-efficients of variation.

CARBON RATIO THEORY.—In the *Journal of the Institute of Petroleum Technologists* for April, Dr. Murray Stuart raises a significant point in connexion with the real interpretation of the carbon-ratio theory. As is generally known, David White first observed the relationship between the carbon-ratio of coals and the likelihood of oil occurrence in associated strata in America, since which time the theory has been applied to similar occurrences in many parts of the world, perhaps with indifferent success. However, it is now pointed out that what has hitherto been loosely referred to as the carbon ratio, *i.e.* ratio of C to H, is really not a ratio at all, since what is meant is the percentage of fixed carbon (pure coal basis) in the coal. The analysis of coal is usually expressed in terms of moisture, fixed carbon, volatile matter, and ash; neglecting moisture and ash, it is the relationship between fixed carbon and volatile matter which constitutes the so-called carbon ratio. "As the percentage ratio is taken as the basis of the carbon-ratio theory, it is not necessary to express the ratio as a ratio, . . . (but as) the percentage of fixed carbon in the sum total of the fixed carbon plus volatile matter of coal." Thus if the carbon ratio is quoted as 55, then the ratio of fixed carbon to volatile matter in the coal is 45. To some extent the mistake has arisen in thinking that all the carbon in coal exists in the fixed carbon portion and that the volatile matter is exclusively hydrogen, in which case the C/H ratio is a reasonable interpretation; but, as Dr. Murray Stuart points out, there is a considerable quantity of carbon in the volatile matter of a coal, and coals are known where the carbon ratio is 50, but where the percentage ratio of carbon to hydrogen is more than 90, in the same examples.

CAT CREEK AND DEVIL'S BASIN OILFIELDS, MONTANA.—In a somewhat unusually stereotyped bulletin (No. 786B) of the United States Geological Survey, Mr. Frank Reeves gives an account of two recently discovered oilfields in Montana. The area falls within the Great Plains province, though it possesses a diversified topography, much of which is formed by the Lance formation (?Eocene). The principal structural feature is that of the Cat Creek-Devil's Basin uplift, a rectangular area of some 2000 square miles, characterised by numerous and pronounced domes along the margins. Of the two oilfields in the region, that of Cat Creek is commercially the more important, having a daily production of about 2800 barrels (1926) from 190 wells. Four distinct sands have been recognised in the field, the

Mosby, First, Second, and Third sands, most of the oil being derived from the First and Second horizons, especially the former, the stratigraphical horizon of which is the base of the Colorado Shale, bottom of the Upper Cretaceous. Mr. Reeves believes that the source of the oil is the Colorado Shale, which, besides having the colour suggestive of abundant organic matter, has been proved by testing to contain free oil and pyrobitumens; this formation is, incidentally, the most prolific oil-producing horizon in the Rocky Mountain region. The Cat Creek oil is of mixed base, with a gravity varying from 47° to 50° Baumé and containing little sulphur; thus it is a remarkably light oil, some 6° lighter than the average Appalachian oil. The author does not believe that such oil is due to natural fractionation of heavy oil through porous strata of the fuller's earth type, as suggested in some quarters, but attributes its high quality to normal conditions, pointing out that only a slight modification of much of the Cretaceous oil of this region is necessary to produce a crude of the type met with at Cat Creek.

THE SPECTRA OF ZIRCONIUM AND SCANDIUM.—Papers 548 and 549 of the United States Bureau of Standards are devoted to wave-length measurements in the arc and spark spectra of zirconium, and in the arc spectrum of scandium, by C. C. Kiess and W. F. Meggers respectively. The scandium ammonium oxalate which was used was originally prepared and purified by Auer von Welsbach, and had at one time formed part of Prof. Eder's collection. The zirconium metal, although of high chemical purity, showed considerable spectroscopic contamination, and amongst the foreign lines there were a number due to the recently discovered element hafnium. 700 scandium lines are listed between 2500 Å.U. and 8600 Å.U., and about 1500 zirconium lines between 2100 Å.U. and 9300 Å.U. Both arc spectra are superposed on a system of bands. The latter have not been analysed, but it is stated that a very satisfactory analysis of the line spectra of scandium has been effected, which will be published shortly.

ELECTROMETER CAPACITANCES.—In the issue of the *Physikalische Zeitschrift* for June 15, Dr. H. Witte gives an account of his measurements of the capacitances of a number of electrometers and their variation with the deflexion of the instrument. The work was undertaken at the suggestion of Prof. Ludewig and was supported by a grant from the Helmholtz Association. Two radio valve circuits of frequency 10^5 were magnetically coupled by a circuit containing a telephone to a third similar valve circuit. Two of the valve circuits contained small adjustable capacitances, and the method of measurement consisted in inserting the electrometer in one valve circuit and either counting the number of beats heard in the telephone or in adjusting one of the capacitances until the beats ceased. For a single filament electrometer with attracting plates, the positions of the plates made a change of 4 per cent. in the capacitance, which was of the order 1·5 cm. For a Wulf single filament electrometer without attracting plates, the deflexion of the filament altered the capacitance of 2·1 cm. by about 2 per cent. For a gold-leaf electroscope of the Elster and Geitel type, the capacitance, 8 cm., varied 6 per cent. with the deflexion.

LIMITING VOLUMES AND CRITICAL ISOTHERMALS OF LIQUIDS.—Although in most of the equations of state hitherto proposed the limiting volume of a liquid at infinitely high pressure, v_∞, has been assumed constant and equal to the limiting volume at the absolute zero of temperature, v_0, this assumption does not seem to have any theoretical basis. The *Proceedings of the Physico-Mathematical Society of Japan* for Feb. 1927 contain a paper by Y. Tasiro in which values for v_∞ for some organic liquids have been extrapolated from Bridgman's well-known data. The calculated values of v_∞ tend to increase as temperature decreases, but since the method of extrapolation is of doubtful accuracy, it is not safe to draw any positive conclusions as to the constancy of v_∞. On comparison with the corresponding calculated values of v_0, however, it is quite clear that the two quantities are not equal, v_∞ being much smaller than v_0. From the values of v_∞ the constant b of the Van de Waals equation has been obtained, and the values of v_∞, v_0, and b have been applied to the calculation of the pressure-volume relationship of isopentane, using a modified equation of state. The calculations agree with the observed values of Young even up to high pressures.

