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Organisation and Registration of Chemists.

In a recent leading article (Nature, June 4) attention was directed to a notable achievement in chemical co-operation exemplified by the recent publication of a volume of abstracts covering the whole field of pure and applied chemistry, issued under the direction of the Bureau of Chemical Abstracts. This unifying enterprise is a significant manifestation on the literary side of a wider movement towards the consolidation and standardisation of the chemical profession within the British Empire. Another aspect of chemical co-ordination is revealed by the remarkable growth in membership and in national importance of the Institute of Chemistry, which this year celebrates its jubilee. This record of progress is admirably reviewed in a recent lecture to the Institute by its immediate past president, Mr. A. Chaston Chapman.[1]

In the years immediately preceding the birth of the Institute, there was little or no professional cohesion among those who then practised chemistry either as a whole-time profession or as an addition to such other vocations as medicine, pharmacy, or engineering. In the absence of any code of professional ethics, it was inevitable that marked inequalities should exist in regard to the status and qualifications of chemical practitioners. Even the designation of chemist became misapplied systematically until, as the result of general usage, the term was taken to denote a member of another and better-known profession, that of pharmacy.

In 1876 a meeting of prominent chemists resolved "that it is desirable that an organisation of professional chemists be formed," and this resolution furnished the germ from which the Institute of Chemistry developed. The immediate objectives were the protection of qualified chemists from the unfair competition of unqualified men and a raising of the standard of professional ethics. The latter aim has been steadily pursued, and with noteworthy success, for although in 1893 the censors of the Institute reported that practices of an unprofessional character were unduly prevalent, yet in the last few years the censorship has had to deal only with cases of slight misunderstanding, and instances of serious misconduct have happily become exceedingly rare.

In 1878 the number of chemists who desired to join the Institute, and whose claims had been approved, was 225, and by 1914 the total member-

[1] The Growth of the Profession of Chemistry during the Past Half-century (1877–1927). By A. Chaston Chapman. (London: Institute of Chemistry, 1927.)

ship of fellows and associates was in the neighbourhood of 1400. During the intervening years the Institute had become sufficiently powerful and exclusive to impose examinational tests on applicants for the associateship, even when such candidates possessed high academic distinctions and had gained considerable industrial experience. At first these tests were entirely practical, and the essential qualification of an aspirant for the associateship was proficiency in the laboratory arts. Later, however, written papers in chemistry, and exercises in translation from French and German chemical literature, were set to candidates whose scientific training had not been taken at a recognised college or university. Very occasionally, older chemists of outstanding eminence and experience were admitted to the senior grade of fellow without examination.

During the upheaval of the War years, other avenues into the Institute were opened for those who had made good as chemists either in the fighting services or in chemical factories producing munitions of war, and although the expediency of this step was contested at the time, the later history of the Institute has proved the wisdom of a judicious opening of the doors without examination in cases which, after careful scrutiny, had been recommended by a zealous Nominations and Examinations Committee.

This provision of alternative methods of qualifying for membership came very opportunely at a time when the sudden realisation by the nation of the fundamental importance of applied chemistry as a key industry led to a rapid growth in the number of chemical practitioners, and to a remarkable development in the schools of chemistry, where many more students than heretofore were entering on courses of higher instruction and research. At present, the total membership of the Institute is approximately 5200, so that after a brief half-century of steady growth this professional body may now claim to include a majority of the practising chemists of the British Empire. The progress of the Institute is not, however, to be measured entirely in terms of increased membership, but rather in relation to the greatly enlarged scope of its activities for the nation as well as for the profession. Government departments and other public bodies consult the Institute and accept its help to an extent unknown in the earlier days.

Within the profession the Institute has been a rallying-point for chemical altruism. It holds out a helping hand to all chemists whether members of the Institute or not, although obviously the assistance is more effective in the former alternative. Students of chemistry can become registered students of the Institute and are thus eligible to receive its publications and to use the library. They are also invited to its scientific meetings and social gatherings. The appointments register, which gives prompt and ready access to lists of suitable vacancies, has done inestimable service in reducing to small proportions the amount of unemployment. Even in the leanest years of industrial depression the unemployed have been less than four per cent. of the total membership, and in the last resort the benevolent fund of the Institute operates in hard cases of undeserved misfortune.

A review of the present position of organised chemists would, however, be incomplete without reference to another professional organisation, the British Association of Chemists, which came into existence in 1917 as the outcome of a feeling among certain of the younger chemists that the Institute, by reason of its charter, was precluded from taking active steps in such matters as trade disputes, individual or collective bargaining with employers, and in other cases where the material advantage of its members was involved. The prime movers in this development were at first uncertain whether to start the Association as a limited liability company or as a trade union, but ultimately the latter course was adopted, thus bringing the Association into harmony with the operation of the Whitley Councils as applied to the chemical profession.

The Association, which is now a registered trade union although not affiliated with the T.U.C., has a membership of about 1000, of whom about 25 per cent. are also members of the Institute of Chemistry. It is of interest to note that the Association, like the Institute, is representative of all branches of the chemical profession. The Association has its own appointments register and a legal aid department. One of its most beneficent works has been the disbursement of £4000 in unemployment pay during the last two years. This practical demonstration of brotherhood and mutual assistance is one of which all British chemists should be proud, whether they are members of the Association or not.

The foregoing brief sketch of the activities of the two professional bodies depicts a widespread movement towards unification in the chemical profession, but the picture would be unfinished and out of true perspective without an outline of

another modern tendency which makes for disunion and separatism.

When systematic training in chemistry first began in Great Britain, students received a comprehensive training in chemistry and the allied sciences, and at the end of such a training went out with the simple label of chemist. The choice of allied sciences naturally varied from one college to another, but this variation did not alter the main intention of the curricula, which was to produce a well-trained student of chemistry. Such were the courses at the old College of Chemistry and at its successor, the Royal College of Science. In the now defunct Finsbury Technical College, chemical students devoted the major part of their first two years of study to engineering subjects, but they were not on that account called chemical engineers. They were primarily chemists who, on reaching the works, found that their elementary acquaintance with engineering was of real service to them.

Nowadays, owing to academic specialisation, students leave university or college under a bewildering array of categories. We now have bio-chemists, chemical engineers, metallurgical chemists, petroleum chemists, pharmaceutical chemists, tinctorial chemists, and many other kinds. It is possible that, in spite of premature specialisation, these graduates may have the essential qualifications of a chemist, but there is also the ever-increasing risk that chemistry may not have entered adequately into the mental make-up of such a student, in which case all his subsidiary studies in other branches of technology will not make him into a chemist, although sometimes they may enable him to acquire a chemist's job. Already this contingency is exercising the minds of many members of the two professional associations, because it is becoming apparent that unless the registration of *bona fide* chemists is speedily accomplished, chemistry as a clearly defined whole-time profession will cease to count in Great Britain.

There are many difficulties in the way, one being the matter of designation already mentioned, and another which arises from the diversity of circumstances in which chemists pursue their avocation. There are academic chemists in universities, colleges, and schools, chemists in the civil service and in the employment of local administrative authorities, chemists engaged either as employers or employees in chemical industry throughout its varied ramifications, and there are private consultants who serve the public directly as analysts, chemical advisers, forensic chemists, and specialists in many other unclassifiable ways. In regard to these numerous categories, chemistry differs essentially from medicine and the law, and resembles more closely engineering, in which profession each addition to the scope of its practitioners is soon followed by the creation of a new institution of engineers.

The danger to the chemical profession of à similar fissiparous tendency renders registration the vital problem of the immediate future. The subject is being warmly discussed, and already acute differences of opinion on this burning topic are apparent even within the profession. Those in favour of registration for chemists will, however, derive encouragement and hope from the reflection that a similar battle of the giants was waged fifty years ago between the advocates of a new 'organisation of professional chemists' and the champions of the long-established Chemical Society.

Registration will not solve all the troubles of chemists, but it will benefit both them and the community by assisting to maintain to the fullest extent the high professional standard now reached after fifty years of combined effort.

Meteorology: Ancient and Modern.

Manual of Meteorology. Vol. 1: *Meteorology in History.* By Sir Napier Shaw, with the assistance of Elaine Austin. Pp. xx + 339 + 18 plates. (Cambridge: At the University Press, 1926.) 30*s.* net.

THIS is a most interesting book, and the name of the author, so well known to all students of meteorology, is a sufficient guarantee of its accuracy and pleasant style. The aim of the book is defined by the following quotation from the preface:

"The object of the book is to present the study of meteorology, not only as making use of nearly all the sciences and most of the arts, but also as a world study of a special and individual character, going back inevitably to the very dawn of history and beyond that to the mazes of geologic times."

Much information is given upon sundry subjects that are not strictly meteorological, but only incidental thereto, as, for example, the Kalendar and the causes of Equation of Time. The early chapters are devoted to the connexion of meteorology with European culture in primitive times. The part of the world best known to the ancients was confined to the shores and islands of the Mediterranean, and data are given concerning the

temperature, rainfall, and wind prevailing at the present day at twelve stations in that region. There are also many quotations from the poets and historians of Greece and Palestine. It is pointed out that Egypt, being dependent upon natural irrigation by the waters of the Nile, was in a different position from Greece and Palestine, where the failure of the rains might easily, and indeed often did, produce a famine.

The question of the source of the water of the rivers seems to have afforded ground for much conjecture to the Greeks; but apparently it was known to the Jews, if we may judge from a passage in Ecclesiastes: "All the rivers run into the sea, yet the sea is not full; unto the place whither the rivers go, thither they go again." It is also apparent from the tables relating to the Mediterranean area that the region is a dry one during the summer, many stations having no rain for three or four consecutive months.

From the heat of the summer and the copious supply of moisture afforded by the warm water of the sea, one would expect frequent thunderstorms and heavy rain, a climate, in fact, like that of the Doldrums; but, as Sir Napier explains, the latitude is that in which all the great deserts of the world are found, and but for the sea the region itself would also be a desert. The conditions produced by the general circulation of the atmosphere must therefore overpower the local conditions that are favourable to rain.

In Chapter vi. the variability of the Mediterranean climate in historical times is considered, and after carefully summing up the evidence, Sir Napier comes to the conclusion that "the seasons are the same and the crops are still mainly the same and require the same cycle of seasons, though the area over which they can be profitably cultivated may have been considerably reduced, and some of the region may have been transformed from habitable land into inhospitable desert."

The next chapter is on weather lore, and covers the time from Aristotle to the invention of the barometer. A translation is given of the well-known passage from Virgil in the first book of the "Georgics," containing instruction to husbandmen.

Chapter viii. contains seventy-four brief biographies of pioneers in the science of weather, the list consisting of the names of men who lived between the years 1561 and 1860 and were either meteorologists, designers of meteorological instruments, or makers of discoveries in physical science on which meteorology depends. It begins with Francis Bacon and ends with Angelo Secchi, an Italian astronomer. The chapter includes a copy of Fitzroy's instructions for the use of a barometer to foretell the weather.

Chapter ix. is on meteorology as an international science, a subject on which Sir Napier's long service as president of the International Committee especially qualifies him to speak. For the purpose of forecasting weather, telegraphic information from neighbouring countries is required: each country has its own organisation and receives telegrams from a more extensive region than its own country covers. Naturally, therefore, many questions arise involving such matters as the units to be employed, the code to be used, the hours of observation, etc. These questions can only be settled by mutual agreement between the chiefs of the various meteorological services. The details of the different committees are given, and the necessity for further collaboration is emphasised. Observations, though greatly increased by the facilities afforded by radio telegraphy, are only available from well-populated districts, and on the sea from the lines of steamer traffic, and Sir Napier advocates the formation and maintenance of stations for purely meteorological purposes wheresoever they may be required. He also advocates an International Weather Office, that should be staffed with the most competent of meteorologists and physicists.

The following chapter deals with the surface air, and discusses without detail the instruments, self-recording and otherwise, that are commonly required in the meteorological observatory.

We then come to Chapter xi., which deals with the upper air. This chapter contains seventy-five very beautiful illustrations of cloud forms, with some remarks upon the classification of clouds, the measurement of their height and of their motion. The methods of observation of the upper wind by means of pilot balloons are described, so also are the meteorographs used with *ballons-sondes*. The chapter ends with two useful tables which give particulars of the type and cost of balloons, meteorographs, and accessories used by the various countries in obtaining a sounding to ten or more kilometres height.

The next chapter (xii.) is concerned with the study of the atmosphere, and consists largely of descriptions of instruments for measuring solar and terrestrial radiation and electrical forces. It is good to find the importance of radiation fully recognised in a volume on meteorology; it is undoubtedly one means by which heat flows in a vertical direction from layer to layer of air; yet

many writers ignore this, while others seem to ascribe the vertical distribution of temperature to it alone, which seems to the reviewer as far from the truth as is its entire neglect.

Radiation and dynamic heating and cooling are the only means that can produce a change of temperature in a mass of air above the level where the condensation of water vapour becomes negligible.

The author prefers to measure radiative energy in a dynamical unit and states that he finds kilowatts per square dekametre the most convenient. The more usual unit is a gram calorie per square centimetre per minute, but something may be said in favour of gram calories per day, since a gram calorie is more generally understood than a joule and the day is the natural meteorological unit.

Chapter xiii., which is on "The Development of Arithmetical and Graphical Manipulation," gives a description of the usual diagrams that one finds in books and papers on meteorology; it also explains and gives formulæ for obtaining various quantities, such as the standard deviation, the amplitude and phase angle of the terms in a Fourier's series, the method of searching for periodicities, and other similar quantities.

The explanations are very lucid and easy to follow; in fact, the chapter may be taken as a useful text-book on the commonly used statistical formulæ. As an illustration of the use of semi-logarithmic squared paper, the author gives a graph of his tephigram, a method which he has suggested for showing the data obtainable from the *ballon-sonde*. This graph is very useful, and a full explanation of its use is promised for Vol. 3.

Limitation of space forbids comment on Chaps. xiv. and xv. They are not wanting in interest, and are on "Air Movement into the General Circulation and the Cyclone" and on "Meteorological Theory in History."

The book, with the index, contains 339 pages, including 121 illustrations, numerous bibliographies, and references to original papers. It is excellently printed and will be read with pleasure by all those who are interested in any way in scientific matters. Meteorologists already owe a debt of gratitude to Sir Napier Shaw for his previous books, and their debt is greatly increased by this volume; they will look forward to the publication of the two succeeding parts, one of which is already in the press.

W. H. DINES.

Problems in Tropical Africa.

East Africa, a new Dominion: a Crucial Experiment in Tropical Development and its Significance to the British Empire. By Major Archibald Church. Pp. 315+12 plates. (London: H. F. and G. Witherby, 1927.) 18*s*. net.

TO students of tropical African development, this book may be commended as the earnest effort of an acute thinker to set out a problem and provide the answer to it. In his description of present-day conditions in that large group of East African territories, which vary as greatly in the character of their native inhabitants as in that of their geographical features, Major Church has been studiously fair-minded, and his treatment of local personalities and local policies will go far to undo the mischievous effects of the work on Kenya published three years ago by Dr. Norman Leys. Almost every page in the book raises questions of interest or points of controversy, and it is not possible within the limits of a short review to do more than select a few items for comment.

In the chapter upon development the author comments severely upon the neglect of water transport. On all the great lakes navigation has been maintained ever since these countries came under European control, but transport services cannot be maintained on a lavish scale without cargo to transport, and the presence of 'fly' and malaria near the lakes militates against native cultivation in their immediate vicinity where the ground is low-lying and fertile. The congestion on Victoria Nyanza witnessed by the author was a passing phase due to an increase in the Uganda cotton crop, for which the railway was not prepared that season. On the other hand, in considering river transport it should be noted that in Africa, as in India, great rivers like the Zambezi, with their alternating seasons of flood and drought, make it quite impossible to maintain trustworthy transport services by water; while on the Nile in Uganda in seasons of high water the river is dangerous to navigate on account of the floating sudd, and sometimes becomes blocked for months at a time. Only this last season the products of Bunyoro, dependent upon the Nile for outlet, were held up for some months on this account. Thus the present conditions of water transport are the outcome of practical experience; they cannot fairly be attributed to lack of imagination as suggested by the author.

In his proposals to introduce the methods adopted by the French in Madagascar to foster the

native cattle industry, Major Church has made no allowance for the resistance offered by pastoral tribes, and by the Masai in particular, to what amounts to a revolution in their regard for, and treatment of, their cattle from time immemorial, and yet we have in India an ever-present example of the difficulty of inducing a change in the mental attitude of ancient and backward races towards their cattle. Nor has he given the local governments credit for the efforts which they have been, and still are, making to wean some of the younger men from old tribal customs by teaching them modern methods of animal husbandry. Moreover, he seems to be unaware of the conditions under which the meat industry was established in Madagascar. What would be said by the political opponents of the existing government of Great Britain if they encouraged the local government to grant a monopoly in the trade to one of the international meat trusts, and lent them their support not only in procuring the meat in the colony, but also in its sale in the home country ?

The most interesting proposal in the book is the suggestion that the system of government in these territories should be based upon 'community self-government,' each community, white, black, Arab, and Indian, raising its own taxes and disbursing them. Each territory would have its own legislative council, upon which each of the four communities would be represented, and eventually a central government would be set up with an elected house of representatives and a senate. Presumably the principle of community representation would be extended to these bodies also. Too little information is given to show how this 'model constitution' could be made to work in practice, and experienced administrators will probably rub their eyes as they read the all-too-short paragraph devoted to the subject. But, in fact, it is difficult to take the proposal seriously in view of the author's previous declaration in his chapter on the colour problem that he was "forced to the conclusion that the Whites must accept full responsibility for the government of the peoples of East Africa, and that any attempt to share it with the brown races will be disastrous in its consequences upon black and white races." How can the one statement be reconciled with the other ?

A passing reference may be made to Major Church's comparison between the East Africa Committee set up by the late Secretary of State and the Joint East African Board. Whatever the merits of the former, and its personnel was certainly unexceptionable, it had all the defects as well as the merits of a committee of experts appointed by a government to advise it. It would probably prevent some mistakes being made ; it would also block progress. The latter body, whatever its demerits may be, has at least the democratic merit of being directly elected by those whom it serves, namely, the whole body of white people actively engaged in agricultural, commercial, and industrial pursuits throughout East Africa from the Zambezi to the Sudan border. It was in existence a year before the East Africa Committee was set up. It has already survived it by nearly three years.

However one may sympathise with the author's desire that the Mandates Commission of the League should apply the principle of trusteeship to the whole of tropical Africa, it would be well to bear in mind that the very existence of the League depends upon the goodwill of its members, and that the merest semblance of dictation will shatter its authority and dissolve its membership. It should not be forgotten that a *questionnaire* issued last year to the members of the League holding mandates was regarded as inquisitorial and excited strong protest from Australia in particular ; while throughout the whole of East Africa at the present time there are grave misgivings regarding the disabilities of Tanganyika as a mandated territory. At this juncture any proposal to extend the scope of the mandate system would inevitably lead to a concrete demand to throw off our obligations under the existing mandate. This would certainly not serve the cause of the League of Nations.

While one may differ from the views of the author on particular points, one can close the book in whole-hearted agreement with his final conclusion as to the effects of white settlement on the native races. He says :

"It is my firm conviction that the natives in East Africa are far better treated than in any other part of Africa—except, perhaps, in parts of British West Africa—and that within a few years, through their more intimate contact with the white peoples, they will have progressed far more rapidly than the native communities in the West."

A few mistakes in the book may be noted. It is a pity that the name of the Kabaka of Uganda, Daudi Chwa, is incorrectly printed at the foot of his photograph facing page 30, as this young man is likely to figure more prominently in East African affairs in the future than he has in the past. On page 48 North-Western Rhodesia should read North-Eastern Rhodesia. The correction is import-

ant as the political future of Northern Rhodesia is somewhat uncertain, and a casual reference to this work might confuse the reader. A glance at any map will explain the point. At several points in the book reference is made to a "Chamber of Conventions." There is no such body in East Africa. The context shows that reference is intended to the Convention of Associations, that is, the periodical meeting in convention of the various white associations throughout the country. On page 151 reference is made to Brooke Washington as the author of "Up from Slavery." The writer of that most excellent book was, of course, the late Booker T. Washington.

The Unity of Life.

Plant Autographs and their Revelations. By Sir Jagadis Chunder Bose. Pp. xiv + 231. (London: Longmans, Green and Co., Ltd., 1927.) 7*s.* 6*d.* net.

APROPOS of the theme under review, it may be not without interest to mention at the outset that an eminent botanist, the late Sir Francis Darwin, in the course of his presidential address before the British Association in Dublin, so far back as 1908, formulated the opinion that "it is consistent with the doctrine of continuity that in all living things there is something psychic, and if we accept this point of view we must believe that in plants there exists a faint copy of what we know as consciousness in ourselves." Wherein resided this plant psyche, this faint copy of consciousness? Diffused throughout the cellular elements as in lowly organisms? Our views seemed nebulous; and yet why should they remain so? An oak-tree is as highly developed a representative of the vegetable world as one of the higher vertebrates is of the animal world. It seems in some measure strange that before now some one had not thought of trying to find out if any special system of plant-tissue had become established which showed definite association with psychic phenomena. We welcome, therefore, an attempt which has been made, through the researches of Sir J. C. Bose, to lift the mist which has so long enshrouded the analogous workings of plant and animal life.

In affording evidence that plants possess a 'heart' and circulatory system, and a 'nervous' system, Bose's researches bring into closer harmony the main phenomena of life in general. Herein lies the kernel of his theme, the key to the situation; and so our story becomes not only fascinating but also supremely important. The establishment of a closer and at the same time a more rational kinship between plant and animal—a kinship which *a priori* we might expect to have existed from the beginning—clothes the author's theme with a special charm. His data (made possible largely through experiments which necessitated the use of wonderfully delicate and ingenious instruments) have resulted in such profoundly interesting findings that the expert plant-physiologist feels bound to question the values set upon material, technique, and experiment as a whole. We must look to experts for confirmation. Here is a theory at stake, something offered, too far-reaching in its nature to remain in abeyance. The 'Boseian' doctrine must stand or fall: experts will not allow the verdict to remain an open one. In the meantime, those of us who have not devised instruments delicate enough to measure, in millionths of an inch, the throbbing tissues of the plant; or other instruments which can amplify a movement by millions of times, for the purpose of following minutely the phenomena of plant-growth; or yet again, those of us who have not connected up and put to the test the delicate electric probe in circuit with the galvanometer, for the purpose of determining the localisation of nervous tissue, should hesitate to look altogether askance, on learning that plants have what may be regarded as a nervous system, and a pulsating action like that of a 'heart,' analogous to what are found in animals. The sceptic overmuch may find it profitable to reflect on the fact that it requires an amazing degree of amplification to record the responses of ordinary plants to stimulation. Indeed, in insisting upon strict analogy, it must be borne in mind that vegetable pulsations represent but a very faint copy of what takes place in the blood-vascular system of animals.

No doubt some biologists may reject Bose's views on the grounds of their being too extravagant. This is not altogether to be unexpected. Much of what the investigator has given us is so pronouncedly novel that the strongly conservative mind may find it most difficult to see other than phantasy and even wild conjecture! Here, however, it is noteworthy that if the plant be endowed with the power of telling us something about its doings, and if its own signature (a signed autograph, rendered possible through the medium of an exquisitely delicate instrument carrying a fine 'pen') be proved correct, this written evidence will surely militate against hasty and unproven indictments. We all know Mimosa—the sensitive plant—which closes its leaves when they are

touched. To most of us little more is known regarding vegetable sensitiveness. Sir J. C. Bose aims at demonstrating the universality of sensitiveness in the vegetable world. His book abounds with highly interesting 'graphs' representing responses to stimuli from without, mechanical, thermal, electrical, and chemical.

Again, it should be emphasised that the values attached to these 'autographs' demand the closest scrutiny of expert plant-physiologists. Meanwhile, it is not a difficult matter, nay, rather a pleasure, to recommend the book warmly and with a considerable degree of confidence. The text is couched in language which every one can follow, and from start to finish arrests attention. Certainly, the ordinary man who reads this book gains a fresh and broader outlook on life. If for a moment we presuppose that the Boseian doctrine failed to convince, and that it even fell back into obscurity, we can still feel a deep sense of gratitude to the author for giving us an opportunity of becoming cognisant with his fundamentally important views. It is pleasant to follow his patient researches, in which his skilfully devised technique (displaying minutiæ in every detail) goes hand in hand with his experiments.

From a survey of the illustrations, which greatly enrich the pages of the work, we turn our attention to a perusal of the text. Here, were scientific facts not demonstrable, we would feel at times carried by the narrative almost into fairyland. Parts of the story savour of romance, the sequence of which is maintained in a charming style from chapter to chapter. The dumb plant, in its silent life, can be made to write an account of its own history, revealing its marvellous and varied behaviourism, which, in principle, coincides with that in animals. The plant sleeps and awakens with a rhythmic regularity: consequently it yields distinct variations of sensibility during different periods of the day. The script which the plant can be made to furnish explains clearly, among many other things, the varying effects of wounds upon its tissues, leaving finally as a legacy a faithful autograph of its many and varied forms of death-spasms.

Such is a mere passing glance at part of the synopsis of a fascinating story. For the rest, which recounts many other interesting aspects of plant-life, we must refer the reader to the book itself. But, having read the text through, we find that the author's views lead us to accept all the more fully that supremely important doctrine, namely, that *life is a unified whole*. To quote the author's own words: "The barriers which seem to separate kindred phenomena will be found to have vanished, the plant and the animal appearing as a multiform unity in a single ocean of being." No dictum in philosophy is more acceptable to the thoughtful biologist. C. J. PATTEN.

Our Bookshelf.

The Essential Oils. By Horace Finnemore. Pp. xv + 880 + 11 plates. (London: Ernest Benn, Ltd., 1926.) 70*s*. net.

THERE are two ways in which an author may arrange the subject matter of a book such as that under notice—biological and chemical. Mr. Finnemore adopts the former method and is thereby committed to a plan which precludes any general discussion of the constitution, reactions, and relationships of the commoner constituents of essential oils, but permits of some account being given of the chemistry of the rarer substances such as diosphenol and ascaridole, each found in only one kind of essential oil. This is not a serious disadvantage, since every chemist probably has on his bookshelves, in these days, at least one text-book giving a good account of terpene chemistry.

Mr. Finnemore has, however, not taken full advantage of his own plan. He has arranged his material according to the natural orders of the plants from which essential oils are derived. It would have been easy to introduce each of these natural groups with an account of the kind of constituent found in and possibly peculiar to the oils of the group, but this has only been attempted in one sub-group, the eucalypts, and there probably only because such relationships have been thoroughly worked out for this genus, thanks to the admirable researches initiated and largely carried out by Baker and Smith at the Sydney Technological Museum. Introductory statements of the kind suggested would have directed attention to the need for similar investigations in other plant genera yielding essential oils.

There can be no question that these researches have been of great industrial value to Australia, and similar studies elsewhere might do something to bring about that closer association of science and industry which the author thinks is desirable in the interests of the development of this branch of the fine chemical industry within the Empire.

Mr. Finnemore is an assiduous collector and a careful and discriminating compiler. It is not an easy task to search the files of agricultural, commercial, technical, and scientific literature for the kind of information required to make a work of this description complete, and the author has clearly spared no pains to ensure this. As a result the book can be cordially recommended not only to the biological and chemical research worker, but also to the manufacturer and user of essential oils, as an authoritative and up-to-date account of this particularly interesting group of natural products. T. A. H.

The Civilization of the South American Indians: with Special Reference to Magic and Religion. By Prof. Rafael Karsten. (The History of Civilization Series.) Pp. xxxii + 540. (London: Kegan Paul and Co., Ltd.; New York: Alfred A. Knopf, 1926.) 25*s.* net.

SOUTH American peoples have received inadequate attention from ethnologists, and the number of studies of their culture which are of substantial and permanent value is surprisingly small. On this ground alone, Dr. Karsten's book would be welcome as a record of observed fact; but in addition he is an original thinker whose work must receive consideration as a contribution to theory in social anthropology, whatever may be our ultimate judgment as to the validity of his conclusions when given extended application. In a preface contributed by Dr. E. Westermarck, this distinguished authority says: "Dr. Karsten's book is the most important contribution to the study of certain aspects of the South American native civilization which has yet appeared." The weight of this dictum is indeed increased by the fact that for some pages he then goes on to argue against views put forward by Dr. Karsten in criticism of his own conclusions.

The material contained in the book is the outcome of studies carried on during a stay in the Argentine and Bolivian Gran Chaco from 1911 until 1913, and among the tribes of eastern Ecuador from 1916 until 1919—five years which were devoted specially to the study of religious beliefs and practices. The starting-point of the investigation—and of the book—was the self-decorative practices of the Indians and their connexion with religious beliefs. By a natural transition the author passes on to the study of the bearing of ritual and beliefs, including ornamental art, spirits, magic, taboo, mana, beliefs relating to birth and conception, and the practice of *couvade*.

Interpolation. By Prof. J. F. Steffensen. Pp. ix + 248. (Baltimore, Md.: Williams and Wilkins Co.; London: Baillière, Tindall and Cox, 1927.) 36*s.* net.

THE theory of interpolation is a subject which has progressed more slowly than many other branches of mathematics, and the reason is not far to seek. A practical computer is sufficiently occupied in performing lengthy calculations and leaves the mathematician to provide the necessary equipment. The mathematician, when interested in interpolation-series expansions, looks primarily at the question as a branch of the theory of infinite series, which is of little use to a computer needing limits to the error involved after the first few terms.

At present a non-rigorous treatment dominates most text-books on interpolation. The earliest attempt to bring together those approximate formulæ which are simple enough to admit a remainder term giving limits to the error involved was made by Markoff in 1896. During the past thirty years, the number of formulæ with workable remainder terms has greatly increased, and the object of Prof. Steffensen in the book before us is to give an account of the present state of the subject. The formulæ collected here will appeal mainly to actuaries and to computers engaged in calculations of the actuarial type. Prof. Steffensen has very successfully filled a real gap in the computer's library, although he impresses us with the fact that he has published a text-book, and not an encyclopædia on the subject.

Anatomy: Descriptive and Applied. By Henry Gray. Twenty-third edition, edited by Prof. Robert Howden. Notes on Applied Anatomy revised by John Clay and Dr. James Dunlop Lickley. Pp. xvi + 1400. (London: Longmans, Green and Co., Ltd., 1926.) 42*s.* net.

IT is just a century since the birth of Henry Gray, a brilliant anatomist who was elected a fellow of the Royal Society at the early age of twenty-five years, and in his thirtieth year published his text-book, "Anatomy: Descriptive and Applied," which after passing through twenty-three editions in the sixty-nine years of its existence is more popular than ever with students.

The success of the book was in large measure due to the excellence of the wood-engravings made for the original edition by Dr. H. Vandyke Carter. Their strength and clearness, their accuracy and insistence on essentials, made an irresistible appeal to students and simplified the process of learning. Prof. Howden is to be congratulated on maintaining the qualities that originally made this book's reputation, and for insisting, in a generation that is prone to be satisfied with half-tone blocks, on the continued use of wood-engraving as the only adequate means for illustrating text-books of anatomy.

The only criticism to be made of the twenty-third edition is to express regret that the section dealing with the central nervous system is not being kept abreast of the growth of knowledge and the needs of the clinician.

Le calcul des probabilités: son évolution mathématique et philosophique. Par Prof. L.-Gustave Du Pasquier. Pp. xxi + 304. (Paris: J. Hermann, 1926.) 49 francs.

THIS account of the mathematical theory of probability divides naturally into two parts. After a historical introduction the writer gives an account of the addition and multiplication of probabilities, probable errors, and Bernoulli's theorem. Elementary methods only are used in establishing or illustrating these classical results. The second and more valuable part opens with a fairly exhaustive account of the various interpretations of the calculus of probabilities and then proceeds to a critical analysis of its logical foundations. This investigation is interrupted by a chapter dealing with the applications of the theory of probabilities to physics, and then concludes with a rather diffuse account of a definition of probability resting upon the theory of aggregates. The aim of this work is to place the theory of probability on a satisfactory logical foundation, but this goal appears to recede into the distance as we advance towards it.

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.*]

Distribution of Sizes among Rain-drops.

COL. GOLD'S article in NATURE of April 30, p. 654, has prompted us to communicate the results of some observations which we have made of the size of rain-drops. The work has had to be discontinued for the moment, but possibly the results, incomplete as they are, may be useful to other workers in this field.

The accompanying diagram (Fig. 1) shows the distribution of sizes among 3026 rain-drops observed between Oct. 1924 and June 1925. The method of measurement was that described by us in the *Proc. of the Royal Dublin Society*, vol. 17, p. 1, 1922. The rain-drops measured by Defant (*Akad. Wiss. Wien, Sitzungsber.*, **114**, 2a, p. 585, 1905) are for the most

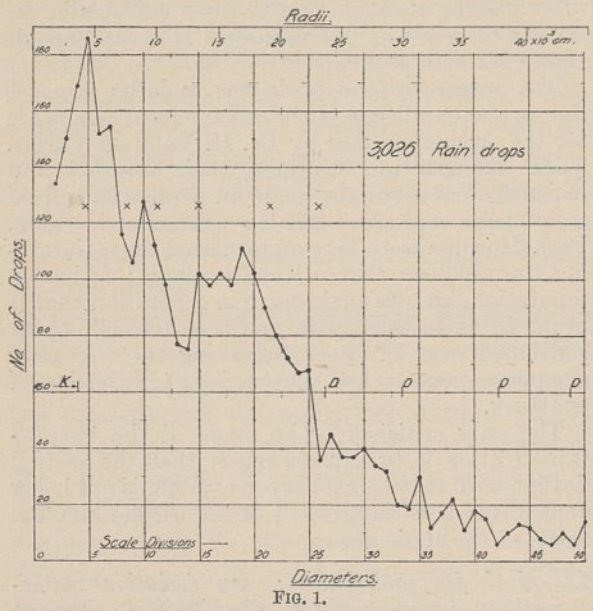

FIG. 1.

part larger than those observed by us. For the range in which our observations overlap, we have marked the sizes which Defant found of most frequent occurrence (*D*, *D*). The range of Kohler's observations on mist particles ("Geofysiske Publikationer," vol. 2, No. 6, Kristiania, 1922) is also indicated on the left of the diagram (*K*).

It was suggested to us that the peaks on our curve of sizes might be due to the tendency, in measurements of this kind, for the readings to group themselves round the fives and tens of the scale employed. We therefore undertook a further series of measurements with a magnification about 1·8 times that previously employed. Observations on 909 drops gave a curve on which only one peak out of many coincided with a multiple of 5 scale divisions. Apart from the maximum at radius 4×10^{-3} cm., the general correspondence of the curves was not very satisfactory. The positions of the principal peaks on the second curve are indicated (*X*, *X*). It is evident that a great number of observations must be accumulated before definite conclusions can be arrived at.

J. J. NOLAN.
J. ENRIGHT.

University College, Dublin.

The Supposed Law of Flame Speeds.

ON behalf of my colleagues and myself, I desire to submit the following observations upon the letter from Dr. Payman and Prof. Wheeler on p. 779 of NATURE of May 28 about our recent experimental examination (*Proc. Roy. Soc.*, A, **114**, pp. 404-449) of their supposed 'law of flame-speeds.'

It is true that in a paper entitled "The Interpretation of the Law of Speeds" (*Trans. Chem. Soc.*, **123**, pp. 412-420; 1923) Dr. Payman had explained that "the fact that the rate of reaction must also depend on the concentrations of the reacting gases results in small divergences from the law when the oxygen is in deficit," and that "the correction necessary to allow for this cannot be correctly estimated, but the general effect of this factor is to make the speeds of the uniform movement of flame in complex mixtures rather slower than the speeds calculated from the law of speeds." Such qualification—which was fully quoted and set forth in our Royal Society paper (*loc. cit.* p. 421)—implied only *small* divergences from the 'law,' that is, *rather slower* flame speeds than it would predict; but by no stretch of language can it be held to cover deviations of such magnitude as were discovered during the flame-speed tests described in our recent papers.

The statement that the principal hydrocarbon mixtures chosen for our blending tests were of acetylene or ethylene with oxygen, and that the choice was made *because* such mixtures are 'so sensitive' is incorrect, as will be seen from the following catalogue of the different pairs of primary mixtures (*A* and *B*) actually used in our blending tests:

A		*B*	Flame speeds, cm. per sec.
(1) 64·4 C_2H_2/35·4 O_2	and	83·1 H_2/15·4 O_2	1400
(2) 12·35 C_2H_4/87·5 O_2	and	38·7 H_2/61·2 O_2	2190
(3) 49·9 C_2H_4/49·9 O_2	and	92·5 H_2/7·4 O_2	180
(4) 55·45 C_2H_4/44·35 O_2	and	93·45 H_2/6·45 O_2	75
(5) 53·2 CH_4/46·5 O_2	and	92·9 H_2/7·0 O_2	115
(6) 11·05 CH_4/88·95 Air	and	71·9 H_2/28·1 Air	64
(7) 11·5 CH_4/88·5 Air	and	72·6 H_2/27·4 Air	51

Of these seven pairs of primary mixtures, only (1) and (2) can be regarded as in any way 'sensitive'; the remaining five (which, be it noted, showed the greatest deviations from the 'law') were certainly not so, as their quite moderate flame speeds indicate. Also, in the last three series of blending tests the hydrocarbon used was neither acetylene nor ethylene but methane; and in the last two the supporter of combustion was not oxygen but air. Indeed, the last three series of blending tests were made because Payman and Wheeler had declared that such complex methane-hydrogen-oxygen (or -air) mixtures obey the 'law.'

Readers of NATURE who may be specially interested in the subject will doubtless study for themselves the evidence contained in our paper, and we will leave them to form their own conclusions upon it. For those who have not time to do so, we need only say that, although the test applied to the 'law' in our experiments was the one prescribed by its authors, in not a single instance was the 'law' obeyed. Indeed, in all but one case (and that with the rather 'sensitive' acetylene-hydrogen-oxygen blendings), it broke down utterly.

Our conclusion against the general validity of the 'law' was chiefly based upon the following facts, which are in direct contradiction to it, namely:

(1) That when an acetylene-hydrogen-oxygen mixture of the composition $C_2H_2 + 2H_2 + O_2$ is exploded, neither carbon is deposited nor any appreciable

steam formed, all the hydrocarbon being burnt to carbonic oxide and hydrogen, leaving the original hydrogen intact.