DIESEL-ELECTRIC LOCOMOTIVES.—Experiments are being carried out by railway engineers in America and in several European countries on the use of Diesel engines in connexion with traction. In the *Brown Boveri Review* for July, details are given of a Diesel-electric locomotive of 400 horse-power which has been built for the Strade Ferrate del Mediterraneo (Italy). This railway has about 600 miles of track in the provinces of Basilicata and Calabria, on which there are several long 6 per cent. inclines. Experiments are also being made at the same time on special steam locomotives. It is specified that the locomotives must be able to draw a train weighing 110 tons up a 6 per cent. incline at a speed of 27 miles per hour. The engine of the Diesel locomotive is rated at 440 brake horse-power, but it can develop 500 B.H.P. for short periods. The electric generator, which drives four ordinary traction motors mounted on the axles of the locomotive and two of the same type on the trailer, is directly connected to the Diesel engine by a rigid coupling, a special electrical system being used to minimise losses during the starting and stopping of the train. Experiments carried out on this locomotive by the Swiss manufacturers show that the mean consumption of naphtha per ton mile trailing load was about 0·068 pound. With steam service the fuel cost was practically twice as much. In the earlier experiments vibrations were pronounced owing to sudden variations in the load and owing to the machines being out of balance. The special balancing device now employed has notably diminished these vibrations. In special cases where no suitable electric supply is available these locomotives should prove useful.

REDUCTION OF MIXED OXIDES.—It has been stated (H. G. Wells, "The Outline of History") that "bronze is not only harder than copper, but the mixture of tin and copper is more fusible and easier to reduce." Thus it would appear that an oxide is actually reduced at a lower temperature when in presence of a second metallic oxide. This subject has been investigated by W. Rogers, using a mixture of zinc and copper oxides. The mixtures were heated electrically to 300° in a glass tube through which a current of dry hydrogen was passing. The water formed in the reduction was collected in weighed tubes of calcium chloride. The data has been published in the *Journal of the American Chemical Society* for June, and it is obvious that all the zinc oxide in the mixtures has been reduced. It is suggested that on fusing the oxides together, the presence of the second oxide prevents the units in the lattice structure of the other from arranging themselves in the normal way. This would cause the forces between the units in the structure to be altered and would result in a change in the reactivity of the oxides towards hydrogen.

Pelagic Nemerteans.[1]

THE power of progressing through the water by swimming has long been known in the nemerteans; thus Nardo mentions it in *Cerebratulus marginatus*, Grube in *Meckelia aurantiaca*, De Quatrefages in *Polia bembix*, whilst more recently it has been described in *Amphiporus pulcher*, O.F.M., *A. (Drephanophorus) spectabilis*, De Quatref., *Micrura fusca*, McI., and *Tetrastemma dorsalis*, Abild. But the first truly pelagic nemertean was only brought into notice by Prof. Moseley during the voyage of the *Challenger* (1875). Now, through the labours of Hubrecht, Verrill, Craven and Heath, Brinkmann, Joubin, Gerarda Stiasny-Wijnhoff, and others, a long list of species from all the great oceans, except perhaps the Antarctic, demonstrates their wide distribution, though they are always thinly scattered, so that, as regards some, only one sex is known. Moreover, whilst the littoral nemerteans as a rule form two marked groups of the Enopla and the Anopla (the armed, with the mouth in front of the ganglia, and the unarmed, with the mouth behind the ganglia), the pelagic forms fall under a section of the armed. They are further distinguished by their comparatively short, flattened, and, in some, translucent bodies, the walls of which are in marked contrast to the firmer tissues of the littoral forms, for the almost gelatinous parenchyma is largely developed. Further, some possess a caudal fin, and a few, in addition, a lateral fin. The dorsal and the ventral longitudinal muscles with vertical bands are best developed. Eyes are often absent and sense organs few and peculiarly modified. The typical proboscis and its sheath, with the armature of the former leaning to that in Drephanophorus, is present, though no mention is made by either Prof. Brinkmann or the present author of the remarkable corpusculated fluid in its sheath. Moreover, the males of the pelagic group carry their spermaries in the cephalic region with or without *penes*, whilst the females follow the littoral nemerteans in having the ovaries arranged along the body—in this case interdigitating with the alimentary cæca. Lastly, some males are provided with a pair of muscular tentacles anteriorly.

The monograph of Mr. Wesley R. Coe has appeared nine years later than that of Prof. Brinkmann,[2] and thus has the advantage of that masterly treatise, the classification in which the author follows, namely, the order Holopnemertini of Hubrecht being divided into the sub-orders Polystylifera and Monostylifera. The former has two tribes, the Reptantia, including the family Drephanophoridæ, whilst the Pelagia has no less than nine families. Further investigations and discoveries may perhaps lead to changes and simplification, but in the meantime order is maintained. The treatise contains a description of the pelagic nemerteans obtained (1) off the west coast of Mexico, Central and South America, and the Galapagos Islands, (2) those from the eastern tropical Pacific, and (3) those from the North-West Pacific Expedition.

The collections were originally taken in hand by the late Dr. Woodworth, but, on his death, the task fell to Mr. Coe. After an introduction, in which the history of the pelagic group is outlined, the author gives a general survey of their structure under the head of morphological peculiarities. He differs from Gerarda Wijnhoff and Brinkmann in not reckoning the layers of the proboscis as if it were entirely evaginated, and he gives the anterior region nine layers, the most remarkable of which is the main nervous layer with its numerous longitudinal trunks and reticulations, the whole forming a system far larger than the two original (anterior) nerves, and which misled the reviewer in 1868 [3] in thinking it a reticulated non-nervous layer. Like Brinkmann, he does not allude to the corpusculated fluid in the cavity of the sheath, nor is any light thrown on the function of this complex organ. He points out the importance in a pelagic form of the dorso-ventral bundles of muscle which are interdiverticular in position, and he agrees with Brinkmann that the muscular tentacles in the males of certain forms may be of use in holding the females whilst the sperm-sacs shed their contents, though in the littoral forms it is sufficient for the male to be in the proximity of a spawning female to cause an immediate issue of a cloud of sperms. He describes the subcutaneous sense organs as differentiated parts of the integument, and alludes to peculiar organs in connexion with the dorsal nerve in *Neuronemertes aurantiaca*—hinting that they may be phosphorescent organs, but such is unproved.

The contrast with the littoral forms in sense organs is striking, and yet it might have been expected that a free-swimming race was more in need of them. Mr. Coe devotes much attention to the minute structure of the reproductive organs both in text and illustration. He concludes with remarks on their food, habits, parasites, and enemies, and a detailed description of the 47 species in the collections. The whole forms a notable and independent contribution to our knowledge of the group in text, text-figures, and plates, and is alike creditable to the Museum and the author. W. C. M.

[1] "The Pelagic Nemerteans." By Wesley R. Coe. (Memoirs of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A.) Vol. 49, pp. 242+30 Plates. 1926.

[2] *Vide* NATURE, July 4, 1918, p. 353.

[3] *Trans. R. Soc. Edin.*, vol. 25, pp. 305-433.

Tribute to Prof. H. F. Osborn.

THE seventieth birthday of Prof. Henry Fairfield Osborn, president of the American Museum of Natural History, was celebrated by the presentation to him of a Queen Anne cup made by Thomas Folkingham in 1711, and an illuminated book containing an address of congratulation, with the signatures of his colleagues and friends all over the world. These signatures were made on individual slips of vellum and included nearly a thousand names. The design and decorations of the book were executed by Mr. William E. Belanske. Owing to Prof. Osborn's absence from the city on Aug. 8—the date of his birthday—the Committee in charge of the celebration waited upon him at Garrison on July 28 to make the presentation. They also invited Prof. and Mrs. Osborn to be the guests of honour at a reception to be given them on Sept. 29, on which occasion the balance of the birthday fund raised by his friends, amounting in all to nearly seven thousand dollars, will be presented to Prof. Osborn for his research work.

The congratulatory address in the album presented to Prof. Osborn reads as follows:

"On your seventieth birthday your colleagues and friends join to salute you, to congratulate you, and to express their delight in finding you radiant in health and spirit, joyously carrying on your life work.

"We desire to thank you most heartily for your leadership in many fields. Drawing around you in the American Museum of Natural History a staff of explorers and co-workers who are animated by your

spirit and who gladly enrol under your banner, you have penetrated to the uttermost parts of the earth and have brought its natural history treasures to the Museum. To your unceasing labours, as Curator of Palæontology and as President, we owe the series of

FIG. 1.—The inscription on the base reads: "To Henry Fairfield Osborn, master builder, upon the occasion of his seventieth birthday, August 8, 1927, from his friends."

unique exhibition halls at the Museum, where countless visitors pass before an impressive panorama of extinct life. Thanks to your sympathetic understanding, the school children of New York and their teachers enjoy all the educational and emancipative opportunities of the Museum's School Service. And in the near future the Museum will also display still other imposing evidences of your constructive genius when the Roosevelt Memorial Hall and the Akeley African Hall take their places in the assemblage of buildings devoted to science and education.

"We desire also to express our admiration of the creative, tireless spirit which, during a life crowded with administrative work, has produced a series of publications, covering many hundreds of titles and ranging from brief articles in *Natural History* to the great monographs on the titanotheres and the proboscideans now in press.

"We congratulate you upon the many distinguished honours that the highest scientific tribunals of the world have awarded to you in recognition of your services to science. We join the great company of your readers in acknowledging our indebtedness for such classic works as 'From the Greeks to Darwin,' 'The Origin and Evolution of Life,' 'The Age of Mammals,' and 'Men of the Old Stone Age.'

"Princeton University will not forget your services when in 1877 as co-leader with your life-long friend Professor W. B. Scott, you led the first Princeton expedition to the fossil fields of Wyoming; or when, after your return from your graduate studies at Cambridge University, you brought the Huxleyan gospel of comparative anatomy to your pupils.

"Columbia University has reason to remember the great part you played in planning and guiding the Department of Zoology in its formative period; nor will your old students, either of Princeton or of Columbia, ever forget what new worlds you opened to them and showed them how to enter.

"The New York Zoological Society owes to you thirty-one years of brilliant service as Chairman of the Executive Committee and later as its President.

"From many parts of the world, therefore, your friends unite to testify their appreciation of your services as a leader in biological science, in education, and in the highest ideals of citizenship.

"We congratulate you again upon this unique record of service. We delight in the admirable spirit of fairness, generosity, friendliness, and comradeship which you have shown, not only to your colleagues but to the least of your assistants. And we rejoice with your devoted wife and your sons, daughters and many grandchildren, that this seventieth birthday finds you with forces unimpaired, still planning, still building, under the inspiration of a dauntless optimism."

The Conservation of Forests.

FORESTRY propaganda, by which is understood the endeavour to cultivate a forestry 'sense' in the people, has been in force for some time in the United States of America. The unrestricted lumbering under which so large a proportion of the forests of the country have been ruthlessly destroyed by axe, saw, and fire, led to the introduction of a forest service and forestry societies. It became recognised, however, that before any efficient protection of the remaining forest areas and the rehabilitation of portions of those destroyed could make any real progress, the people and the big lumbering companies would have to be educated as to the real meaning and value of the forest to the community and the nation. Various steps have been taken during the last decade or two, but progress in the direction desired was admittedly slow. Latterly this crusade has been taken up with renewed vigour, and the methods employed are worthy, not necessarily of imitation, but at least of study and consideration; for propaganda of a similar kind is urgently needed if the new woods now being created in Britain are not to suffer from acts of negligence or worse at the hands of members of the community, entirely unacquainted with the objects aimed at in bringing into being this form of national (as also privately owned) property.

Two notes in the Daily Science News Bulletin issued by the Science Service of Washington, exemplify the type of propaganda in force in the United States. The language used is simple, technical terms being avoided, in order that the matter may be readily understood by the man-in-the-street. The first of the notes is entitled "Forest Trees Wage Fierce Struggle for Existence." A simple description of the forest is given, pointing out the different methods of growth of a tree growing singly or in a crowded forest, with examples of species which naturally grow in pure woods as against those appearing in mixture. The effect of the tree on the soil, and its demands and so forth, are simply treated of, the writer summarising his note with the remark: "A forest is a complete plant society in which the individuals compete in a struggle for existence, help each other by co-operating in keeping soil, moisture, and climatic conditions favourable to all, and are helped or hindered by thousands of subsidiary forms of life."