(2) That in *all* the complex ethylene-hydrogen-oxygen or methane-hydrogen-oxygen (or -air) mixtures examined by us, which were formed by blending a hydrocarbon-oxygen (or -air) mixture (*A*) with a hydrogen-oxygen (or -air) mixture (*B*), both having the same flame speed and both containing oxygen in defect (*i.e.* the respective pairs of primary mixtures numbered 3 to 7 inclusive in the foregoing list) *the effect of progressively increasing the proportion of* (*B*) *in the various blendings in each given series of tests was to lower the observed flame speed progressively until a point was reached when the resulting complex mixture no longer propagated flame at all.*

The fact that the flame speeds for $(CH_4 + H_2)$-air mixtures exhibit only small deviations from the supposed 'law' is scarcely relevant to the discussion because of the comparatively small proportion of a hydrogen-air mixture which has to be blended with a methane-air mixture of the same type and speed to produce a $(CH_4 + H_2)$-air mixture containing oxygen in defect, the only condition that really matters. Thus, for example, in the case examined by us, only 13·35 volumes of a 71·9 H_2/28·1 - air mixture (flame speed = 64·1) would have had to be blended with 86·65 volumes of an 11·05 CH_4/88·95-air mixture (flame speed = 64·5 cm. per sec.) to produce a $(CH_4 + H_2)$-air mixture with a flame speed of 58 cm. per sec., that is, with a deviation of only 10 per cent. from that required by the 'law' (see Table V. on p. 439 of our paper). When, however, oxygen was substituted for air as the supporter of combustion, a much greater deviation was observed; for, as will be seen from Table IV., p. 437 of our paper, if a 53·2 CH_4/46·5 O_2 mixture were to be blended with a 92·9 H_2/7·0 O_2 mixture so as to form a $(CH_4 + H_2)$-oxygen mixture, the speed of the two primary mixtures (each 114 cm. per sec.) would be lowered in the process to about 88 cm. per sec., or by about 23 per cent. Our experiments also indicated that a series of $(CH_4 + 2H_2)$-oxygen (or -air) mixtures (oxygen being in defect) would show even more considerable deviations from the 'law.'

In conclusion, I would add that our experimental examination of the supposed 'law' was undertaken from a sense of duty, and that, having satisfied ourselves that it does not apply to gaseous explosions generally, it has no further interest for us. So, with more important matters to investigate, we do not propose continuing its discussion any further.

WILLIAM A. BONE.

Imperial College of Science,
South Kensington,
London, S.W.7,
June 3.

The Walrus.

ALTHOUGH the walrus is usually found near the land subsisting on the shell-fish it finds at the bottom, it is also on rare occasions found amongst the drift ice in deep water, far from land, subsisting on seals and other mammals.

A few examples of the latter kind are recorded in the log-books of whaling and sealing voyages to the Greenland Sea in my possession, and several others came under my own observation during voyages to the same locality

On one occasion (July 1890), when amongst the ice, off the east coast of Greenland, I noticed an unusual number of birds, some oily water, and something floating in it. Lowering a boat, I found it to be a dead narwhal. It was criss-crossed with deep wounds, had its abdomen ripped open and partly eaten away, and its viscera, including most of the liver, removed. It was only recently dead. Hidden from me and my companions in the boat by a high piece of ice, but visible from the mast-head of the ship a mile or two away, a large walrus lay asleep on an adjoining piece of ice. Unaware of this, and considering the narwhal—a female without a tusk—valueless, I returned on board empty-handed, to learn about the walrus and to be told by my father that the ship could no longer be delayed.

On an earlier voyage, before I commenced sailing with him, my father, the late Capt. Gray of Peterhead, came across a narwhal recently dead and a walrus engaged either in killing it or eating it. The facts will be found fully reported in *Land and Water*, December 1879. Briefly, in July 1879, in lat. 78°, long. 3° W., amongst the ice between Greenland and Spitsbergen, my father noticed an unusual commotion in the water, and, on ascertaining the cause, lowered a boat and secured both the walrus and its victim. The body of the latter was scored with deep wounds, and the stomach of the former was packed with its blubber.

On another occasion (June 1887), in lat. 73°, long. 16° W., we saw a walrus in the water with a seal in its mouth. Lowering a boat, we killed the walrus and retrieved the dead seal. The latter, a floe-rat, *Phoca hispida*, was almost cleft in twain by a single wound. On other occasions I have removed portions of seal (bits of skin, blubber and liver) from a walrus's stomach. (Particulars are to be found in the *Zoologist*, 1889, p. 8.)

The solitary animals that we used occasionally to find amongst the ice far from land subsisting in the way described were all of large size, and may well have belonged exclusively to the male sex. In the only two instances in which it is recorded the sex is male; none of them were accompanied by calves; moreover, in the summer months the adult males cling less to the land than the females and immature animals, venture farther afield, and are more likely to be seen far from land. In fact, the old 'bulls' are not to be found in the in-shore waters of Spitsbergen and Franz Joseph Land in June and July (see Allen, "North American Pinnipedia," p. 108, and *Zoologist*, 1895, p. 75).

In Scoresby's time straggling walruses were apparently more frequently seen by the whalers on the so-called 'whaling banks' between Greenland and Spitsbergen. In his "Arctic Regions," vol. 1, p. 508, we read of a single ship, while engaged in its quest for whales, picking up as many as half-a-dozen in a single season without approaching either Spitsbergen or Greenland with the express purpose of catching it. This may well have been the case, for it was not until a later date that the Norwegian walrus hunters began to kill them in the in-shore Spitsbergen waters and that it became seriously depleted in number.

R. W. GRAY.

11 Hulham Road,
Exmouth, Devon.

Surface Film of Aluminium.

IN NATURE of May 7, p. 673, I have read with a good deal of interest an account of some experiments made on aluminium foil which had been treated by the Bengough anodic process. In some experiments made on ordinary aluminium foil in connexion with a research on the determination of oxide in aluminium, details of which work was published in the *Jour. Soc. Chem. Ind.*, vol. 45, p. 170, the writer, in collaboration

with Miss H. E. Millar, had previously made the same observations as Messrs. Sutton and Willstrop. In our experiments, and employing the same method, it was even possible to notice the film on such thin foil as 0·00075 in. in thickness, and moreover we were able to identify surface markings on the layer which were originally present on the original metal. Messrs. Sutton and Willstrop are probably unaware that we had previously made this observation, and therefore the correctness of our conclusions becomes the more certain.

W. H. WITHEY.

The National Physical Laboratory,
Teddington, Middlesex,
May 17.

WE are glad to have been given the opportunity of reading the letter from Mr. W. H. Withey. We had already read the paper by Mr. Withey and Miss Millar with much interest, and had spent a good deal of time in an attempt to interpret their results. These appeared to us to indicate that the material of their sheet No. 1 was free from both internal and superficial oxide; that rolling sheet 1 down from 0·01 to 0·006 in. in thickness produced a film thicker than that which we have so far found present on aluminium which has stood over long periods exposed to air, and that later rolling reduced the thickness of the film as well as that of the metal to a value much below the normal, assuming equal density of the films.

It appeared to us possible that under the very high pressure exerted by the rolls, the metal may attain a very high temperature locally and oxidise rapidly in the same way in which, for example, steel is known to do in an overloaded ball race, but that the oxide film formed in the early stages of rolling may obstruct further superficial oxidation during subsequent rolling. We do not know whether Miss Millar and Mr. Withey have any further results which would throw light on this matter or whether they would regard this tentative explanation as a reasonable one.

Accepting the results of Miss Millar and Mr. Withey regarding film formation in rolling, of which we have no experience, our experiments have so far indicated that by long standing in air, a surface film is formed of three to five times the thickness of that present on their finished sheet, but at present our experience has been confined to thin sheets. Also, the directly observed increase in weight of aluminium standing in air, recorded by Dr. Vernon in the second report to the Atmospheric Corrosion Research Committee, corresponds to about twice the thickness of film present on the finished sheet of Miss Millar and Mr. Withey, assuming the films to have the same composition.

H. SUTTON.
J. W. W. WILLSTROP.

Metallurgical Department,
Royal Aircraft Establishment,
S. Farnborough, Hants,
May 31.

Etch Planes in Metallic Single Crystals.

IT is well known that when an etching solution is applied to a metallic crystal, the action takes place so as to leave the surface 'stepped' in such a way that optical reflection takes place from planes in the crystal which are definitely related to the crystallographic axes. We have investigated this relationship with single crystals of iron, nickel, and aluminium.

The iron crystals were etched with a 10 per cent. solution of nitric acid in alcohol, and the nickel ones with concentrated ferric chloride solution. We have obtained very good etch patterns on aluminium by treating first in caustic soda and then with ferric chloride solution. This process appeared to give a better contrast etch than the ordinary treatment with caustic soda alone.

The apparatus for locating the etch planes by means of the optical reflections consisted simply of a crystal goniometer mounted in place of the prism table on an autocollimating spectrometer. The planes from which reflection takes place can be identified by measuring the angles between different reflecting facets. By setting the crystal so that a zone axis is parallel to one of the goniometer axes, the angle between two reflecting planes can be measured by a single movement of the goniometer.

In the case of iron, which is a body-centred cube, the problem appears quite simple, the etch reflections being mutually perpendicular, indicating that the planes are {100}. (See also McKeehan, NATURE, May 14, p. 705.) The case of aluminium (face-centred cube) is similar, except that in a few cases reflections were obtainable from {110} planes. These reflections, however, were always very faint compared with those from {100} planes. Although the structures of aluminium and nickel are similar, they etch in different ways. Davisson and Germer (NATURE, April 16, p. 558) state that nickel crystals etched by vaporisation develop {111} facets. Using the etch method described above, we have found that {111} and {100} facets are formed, as is shown by the fact that strong reflections were obtained in directions inclined to one another at 90°, 70°, 55°, or the supplements of these angles.

A considerable number of crystals were examined by the optical method and the measured angles were generally within 1° of the calculated values. X-ray examination by Müller's method (*Proc. Roy. Soc.*, **105**, p. 500) of a number of nickel crystals gave results in agreement with the optical data. The development of two etch planes does not in any way invalidate the use of etch reflections for the determination of crystal planes, but a more thorough examination of the crystal becomes necessary to avoid ambiguity.

H. H. POTTER.
W. SUCKSMITH.

Physics Department,
The University,
Bristol, May 20.

'Active' Nitrogen.

IN all the work, both theoretical and experimental, which has so far been done with regard to active nitrogen, it has at least tacitly been assumed (*a*) that active nitrogen is homogeneous and (*b*) that the afterglow and chemical activity are necessarily co-existent, although from Saha and Sur's theory of the nature of active nitrogen (*Phil. Mag.*, **118**, 421; 1924), it follows that nitrogen may be 'active' and yet show no luminosity. Dr. H. W. B. Skinner has recently suggested to the author that in view of the production of H atoms, excited H_2, and H_3 by the discharge in hydrogen, it does not necessarily follow that the form of nitrogen which is responsible for the afterglow is that which is chemically active. Experimental evidence completely in support of this theory has now been obtained.

If a stream of glowing nitrogen be led through a second and weak discharge, the luminosity is destroyed or very considerably diminished, as described by Lord Rayleigh (*Proc. Roy. Soc.*, **92**, 438; 1916). The concentration of active nitrogen in the gas stream may be determined by the admission of nitric oxide to the gas below the discharge (Willey and Rideal, *Jour. Chem. Soc.*, 1926, 1804), and it has now been found that when two independent discharges are provided, one

strong and producing the afterglow and the other feeble, the gas being led from the former to the latter, the yield of nitrogen peroxide is *greater* with the two discharges than when the stronger is used alone, in spite of the almost complete extinction of the glow by the weaker discharge. Moreover, if the latter be used alone, little or no luminosity is visible in the gas in the exhaust line, but abundant formation of nitrogen peroxide occurs.

It thus appears that the glowing and chemically active forms of nitrogen are distinct from each other, and that the estimates as to the energy of 'active' nitrogen made severally by spectroscopists and Dr. Rideal and myself have really been upon different modifications of this element. The same applies to the respective deductions as to the nature of 'active' nitrogen. While we may now with confidence regard the luminous variety as being due to the recombination of atoms with a heat of formation of *ca.* 250,000 cal./gm. mol., the nature of the other kind, which is apparently the chief constituent of 'active' nitrogen and possesses an energy of *ca.* 45,000 cal./gm. mol. is still somewhat obscure; the choice would appear to lie between metastable molecular nitrogen and a more complex body such as N_3.

A full account of these investigations will shortly be published. E. J. B. WILLEY.

Laboratory of Physical Chemistry,
Cambridge, May 4.

Designation of Thyroxine.

KENDALL (*Proc. Am. Physiol. Soc., Am. Jour. Physiol.*, **45**, 540; 1918) named the crystalline compound he isolated from the thyroid *thyroxin*, as an abbreviation for *thyro-oxy-indole*, since he believed it to contain an indole nucleus. Harington has shown that, on the other hand, it is an iodised amino-acid, derived from tyrosine. He has gracefully accepted Kendall's name, merely adding the final *e* necessary for an amino-acid in English terminology.

Nevertheless, from a teaching point of view, a name that signifies something incorrect is undesirable, in spite of numerous examples that persist (the majority of bio-catalysts do not produce a 'boiling' and do not occur in yeast, and are but clumsily, therefore, termed ferments or enzymes; it is doubtful if the majority of 'hormones' 'arouse').

It seems very desirable that Harington, or, if he refuse, some one of the elder endocrinologists, should find a new name for this internal secretion of the thyroid gland which will more accurately suggest its derivation. I would suggest for their consideration a term such as *thyrosine*, or *thyroisine*, either of which practically retains Kendall's name, and at the same time emphasises both the thyroid origin of the compound and its close relationship with tyrosine, the two points which obviously require emphasis.

May I also suggest that stress should be laid on Harington's opinion (*Biochem. Jour.*, **20**, 298; 1926): "In view of the constitution of thyroxine . . . racemisation during the alkaline hydrolysis (of thyroid tissue) is the probable explanation of the absence of optical activity in the product." It seems, by analogy, extremely unlikely that thyroxine, as secreted by the thyroid gland, should be optically inactive; and further, by comparison with adrenine, we may reasonably infer that one of the two optically active isomers will be physiologically completely, or almost completely, inert. If this should prove to be the case, then commercial thyroxine will have but one-half the activity of thyroxine in thyroid, and an explanation may be available for that discrepancy between the physiological activities of thyroxine and of desiccated thyroid tissue that Reid Hunt found by use of his acetonitrile test with mice (*Am. Jour. Physiol.*, **63**, 257; 1923); my own experiments, utilising growth and organ-hypertrophy effects on rats (*Trans. Roy. Soc. Canada*, **20**, 307; 1926) have supported his conclusion that (*optically inactive*) thyroxine does not represent the full activity of the thyroid gland. A. T. CAMERON.

University of Manitoba,
Winnipeg, Canada, May 25.

The Calibration of Photographic Plates.

IN NATURE (May 14, p. 707) Dr. E. A. Baker discusses the calibration curves of photographic plates. The curves he gives certainly show a good agreement in sensitivity between the different batches of plates used under his conditions of standardisation. Concerning the reference to Harvard results (Harvard Circular 302), it may be of interest to note several points not fully discussed in the original paper on spectrophotometric method.

The curves to which Dr. Baker refers are the density curves of ten of the photographic plates analysed in our regular photometric programme, and are representative of the general results obtained. Intercomparison of the curves allows us to examine the effects of emulsion and developer. Curves for plates taken from the same box show no closer agreement among themselves than do those for different boxes of plates coated with the same emulsion. Even plates with two different emulsions show no greater differences from one another than do plates with the same emulsion.

A similar result is obtained with regard to developer. Plates developed with different batches of one developer agree as well as do those from a single batch of developer, while plates developed with one of the two kinds of developer used at Harvard show an agreement among themselves that is little, if any, closer than the agreement for plates developed with the two different kinds of developer.

The idea of the Harvard individual plate calibration curves, however, was not specifically the elimination of differences in emulsion or developer, though this will of course follow. It was to set up a density curve for the plate used, *for the conditions under which it was exposed*, rather than to ensure the constant sensitivity of different plates under carefully standardised conditions. The calibration curves, as described in Harvard Circular 301, will allow for any possible changes in sensitivity due to the temperature and humidity during exposure in the telescope, to the ageing of the plates, or to delayed development, as well as for any loss of transparency of the background and exposed portions of the plate due to sky fog.

Exact agreement between various reduction curves is not to be expected, nor would it have any significance for the spectrophotometric results. Individual plate calibration is at least a safe procedure until such time as a greater knowledge of, and dependence on, the actions of photographic plates under various conditions is obtainable. FRANK S. HOGG.
CECILIA H. PAYNE.

Harvard College Observatory,
Cambridge, Massachusetts, June 3.

The Spectrum of Ionised Neon (Ne II).

FOR some time the spectrum of ionised neon (Ne II) has been a subject of investigation in the Amsterdam Laboratory "Physica." The analysis of the F I spectrum, given in former papers (*Verslagen Kon. Acad. Amsterdam*, June 1926; December 1926)

and the theory of complex spectra of Heisenberg and Hund formed preliminary steps for the analysis of Ne II. A great part of the Ne II lines have now been classified by me in a term scheme exhibiting a perfect analogy to that of F I. The following table gives an example of this analogy:

F I.				Ne II.						
Term.	j.	Term Value.	Term Difference.	Term.	j.	Term Value.	Term Difference.	Hund's Theory.	Interval Ratio. Landé.	F I.	Ne II.
a^2P	2	135320	407	a^2P	2	270000	[780]	$^3P+2_2$			
	1	134913 (16·6 volt)			1	269220 (33·4 volt)					
^4P	3	58617·0	274·7	^4P	3	117000·0	518·0	$^3P+3_1$			
	2	58342·3	160·0		2	116482·0	299·0		1·67	1·72	1·73
	1	58182·3			1	116183·0					
$^4P'$	3	45104·8	122·9	$^4P'$	3	89938·2	222·6	$^3P+3_2$			
	2	44981·9	102·7		2	89715·6	182·5		1·67	1·19	1·21
	1	44879·2			1	89533·1					
^4D	4	44035·4	176·7	^4D	4	87022·7	337·8	$^3P+3_2$			
	3	43858·8	144·5		3	86684·9	249·7		2·33	2·11	2·34
	2	43714·3	83·4		2	86435·2	144·1		1·67	1·73	1·73
	1	43630·9			1	86291·1					
^4S	2	42595·0		^4S	2	83178·0		$^3P+3_2$			

The complete term table for Ne II and the lists of classified lines with further details will be published elsewhere. T. L. DE BRUIN.

Laboratory "Physica,"
Amsterdam, May 24.

The Nomenclature of Chromosome Groups.

IT is well known that several plants and animals have been found which have (*a*) three, four, or more haploid groups of chromosomes, instead of the usual two. These groups are typically identical, not only in the number, but also in the nature of their members; thus being homologous groups. On the other hand (*b*), in certain genera, species, or subspecies, have been found the haploid number of chromosomes of which is two, three, or four, etc., times that of the half number of a basic species in the same genus. In typical cases of this kind these extra chromosomes are not homologous, or not completely homologous, with those of the basic group.

Now in the first case (*a*), the words diploid, triploid, and tetraploid have been some time in use. It would be scarcely possible, in the writer's opinion, to change the application of the word 'diploid,' for example, and confine its use to case *b*, as has been lately suggested (O. F. I. Langlet, *Svensk Bot. Tidskr.*, vol. 21, pp. 1-17; 1927). The cytologists who are doing such praiseworthy work in counting the chromosomes in different genera are not compelled to make use of a Greek terminology already employed in a different sense. They may have recourse to the mother tongue, and the terms, *single*, *double*, *triple*, *quadruple* . . . *multiple*, convey no necessary implication of homology, and would hence suit case *b*. Or, if technical terms are wanted, they are at hand in the Latin, where *uniplex*, *duplex*, *triplex*, *quadruplex* . . . *multiplex*, await application to case *b*.

JOHN BELLING.

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May 27.

Absorption Bands of Liquid and Vapour Amines.