The second note, "Conserve Trees by Selective

Felling," has not the same application in Great Britain. For some years the U.S. forest officers have been striving to educate the lumberers and to reduce the damage and waste which have resulted from the lumbering of the forests in the past. Under these practices most of the young growth, which is not of size to be converted into lumber, has been recklessly destroyed whilst extracting the logs; moreover, large amounts of slash and refuse are left on the areas which, being so inflammable, usually catch fire, the fire often spreading to and destroying neighbouring valuable forests. The loss in this way, both in the United States and Canada, has been enormous. The present note is designed to show, from actual proof on the ground, that it is possible to lumber, *i.e.* to cut in a forest under a system of selective fellings by which the younger growth, or age classes, of the forest are left unharmed; and that this method actually gives better financial returns per acre, whilst subsequent fire danger is greatly reduced, since little slash remains. A further advantage of major importance is that additional fellings will be possible on the area when the young growth conserved has reached exploitable size. The figures and results attained as given in this note merit the careful attention of the lumberer, not only in the United States but also in Canada.

University and Educational Intelligence.

CAMBRIDGE.—Dr. F. J. W. Roughton, Trinity College, has been appointed lecturer in physiology and Mr. J. D. Bernal, Emmanuel College, has been appointed lecturer in structural crystallography in the department of mineralogy.

FREE displays of films illustrating life in the British Dominions and Colonies will be given four times daily on week days and once on Sundays at the Imperial Institute, South Kensington, during September. The programme is as follows: Sept. 4-7, Australia, New Zealand, and Canada; Sept. 8-10, South Africa and Australia; Sept. 11-14, South Africa, East Africa, Malaya, West Indies, Fiji; Sept. 15-17, India, Gold Coast; Sept. 18-21, Nigeria, Palestine; Sept. 22-24, Canada, British Guiana; Sept. 25-28, New Zealand; Sept. 29-Oct. 1, Canada and Australia. Teachers wishing to take organised parties of school children are advised to notify the Secretary, Imperial Institute, at least three days in advance of the proposed visit.

UNDER a recent regulation, the Board of Research Studies at the University of Cambridge now issues annually a volume of abstracts of the dissertations which have been approved for the research degrees (other than for the higher doctorates which are awarded on general published work at a later stage of a graduate's career). This volume will be useful as a guide to the ground covered by a piece of research where the complete work is only accessible in the University library. The need for it does not arise when the work is published in the standard scientific or literary periodicals, but the present pressure on the space of these journals makes it growingly difficult to publish work in full, and this summary of work may well fill a real gap. The summaries are arranged by faculties, and it may be of interest to note that the departments most largely represented are chemistry ten, physics and biochemistry six each, and botany five. On the literary side, history is the only faculty with a comparable output. Of the graduates, eight come from Caius and from Trinity, five from Emmanuel, while Corpus Christi, Jesus, King's, Queens' and Selwyn are all unrepresented. The research graduates are fairly evenly divided between graduates of Cambridge and graduates of other universities. The steady development of the research degree work at Cambridge is of considerable interest and importance.

'JUNIOR' colleges, offering the courses ordinarily taken during the first two years of the four-year college of liberal arts, are rapidly increasing in number in the United States, and are causing much attention to be focussed on the organisational relationship between the secondary schools and the universities and degree-conferring colleges. This subject is dealt with in a closely reasoned and illuminating article contributed by Prof. Leonard V. Koos of Minnesota to the May number of *School Life*, the official organ of the United States Bureau of Education. The main purpose of the article, publication of which is sponsored by the National Committee on Research in Secondary Education, is to show that present-day conditions point to the desirability of the integration of the junior college with the grades and work of educational units immediately below it—of definitely incorporating it, in fact, in the secondary school system. Prof. Koos first exposes the fallacies of the chief arguments which have been adduced for the separation of the public junior colleges from the grades of the 'high' school below, namely: the advantage in 'selling' the junior college to the community, encouragement of the development of 'college life,' and safeguarding the standard of work. He next points out that experience with other two-year units, like the two-grade junior high school and the normal school, has been unsatisfactory. His main arguments are that a review of reorganisation of secondary and higher education during the past hundred years shows the essential similarity of the purposes of education in high-school and junior-college years, and that their separation involves deplorable overlapping and waste of time.

THE Carnegie Endowment for International Peace has Divisions of (1) Intercourse and Education, (2) International Law, and (3) Economics and History. The work of Division (1) during the year 1926 is described in a report, dated April 2, by its Director, Dr. Nicholas Murray Butler, who is also president of the Endowment and chairman of its executive committee. Of the total disbursements of the Division in the year, amounting to 363,663 dollars, the largest items were a grant-in-aid for the library building of the University of Louvain (50,000 dollars), and the expenses of a trip to Europe of American professors of international law and relations (63,312 dollars). Among the many activities for the promotion of which the rest of the expenditure was incurred were those of the International Relations Clubs, which are now established in 116 educational institutions in the United States. The members are chiefly undergraduates. The Division prepares for them fortnightly summaries of international events and supplies them with books and pamphlets. A handbook describing the work in detail is obtainable from the office at 405 West 117th Street, New York. The Division is responsible for the publication of "International Conciliation," a series of bulletins, begun in 1907, including texts of official treaties, articles by eminent statesmen, etc. The Centre Européen, maintained by the Division at a cost of 20,000 dollars yearly, published in January the first number of a quarterly, *L'Esprit International*. Its Directeur-Adjoint has recently conferred with the British Institute of International Affairs with the view of co-operation on lines already found effective in connexion with the Institut des Hautes Études Internationales and the Deutsche Hochschule für Politik, in which a Carnegie chair of international relations has been founded.

Calendar of Discovery and Invention.

August 28, 1789.—The most magnificent of eighteenth-century telescopes, the great forty-foot reflector built by Herschel at Slough, was begun in 1785 and finished in 1789. It was built at the expense of George III. Herschel gave a description of it in the *Philosophical Transactions* in 1795. The first mirror was placed in the tube in February 1787 but was unsatisfactory; the second was cast in January 1788 but cracked, while the third and last was cast a month later. On Oct. 24 of that year Saturn was observed with it, "but," said Herschel, "not being satisfied, I continued to work upon it till Aug. 27, 1789, when it was tried upon the fixed stars and I found it to give a pretty sharp image." Then he continues, "Aug. 28, 1789, Having brought the telescope to the parallel of Saturn, I discovered a sixth satellite of that planet; and also saw the spots upon Saturn better than I had ever seen them before; so that I may date the finishing of the 40-feet telescope from that time."

August 29, 1864.—From his spectroscopic examination of the stars, Huggins turned to the examination of the nebulæ, and on Aug. 29, 1864, he applied his spectroscope to a planetary nebula in the constellation Draco. It was then, to his surprise, that he saw a spectrum of bright lines, thus proving that the nebula was a mass of glowing gas.

August 29, 1799.—Among famous steam-engine patents is that of William Murdock dated Aug. 29, 1799, for the D-shaped slide valve which in modified form is the commonest type of valve used in steam engines to-day. It took the place of the four poppet valves of Watt, who afterwards wrote: "When Mr. Murdock introduced the slide valve, I was very much against it, as I did not think it so good as the poppet valve, but I gave in from its simplicity."

August 30, 1576.—On this date the foundation stone of the famous Uraniborg, Tycho Brahe's great observatory on the island of Hven, was laid. One of the most remarkable instruments employed was the mural quadrant with which the altitude of the celestial bodies could be observed with far greater accuracy than hitherto.

August 31, 1857.—The first of the great Alpine tunnels, the Mont Cenis, was begun on Aug. 31, 1857. Steam was originally used for driving the drilling machines, but, through Colladon, compressed air was utilised. The engineers of this great undertaking were Grattoni, Grandis, and Sommeilier. The tunnel is 7½ miles long and cost £2,600,000. On Sept. 13, 1871, an experimental train was run through it and the tunnel was inaugurated four days later. The other great Alpine tunnels are the Simplon, the St. Gothard, the Lötschburg, and the Arlberg.

September 3, 1832.—From Oersted's discovery came those of Ampère, Arago, Sturgeon, and Faraday, while immediately after the publication of Faraday's work a group of inventors began to apply his discoveries. Among this group was H. Pixii, an instrument maker of Paris, who produced a magneto machine in 1831, and on Sept. 3, 1832, completed a machine with a commutator, in which a permanent magnet was revolved in front of a soft iron horseshoe magnet with bobbins of insulated wire.

September 3, 1860.—In the splendid collection of meteorological instruments at the Science Museum, South Kensington, are many interesting records, including the first Daily Weather Report issued in England. This is dated "London. September 3, 1860." The particulars given are: Bar.: 30.13 in. Temp.: shade 58°. Wet bulb, 54°. Wind, W. Force of wind, 2. Cloud, 2. Sky blue. E. C. S.

Societies and Academies.

PARIS.

Academy of Sciences, July 18.—G. **Bigourdan**: The differential determination of time with high precision.—A. **Desgrez** and J. **Meunier**: The presence of lithium and strontium in the teeth and in human bones. Their chemical condition. The existence of lithium and strontium as normal constituents of bones and teeth is definitely established. Lithium is present as phosphate and strontium as carbonate.—Léon **Guillet**: The properties of pure aluminium. Aluminium containing 99·8 per cent. of the metal is now commercially obtainable. Details of its electrical and mechanical constants are given. These do not differ greatly from those of the ordinary aluminium containing 0·5–1 per cent. of impurities.—Louis **Ravaz** was elected *correspondant* for the section of rural economy in succession to the late A. Balland.—Georges **Bourguignon**: Chronaxy of the muscles of the leg of the rabbit. Comparison with the chronaxy of the leg muscles of man in the normal state and in lesions of the pyramidal bundle.—Eugène **Slutsky**: A limiting theorem relating to series of eventual quantities.—Edm. **Lahaye**: A new method of integration of certain groups of differential equations.—S. **Stoïlow**: Continued transformations and Picard's theorem on integral functions.—René **Lagrange**: Certain suites of polynomials.—**Krawtchouk**: The poles of meromorph functions.—D. **Riabouchinsky**: Fluid movements round infinitely near solids.—Henri **Mémery**: The sun and the atmosphere. In attempts to find a relation between variations of solar phenomena (sunspots) and temperature variations in western Europe, results are more likely to be obtained by making comparisons each day than by using annual averages.—J. **Struik** and Norbert **Wiener**: The relativist theory of quanta.—H. L. **Vanderlinden**: The fine spectrum structure in the gravific field of the sun.—R. **Anthouard**: The conditions of discontinuity of discharge in gases. Considering the tube through which the discharge passes as a condenser, a formula is developed which has been experimentally confirmed.—Max **Morand**: The distribution of the electric field in the dark space.—E. **Delauney**: The atomic character of some properties of the X-rays. Experiments with irradiated mixtures of barium chloride and strontium chloride show that the numbers obtained for the intensity of the fluorescence do not follow the additive law; the intensity of fluorescence increases much less rapidly than the proportion of barium chloride.—Ny Tsi **Ze**: Changes in the optical properties of quartz under the influence of the electric field.—Paul **Soleillet**: The influence of the magnetic field on the polarisation of the resonance radiation of cadmium.—Ch. **Bouhet**: The elliptical polarisation produced by reflection at the surface of liquids.—A. **Andant** and E. **Rousseau**: The resonance power of some metallic salts irradiated by filtered light from a mercury arc. The phenomenon of resonance in the presence of a manganese salt described in a previous communication, is not an isolated experimental fact. The same phenomena are found in the presence of salts of magnesium, sodium, potassium, and uranium.—P. **Bonèt-Maury**: The vaporisation of polonium. Experimental results obtained by the method described in an earlier communication.—M. **Wilmet**: A method for the rapid estimation of hydrogen phosphide in a gas mixture. The gas is allowed to react with a solution of mercuric chloride and the hydrochloric acid produced determined volumetrically.—V. **Auger** and C. **Eichner**: A compound intermediate between