BY measuring, below wave-length 4 μ, the absorption of secondary and tertiary solid and liquid amines, it was shown that the N-H bond has a strong characteristic absorption band around 3 μ (*Proc. U.S. Nat. Acad. Sci.*, **12**, 74; 1926). It seemed, from the data on various substances by other workers, that this was an overtone of a fundamental at 6 μ.

Measurements, with a rock-salt prism spectrometer, of the absorption of longer waves by liquid and vapour amines, have recently been made here. They show a weak 6 μ band both for secondary and tertiary amines, so that this band cannot be taken as the fundamental of the 3 μ N-H, the latter being, then, a fundamental.

This is in harmony with the recent results of Ellis for aniline liquids, whose very accurate measurements below 2·8 μ showed a series of overtones characteristic of N-H, the calculated fundamental of the series extrapolating to 2·8 μ, not to 6 μ (*J. Am. Chem. Soc.*, **49**, 347; 1927). E. O. SALANT.

Physics Department, Johns Hopkins University,
Baltimore, Maryland, U.S.A.,
May 19.

Unauthorised Publication of the "Grammar of Science."

MESSRS. STECHERT AND CO., of New York, have issued, entirely without my sanction, a reprint of the last edition of my "Grammar of Science." Copies of the book have been recently sold in England. I should like to inform possible purchasers, through the columns of NATURE, that the book is unauthorised and can only be sold illegally in Great Britain.

Messrs. Stechert & Co. kindly inform me, having regard to the issue of a new and revised edition, that "it is better"—they do not say for whom—"to have the book constantly on the market." It is needless to add that the "Grammar of Science" in its last edition, without a thorough revision, is not a book such as I should wish to issue under my name; it is not abreast of the recent advances in physical science and epistemology.

This is not the place to comment on the morality of American copyright law. KARL PEARSON.

University College,
London, W.C.1.

Some Recent Services of Metallurgy to Engineering.[1]

By Prof. H. C. H. CARPENTER, F.R.S.

IN honouring me with the invitation to deliver the James Forrest lecture this year—the thirty-third of the series—the Council of this Institution expressed a desire that I should deal with recent advances in metallurgy which have a bearing on engineering practice. It is twenty-one years since my distinguished predecessor Sir Robert Hadfield delivered the last lecture in which metallurgy constituted the main subject, and it would seem convenient, therefore, that I should deal with the progress made since that date.

FLOTATION.

As regards ore-treatment, water-concentration is eminently satisfactory in the concentration of ore containing relatively coarse and granular mineral and a light gangue. Chemical treatment is equally satisfactory when the valuable mineral crushes to powder and the gangue is not soluble. Between these two lies the field of flotation, this method of concentration being effective both in the presence of a heavy gangue and a fine mineral. It belongs to the present era of mining, which dates back to the exploitation of the rich auriferous gravels of California and Australia about the middle of the nineteenth century, though the first flotation process to be applied commercially was that developed by Elmore in London in 1898. He was, moreover, the first to apply the selective action of oil to a pulp flowing freely from a wet-crushing machine. Put briefly, in flotation the mineral is floated on an air froth, while the gangue sinks to the bottom, whereas in concentration the mineral sinks to the bottom and the gangue is floated away.

There are three main types of froth-flotation machines, known respectively as the mechanical, pneumatic, and cascade. Of these the mechanical flotation machine is the widest applied. The standard pattern machine has a capacity of about 1·25 tons per square foot of machine area per day. A machine of ordinary size will treat about 400 tons per day, and require about 100 H.P.

Flotation first established itself by the recovery of lead and zinc-blende from an association with heavy gangue at Broken Hill, New South Wales, its success being complete about 1910. Whereas with water concentration, before the advent of flotation, the recovery was only 60 per cent. of lead, less of silver, and none of the zinc, the recoveries to-day are about 85 per cent. of the lead, 65 per cent. of the silver, and 83 per cent. of the zinc. These percentages do not include the lead in the zinc concentrate, or the zinc in the lead concentrate. The cost of flotation is about 6*s.* per ton, and that of complete dressing about 9*s.* per ton. At the Butte, Superior, Montana, the present recovery is about 92 per cent. from an ore assaying about 17 per cent. of zinc, flotation being responsible for about three-quarters of the production.

At Anaconda, where in 1915 the recovery of copper by water was 78 per cent., a flotation equipment was erected in the expectancy of raising the recovery to more than 90 per cent. This expectation has been realised. At Utah-Leasing, Newhouse, Utah, a tailing dump containing about 700,000 tons, assaying about 0·7 per cent. of copper, was successfully treated by flotation, the concentrate assaying about 18 per cent., and the final tailing about 0·2 per cent. At Calumet and Hecla at Lake Superior, a conglomerate of ore containing native copper is treated by a flotation plant having a capacity of about 2000 tons per day. From this material, which contains less than 1 per cent. of copper, a recovery of 60 per cent. is made at a cost of about 10*d.* per ton.

To-day, in fact, flotation is applied on practically every important non-ferrous mining field. Tin alone has not yet benefited by it. In general terms, where formerly water concentration yielded a 65 per cent. to 70 per cent. recovery, the adoption of flotation has raised the recovery to from 80 to 85 per cent.

REVERBERATORY FURNACE SMELTING.

As the finely divided concentrate cannot be smelted in a blast furnace, one of the principal consequences of the development of the flotation process has been the necessity of designing a new type of furnace. This has been developed from the original small reverberatory furnace, used many years ago in copper smelting in Swansea. The modern furnace, however, is so much larger and its method of working so different that the process is really a new one.[2] The fuel used in the modern large reverberatory furnace is pulverised coal or fuel-oil, depending upon the relative cheapness of the two fuels. When pulverised coal is used, it is ground so that 80 to 90 per cent. will pass a 200-mesh screen, and is blown into the furnace with about 15-oz. air pressure. The coal used may vary in ash content from 6 to 7 per cent. up to as high as from 15 to 20 per cent., without giving trouble. The ratio of charge to fuel varies from 5 to $7\frac{1}{2}$: 1. The burners are inserted directly in the rear wall of the furnace, and several are used, from four to six being the usual number. The type of burner varies in each plant with apparently equally satisfactory results.

When using fuel-oil in the furnaces it is generally from 17 to 19 Bé., and is preheated to about 200° F. to 250° F. before burning, as this results in fuel economy. When as much heat as possible has been extracted from the gases, they are passed through waste-heat boilers for a further recovery. These are from 500 B.H.P. to 750 B.H.P., and are frequently connected to a common cross flue,

[1] From the thirty-third James Forrest Lecture delivered before the Institution of Civil Engineers on May 3.

[2] Liddell, "Handbook of Non-Ferrous Metallurgy," vol. 2, pp. 948-951.

extending from all the reverberatory furnaces, so that in case of a shutdown of a furnace the boiler capacity will not be lost; and if a boiler is down for cleaning or repair, the other boilers are available for the utilisation of the waste heat. It has been found advisable to have the flues from the furnaces to the boilers sloping slightly towards the furnaces, as otherwise trouble may be experienced from the accumulation of slag.

The reverberatory furnace is the most satisfactory apparatus in which to treat fine ores, but it usually requires an extensive roasting plant, occupies a large amount of space, and locks up a large amount of valuable metal. Hence the investment is large for a given tonnage.

LEACHING.

Copper has been extracted from its ores by heap-leaching methods in Spain since 1752, but these contain from 2 to 3 per cent. of metal. With modern methods it is economically possible to treat ores containing much smaller quantities of copper. In the spring of 1923 the Ohio Copper Company of Utah commenced the leaching of an ore which averages only 0·3 per cent. of copper. This has since proved to be a profitable undertaking. It consists of a copper-bearing quartzite, in which the copper minerals exist principally in the fissures. The quartzite is practically inert to chemical action, while the copper minerals are readily attacked by the leaching solution. At the Calumet and Hecla mine, an old tailing containing only 6 lb. of copper per ton (0·27 per cent.) has been successfully treated by an ammonia process. It has been estimated that about 15 per cent. of the copper output of the world is now produced by leaching, and two of the largest of such plants in operation at the present time produce copper at a considerably lower cost than by any other method of treatment. The leaching of copper and silver ores is now in a similar position to that of gold and silver cyanidation, and, especially in the case of copper ores, the process and plant used have followed very closely those employed for cyanide work. Since 1905, processes for the wet extraction of zinc and lead have been developed, and will probably in a few years become formidable rivals to smelting methods. Already the wet metallurgy of zinc is of considerable economic importance. Lead leaching at the moment has not attained so favourable a position as copper and zinc, and there is room for much further research in this direction.

REFINING.

Twenty years ago the manufacture of steel in the electric furnace was still in the embryonic stage. To-day more than 1200 such furnaces are in operation in Europe and America (including Canada), in about equal numbers in the two continents. In the decade 1910–20 the development of what may be called 'electric steel' has been astonishing. It increased from 52,141 tons in 1910 to 502,152 tons in 1920. In 1925, 1,042,000 tons were produced, of which the U.S.A. was responsible for 615,000, Italy 129,000, Germany 127,000, France 68,000, and Great Britain 44,000. The principal use of such furnaces has been in producing alloy and tool-steel ingots and castings. The first advantage of the electric furnace is its flexibility; the second consists in the method of applying the heat; and the third lies in the quality of the product. The outstanding disadvantage of the electric process is its cost. It may be expected that, with the continued improvement in efficiency of power-production plants, this disadvantage will tend to become less and less. Another factor which will operate in the same direction will be that economies in furnace operation will be more thoroughly understood and practised. Another disadvantage, from which the furnace has suffered more or less hitherto, is that it has been operated by men unfamiliar with its possibilities. To some extent the view has prevailed that electric steel occupies a field midway between acid and basic open-hearth steel and crucible steel. This is not the case. The quality of electric steel is fully equal to that of crucible steel, and can be achieved provided that refining is properly carried out metallurgically. If the electric steel is manufactured with care and the metallurgical treatment is correct, none of the five classes of non-metallic impurities (of which products from the reaction between dissolved and suspended oxides and gas and deoxidisers, and oxides not acted upon by deoxidisers, are the most important) ought to be present in more than small amounts. Except for small amounts of manganese sulphide and silicate, electric steel should, in fact, be free from non-metallic inclusions when melted with restricted or with no oxidation. Even when melted with complete oxidation, if it is deoxidised thoroughly it should still be cleaner than basic open-hearth steel.

Oberhoffer and Beutell[3] have shown that in a very large number of open-hearth steels the gas dissolved averaged from 13-130 c.c. per 100 grams of metal. The gas contained about 75 per cent. carbon monoxide, the rest being hydrogen, nitrogen, and a small amount of carbon dioxide. Steel metallurgists have paid far too little attention to the presence of gas in steel and to the effect on its quality, but it has been proved that the content nitrogen reduces the tensile strength, and still more the ductility. In the open-hearth process the atmosphere with which the metal is in contact contains oxygen, nitrogen, hydrogen, and carbon monoxide. In the electric process, on the other hand, the amounts of oxygen, hydrogen, and nitrogen should be very much less, and the only gas that should be present in any quantity is carbon monoxide. Even this will only occur in small amounts, as furnace gases containing oxygen are absent. Precise figures as to the amounts of gas actually present in electrically-made steel are, however, still lacking.

'PEARLITE' CAST IRON.

One of the outstanding advances of the last twenty years has been the practical use of the

[3] *Stahl und Eisen*, 1919, vol. 39, pp. 1584-90.

equilibrium diagram in the scientific manufacture of industrial metals and alloys. So important has this aspect of metallurgy become that in 1920 a society was founded in the U.S.A. known as the American Society for Steel Treating, for the purpose of improving the scientific manufacture of metals. This society has to-day a membership of 3500.

High-carbon iron carbon alloys solidify 'white' unless a particular stimulus is present to cause the precipitation of graphite. They consist accordingly of cementite and pearlite. Since 'white' iron is so hard as to render it incapable of being machined, its use is greatly restricted in mechanical engineering work. The addition of silicon, however, causes the formation of free carbon from such a white iron, and it is possible in certain favourable conditions, including slow cooling, to produce a cast iron consisting only of silico-ferrite and foliated coarse graphite. Such a material is very weak, although soft, and apart from a few special cases, such iron is but little used for mechanical engineering work. Between these two limiting conditions come the usual technical kinds of grey iron. The microstructure depends on the smelting and casting processes used, the conditions of solidification and cooling after casting, and upon the chemical composition. The rate of cooling is, of course, considerably affected by the cross-sectional area of the particular casting. In the microstructure of ordinary grey iron are usually found together varying quantities of graphite, silico-ferrite, pearlite, free cementite, and the phosphide eutectic, with inclusions of iron and/or manganese sulphide.

A carbon steel containing 0·9 per cent. of carbon consists, when annealed, of eutectoid pearlite only, the structure being uniform and dense. This material is pure steel. It has, as is well known, very remarkable mechanical properties. The problem of improving the qualities of cast-iron consists essentially in preparing a material composed mainly of pearlite with deposited graphite. A cast iron of this kind would certainly be superior in properties to any of the ordinary varieties, and it might be expected to exhibit mechanical properties approximating to those of pearlite steel, which would be influenced only by the graphite. Numerous tests carried out by different investigators on castings approximating to the above structure bear out this view. It was at first not found possible to get the desired structure in current practice. Diefenthaler and Sipp were, however, able to devise a process to enable this structure to be obtained regularly. It was patented in 1916. It has been improved upon, and has finally led to very definite rules for achieving the desired properties.

The properties found in the cast iron are: (1) High transverse and tensile strengths and toughness; (2) high resistance to impact stresses; (3) moderate hardness when properly treated; (4) only a slight tendency to the formation of 'pipes' and hence the possibility of making complicated castings; (5) great resistance to sliding friction (abrasion); and (6) fine and dense structure which is unaffected by temperature changes.

Sorbitic Steel.

Steel wire ropes, after passing through the 'patenting process,' which consists in heating to a temperature at which steel scales, and then cooling more or less rapidly through the critical points, contain large quantities of 'sorbite' readily detected by the microscope after etching, or by the dark colour that the whole surface assumes when etched side by side with the rod before patenting. The property of enabling the patented rod to be drawn to a much greater fineness than is possible in the unpatented material is due to the effect of the sorbite present. Stead and Richards [4] concluded that if sorbite is responsible for the excellent qualities of oil-quenched steel and negatively quenched steel wire rods, there is no reason why it should not be produced in steel rails, tires, etc., without great expense. With this object in view they experimented on 5-foot lengths, subjecting them to a variety of treatment.

Although the results of these experiments were decidedly promising, they were not able satisfactorily to treat a normal 30-foot length of rail. In all cases the distortion of the longer lengths was so considerable that their process never became a commercial success. The practical problem of treating the full lengths satisfactorily has been solved by Messrs. Sandberg so as to produce sorbitic structure. They realised that the right temper in the rail could be obtained in the course of one single operation if the correct rate of cooling through the critical range of temperature was secured. The precise range depends upon the composition of the steel. Their experiments using air-cooling were so encouraging that they were soon able to treat full-length rails of heavy section. The results obtained made it perfectly clear that their process could be carried out without interfering in any way with the output of the rail mills and at a comparatively low expenditure. The first rails treated were tramway rails, and gaugings taken from these after they had been one year in the track under very severe traffic showed that their life would be about 100 per cent. longer than that of the Sandberg high silicon rails of the same composition but untreated and laid at the same time in the same track. Plants for the Sandberg treatment of rails were put down by the Bethlehem Steel Company at their Sparrow Point Works, where trials were carried out and excellent results obtained. Shortly afterwards another plant was put down at the Dowlais Works of Messrs. Guest, Keen and Nettlefold, while a number of trial orders have been carried out on rails for various home railways.

The tensile strength of rails has frequently been raised from about 55 tons per square inch untreated to 65 and 70 tons per square inch after treatment, and even higher, without showing any signs of brittleness. Treated rails have, in fact, stood up to twice and even three times their specified falling weight test without breaking. The Brinell tests also clearly show that the process does not merely

[4] *Journal of the Iron and Steel Institute*, 1903.

give a surface hardening, but that the treatment effect is produced throughout the head. The increased resistance to shock is due to the peculiar fineness of the structure of sorbite, which also gives smaller surface particles for tearing away by abrasion, and thus greatly reduces the wear in service. From careful observation under severe traffic conditions it has been found that treated rails have given double the life of untreated rails, and in some cases even better results have been obtained.

HIGH-SPEED TOOL STEELS.[5]

The revolutionary feature wherein tools made of these steels differ and exceed in service the tools formerly used, is their ability to maintain a sharp, strong cutting edge while heated to a temperature far above that which would at once destroy the cutting ability of a simple steel tool. A high-speed tool can be made to cut continuously at speeds from three to five times as great as that practicable with other tools and even when, as the result of the friction of the chip on the tool, it may be red hot at the point on top where the chip rubs hardest, and the chip itself may, by its friction on the tool and the internal work done on it by upsetting it, be heated to a blue heat of about 300° C. or even hotter. Accordingly these tools have in the past twenty years worked a remarkable revolution in the machine-shop business of the whole world, affording largely increased outputs and commensurately lower costs. As a consequence they are now used very generally, and in some shops almost exclusively, for machining iron and steel as well as some other metals by cutting operations by machine tools.

The property of red hardness, or ability to retain hardness at a red heat, may be imparted to steels of suitable composition containing chromium, tungsten and vanadium and, in the most recent tools, cobalt as well, by a unique heat treatment to which they are subjected. This is the Taylor-White process[6] introduced at the works of the Bethlehem Steel Company in 1899. Tools thus treated were shown at the Paris Exhibition in 1900.

In the early days, after a good deal of experiment, the composition settled down to a basic one of about 14 per cent. of tungsten with from 3 to 4 per cent. of chromium. The next step was to introduce still greater percentages of tungsten and also to add vanadium. A class of steel has now been on the market for some time containing about 18 per cent. of tungsten, 4 per cent. of chromium, and anything up to 2 per cent. of vanadium. This class appears to have justified itself as indicated by the wide demand for it. The latest development came comparatively recently with the addition of cobalt (from 2 to 6 per cent.). These steels have also taken their place and found a market. In some steels molybdenum is added as well as the above four alloy elements.

The cutting edge of a rapid tool at work is probably never so hot as the metal which is behind it, where the heating caused by the friction of the chip as it is deflected and rubs hard on the tool is most intense. The edge itself is kept relatively cool by the cold metal flowing upon it. It is not generally realised that the point of the tool does not cut, and that it only drives open the crack which advances in front of it. A high-speed tool fails through the turning, which impinges on the top face of the tool, wearing away the steel until the cutting edge is actually broken off.

[5] Hibbard, "Manufacture and Uses of Alloy Steels."
[6] Taylor, F. W., "On the Art of Cutting Tools," *Trans. Am. Soc. Mech. Eng.*, vol. 28 (1908), pp. 31-350.

MUMETAL.[7]

The first commercial application of high-frequency melting in Europe was made by a British firm for the preparation of nickel-iron alloys for submarine cables. The research work pursued in order to find a suitable alloy was thereby much facilitated, and quickly resulted in the perfection of the series of alloys known under the name of 'mumetal' (so called because the Greek letter μ is used as the symbol of permeability). These alloys have highly desirable characteristics, and by their use the speed of cabling can be increased seven to eightfold.

A typical mumetal alloy has the following composition:

Nickel	74·0 per cent.
Iron	20·0 ,,
Copper	5·3 ,,
Manganese	0·7 ,,

An alloy of this composition has a magnetic permeability of 7000. Low hysteresis loss with a very high permeability at low magnetising forces are the characteristics chiefly required in these metals.

The composition of the mumetal may be varied according to the type of cable which it is proposed to use, and the annealing may be adjusted to give either (*a*) maximum neutral permeability, (*b*) maximum permeability at magnetic saturation, or (*c*) high or low fields for magnetic saturation.