vanadium sulphate $V_2O_5 . n SO_3$ and vanadyl sulphate (VO) SO_4.—W. N. Ipatieff and B. N. Dolgof: The hydrogenation of tetraphenylmethane and *p*-oxytetraphenylmethane under pressure. With hydrogen under 80–100 atmospheres pressure and at 275°–285° C., tetraphenylmethane gives cyclohexane and tricyclohexylmethane: *p*-oxytetraphenylmethane under similar conditions gives cyclohexanol, dicyclohexylmethane and some tricyclohexylmethane.—Jacques de Lapparent: The texture of bauxites and their origin.—G. Dubar: The metamorphic strata of Betchat (Ariège).—F. Dienert: The influence of the soil on the cooling of waters.—E. Blanchard and J. Chaussin: The antagonism between chlorides used in large quantities and sulphates on the course of the development of wheat and oats.—J. Pien: The influence of calcium cyanamide on the reaction of the soil. Calcium cyanamide causes an increased alkalinity of soil for five to ten days: later, there is a slight reduction, but the final result is a clear variation of the *p*H of the soil towards alkalinity.—Th. Bieler-Chatelan: Chestnuts, ferns, and brooms. In spite of their preference for soils containing little or no chalk, the chestnut, fern, and Spanish broom may flourish in places where calcium carbonate renders the soil distinctly alkaline.—P. Petit and Richard: The saccharification of the dextrins.—Charles Pérez: A protelian parasitism of Nectonema.—F. d'Herelle and E. Peyre: Contribution to the study of experimental tumours.—Daniel Chevrier and Max Salles: The sterilisation of potable waters by electrolysis. The apparatus proposed consists of a metal tube forming the cathode with a fine platinum wire, placed along the axis of the tube, as anode. The voltage used is 110 to 120 volts.—Roger Douris and Charles Mondain: The differentiation of pathological sera by means of their dehydration figures.

CAPE TOWN.

Royal Society of South Africa, June 15.—B. F. J. Schonland: The exchange of electricity between thunderstorms and the ground. Measurements were made in the summer of 1927 at Somerset East to determine the nature and magnitude of the exchange of electricity between thunderclouds and the earth. Seventeen active storms have been observed to pass over the station, all of which produced strong negative fields below them. Taking the average amount of electricity discharged in a flash to earth and the average interval between such flashes as 20 coulombs and 120 sec. respectively, the effect is equivalent to a current of 0·17 amp. The effect of point discharge was estimated by setting up a typical thorn-tree (*Acacia Kaffra*) on sulphur insulators and determining the average value of the current leaving the tree when the thundercloud was overhead. This amounted to 0·9 micro-amperes, averaged over an area of 50 sq. km. beneath the cloud. The total number of such trees in this area was estimated at $2·0 \times 10^6$, so that the upward discharge of electricity from them would amount to 1·8 amp. The effect of the charge carried down by rain was negligible in comparison with that due to the flash and point discharges. The net result is a current of about 2 amp. between the bases of the clouds and the ground in such a direction as to give a negative charge to the earth.—J. H. Power: On the herpetological fauna of the Lobatsi-Linokana area.

GENEVA.

Society of Physics and Natural History, July 7.—R. Chodat and F. Mayer: The production of carotine in pure culture of green algæ. It is possible to vary at will the quantity of carotine produced by algae in a nutritive medium of glycogen to which suitable proportions of calcium nitrate are added. Maximum production occurs in a medium poor in assimilable nitrogen.—R. Wavre: Remarks on the stratification of the planets. The author demonstrates the following proposition: if the density $\sigma\ (x, y, z)$ admits of first and second partial derivatives throughout the mass, the angular velocity and external surface being given, if a stratification exists with relative equilibrium without absolute rest, this stratification is unique.—Pierre Dine: General movements of rotation of the heterogeneous fluid mass and geodesy. The author proves the following fundamental propositions: whatever may be the law of flattening of surfaces with density constant, there exists an angular velocity of rotation, definite at each point of the mass and capable of maintaining its molecules in a state of uniform and permanent rotation. This angular velocity decreases constantly from the centre to the surface and from the pole to the equator, except perhaps in two extreme cases, one of which includes the particular case of Clairaut. In a heterogenous fluid in rotation, stratified in homothetic ellipsoidal layers according to Roche's law of densities, the square of the angular velocity of a molecule is a rational algebraic function of the co-ordinates of this molecule.—R. Cherbuliez and G. de Mandrot: A new method of splitting up proteids. The proteid materials dissolve on heating (150°-200° C.) with acid amides. Acetamide extracts from casein, with a yield of nearly 100 per cent., a substance of the same percentage composition in carbon, hydrogen, and nitrogen, but possessing very different physical and chemical properties. The question arises as to whether there is a simple depolymerisation.—W. N. Schopfer: Researches on the influence of the nutritive medium on the formation of the zygotes in the heterothallic Mucorineæ. The study of *Mucor hiemalis* shows that in a sugar (maltose) nitrogen medium there exists, for the formation of zygotes, an optimum concentration characterised by a high proportion of sugar.—M. Gysin and C. Couchet: Remarks on the methods of analysis of platinum minerals. The authors have submitted to a very detailed control Thuringer's method and that used in refineries. Neither method gives a complete separation of iridium.—A. Naville: Fertilisation and the chromosome cycle of *Chloromyxum Leydigi*. Studying the evolutive cycle of *Chloromyxum Leydigi*, the author shows that in this species there should be two successive fertilisations, one isogamous after the formation of the spore, the other anisogamous before the formation of the spores. This hypothesis reconciles the two theories concerning the fertilisation of the Myxosporidieæ and possesses the advantage of explaining all the figures of Keysselitz.

Official Publications Received.

BRITISH.

Department of Scientific and Industrial Research. Report of the Food Investigation Board for the Years 1925, 1926. Pp. vi+80+2 plates. (London: H.M. Stationery Office.) 2*s.* 6*d.* net.

Proceedings of the Cambridge Philosophical Society. Vol. 23, Part 7, July. Pp. 755-844. (Cambridge: At the University Press.) 5*s.* net.

Mines Department. Fifth Annual Report of the Safety in Mines Research Board, including a Report of Matters dealt with by the Health Advisory Committee, 1926. Pp. 55. (London: H.M. Stationery Office.) 9*d.* net.

Ordnance Survey. Report on the Experimental Revision of the 1/2500 Ordnance Survey Plans with the Aid of Photographs taken from the Air. Pp. 14. (London: H.M. Stationery Office.) 4*d.* net.