The range of alloys developed for this class of work contains from 75 per cent. to about 50 per cent. of nickel, with percentages of iron varying from 20 to 25, and certain quantities of copper and manganese, but in every case freedom from carbon is one of the primary essentials, and for this reason the high-frequency furnace has proved the only suitable melting equipment.

In certain types of cable an increase in electrical resistance of the alloys is desirable, and in this case an extra element, which may be tungsten, chromium, silicon, vanadium, titanium, molybdenum, or aluminium, may be added in small quantities.

ANTI-CORROSION METHODS.

Aluminium is ordinarily covered with a protective film of oxide or hydroxide. It does not, however, constitute a perfect protection in the presence of corrosive liquids and even neutral salt solutions. It tends to crack and lose its power of adhesion

[7] Campbell, *Journal of the Iron and Steel Institute*, vol. 112, p. 74.

to the metallic surface. Local corrosion (pitting) then sets in. Moreover, this film is much more liable to crack when subjected to alternate wetting and drying, particularly at an air-liquid interface. Probably the interfacial tensions of metal, air, and water operate in producing this result. The practical problem therefore consists in finding a method of forming a strong and tightly adherent film of oxide or hydroxide instead of the thin film. Mott [8] showed that such a hydroxide film could be formed by making the metal the anode in a bath of sodium hydrogen phosphate, and recommended this treatment as a protection against corrosion. Working for the Corrosion Research Committee of the Institute of Metals, and with the aid of financial assistance from the Department of Scientific and Industrial Research, Dr. Bengough and Mr. J. M. Stuart, during the years 1921–24, carried out a series of investigations starting from this point, and found that the film produced by 'anodic oxidation' in a bath containing a chromate, bichromate or, best of all, chromic acid, protects the metal much more effectively against corrosion.

The process is carried out as follows: "After thoroughly cleaning the surface of the aluminium or its alloy, it is immersed in a suitable bath, *e.g.* dilute chromic acid, along with a carbon rod; a small external electromotive force is applied so as to make the aluminium the anode and the carbon the cathode. The applied electromotive force is gradually raised to a value depending on the nature of the alloy and on the composition of the bath. Thus with duralumin in a chromic bath the voltage may be safely raised to 50 volts. After treating for some time in this manner, the surface of the metal becomes covered with a semi-opaque uniform white coating. This seems to consist almost entirely of aluminium hydroxide in a glassy adherent form. The hydroxide is possibly hydrated to some extent, but the hydration cannot be much, since the coating can be heated to at least 350° C. without changing in appearance or density."

The laboratory investigations were followed by successful experiments on a larger scale at the Royal Aircraft Establishment at Farnborough, by agreement with the Air Ministry, and the process, which is protected by patent, is now being worked in Great Britain by several firms on non-exclusive licences from the Department of Scientific and Industrial Research.

[8] Mott, "Electrochemical Industry," 1904, 2, p. 129.

Organography of Plants.[1]

A 'FESTSCHRIFT' celebrating the seventieth birthday of Dr. Karl von Goebel, professor of botany in the University of Munich, was published in 1925 as a special volume of *Flora*. It was initiated by an international committee including many of his colleagues, pupils, and friends: it comprises thirty-eight memoirs on the most varied botanical topics, and these themselves bear witness to the catholicity of the interests of the veteran whose birthday they celebrate. His election in 1926 as a foreign member of the Royal Society has marked the recognition in Great Britain of his great scientific career, happily by no means ended, though it has reached the prescribed span of life. These events followed closely upon the completion of the second and greatly enlarged edition of his "Organographie der Pflanzen." The interest which they have aroused among botanists is readily understood, for the name of von Goebel is intimately associated with an essential change of scientific outlook upon the organisation of plants. This has lately been made more than ever apparent in a volume from his own pen, written in celebration of the centenary of the birth of his teacher, Hofmeister, a translation of which into English was lately published by the Ray Society, and reviewed in NATURE (Oct. 2, 1926, p. 473). This essay reveals with a truly philosophic touch the genius of the master, while it serves also as a natural guide to any appreciation of the life-work of the pupil, von Goebel himself.

In the early part of the nineteenth century a stiff and artificial nature-philosophy was still dominant. This was clearly incompatible with those evolutionary views which were then forming themselves in men's minds. Even before "The Origin of Species" was published, a change of outlook had been initiated. Hofmeister's keen insight had tracked down, and his pencil had recorded in detail, facts relating to Archegoniate plants, which more than any others were at that time essential for any consecutive evolutionary scheme for the plant kingdom as a whole. These facts were stated by Hofmeister with a breadth of view which allowed of their ready application later in terms of adaptation to environment. He was not merely an observer of stark structure, but he broached the subject of causal morphology, a branch of study then only nascent, but great with the promise of the future.

It has been the happy lot of von Goebel as his pupil to carry on the torch which Hofmeister had thus placed in his hands, and to deliver it with ever-increasing glow to a later generation. Morphology in his hands has taken a more rational place than was possible before. Under the title of "Organography,"—a word already used by Sachs in 1882, from whom also von Goebel will have drawn stimulus and guidance in the years of his assistantship in Würzburg—he has embodied in two stately volumes a wealth of fact treated comparatively, experimentally and developmentally, and related throughout to function. While maintaining the Hofmeisterian tradition of exactitude, he has promoted the living aspect already so

[1] 1. "Organographie der Pflanzen," Dr. K. Goebel. Zweite Auflage. (Jena: Fischer, 1913–1923.)
2. "Die Entfaltungsbewegungen der Pflanzen." Ergänzungsband zur Organographie der Pflanzen. (Jena: Fischer, 1924.)
3. "Festschrift zum siebzigsten Geburtstage von Karl von Goebel, in München." (Jena: Fischer, 1925.)
4. "Morphologische und biologische Studien." Von Prof. Dr. K. von Goebel. *Ann. Jard. Bot. de Buitenzorg*, 36. (Leyden, 1926.)

prominent a feature in Hofmeister's later writings. The first edition of von Goebel's great work was translated into English, and published as one of the botanical series issued by the Oxford Press (1900–1905). The second German edition, completed in 1923, may be held as embodying the mature views of its author: at the same time it reflects the attitude of modern morphology, in which form is not divorced from the study of function as it used to be.

The closing volume, styled "Ergänzungsband zur Organographie der Pflanzen," was published in 1924: it relates to the movements of development of plants, and their teleological meaning. While the author at once notes that erroneous teleological interpretations have frequently been enunciated in the past, and points out how movements may exist to which no useful end can be ascribed, he boldly accepts legitimate teleological interpretations. He asserts that organography is in itself the discussion of the relations that exist between morphology and teleology, and he quotes from Asa Gray the passage: "Let us recognise Darwin's great service to natural science in bringing back to it Teleology: so that instead of Morphology versus Teleology we shall have Morphology wedded to Teleology." The broad sweep of this volume, the variety of the facts adduced, and the wide quotations of literature, often varied in origin and remote in time, impress the mind with the catholicity of interest of its author. It fully justifies an incident that occurred long ago at an international meeting of botanists, where an unusual plant presented a puzzle to us all, and some one said, "Ask Goebel." The question was not put to him in vain.

To British students of botany the name of Goebel will have first become familiar through the publication of a translation of his "Systematik" under the title "Outlines of Classification and Special Morphology of Plants" (Oxford Press, 1887). It was in fact a new edition of Book II. of Sachs' text-book. But, earlier still, the young professor of Rostock had profoundly impressed those of us who followed the German botanical literature by his writings in the *Botanische Zeitung*, and elsewhere. Much of this early work was summed up in his "Vergleichende Entwickelungsgeschichte der Pflanzenorgane," included in Schenck's "Handbuch der Botanik" (vol. 3, 1884). Here, with the true Hofmeisterian touch, he uses ontogenetic details as an avenue to comparative conclusions. In his hands the story of floral development, traced in skilfully selected examples, furnished a living commentary upon the dryer facts of Eichler, and rendered them into terms more closely related to the life of the organism. On the other hand, his comparative studies of the development of the sporangium might at first sight appear as mere *tours de force* of developmental observation. But they worked out naturally into questions of the widest evolutionary interest. In the 'eighties we soon found ourselves reaching out towards some ultimate point of view as to the real nature of the sporangium of land-living plants: whether it is a part *sui generis*, or the result of some transformation of a pre-existent part, as the older morphologists had held. Or we entered deeply into the cell-cleavages which precede the definition of the sporogenous cells, in a study which lent precision to knowledge of development, but left us there in a manner stranded. In either case we were brought face to face with far-reaching questions of ancestry and origin, which even the subsequent disclosure of the fossils of the Rhynie Chert have not fully resolved.

As an administrator von Goebel has taken his full share of duty. The head of a large institute and garden, he has passed through his hands a stream of pupils drawn from many nations. Since 1889 he has edited *Flora*; and the pages of that great journal not only witness to his own activity, but also show the variety and quality of the work of his school. But it would be vain to attempt here to follow this indefatigable worker through all the activities of a long and busy life. The mere list of his publications as given in the 'Festschrift' runs to nearly two hundred titles, many of them books. It is more to the point here to refer to one of his latest works, published since his seventieth birthday. Travelling recently to Java, as he wrote in a private letter "once more to see the tropics," he did not go as a mere spectator, but as a worker. A volume of two hundred pages with sixteen plates, entitled "Morphologische und biologische Studien," is the result. In it he canvasses questions ranging from the lichens to the flowering plants. Specially characteristic is the memoir on the relations of certain Javanese ferns; for here von Goebel selects some which are well known as presenting systematic problems, and helps materially towards their solution. It is inevitable in such work that differences of opinion should arise. But here there need be no apprehension; for when von Goebel differs, he lays all his cards upon the table, and after expressing his own opinion he will adorn the difference with a quotation from the classics, or it may be with a humorous touch which leaves the social field unscathed, while the scientific arena is as open as before for friendly rejoinder.

It will be gathered by those who know von Goebel only by name that we see in him a very impressive figure: the bearer of a great tradition from the past, who through a long life has amplified and extended it. More than any other writer of the time he has saved plant-morphology from itself, by diverting its higher pursuit from formal and scholastic channels, and leading its adherents by preference towards middle lines of thought. This tends to promote the general advance much more effectively than any narrow specialism. Unfortunately the mental effort involved in the pursuit of some circumscribed theme is much less than that entailed by more generalised study. It is this that is apt to exercise an undue influence on those who desire to achieve immediate results, an attraction always resisted by von Goebel. F. O. B.

Obituary.

DR. E. S. HARTLAND.

DR. EDWIN SIDNEY HARTLAND, the elder son of the Rev. E. J. Hartland, Congregational minister, was born at Islington in 1848. He joined the legal profession when a youth and practised as a solicitor at Swansea from 1871 to 1890. He was the first Clerk to the Swansea School Board and throughout his life devoted much of his time to further Welsh education, being much interested in educational matters in Wales and also in Public Libraries. In 1890 he was appointed Registrar of the County Court at Gloucester, and District Registrar of the High Court, and afterwards was appointed District Probate Registrar. Here he continued to act as a public-spirited citizen and gave especial attention to education. He was an alderman and mayor of Gloucester, chairman of the City Education Committee, of the Board of Governors of the secondary schools, and of the Public Library and Museum Committee. In the spring of 1924 a grave illness compelled him to resign all his public duties, and thereafter he was debarred from all physical and mental exertion. During the years he was bedridden he was always unrepining and cheerful and retained his sense of humour. The end came peacefully on June 19. He is survived by his widow, one son, and two daughters.

In recognition of Hartland's contribution to the study of folklore the degree of LL.D. was conferred on him by the University of St. Andrews in 1917, and that of Lit.D. by the University of Wales at Bangor in 1924. He presided over the Anthropological Section of the British Association at York in 1906, and over the Section of the Religions of the Lower Cultures of the International Congress of the History of Religions held at Oxford in 1908. He delivered the first Frazer Lecture at Oxford in 1922, and was awarded the Huxley medal by the Royal Anthropological Institute in 1923, but was prevented by ill-health from delivering the Huxley Lecture.

When one remembers the busy life Hartland spent in public duties it is surprising what an amount of literary work he accomplished. He was an early member of the Folk-Lore Society, and for many years was a contributor of articles and reviews to the journal of the Society, also as member of the council and as president of that Society, and, in continually helping other students by his erudition, he did a very great deal to establish folklore as a serious study. Folklore for Hartland was not merely the collection of curious superstitions and odd usages and rites, but he sought for their interpretation by an extensive and intensive study of anthropological literature, as is well exemplified in his great work, "The Legend of Perseus" (1894–96), and in "Primitive Paternity" (1909–10) and "Ritual and Belief" (1914). In addition to many papers in folklore, anthropological, and archæological journals published in Britain and elsewhere, Hartland wrote some important articles for the "Encyclopædia of Religion and Ethics," and in various other ways he did what he could to spread an interest in the anthropological aspect of the survivals of belief and custom found among civilised peoples. He was interested in the problems connected with matrilineal and patrilineal kinship, and in the relations of magic and religion.

It will be evident that Hartland studied a wide range of subjects, to all of which he brought to bear a mind trained in the value of evidence and a sympathetic, kindly nature. His writings are marked by a pleasing, lucid style with occasional lighter touches. He was a typical representative of the British school of anthropologists of the latter part of the nineteenth century. He often took an independent line and regarded "criticism as a form of co-operation in the pursuit of truth," but in criticism and debate was always tolerant and friendly. His place in the history of anthropology is assured. Few of his contemporaries now remain, but to them he will be remembered as a genial and constant friend who was always ready to receive and impart information. A complete list of his writings will be published in an early issue of *Folk-Lore*.

A. C. HADDON.

DR. IRVING BARDSHAR CRANDALL, a member of the technical staff of the Bell Telephone Laboratories and an authority on the telephonic transmission of speech and methods of recording it, died on April 22, at the age of thirty-six years. Dr. Crandall was born in Chattanooga, Tenn., on May 27, 1890, and graduated from the University of Wisconsin in 1909; later he studied at Princeton, and in 1916, three years after he had become associated with the Bell Telephone Laboratories, he received his doctorate from Princeton. At the time of his death, Dr. Crandall was engaged on important experiments. He recently published a book, "Sound and Vibrating Systems," and he had previously written monographs on the scientific aspects of speech, analyses of its mechanisms, and methods for recording it.

WE regret to announce the following deaths:

Prof. Gustave André, professor of agricultural chemistry at the Institut National Agronomique, Paris, who contributed to our knowledge of plant absorption and assimilation of elements from the soil, on May 14, aged seventy years.

Surgeon-General Henry Cook, I.M.S. (retd.), formerly principal and professor of medicine and hygiene at Grant Medical College, Bombay, and dean of the Faculty of Medicine in the University of Bombay, on May 30, aged ninety-five years.

Father William F. Rigge, for many years director of the observatory of Creighton University, Omaha, who was known for his work on eclipses and eclipse maps, on Mar. 31, aged sixty-nine years.

Dr. G. von Tschermak, emeritus professor of mineralogy and petrography in the University of Vienna, aged ninety-one years.

Dr. Anton Wassmuth, formerly professor of mathematical physics in the University of Graz, aged eighty-two years.

News and Views.

A CASE of considerable interest to owners of land, to entomologists, and to public health authorities, has recently been heard in the Sheriff Court of Paisley. The pursuers, the Committee of the Upper District of the County of Renfrew, craved the Court to find that there exists upon the lands of Muirend, in the Parish of Cathcart, a nuisance within the meaning of the Public Health (Scotland) Act, 1897, in that certain ditches are so overgrown with vegetation that the flow of water therein is impeded and they have become breeding-places for mosquitoes. Complaints were received from a considerable number of residents in the houses within about five hundred yards of the Muirend estate that they had suffered severely as the results of mosquito bites, medical treatment having been rendered necessary in a number of cases. The pursuers therefore held that the ditches are "in such a state as to be a nuisance, or injurious or dangerous to health," and they craved that the defender (the owner of the land) should be required to clean out the ditches and to do such other things as may be required for the removal of the nuisance complained of. The mosquito in question is *Anopheles bifurcatus*.

THE defender's reply to the petition is that the existence of mosquitoes does not constitute a nuisance in the sense of the Public Health Act, and also that the bed of the stream a short distance beyond his property has been raised, thus causing damming back of the water. The inquiry lasted four days, and expert witnesses were heard on various aspects of the problem—engineering, entomological, medical, and legal. Sheriff Hamilton has decided in favour of the District Committee. He finds that the ditches have become so encumbered with silt and vegetation as to be ineffective as watercourses; that the ditches and the adjacent overflowed ground have become a breeding-ground for large quantities of mosquitoes; that mosquitoes from the area in question have invaded the residential district and attacked the inhabitants, and by their bites caused pain and swelling, occasioning in some cases temporary incapacity; that the presence of mosquitoes caused reasonable apprehension and diminution of comfort in the community; and that there is a reasonable probability of a repetition of these conditions in the following years. The Sheriff ordains the defender to clear the ditches of the silt and vegetation with which they are encumbered, and thereafter to maintain them clear of silt and vegetable growth. The case is of special interest as being the first of its kind under the Public Health Acts in Great Britain.

THE opening by Lord Onslow of the new Reptile House at the Zoological Gardens in Regent's Park, London, on June 15, marks an important stage in the development of the exhibition of living animals. The extraordinary appeal which the overhead lighting of the Aquarium made to the eye of the public ensured that this method would be extended to other types of exhibits, and a first experiment in this direction was made at the Scottish Zoological Park, where, a little more than a year ago, there were opened to the public a tropical bird house and a reptile house with natural surroundings, in which daylight falls upon the inmates while the spectator is shielded from the direct rays. The new Reptile House at the London Zoo develops still further the ideas of concentrating attention upon the animals and of suggesting in the enclosures themselves the type of surroundings in which the various creatures naturally dwell. The technical experiments and artistic conceptions of the curator, Miss Joan Procter, have combined to give most successful results. In the larger enclosures the natural surroundings of the foreground are very effectively carried away into the distance by suitably designed backgrounds painted, for endurance, with motor-car enamels; vita-glass permits the access of the most beneficial of the sun's rays; and the compartments are fitted with elaborate electric installations for heating and lighting. Many of the creatures exhibited are themselves of the greatest interest: the seven-foot, yet immature, 'dragons' of Kermodo are shown alive for the first time in Europe; but the scheme of the Reptile House adds enormously to the attractiveness and to the instructional value of the exhibits. The new house bids fair to catch the public fancy as completely as the Aquarium has done.

THE Royal Society of Edinburgh, like many another learned society, is concerned at the increasing volume of material offered for publication, and at the inroads which the publication of work of first-rate quality is making upon its resources. Its *Transactions* and *Proceedings* are very largely financed by the contributions of its fellows, with modest assistance from a Government grant and occasional help from the Government fund allocated by the Royal Society of London. Already the fellows have contributed a special Reserve Fund of £1100, but it is evident that if further provision cannot be made, scientific contributions of undoubted merit must be rejected, solely on financial grounds. An attempt to meet the difficulty is being made by the creation of a Publications Fund, to which the Council has already allocated sums amounting to more than £2000, and for which, it is hoped, further gifts will be earmarked in due course by fellows and others interested in this vital branch of the Society's activities. Papers submitted to the Society are already stringently 'refereed,' but the increasing claims made upon all publishing societies suggest that if publishing is to keep pace with production radical changes must take place in the form in which results are presented, so that while the main lines of investigation and the finished conclusions appear in scientific journals, the masses of detail and data, which at present occupy so much space, may be eliminated and yet be made available for consultation by scientific workers by being stored in manuscript form in recognised and specified scientific libraries.

AN exhibition designed to show the practical applications of recent scientific research work in the woollen and worsted industries was opened by Lord Novar in the Royal Scottish Museum, Edinburgh, on June 16. Lord Novar pointed to the need of closer co-operation between manufacturer and sheep-master, so that the latter might be aware of the exact requirements as regards grade and quality demanded for manufacturing purposes, with the view of breeding towards well-defined standards in these respects. He also indicated the important part research, conducted on scientific lines, has taken and is likely to take in furthering the aims both of breeder and manufacturer. The exhibits, which have been arranged by the British Research Association for the Woollen and Worsted Industries, cover a wide range, from samples of wool illustrating the characteristic qualities of various breeds of sheep and of some of their crosses, to delicate apparatus designed for the examination of spindles in rapid motion, for the testing of moisture content, elasticity, resistance to strain, etc., an ultra-violet radiation lamp by which faults of contamination may be readily detected, and a series of finished products illustrating common defects of manufacture and the methods by which they may be eliminated. The exhibition shows the purely scientific as well as the practical side of the work of the Research Association, which is to be congratulated on the great progress it has made and on its initiative in bringing to the notice of the public and the specialist these particular developments of scientific research.

AN exhibit of outstanding historical importance has just been added to the national collection at the Science Museum, South Kensington, through the generosity of Sir Charles Parsons and the directors of the Parsons Marine Steam Turbine Co., Ltd., who have presented to the nation the machinery and a portion of the hull of the epoch-making steam yacht *Turbinia*. This vessel ranks in historic interest with Patrick Miller's boat of 1788, Bell's *Comet* of 1812, and Pettit Smith's *Archimedes* of 1840, and no more suitable place for her could be found than in the museum which already possesses Symington's engine for Miller's boat and the engine of the *Comet*. The Parsons Marine Steam Turbine Co., Ltd., was formed in 1894 to test the application of the steam turbine—which had been in use ashore for ten years—to the propulsion of vessels, and the *Turbinia* was their experimental craft. Of 44½ tons displacement, 100 ft. long, her machinery developed no less than 2000 H.P. and gave her a speed of 34½ knots, or four knots faster than any other vessel of her day. Her performances at Spithead during the Diamond Jubilee review astonished the whole Navy. Though the majority of steam vessels afloat are still fitted with reciprocating engines, steam turbines are used in practically all high-speed vessels, in the majority of liners, and without exception in battleships, cruisers, and destroyers. The *Turbinia*, indeed, led directly to the *Hoods* and *Mauritanias*, and as such marks an epoch in the development of marine engineering second to none in importance.

PROF. GEORGE A. GIBSON, who has just resigned from the chair of mathematics in the University of Glasgow, was born at Greenlaw, Berwickshire, in 1858. He received his mathematical education at Glasgow under Prof. Jack and Lord Kelvin, and at Berlin under Kronecker and Weierstrass. From 1883 until 1895 he acted as assistant and lecturer in mathematics in the University of Glasgow. During that period he originated and conducted numerous special courses of lectures for honours students on advanced mathematical subjects, both pure and applied. In 1895 he was appointed to the chair of mathematics in the Royal Technical College, Glasgow, and in 1909 was recalled to the University as professor of mathematics. In the eighteen years during which he has held the chair, he has been to his staff an example of devotion to duty and to his students a great teacher. As the source and centre of a school of mathematics in Glasgow, he has expanded the scope and raised the standard of mathematical study in the University, fostered original research, and stimulated and encouraged the publication of many treatises on higher mathematics. Prof. Gibson has himself made valuable contributions to the theory of Fourier series and to other mathematical subjects. He is an authority on the history of mathematics, and has written important memoirs on famous Scottish mathematicians. He is the author of several well-known text-books, his "Treatise on the Calculus" being a standard work used throughout the British Empire. Prof. Gibson has always taken a keen interest in secondary education, and has rendered valuable services to the teaching of elementary mathematics in Scotland. He has been a conspicuous figure in the history of the Edinburgh Mathematical Society, and in 1902 he was elected an honorary member in recognition of his services and of his eminence as a mathematician. From 1917 until 1920 he held the office of vice-president of the Royal Society of Edinburgh, and in 1905 the University of Edinburgh conferred on him the degree of LL.D.

FOR some time past the problem of providing more adequate accommodation at Bedford College, London, for the greatly increased number of students, has been receiving attention. The present buildings were intended for 450 students only, while the College contains now 600. Six years ago, as a temporary measure, a new chemical laboratory was constructed out of old army huts. While never really adequate for their purpose, these relieved the more immediate pressure in one department but did not touch the growing needs elsewhere: they are now at the end of their life, and replacement before they are overtaken by complete dissolution has become urgent. It was decided to erect a new permanent building to meet the present needs, and the first step towards the materialisation of this project was taken on June 9 when Princess Mary, Viscountess Lascelles, visited Bedford College in the afternoon and laid the foundation-stone of the new wing. The existing science departments form the two wings of an open quadrangle, and it is proposed that the new extension shall

occupy a position to the south-west to join on to these and so form the fourth side of an enclosed quadrangle of about 150 feet by 120 feet. The total cost of the scheme is estimated at not less than £110,000, towards which there is in hand approximately £53,000. Beyond this limit it is impossible for the College to raise further sums from its own resources, and an appeal is therefore being made to the public for aid. The new building is designed to provide a laboratory of inorganic and physical chemistry in place of the army huts, a lecture-hall to accommodate 600 persons, a department for geography, additional space for physics, zoology, history, French, etc., and also much-needed additional students' cloak-rooms. On the roof there will be a small astronomical observatory. After the ceremony of laying the foundation-stone, Sir Hildred Carlile, president of the Extension Fund, made a statement as to the documents to be placed under the stone. These latter included a current copy of the *Times*, the College Calendar, coins of the realm, and other contemporary objects. After the ceremony, Her Royal Highness visited some of the science departments, the library, and the residence wing.

LAST week Corpus Christi College, Cambridge, celebrated the two hundred and fiftieth anniversary of the birth of the Rev. Stephen Hales, who was born in 1671, died in 1761, and was buried in the south transcept of Westminster Abbey. In an appreciation of Hales in the *Times* of June 17, Dr. Monckton Copeman refers to Hales as one of the most remarkable of the many distinguished men that Corpus has produced. For fifty years Hales was perpetual curate of Teddington, and it was there he wrote his "Vegetable Statics" of 1727. His portrait is given in Schuster and Shipley's "Britain's Heritage of Science." A fellow of the Royal Society, a foreign member of the Paris Academy of Sciences, and one of the enthusiastic supporters of the Society of Arts, Hales' scientific work took a practical turn, and he was instrumental in improving the ventilation of ships and prisons, his work on which entitles him to be called a public health pioneer.

THE *Chemiker-Zeitung* of June 4 contains an interesting account of the thirty-second annual conference of the Bunsen Society for applied physical chemistry, which was held in Dresden on May 26-29, under the presidency of Dr. Mittasch of Ludwigshafen. In recent years it has been customary to make a special study of a particular branch of the subject, the theme chosen for this year being electro-chemical problems. Papers were read dealing with a variety of topics, *e.g.* electrical insulators, the corrosion of metals, the passivity of metals in alkaline media, the electrolytic separation of magnesium from complex fluorides, the influence of adsorbed ions on the sensitiveness to light of silver bromide, electrolytic processes in the alkali industry, etc. Prof. Billiter, of Vienna, in dealing at some length with the electrolysis of sodium chloride, pointed out that chlorine, instead of being a by-product of the manufacture of caustic alkali, has recently become more valuable than the latter, owing to its application, particularly in Italy, to the manufacture of cellulose.

IN a pamphlet issued by the English Electric Co. describing electric locomotives for every-day haulage work in factories, a strong case is made out for their wider adoption. At the present time when wages are high and fuel is dear, any saving effected in either has a marked influence on production costs. In many works steam locomotives are used. Before the locomotive goes into service, steam has to be raised, necessitating the attendance of a fireman. The bunkers have to be filled and water must be taken on board. During service, consumption of fuel continues even when the locomotive is not usefully employed. In the majority of cases this standby loss is considerable. After service the fires have to be drawn and the ashes cleared away. Repairs and renewals are frequent, and during this time the locomotive represents capital lying idle. On the other hand, the electric locomotive is immediately ready for use, there are no standby losses, and it needs little attention. It will also for short periods sustain a heavy overload, and thus the rated horse-power of the locomotive may be much less than when steam is used. In general two electric vehicles can supersede three steam locomotives. The electric power is obtained either from self-contained batteries or from an overhead line, the latter method being as a rule the more economical. As all modern works have some kind of electric supply available, there seems no reason why electric traction should not be more widely used.

THE seismograms of the great Chinese earthquake of May 22, obtained at nine observatories in North America and at Honolulu, have recently been studied by Commander N. H. Heck (Science Service News Bulletin). He places its epicentre in lat. 35° N., long. 100° E. or some distance to the west of the position given in our previous note (NATURE, June 4, p. 826), and still farther to the west of that of the great earthquake of Dec. 16, 1920. It thus lies either in western China or eastern Tibet. It is worthy of notice that the faults in this district have a general east-and-west direction. No details of the earthquake have yet reached us, but it will be remembered that three months elapsed before the outside world knew of the earthquake of 1920, in which about a hundred thousand lives were lost.

THE International Union of Geodesy and Geophysics has published volume 3 of the Proceedings of the Section of Geodesy at the meeting of the Union held at Madrid in October 1924. This bulky volume consists of the reports on the geodetic work of various countries adhering to the Union. These reports, which are mainly in French and English, were presented to the meeting and are now bound together for convenience of reference. For the most part they cover work done between 1922, the date of the previous meeting at Rome, and 1924, but a few con-

tributions include additional papers such as one by Mr. J. H. Cole, of the Survey of Egypt, on errors in spirit levelling, another on changes of levels caused by the Japanese earthquake of 1923. The volume embraces reports from the chief European States except Great Britain, Germany, and Austria, and also from Canada, the United States, Mexico, Japan, and Siam.

A SECTION of experimental biology in which tissue culture figures prominently has been planned for the tenth meeting of the International Zoological Congress which meets in September in Buda-Pesth. So far as we are aware, this is the first time that tissue culture has practically a whole section devoted to it at an international scientific gathering. Numerous papers and demonstrations figure on the programme. Prof. Ross Harrison, who may be regarded as the founder of tissue culture, will very appropriately open the proceedings on Sept. 5, and Drs. Carrel, Warren H. Lewis, Levi, Lumsden, and Maximow are among the workers who are contributing papers. There will be special discussions on the bearings of pathology on tissue culture (Sept. 7), and on vital staining (Sept. 8). Prof. Rhoda Erdmann, herself a distinguished worker in the sphere of tissue culture, is to be congratulated on her initiative in preparing a very interesting programme.

AT the meeting of the executive board of the U.S. National Research Council the following general officers were elected: *Chairman*, Gano Dunn, president of the J. G. White Engineering Corporation, New York City; first vice-chairman, Prof. T. H. Morgan, president of the National Academy of Sciences; second vice-chairman, Dr. John C. Merriam, president of the Carnegie Institution of Washington; third vice-chairman, Prof. R. A. Millikan, California Institute of Technology, Pasadena. The permanent secretary of the National Research Council, Dr. Vernon Kellogg, and the treasurer of the Research Council, Dr. George K. Burgess, director of the Bureau of Standards, continue in these offices. The following new members of the executive board were elected: Prof. James F. Norris, professor of organic chemistry, Massachusetts Institute of Technology, Cambridge, Mass.; Prof. F. R. Moulton, professor of mathematics, University of Chicago; and John R. Freeman, consulting engineer, Providence.

VOLUME 19 of the Collected Research of the National Physical Laboratory, Teddington, is a quarto of 444 pages and is devoted to the work published by the Physics Department of the Laboratory during the years 1920–25. A large proportion of the papers deal with the heat-insulating properties of materials which are used or may be used in the construction of refrigerator chambers, and with the heat which is transferred to or from bodies by the convection currents they set up in the air surrounding them. Hygrometers suitable for use in cold-storage chambers are thoroughly discussed and new instruments described. High vacuum mercury condensation pumps have been considerably improved by the staff of the Department, research in the direction of establishing the composition of the X-rays from various metals and of using the rays to analyse alloys and other substances has been continued, and some advance made towards the more efficient protection of the X-ray worker. The volume is full of most valuable information, and it shows clearly how much can be done for science and industry by ten or twelve active workers in a well-equipped laboratory.

TOO much caution cannot be exercised in naked-eye observations of the sun and its total eclipse on Wednesday next, June 29. Several contributors to our supplement last week referred to the danger of looking at the sun through unsuitable glasses or screens before totality. If, however, it is desired to observe the passage of the moon over the sun's face, no better device could be used than the "Combined Dark-Adaptation Mask and Graduated 'Eclipsia' Screen," made at the suggestion of Dr. R. L. Waterfield and sold by Messrs. Theodore Hamblin, Ltd., 15 Wigmore Street, London, W.1 (price 5*s*.). By means of a film of varying density, it will be possible to look at the sun from time to time before totality, and during total eclipse to observe the corona without any screen at all. The device should be very useful to all who are arranging to watch the eclipse on Wednesday next.

THE annual conversazione of the Institution of Electrical Engineers will be held at the Natural History Museum, South Kensington, on Thursday, July 7, at 8.30-11.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A lecturer in chemistry at the Leicester College of Technology—The Registrar, Colleges of Art and Technology, Leicester (July 1). An assistant in electrical engineering at the Crewe Technical Institute—The Director of Education, County Education Offices, City Road, Chester (July 2). An analytical assistant in the laboratory of the Public Analyst and Chemist to the Council of the Borough of Stepney—The Town Clerk, Municipal Offices, Raine Street, E.1 (July 4). An assistant examiner in the Standards Department of the Board of Trade—Principal Establishment Officer, Board of Trade, Great George Street, S.W.1 (July 6). A principal of the L.C.C. School of Building, Ferndale Road, Clapham—The Education Officer (T.1.a), The County Hall, S.E.1 (July 9). An assistant lecturer in philosophy at the University College of Swansea—The Registrar, University College, Singleton Park, Swansea (July 9). Research chemists at the Building Research Station, Garston, Herts; the Chemical Research Laboratory, Teddington; the Fuel Research Station, East Greenwich, and local stations of the Physical and Chemical Survey of the National Coal Resources—Secretary, Department of Scientific and Industrial Research, 16 Old Queen Street, S.W.1 (July 11). Research Physicist at the Building Research Station, Garston, Herts—Secretary, Department of Scientific and Industrial Research, 16 Old Queen Street, S.W.1 (July 11). An assistant govern-

ment chemist under the Sudan Government—The Controller, Sudan Government London Office, Wellington House, Buckingham Gate, S.W.1 (July 14). A glass-blower for the Egyptian University, Cairo—The Director, Egyptian Educational Office, 39 Victoria Street, S.W.1 (July 14). A junior scientific officer for the Air Ministry Scientific Research Staff, primarily for research work in the aerodynamics department of the Royal Aircraft Establishment—The Chief Superintendent, R.A.E., South Farnborough, Hants (July 16, quoting A.180). A zoologist and a hydrologist for the *Discovery* Expedition—The Private Secretary (Appointments), Colonial Office, 38 Old Queen Street, S.W.1 (July 16). A research entomologist at the Long Ashton Fruit Research Station—Registrar, University, Bristol (July 16). An assistant lecturer in geology—Registrar, University, Manchester (July 16). A live-stock officer and an assistant agricultural officer for the department of agriculture, Kenya Colony—The Private Secretary (Appointments), Colonial Office, 38 Old Queen Street, S.W.1 (July 31). A lecturer in physics at University College, London—The Assistant Secretary, University College, Gower Street, W.C.1. An assistant teacher in the engineering department of the Woolwich Polytechnic—The Principal, Woolwich Polytechnic, S.E.18. Laboratory attendant for botanical department of University College, Leicester—Dr. E. N. Miles Thomas, 8 Inglewood Mansions, West End Lane, London, N.W.6.

Our Astronomical Column.

COMETS.—Comet Pons-Winnecke, 1927*c*, is now very near the earth; on the night of June 26-27 it will approach within about 3½ million miles, which is closer than any cometary approach within living memory. Since, according to Mr. B. M. Peek, the nucleus is well-defined, it is worth while to take carefully timed photographs with the view of determining the solar parallax. The comet should be faintly visible to the naked eye as a large ill-defined area of faint luminosity. Its apparent motion will be as rapid as that of the moon in apogee.

Mr. B. Strömgren has revised the orbit, using observations up to June 10, and obtains:

$T = 1927$ June $21{\cdot}064$ U.T.
$\omega = 170^\circ\ 22'\ 35{\cdot}0''$
$\Omega = 98\ \ 8\ \ 34{\cdot}3$ } 1927·0
$i = 18\ \ 56\ \ 25{\cdot}9$
$\log e = 9{\cdot}836076$
$\log a = 0{\cdot}519227$
$\log q = 0{\cdot}016698$

EPHEMERIS FOR 0^h U.T.

	R.A.	Decl.	log *r*.	log Δ.
June 23.	$19^h\ 16{\cdot}6^m$	$37^\circ\ 41'$ N	0·0169	8·699
25.	20 10·1	24 21	0·0173	8·623
27.	21 3·7	5 54 N	0·0181	8·591
29.	21 52·2	12 2 S	0·0192	8·633

On June 23 the comet is some 7° east of Vega; on June 24, 5° north-east of β Cygni; on June 26, in the diamond formed by the bright stars of Delphinus; on June 27, near α Equulei. It then runs rapidly southward and quickly passes out of our reach, but it will be followed in Australia and South Africa. Perturbations by the earth will have to be applied in further researches on its motion:

CONTINUATION OF THE EPHEMERIS OF COMET 1927*d* (STEARNS) FOR 0^h (*Pop. Ast.*, June-July).

	R.A.	N. Decl.	log *r*.	log Δ.
June 24.	$14^h\ 1^m\ 21^s$	$22^\circ\ 55'$	0·577	0·530
July 2.	13 59 40	23 34	0·579	0·547
10.	13 59 10	24 0	0·581	0·563
18.	13 59 47	24 19	0·584	0·579

Magnitude 10 to 11.

CONTINUATION OF THE EPHEMERIS OF COMET 1927*e* (GRIGG-SKJELLERUP) FOR 0^h.

	R.A.	N. Decl.	log *r*.	log Δ.
June 25.	$16^h\ 33^m\ 30^s$	$50^\circ\ 40'$		9·462
29.	16 53 40	46 30	0·0548	9·502
July 3.	17 10 30	42 21		9·541
7.	17 23 0	38 43	0·0679	9·579
11.	17 33 0	35 28		9·616

Magnitude about 11.

A FIREBALL ON JUNE 10.—Mr. W. F. Denning writes that "a fireball, estimated to be twice as bright as Venus, was observed from Boscombe in the strong twilight on June 10 at $9^h\ 3^m$ P.M. G.M.T. It passed from about 20° below the Polar Star towards the east through the stars in the lower part of Cygnus, its path slightly falling during the five seconds the object remained in view. It left a short trail, and was apparently directed from a radiant point in the western sky. The fireball must have been a very brilliant object as seen from the central and eastern counties of England, but no report of its appearance has been received from those parts.

"It is hoped that further descriptions of its flight amongst the stars will be communicated, for the fireball was one of the most interesting and conspicuous kind, though the prevailing twilight must have considerably moderated its brilliancy."