A List of Official Chemical Appointments, compiled by direction of the Council of the Institute of Chemistry and under the Supervision of the Publications Committee by the Registrar of the Institute. Sixth edition, revised and enlarged. Pp. 335. (London: Institute of Chemistry.)

Ministry of Agriculture and Fisheries: Intelligence Department. Report on the Work of the Intelligence Department of the Ministry for the Two Years 1924–26. Pp. 86. (London: H.M. Stationery Office.) 2s. 6d. net.

The Quarterly Journal of the Geological Society. Vol. 83, Part 2. No. 330, July 19th. Pp. xlix-cxi+195-345. (London: Longmans, Green and Co., Ltd.) 7s. 6d.

FOREIGN.

Agricultural Experiment Station, Michigan State College of Agriculture and Applied Science. Circular Bulletin No. 104: Clothes-Moths and Carpet-Beetles. By Eugenia McDaniel. Pp. 20. Special Bulletin No. 163: Forest Planting in Michigan. By Alfred K. Chittenden. Pp. 24. Technical Bulletin No. 79: Tests for Incipient Putrefaction of Meat. By Ralph H. Weever. Pp. 28. (East Lansing, Mich.)

Technical and Scientific Supplement to the Record. No. 2: Report on Cottons from Siam. By Sir George Watt. Pp. 6. (Bangkok: Ministry of Commerce and Communications.) 50 satangs.

Meddelelser fra Kommissionen for Havundersøgelser. Serie Fiskeri, Bind 8. Nr. 3: A Bottom Sampler for Hard Bottom, by Martin Knudsen; Nr. 4: Preliminary Experiments with Knudsen's Bottom Sampler for Hard Bottom, by A. C. Johansen. Pp. 4+6. Nr. 5: Quantitative Investigations of the O-Group and I-Group of the Plaice, Turbot, Brill and Sole in the Skagerrak, Kattegat and Belt Sea. By Anton Fr. Bruun. Pp. 30. (København: C. A. Reitzels Forlag.)

Skrifter udgivne af Kommissionen for Danmarks Fiskeri- og Havundersøgelser. No. 10: Om Hummeren og Hummerfiskeriet i de Danske Farvande. Af Erik M. Poulsen. Pp. 42. (København: C. A. Reitzels Forlag.)

Berichte der Naturforschenden Gesellschaft zu Freiburg i. Br. Herausgegeben von Prof. Dr. J. L. Wilser. Siebenundzwanzigster Band, Zweites Heft. Pp. 47+20+4+5+8+98. (Freiburg i. Br.: Speyer und Kaerner.)

Diary of Societies.

CONGRESSES.

AUGUST 27–SEPTEMBER 1.

INTERNATIONAL CONGRESS OF ORIENTALISTS (at Oxford). In following sections: General (including Anthropology, Ethnography, Prehistoric Archæology, Comparative Mythology, and Folklore), Assyriology and cognate subjects, Egypt and Africa, Central and Northern Asia, the Far East, India and Iran, including the Indo-European Languages of Asia, the Old Testament, the Language, Literature, etc., of Islam, and Oriental Art.

AUGUST 29–SEPTEMBER 3.

INTERNATIONAL COMMISSION FOR THE EXPLORATION OF THE UPPER AIR (at Leipzig).

AUGUST 31–SEPTEMBER 3.

WORLD POPULATION CONFERENCE (at Geneva).

AUGUST 31–SEPTEMBER 7.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (at Leeds).

Wednesday, August 31, at 8.30 P.M.—Sir Arthur Keith: Darwin's Theory of Man's Descent as it stands To-day (Presidential Address).

Thursday, September 1, at 10 A.M.—Addresses by Sectional Presidents: B (Chemistry).—Dr. N. V. Sidgwick: Co-ordination Compounds.—D (Zoology).—Dr. G. P. Bidder: The Ancient History of Sponges and Animals.—E (Geography).—Dr. R. N. Rudmose Brown: Problems of Polar Geography.—G (Engineering).—Sir J. B. Henderson: Invention.—K (Botany).—Prof. F. E. Fritsch: Some Aspects of the Present-day Investigation of Protophyta.

At 11 A.M.—F (Economics).—Prof. D. H. Macgregor: Rationalisation of Industry.—M (Agriculture).—C. G. T. Morison: Agriculture and National Education.

At 2 P.M.—Conference of Delegates of Corresponding Societies.

At 2.30 P.M.—Discussion (Sections J. L): The Psychology of Special Scholastic Disabilities.

Friday, September 2, at 10 A.M.—Addresses by Sectional Presidents: A (Mathematical and Physical Sciences).—Prof. E. T. Whittaker: The Outstanding Problems of Relativity.—H (Anthropology).—Prof. F. G. Parsons: The Englishman of the Future.—I (Physiology).—Dr. C. G. Douglas: The Development of Human Physiology.—Discussion (Section G): Coal.—Discussion (Sections K. M): The Control of Plant Diseases.

At 11.30 A.M.—Address by the President of Section L (Education), Her Grace The Duchess of Atholl: The Broadening of the Outlook in Education.

At 8.30 P.M.—Evening Discourse by Prof. R. A. Millikan: Cosmic Rays.

Monday, September 5, at 10 A.M.—Addresses by Sectional Presidents: C (Geology).—Dr. H. H. Thomas: Centres of Tertiary Volcanic Activity in Britain.—J (Psychology).—Dr. W. Brown: Mental Unity and Mental Dissociation.—Discussion (Sections A. B): The Structure and Formation of Colloidal Particles.—Discussion (Section G): Lubrication.

At 8.30 P.M.—Evening Discourse by Dr. F. A. E. Crew: The Germplasm and its Architecture.

Tuesday, September 6, at 10 A.M.—Discussion (Sections C. K, and Cosmical Physics Department of Section A): Climates of the Past.—Discussion (Sections F. J): Innate Characteristics and Social Differences.

At 2 P.M.—Conference of Delegates of Corresponding Societies.

Wednesday, September 7, at 12 NOON.—Concluding General Meeting.

SEPTEMBER 1–4.