PHOTOGRAPHS OF MARS.—Lick Observatory Bulletin 387 contains a series of photographs of Mars taken in 1924 by R. J. Trumpler. Yellow and red screens were used on the 36-inch refractor, and the plates were bathed in pina verdol. The plates were used to determine the diameter and polar flattening; the diameter was got both from limb measures and from measures of markings on the disc at different times, the rate of rotation being well known.

The limb measures gave (for unit distance):

	Yellow Screen.	Red Screen.
Equatorial diameter	9″·41	9″·33
Polar diameter	9″·32	9″·24
Polar flattening	1/96	

The measures of disc markings gave:

	Yellow Screen.
Equatorial diameter	9″·178
Polar diameter	9″·075
Polar flattening	1/89

It is concluded that the flattening exceeds the value 1/190 deduced by H. Struve from the Satellites.

RARE ASTRONOMICAL BOOKS.—A sale catalogue of more than usual interest just issued by Henry Sotheran and Co. includes the library of the late Dr. Dreyer. There is an extensive collection of books by Sir Isaac Newton, and by others relating to his work. A specially interesting work is the copy of Euclid's elements used by Newton when he commenced the study of geometry as a sub-sizar at Trinity College. This contains numerous MS. notes of his, which are said to have been written at various periods of his life; they express many of the propositions in algebraic notation. This work is valued at £500. Copies of the first edition of the "Principia" (first and second issues) are valued at £35 and £42 respectively. The second edition is only £2 : 5*s*.

Research Items.

AUSTRALIAN STONE IMPLEMENTS.—A paper on stone implements found on the camping grounds formerly used by Australian aborigines, by Mr. A. S. Kenyon, in *The Victorian Naturalist*, vol. 43, No. 10, which describes the character of these implements and their uses, suggests certain general considerations which are not without interest to students of the use of stone in prehistoric times in other parts of the world. The Australian camping grounds are of three types—those of a purely temporary character, where the remains are of food entirely; those where good shelter and varieties of food were obtainable, but here implements are sparse and of a crude nature; and thirdly, those that were permanent and at which aborigines were always to be found, and where the old men and women stayed and practised their arts and crafts. The first evidence of a camping ground is the presence of foreign stones, which may be either implements or fire stones; and the second the presence of food remains, often large quantities of shell of an edible kind. Raised beaches, especially around Port Phillip, have often been mistaken for kitchen middens. Examination reveals that the foreign stones fall into the following groups, apart from fire-stones: (*a*) small but definite shapes, mostly retouched; (*b*) larger shapes, much less definite, with secondary working of a much coarser nature; (*c*) similar flakes without retouching; (*d*) large pieces with coarse chippings; (*e*) cores. By far the greater number show no sign of working, but cannot be classed as 'wasters.' The aboriginal did not spend time on the elaboration of an implement when once he had obtained the edge he required, and it was thrown away perhaps after a few strokes, when once the edge showed the effect of use.

MAN'S PLACE OF ORIGIN.—In the issue of the *Scientific Monthly* for May, Dr. William K. Gregory surveys the evidence bearing upon the antiquity of man in its relation to the question of his place of origin, inclining strongly to the conclusion that it must be sought in Asia. He naturally attaches considerable importance to the discovery in 1921 in a cave at Chou Kou Tien, south-west of Peking, of the two human teeth (premolar and molar) of Upper Pliocene or Lower Pleistocene age. The close relation in structure between, say, man and the chimpanzee points, in view of the high estimate of geologic time accepted by some authorities, and the slow and unequal rate of evolution apparent when the palæontological data are studied comparatively, to a separation at a period far later than the Lower Eocene. It also supports Darwin's view that man is an offshoot of the primates of the Old World rather than the New. In the Old World, notwithstanding the close approach to human conditions of *Dryopithecus rhenanus* of the European Pliocene, and the provenance of the most primitive known skulls (Piltdown, Heidelberg, etc.), Europe is not a likely place of origin. Notwithstanding the occurrence of members of the man-anthropoid series in the Lower Oligocene of Egypt, central Asia affords the most likely geological evidence of suitable avenues of distribution—this conforming with the peripheral distribution of Pithecanthropus and the Wadjak and Australian skulls, while the Nebraska tooth probably represents a migrant from eastern Asia. The geological, palæontological, and anthropological data from central Asia have suggested the hypothesis that a gradual uplift of this area afforded the cause and the conditions of a gradual evolution of man in group after group of higher types, the lower migrating continuously on the receding lines of the changing environment.

MEDIEVAL ANATOMICAL TEXTS.—The subject of medieval anatomy to which we directed attention some time ago (NATURE, Dec. 5, 1925, p. 811) has recently been brought before us again by Dr. George W. Corner, professor of anatomy in the University of Rochester, U.S.A., in a scholarly treatise which contains a commentary and translation of the more important anatomical texts as well as a bibliography and facsimiles of some of the manuscripts. Dr. Corner has skilfully disentangled the historical facts from the legendary matter connected with the school of Salernum and Constantine the African, whom, like Sudhoff, he regards as one of the founders of modern medicine and indeed of all modern biology. Dr. Corner emphasises the fact, which does not appear to be sufficiently realised, that the translations of Constantine and the school of Salernum gave the Occident some of the fruits of Oriental medicine a hundred years before the later Arabic philosophers and physicians were translated at Toledo. The anatomical texts of the twelfth century consisted partly of three documents known as the two Salernitan demonstrations, one of which was called "Anatomia Cophonis," and "Anatomia Mauri," which were used as practical manuals for teachers and students, and partly of systematic descriptive anatomical works, in which the subject is handled in a highly organised style in accordance with the fashion of medieval scholasticism. Dr. Corner also gives an interesting account of a thirteenth-century text of a work named "Anatomia Vivorum" or "Anatomia Ricardi Anglici," which he regards as one of the very first books of the Middle Ages to show the influence of Aristotelian biology.

FORAMINIFERA FROM THE SUEZ CANAL.—The Cambridge Expedition to the Suez Canal in 1924 collected Foraminifera at nine stations, lying between the Great Bitter Lake and Gulf of Suez, and they are discussed by E. Heron-Allen and A. Earland in *Trans. Zool. Soc. London*, vol. 22, Part I., No. 9, Dec. 1926. The gatherings were not large and yielded few species, most of which belonged to the 'porcellanous' group. There is no evidence of movement of any species from north to south (*e.g.* from the Mediterranean through the Red Sea), but there is thought to be positive evidence of one Indo-Malay and South African species—*Polystomella Milleti* H.A. and E., also found at Suez—migrating northwards, although only represented from the Bitter Lake by one specimen. A single specimen of *Polystomella craticulata* (Fichtel and Moll) occurring in the Bitter Lake is regarded as almost equally strong evidence of northward migration of that species. It is, however, hazardous to draw conclusions from single specimens, and under the heading 'Known Distribution,' P for Palermo is given (perhaps a misprint), although in the text it is stated that *P. craticulata* has not, so far as the authors are aware, been recorded from the Mediterranean. It is interesting that nearly all the Suez Canal specimens of Orbitolithes are abnormal in some way, a peculiarity attributed to the variations in salinity which are apparently productive of deformed and monstrous growth. Three species are recorded, but all differ somewhat from the types, the usual specific characters being more or less obliterated. There is a list of the species of Foraminifera collected comprising 50 in all, 38 being taken in the Bitter Lakes and the remainder at the southern entrance of the Canal. Of the 38, 5 are known from the Indo-Pacific and not from the Mediterranean, and the remainder are from both areas.

A NEW MUTANT IN DATURA.—In the experiments of Drs. C. S. Gager and A. F. Blakeslee (*Proc. U.S. Nat. Acad. Sci.*, vol. 13, p. 75) mutations appear to have been produced by the action of radium emanations on the ovary of the plant *Datura Stramonium*. In the successful case an exposure of 10 minutes, probably just after the reduction divisions in the ovules, resulted in 17·7 per cent. of mutations among 113 plants, whereas the normal rate of mutation is about 0·47 per cent., and an untreated capsule of the same plant gave 36 offspring, all normal. The mutants were mostly forms with an extra chromosome, but included two new gene mutants (found in the offspring of 18 plants tested) and a peculiar type called 'nubbin.' The latter has an extra chromosome, but from various lines of evidence Blakeslee concludes that its composition probably includes two chromosomes each made up of the halves of different chromosomes. Unlike the other trisomic mutants, 'nubbin' gives rise to five different types in its offspring. The radium treatment is held to be 'largely responsible' for all three types of mutation obtained.

PLANT ECOLOGY OF PORTO RICO.—Volume 7, parts 1 and 2, of the "Scientific Survey of Porto Rico and the Virgin Islands," published by the New York Academy of Sciences, is devoted to an account of the ecology of Porto Rico by H. A. Gleason and Mel I. Cook. This work of 173 pages and 50 excellent photographic plates is the result of a few months' field work on the island. All the principal types of vegetation over some 3400 square miles of country were examined, and the results are given as purely those of a field survey, but as such form a good basis for more intensive work of a statistical or experimental nature. Works on island floras (*e.g.* Cooper's "Climax Forest of Isle Royale") are of a special interest from a successional point of view, as factors can be delimited in a manner scarcely possible in the case of continental floras. The authors distinguish three distinct vegetation regions, that of the Northern Coastal Plain, that of the Central Mountain Region, and that of the Southern Coastal Plain. Most of the first region is covered with limestone deposits, which develop a mesophytic upland forest, now nearly destroyed by settlers. Besides these mesarch associations, xerarch, hydrarch, and halarch series are found, the latter in the form of mangrove swamps, and all of those tend towards the development of a Playa Land Climax Forest. The Central Mountain Region was originally entirely covered by forest, except for minor areas of rock outcrops. The forest comprises five ecological types, in which the causal factors seem to be altitude, rainfall, and exposure. Only fragments of lower level forest now remain, but the vestiges show strong floristic relationship to the xerophytic forest of the Southern Coastal Plain. Between 2000 ft. and 3000 ft., the forest is mesophytic in character, consisting of a moist tropical forest and a tropical rain forest. The higher peaks are clothed by the Sierra palm forest and the mossy forest, the two types being differentiated chiefly by their exposure to wind. Each of these five ecological types is associated with a definite set of climatic conditions, which are not subject to modification by the vegetation, and each may thus be regarded as a climatic climax formation. A vegetation map would have been an acquisition to the work.

THE LIAS OF THE MEDIAN PRÉ-ALPS.—The nappe of the Median Pré-Alps has been referred by different authors in turn to each of the three zones of sedimentation—Helvetian, Pennine, and Austro-Alpine—which have contributed to the great recumbent folds of the western Alps. A very careful study of the stratigraphy and fauna of the Lias of the difficult region south of Lake Geneva has been made by E. Peterhans, and his results are published in the *Mémoires de la Soc. Helvétique des Sci. Nat.*, vol. 62, 1926, Mem. 2. It is clearly shown that the Liassic fauna of the "Medianes" is definitely different from those of the Helvetian and Austro-Alpine regions, and that it probably belongs to the Pennine region. The latter deduction, however, cannot be directly proved, for the corresponding rocks of the Monte Rosa nappe are thoroughly metamorphosed. The provisional assumption by some of the Swiss geologists that the "Medianes" represented an extreme north-westerly thrust of the Austro-Alpine nappes, had to face the difficulty that the folding of the "Medianes" is of a type that implies the former presence of a heavy cover. It is now possible to regard this vanished cover as an Austro-Alpine nappe, part of which still remains in the inner belt of the Pré-Alps. The most puzzling feature of Alpine architecture thus still remains, for the push of the Austro-Alpine nappes far to the north-west of their roots still awaits a mechanical explanation.

CLIMATE AND ANIMAL EVOLUTION.—In the memoir entitled "The Environment of Tetrapod Life in the Late Paleozoic of Regions other than North America," published by the Carnegie Institution of Washington, Prof. E. C. Case continues that study of the land animals of Permian time and of the environment in which they lived which has occupied him for some twenty years and formed the subject of those well-known works on the American Permian fauna to which the present volume forms a supplement. Prof. Case holds that, within any restricted period of time, correlation of beds by conditions of environment is a more satisfactory method of understanding the relationships of faunas than is an attempt to establish correlations on the basis of an equivalence with marine deposits. In his former work, Prof. Case was able to show that the animals which form part of the 'Texas' Permian fauna are constantly associated with definite conditions of the environment in which the rocks containing their remains were laid down. He has now added to his very great experience of the American Upper Palæozoic an acquaintance with rocks of similar age in many other parts of the world, founded not only on the literature, but also on a personal examination. The resulting work is most valuable because it brings together in a well-arranged form a vast mass of information on the geology and palæontology of the continental Permian deposits of the rest of the world and discusses the conditions under which they have been laid down. The most interesting general conclusion is that the evolution which takes place in the members of a fauna must be associated in some way with the concurrent climatic changes in the area in which they are living.

MISSISSIPPI FLOODS.—The slow sinking of the lower Mississippi valley was suggested as a cause of the floods by Dr. D. E. White at the recent meeting of the American Shore and Beach Preservation Association. According to a report issued by Science Service of Washington, Dr. White pointed out that while there is no certainty that the gulf coast is sinking, the undoubted downward movement of the Atlantic coast is significant. The region to the north of the great lakes is being tilted upward, which suggests that farther south there may well be an area of depression probably with some warping or twisting of the earth's crust. He cites the well-known occurrence of earthquakes in the Mississippi valley between Cairo and Memphis as probable confirmation of this movement. The rate of sinking,

if it occurs, is no doubt very slow, but it will cause an increasing liability to floods, and furthermore, by reducing the speed of the currents, will render it more difficult for the lower river to keep its bed clear of sediments. Dr. White raised another problem with regard to the silting up of river channels. The levee system is based on the assumption that streams so confined will scour their own channels, but this, he maintains, has not been proved. If the river really drops its load of silt in the bed instead of carrying it out to sea, eventually the bottoms will be higher than the banks, and the raising of the levees to keep pace with this growth will cause increasing peril to the lowlands. Dr. White advocates the national importance of a study of these problems.

GEOPHYSICS IN THE UNITED STATES.—The report of the seventh annual meeting, on April 29–30, 1926, of the American Geophysical Union, has recently been issued as Bulletin No. 56 of the National Research Council. More than a hundred of its 134 pages are devoted to reports and summaries of papers read in the six sections and the general meeting. They afford a valuable and interesting record of American views on the problems of geophysics as a whole, and of their activities and observations within their own large and important field of work. At the general meeting the constitution of the earth was discussed, in the light of cosmical theory, gravity measurements, seismic and magnetic data, and chemical investigation. The section of volcanology also instituted a symposium, not confined to its own special viewpoint, on co-operation in the scientific investigation of the Aleutian Islands. Many papers in the remaining sections dealt with recent instrumental advances and programmes of observation completed or in progress.

THE PHOTO-ELECTRIC PROPERTIES OF MERCURY.—A number of troublesome effects produced in photo-electric work by impurities have been made the subject of a special study by H. K. Dunn. The experiments, carried out under the direction of Prof. Millikan and described in the May number of the *Physical Review*, were performed under conditions similar to those employed in the standard determination of the photo-electric threshold of mercury, with a continually renewed surface, and have incidentally confirmed Kazda's value of 2735 Å.U. for the limit. When the surface flow was stopped in a high vacuum, the threshold rose quickly to 2850 Å.U., and then in the course of a few days fell to 2680 Å.U. If liquid air was not kept on the traps, radiation of still higher frequency was required. The contamination seemed to be due to some relatively non-volatile substance other than water, which was given off by the tap-grease used. With pure hydrogen over the surface, the behaviour was exactly the same, but the presence of hydrogen which had been distilled with the mercury and was apparently in solution in the metal, greatly retarded the rate at which the active impurity became effective. It is suggested that in this case, as well as in other instances where the photo-sensitivity of a plate has been found to be increased by electrolytic generation of gas on the side remote from that exposed to the radiation, undesirable impurities are carried off by the gas diffusing through the substance.

MOVING MAGNET GALVANOMETERS.—Dr. C. V. Drysdale, in the May number of the *Journal of Scientific Instruments*, points out that recent improvements in the design of moving magnet galvanometers have made them for many purposes superior to moving coil galvanometers. By improving the design of the moving system and using cobalt steel magnets of very small dimensions, A. V. Hill and A. C. Downing have succeeded in making galvanometers about 500 times as sensitive as Kelvin four-coil galvanometers. The most serious drawback to moving magnet galvanometers is their susceptibility to magnetic disturbances. This difficulty has been overcome by using a thin cylinder of the new high permeability nickel iron alloy which is generally known as mumetal or permalloy. A simple experiment is described showing the effective nature of this screening. A light cobalt steel magnet suspended by a quartz fibre was found to oscillate with a period of one second in the earth's field and was very sensitive to the motion of a bar magnet at some distance away. When it was screened by a permalloy cylinder closed by plates of the same metal, the time of oscillation was increased to more than ten seconds and the effects of the external bar magnet were negligible. The screening results obtained are far better than those got in the ordinary way by using massive soft iron bells. A notable advance has therefore been made.

CORROSION OF METAL JOINTS.—In the *Journal of the Royal Society of Arts* for April 29, Dr. U. R. Evans discusses briefly the problem of corrosion in general. After the consideration of troubles arising in welded, riveted, or soldered joints, the paper concludes with the following: The choice of materials which are to come in contact at a joint should be made with a view to minimising the E.M.F., although in some cases it may be advisable to make the metal presenting the smaller area weakly cathodic to the other. The nature of the joint itself is important, and care should be taken to avoid crannies which will be anodic to the main surface. Perhaps the most dangerous condition is a capillary crevice existing between the two dissimilar metals. Here the portion of the surface of the nobler metal near the mouth of the crevice will function as the cathodic area, whilst inside the crevice the base metal, and often the noble metal also will suffer anodic attack. It is important whenever possible to apply some coating of efficient protective paint, varnish, or plastic composition to the joints, with special reference to places where microscopic crannies may exist. The possibility of bulging due to cranny-corrosion is another matter of which account must be taken, the size and strength of the pieces being chosen to resist the stresses exerted by the volume changes involved in the corrosion process. The paper contains an interesting discussion from the electro-chemical point of view of the soldering of aluminium.

POTASSIUM NITRATE AS A FERTILISER.—For the enrichment of artificial fertilisers, potassium nitrate appears to possess so many advantages over other compounds of nitrogen that extensive field experiments have been undertaken by the Agrikultur-chemische Versuchsanstalt der Landwirtschaftskammer in the province of Saxony and also in Cassel. The association of potassium with nitrogen in the salt renders it more valuable for this purpose than sodium nitrate, which also possesses the disadvantage of being much more soluble at the ordinary temperature. Since, however, the proportion of potassium to nitrogen is too great, the salt must be suitably mixed with other materials. In the *Chemiker-Zeitung* for May 7 is an account of the first year's experiments upon comparisons between potassium nitrate and other nitrogenous salts. The results seem promising, but it is too soon as yet to draw any definite conclusion. Further reports will be awaited with interest. The tests were carried out with winter-corn, oats, tobacco, potatoes, beetroot, etc., partly on the land and partly in pots.

Chemical Industry and Technical Institutions.

MR. W. J. U. WOOLCOCK, general manager of the Association of British Chemical Manufacturers, delivered a striking address to the annual conference of the Association of Teachers in Technical Institutions which was held at Plymouth on June 4-7. Dealing with technical education and industry, he illustrated his theme by reference to chemistry, pure and applied. With this in mind, he traced the growth of the British chemical industry, which is now, he said, among the six greatest industries of the country; £200,000,000 capital is invested in it; it employs a quarter of a million workers and is exceedingly well organised. Not very long ago its range was small and, in Great Britain, relatively unimportant: to-day it provides the largest field for the scientific chemist. It has made greater strides in its post-War development than any other British industry, and is of such a wide character that it is difficult to set limits to its boundaries.