SCHWEIZERISCHE NATURFORSCHENDE GESELLSCHAFT (at Basel) (in 14 Sections), as follow:—Medical Biology (Prof. R. Stachelin, President); Chemistry (Prof. H. Rivier, President); Physics (Prof. P. Debye, President); Geophysics, Meteorology, and Astronomy (Prof. S. Mauderli, President); Mathematics (Prof. F. Gonseth, President); Pharmacy (J. Lang, President); Geology (Prof. A. Jeannet, President); Mineralogy and Petrography (Prof. M. Rheinhard, President); Palæontology (Dr. A. Tobler, President); Zoology and Entomology (Prof. A. Reichensperger, President); General Botany (Prof. E. Wilczek, President); Systematic Botany and Plant Geography; Anthropology and Ethnology (Prof. R. Zeller, President); History of Science and Medicine (Prof. G. Senn, President).—Presidential Address by Dr. F. Sarasin.—Lectures on, respectively, The Causes and Factors of Morphogenesis, by Prof. A. Brachet; Recent Work and Views in Astronomy, by Prof. L. Courvoisier; The Urals from the Point of View of Geophysics, Geology, and Mining, by Prof. L. Duparc; Paracelsus in Relation to Modern Thought, by Prof. H. E. Sigerist.

SEPTEMBER 3–10.

INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS (at Prague).

EMPIRE MINING AND METALLURGICAL CONGRESS.

Winnipeg Meeting, September 3.—G. E. Cole: The Development of Gold Mining in Canada.—W. A. Quince: Methods of Eliminating Barren Rock from Ore at the Sub-Nigel Mine.—C. R. Davis, J. L. Willey, and S. E. T. Ewing: Notes on the Operation of the Reduction Plant at West Springs, Ltd.—E. J. Laschinger: A New Form of Air Meter and the Measurement of Compressed Air.

Vancouver Meeting, September 14.—C. P. Browning: Canadian Copper and its Production.—F. J. Alcock and T. W. Bingay: Lead and Zinc in Canada.—C. J. N. Jourdan: A Brief Review of the Principal Base Metal and Base Mineral Resources of the Union of South Africa.—R. Craib: Dewatering the Lower Levels of the Simmer and Jack Mines, Ltd.—W. S. Robinson: Manufacture of Sulphuric Acid by the Contact Process. From Zinc Blende Roaster Gases.

Edmonton Meeting, September 20.—R. Strachan, W. J. Dick, and R. J. Lee: The Coal Industry in Western Canada.—J. Ness: Petroleum in Canada.—A. Docquier, L. Bataille, and R. Beetlestone: A Combination of the Baum, the Draper, and the Froth Flotation Systems as applied to the Washing of Coal at the Linsi Mine of the Kailan Mining Administration, North China.—A. E. Cameron: Impact Resistance of Steel at Low Temperatures.

Quebec Meetings, September 5 *and* 26.—J. G. Ross: Asbestos Mining and Milling.—A. W. Nash: Possible Auxiliary Sources of Liquid Fuel.—A. Job: The Sinking and Equipment of the Ventilation Shaft of the Government Gold-Mining Areas.—G. W. Sharp: The Tipping and Guiding of Vertical Skips.—P. M. Newhall and L. Pryce: Improvements in Drilling Efficiency with Jack-Hammers.

Sydney Meetings, September 9 *and* 10.—F. W. Gray: Mining Coal Under the Sea in Nova Scotia.—Sir Robert Hadfield: The Metal Manganese and its Properties: also, the Production of Ferro-Manganese and its History.—Raw Materials for the Iron and Steel Industry in India.—B. Yaneske: The Manufacture of Steel in India, by the Duplex Process.

SEPTEMBER 4–9.

INTERNATIONAL CONGRESS OF ZOOLOGY (at Budapest).

SEPTEMBER 6–9.

INSTITUTE OF METALS (Autumn Meeting) (at Derby).

Tuesday, September 6, at 8 P.M.—Dr. L. Aitchison: Non-Ferrous Metals in Modern Transport (Lecture).

Wednesday, September 7, at 10 A.M.—Reading of Papers selected from *

Thursday, September 8, at 10 A.M.—Reading of Papers selected from *

Friday, September 9.—All-day Excursion.

* W. T. Cook and W. R. D. Jones: The Copper-Magnesium Alloys. Part II.—W. Hume-Rothery: Researches on Intermetallic Compounds. VI. The Reaction between Solid Magnesium and Liquid Tin.—K. L. Meissner: Age-Hardening Tests with Elektron Alloys.—A. R. Raper: The Equilibrium Diagram of Copper-Tin Alloys containing from 10 to 25 per cent. of Tin.—C. S. Smith: Note on Cathodic Disintegration as a Method of etching Specimens for Metallography.—H. Sutton and A. J. Sidery: The Protection of Aluminium and its Alloys against Corrosion.—H. Sutton and J. W. W. Willstrop: The Nature of the Film produced by Anodic Oxidation of Aluminium.—Dr. C. J. Smithells, W. R. Pitkin, and J. W. Avery: Grain Growth in Compressed Metal Powder.—Marie L. V. Gayler: The Undercooling of Some Aluminium Alloys.—A. G. C. Gwyer and H. W. L. Phillips: The Constitution of Alloys of Aluminium with Silicon and Iron.—F. Hargreaves: Effect of Work and Annealing on the Lead-Tin Eutectic.—W. Hume-Rothery and S. W. Rowell: The System Magnesium-Cadmium.—C. H. M. Jenkins: The Constitution and Physical Properties of Some of the Alloys of Copper, Zinc, and Cadmium.

SEPTEMBER 11–17.

INTERNATIONAL CONGRESS OF PHYSICS IN COMMEMORATION OF THE CENTENARY OF VOLTA (at Como).

SEPTEMBER 11–18.

INTERNATIONAL CONGRESS OF GENETICS (at Berlin). In three sections: General Genetics and Cytology, Heredity in Man and Eugenics, Animal and Plant Breeding.

SEPTEMBER 12–14.

INTERNATIONAL SOCIETY OF LEATHER TRADES' CHEMISTS (Bi-Annual Conference) (in London).

SEPTEMBER 18–OCTOBER 3.

INTERNATIONAL CONGRESS OF THEORETICAL AND APPLIED LIMNOLOGY (at Rome). In four sections: Physics and Chemistry, Geology and Hydrography, Biology, and Applied Limnology.

SEPTEMBER 20–22.

IRON AND STEEL INSTITUTE (Autumn Meeting) (at Glasgow).