Three new points are, however, to be noted. While at one time chemical industry was practically the only outlet for the trained chemist who desired to apply his knowledge to industry, there is now no industry which cannot be benefited by the application of scientific knowledge to its control and development. There is, therefore, an almost unlimited field for the technically trained man or woman. Again, the post-War developments have been specially remarkable. Actually, of course, we have always had some sort of chemical industry in Britain, but what is called chemical industry is really an aggregation of a number of industries in many of which we have held our own for more than half a century. Particularly is this true of what are known as the heavy chemical industries. But since the War we have developed and maintained the fine chemical industries such as dyestuffs (the Dyestuffs Act helped considerably), research, medicinal, and photographic chemicals. We are therefore able to speak now with America, Germany, France, or Switzerland in brotherly terms, not in the terms of the poor relation.

There remains a third point, which refers to the boundaries formerly set between scientific and 'non-scientific' industries. Already it has been pointed out that there is no industry which cannot be benefited by scientific methods; it is also true that there is a number of industries doomed to extinction if such methods be neglected. "Thus," said Mr. Woolcock, "I say not only to the chemists here, but to the physicists, electricians, and especially to the biologists, that whatever industry you enter, or whatever part you have to play in teaching those who may become industrialists, yours is a great vocation. I use no words of exaggeration when I say that the future of this country can be very largely influenced by what you can do." He was not concerned at the moment, he said, with the philosophical implications of technical education. He wanted to look at it from the viewpoint of what sort of men and women it produces—a test upon which technical teachers should be prepared to be judged. After all, the business man has to fit the product of teaching into the realities of his business. He can therefore recognise its good results in his own practical affairs, and he is bound to notice what appear to him to be its deficiencies.

On the whole, the present system gives satisfactory results, but there remain certain deficiencies to be made good. Mr. Woolcock would suggest that there is not available a sufficient number of trained scientific persons who have been taught from the point of view of economy. It is possible to teach the principles of chemistry and engineering in such a way as to inculcate throughout those conceptions of efficiency with regard to expenditure on material, labour, wear and tear of machinery and plant, heat, light, power, and so forth, which are essential to industry. It may be replied that this is already being done in some measure; but it must become far more general and must start quite early in the training of young scientific workers. An important aim, too, of technical education is the acquirement of ability in experiment, and by this is meant not only manipulative skill, but also imaginative conception. The teaching of manipulative skill is bound to vary in quality in accordance with the standard of the teacher. That cannot be avoided, but it is still possible that manipulative skill and manipulative conception can be developed in all their bearings from the point of view of their quantitative efficiency. From this it seems to follow that there is need to widen the scope of technical education. It might usefully include administration, costing, and production.

In his sketch of the development of the chemical industry, Mr. Woolcock said that, following the addition of fine to the heavy chemical industries, another development is taking place right under our eyes. It is a development along lines of production in enormous quantities of commonplace articles. "Undoubtedly," he said, "the industry has provided a bigger outlet than any other in the country for your students."

The New Experimental Station of the Safety-in-Mines Research Board.

THE official opening on June 14 of the new Experimental Station of the Safety-in-Mines Research Board at Harpur Hill, near Buxton, is an event of much importance in the mining world. It was fitting that the ceremony should be performed by Lord Chelmsford, chairman of the Miners' Welfare Fund Committee, and should be welcomed in no uncertain tones by Mr. Herbert Smith, president of the Miners' Federation.

Lord Chelmsford, in his speech, made it clear that the assistance of the Welfare Fund had only been obtained on two conditions: (1) that the nature and locality of the Station should be approved by both the owners and miners, and (2) that the experimental plant and its scientific equipment should be the best that could be designed for the purpose. When the Committee was unanimous on these two essentials it had no difficulty in allocating a large capital sum for acquiring and equipping the site at Harpur Hill for the experiments which could only be carried out on a large scale, and for erecting at Sheffield buildings for laboratory researches especially connected with the properties of coal and with improvements in the miners' safety lamp. Besides this capital expenditure, an endowment fund of £250,000 had been invested to provide an annual income for the purposes of research.

The Committee, Lord Chelmsford added, did not suppose that immediate practical results would follow from a few scientific experiments; it is realised that the problem of securing safety in mines becomes more and more complex as the workings are extended, and it is only by the most patient research—not by one man, but by a trained staff working under skilled

direction—that progress can be made. Fortunately, the country possesses in the Research Board a body of experts, administrative and scientific, who can advise on the work, and in Dr. Wheeler it has a director of research who commands the full confidence of the Board. What is eminently desirable is to maintain the closest touch between the mining industry and the Research Board. The public are deeply interested in the problems the Board has to solve, and it should not be beyond the wit of man to keep the public informed of the methods used and the results obtained in language which can be followed by ordinary folk unversed in scientific formulæ.

After the opening speech, the chairman, Col. Lane-Fox, the Secretary for Mines, called on Mr. Eustace Mitton on behalf of the Mining Association (in the absence through illness of the president, Mr. Evan Williams), and on Mr. Herbert Smith, president of the Miners' Federation. The latter at once struck a note to which the large audience were responsive. "There are two things," he said, "in regard to which coal-owners and miners are always friends—first, how to save life and limb, and secondly, how to rescue when life and limb are at stake." On that platform they stood as one. He warmly commended the Welfare Fund, and the work that had been done under the chairman's guidance. He admitted the difficulty of persuading miners that there is danger in coal-dust, and he recognised the importance of the artificial mine that demonstrated the destructive violence of a pure coal-dust explosion, but stated that the plant that appealed to him most as a Yorkshire miner was the building where artificial gob fires could be initiated and studied throughout their various courses.

On the new experimental station the most important sections of the research equipment are the two steel galleries which have been constructed for testing the explosibility of coal dusts under various conditions. One of these, in which the greater part of the systematic work will be carried out, is 4 feet in diameter and 1000 feet long. The other, which will be used mainly for demonstration explosions, is 7½ feet in diameter and 390 feet long. They are connected to fans arranged for creating a current of air in them in either direction.

The 4-foot gallery is equipped with instrument cabins every 100 feet, containing apparatus for measuring the pressures produced during the explosions and the speeds of the flames. These instruments are controlled from a distance at the observation station. Two special sections have been included in this gallery for investigating the effect of openings in the gallery (corresponding to the branches off an underground road) on the development of a coal-dust explosion.

Research on Firedamp Explosions.—The 7½-foot gallery is also used for the study of firedamp explosions. One of the principal series of experiments now in progress is to determine the distance to which the flame of an explosion can be projected along a roadway beyond the area originally occupied by the explosive mixture.

There is another gallery, one foot in diameter and 300 feet long, in use for studying the effect of restrictions in the path of the flame on its speed.

Research on Coal-mining Explosives.—The buildings for this work include (*a*) a research laboratory and gun-room in which photographic methods are used to investigate the flame and the pressure waves sent out by an explosive when it is fired, and (*b*) an explosion gallery and observation station where the igniting power of explosives under different conditions of detonation is tested directly by firing them into explosive mixtures of firedamp and air.

Research on Gob Fires.—Some coalfields suffer from fires which break out in the gob or goaf, the part of the mine where the coal has been worked. The building in which the study of gob fires is being made consists of a central chamber, 30 feet square and 8 feet high, simulating a goaf, with an air passage, approximately 6 feet wide by 7 feet high, circumscribing it. The main object of the research in progress is to determine the limiting conditions necessary for the production and ignition of explosive gas mixtures from a fire behind a stopping, and to study methods of sealing off a fire so as to avoid these conditions. Records of the temperature, and samples of the atmosphere at different points within the sealed-off area, can be taken periodically.

University and Educational Intelligence.

CAMBRIDGE.—Mr. Roger Fry, Sir John Marshall, and Prof. A. V. Hill have been elected honorary fellows of King's College. The Council has proposed to the University that the degree of LL.D., *honoris causa*, be conferred upon the Duke of Northumberland, Sir Archibald Denny, Sir Eustace Tennyson-D'Eyncourt, and Sir Charles Oman in connexion with meetings to be held at Cambridge this summer of the Institution of Naval Architects and of the Royal Archæological Institute. It is also proposed that the degree of M.A., *honoris causa*, be conferred upon Lieut.-Col. J. E. Craster, late R.E. Sir Humphry Rolleston has been appointed to represent the University at the coming Imperial Social Hygiene Congress.

Mr. A. S. Besicovitch, of the University of Leningrad, has been appointed lecturer in mathematics. Mr. H. W. Florey, Gonville and Caius College, has been appointed to the Huddersfield lecturership in special pathology. Dr. C. M. Yonge has been nominated to use the University Table at the zoological station at Naples for six months.

The annual report of the Solar Physics Observatory gives an account of the preparations and programme of Prof. Newall's expedition to Aal in Norway for the total eclipse of June 29.

Mr. R. V. Sayce has been appointed lecturer in material culture and physical anthropology. Dr. J. Chadwick, Gonville and Caius College, has been re-appointed lecturer in physics and assistant director of radio-active research.

F. W. Shotton, Sidney Sussex College, has been elected to the Harkness Scholarship in geology. E. J. H. Corner, Sidney Sussex College, and A. L. Bennett, Christ's College, have been awarded the Frank Smart prizes in botany and zoology respectively. The Tyson medal, in astronomy, has been awarded to C. S. M'Leod, Emmanuel College, and the Mayhew Prize in applied mathematics to J. Hargreaves, Clare College. The Rex Moir Prize in engineering and the Ricardo Prize in thermodynamics have been awarded to J. N. Goodier, Downing College. The John Bernard Seely prize in aeronautics has been awarded to C. E. Maitland, Peterhouse.

A grant has been made by the Balfour Managers to E. B. Worthington, Gonville and Caius College, for researches on the plankton of the Victoria Nyanza.

EDINBURGH.—At the meeting of the University Court on Monday, June 13, it was intimated that the Highland and Agricultural Society had resolved to make a grant of £1000 towards the endowment of the Department of Research in Animal Breeding.

The Court decided to make an annual contribution of £50 to the newly established British Institute in Paris.

NEWCASTLE.—The Council of Armstrong College has made the following appointments: Mr. Clement Heigham to be professor of agriculture, in succession to the late Prof. D. A. Gilchrist; Dr. J. W. Heslop Harrison to be professor of botany in succession to Prof. J. W. Bews, resigned; Mr. James Holmes to be lecturer in geography (a new appointment).

Mr. Heigham was educated at Wellington College and Caius College, Cambridge. He was for some time director of studies in agriculture at Caius College, Cambridge, and during 1923 and 1924 was director of the Norfolk Agricultural Station. Since 1925 he has been farm director at the Ministry of Agriculture's Experimental Station at Rothamsted.

Dr. Harrison is an old student of Armstrong College. He was at one time head of the science department at Middlesborough High School, and since 1920 has been lecturer in zoology in Armstrong College. In 1926 he was given the honorary title of reader in genetics. His researches on genetics, particularly on the question of the transmissibility of acquired characters, have made him widely known.

Mr. Holmes is a graduate of the University of Glasgow, and for the last four years has been senior assistant in the Department of Geography there.

OXFORD.—The great utility of the private laboratories belonging to Balliol, Trinity, Jesus, Queen's, and Christ Church has been recognised by the University in a recent decree authorising the payment of money grants to these laboratories which are to be equal to the normal laboratory fees paid by students working therein. It has long been recognised that Colleges which have scientific laboratories of their own have a very great advantage over those which are not so provided.

The preamble to a statute providing that there shall be an Aldrichian praelector in chemistry to be held by one of the University demonstrators has been approved.

ON June 7, in the presence of a great gathering representative of the west of England, and amid memorable scenes of enthusiasm, the Prince of Wales, president of the University College of the South-West of England, laid the foundation-stone of the new arts and administrative building of the College. The ceremony was of a peculiarly picturesque character and was enhanced by the magnificence of the exceptionally beautiful site which, known formerly as the Streatham Estate, forms one of the beauty spots of the south-west. The deputy-president of the College, Sir Henry Lopes, in welcoming the Prince, outlined the history of the rapid growth of the College, and explained that the increasing number of students and the rising standard and volume of academic work has impelled the College to find fresh quarters, more suited to the expanding needs. He stated that the appeal for a building and endowment fund, launched a few months ago, is evoking from month to month an increasing response. The greater part of the first £100,000 required has already been subscribed, and the lists show that all classes are contributing to the fund. The Prince in his reply congratulated the College on the support which the plans of expansion has evoked throughout the whole area. A people's university, created by the wishes and efforts of all classes, deserves the best that can be provided both as regards building and teaching, and he expressed the hope that the building would be a worthy monument to the hopes and ambitions of the people. His unexpected announcement that Lord Glanely is giving £25,000 to the appeal fund was received with enthusiasm.

Calendar of Discovery and Invention.

June 26, 1794.—The balloon was invented by the French, and the French were the first to use balloons in warfare. In 1793 a company of military aeronauts was formed, Jean Marie Joseph Coutelle (1748–1835) was made captain, and at the battle of Fleurus, June 26, 1794, he made observations from a balloon which it is said contributed to the success of the French. Coutelle and his company accompanied Bonaparte to Egypt, but their whole equipment was destroyed in the burning of *l'Orient* at Aboukir.

June 27, 1889.—The statue of Leverrier at the Paris Observatory was inaugurated on June 27, 1889. In his discourse Tisserand said: "The celestial world gets larger every day. . . . Yet our curiosity is inexhaustible; and however splendid may be the heaven which we are permitted to contemplate, we want to attain to greater knowledge still. We strive to realise what it was like in the most distant past, and what it will become in the most distant future. In this way—so it seems to us—our mind takes its revenge upon the shortness of our span of life and the frailty of our existence."

June 28, 1903.—It was at a meeting held at the Academy of Sciences, Munich, on June 28, 1903, that the Deutsches Museum von Meisterwerken der Naturwissenschaft und Technik was founded. Its inception and development owe much to the acumen and energy of Dr. Oskar von Miller, and its purpose is to represent physical science and its application to industry from the earliest times to the present day.

June 30, 1820.—Among the numerous papers contributed to the Linnean Society by Robert Brown was that read on June 30, 1820, on Rafflesia, the largest known flower.

June 30, 1866.—For centuries a barrier to human intercourse, the Atlantic is now crossed by steamships, submarine cables, aircraft, and radio signals. The first submarine cable, laid in 1858, failed after being in use a month, while the second, laid in 1865, was damaged in the laying. On June 30, 1866, however, the *Great Eastern* left the Medway with 3000 miles of new cable. The shore end was spliced on July 13, and on July 27 the ship steamed into Heart's Content, Newfoundland. No one contributed more to the final success of the project than Prof. William Thomson, afterwards Lord Kelvin, who for his share was raised to the knighthood.

July 1, 1858.—On July 1, 1858, Lyell and Hooker communicated to the Linnean Society papers which they described as relating to the same subject, namely, "The Laws which affect the Production of Varieties, Races, and Species," and as containing the results of the investigation of two indefatigable naturalists, Mr. Charles Darwin and Mr. Alfred Wallace, who "independently and unknown to one another, conceived the same very ingenious theory to account for the appearance and perpetuation of varieties and of specific forms on our planet. . . ." Of his own share Wallace said, "The one great result which I claim for my paper of 1858 is that it compelled Darwin to write and publish his 'Origin of species' without further delay."

July 2, 1919.—The only aircraft which has flown to and fro across the Atlantic was the airship R34. With a crew of 26 she left East Fortune, near Edinburgh, on July 2, 1919, and reached New York in 4½ days. Her return was made in 3 days 3 hours. She was 645 feet long and 79 feet in diameter, contained nearly 2,000,000 cubic feet of gas, and was driven by five Sunbeam engines of 285 H.P. each. A year or two later she was damaged and then dismantled. E. C. S.

Societies and Academies.

LONDON.

Royal Society, June 16.—F. W. **Aston**: A new mass-spectrograph and the whole-number rule (Bakerian Lecture). By means of the first mass-spectrograph, built in 1919, the masses of all atoms, with the exception of hydrogen, were shown to be whole numbers on the oxygen scale, to one or two parts in 1000. In order to measure their divergence a more powerful instrument was necessary. This has been made, with a resolving power of 1 in 600, more than sufficient to separate the mass lines of the isotopes of any known element, and with an accuracy of measurement as high as 1 in 10,000. By means of this instrument the isotopic constitution of mercury has been decided, new isotopes discovered in sulphur and tin, and the two doubtful isotopes of xenon confirmed. 51 types of atom contained in 18 different elements, ranging from hydrogen to mercury, have been examined. Their masses and packing fractions, *i.e.* their percentage divergence from the whole numbers expressed in parts per 10,000, are tabulated on the oxygen scale; *e.g.*, the atom of phosphorus of mass number 31 has a packing fraction $-5{\cdot}6 \pm 1{\cdot}5$ and a mass 30·9825. The relations of tin and xenon have been re-examined and found not to show the striking abnormality previously suggested. The values for Li^6 and Li^7 are obtained by a recalculation of Costa's results. When the packing fractions of the atoms are plotted against their mass numbers, for all atoms above mass number 20 these lie roughly on a single curve. From mercury, packing fraction +0·8, the curve descends to −9 in the region of bromine. It then ascends, and in the case of atoms of odd atomic number continues to do so, in a roughly hyperbolic manner, right up to hydrogen +77·8. The light atoms of even atomic number have packing fractions well below this curve, and approximate to a branch rising much less steeply to helium +5·4. This suggests that the light atoms of odd atomic number have a common loosely packed, and therefore heavy, outside structure, which is not present in the denser and more stable nuclei of helium, carbon, and oxygen.

Linnean Society, May 12.—James **Groves**: Charophyta from Madagascar. Early in 1924, Mr. T. B. Blow made an extensive collection of Charophyta from Madagascar. Seven species of Chara were collected, all belonging to known and fairly distinct types. The representatives of the more intricate genus Nitella have proved difficult to discriminate. The new species described are probably mostly endemic to the island. None of the smaller genera is represented. —T. B. **Blow**: Observations on the alleged larvicidal qualities of Charophyta. Species of Charophyta were cultivated in large glass jars and mosquito larvæ were introduced; the effect of the glucoside from dried *Chara zeylanica* was also tried. In every case the larvæ enjoyed a vigorous life, and a large percentage attained to the winged condition.—T. A. **Sprague** and V. S. **Summerhayes**: The geographical distribution of some Santalaceæ. An investigation into the taxonomic status of the Australasian genus commonly known as Fusanus "R. Br." (non Murr.) led to its being divided into two genera—Eucarya T. L. Mitch. (Australia) and Mida A. Cunn. (New Zealand). It was then discovered that the now extinct *Santalum fernandezianum* F. Phil. (Juan Fernandez) should be transferred to the genus Mida. The distribution of Mida is of exceptional interest, one species occurring in New Zealand (North Island) and the other in Juan Fernandez. If it is monophyletic, the distribution may be interpreted as an extreme example of the well-known New Zealand-Chile (or South America) type, which is generally explained as the result of northward migration from the Antarctic continent. Possibly Mida had a diphyletic origin from Santalum, the ancestors of the New Zealand species having migrated from Australia and those of the Juan Fernandez species from Hawaii. The geographical distribution of *Santalum album* affords a problem of a different nature. *S. album* is known only from (1) southern India and (2) the eastern part of the Malay Archipelago, from eastern Java to Timor. This discontinuity may conceivably be due to extirpation by disease in the intervening area. A second hypothesis—that the species was introduced into India from eastern Malaya —is brought forward by Mr. C. E. C. Fischer.

CAMBRIDGE.

Philosophical Society, May 2.—E. G. **Dymond**: Excitation by high velocity electrons. With the velocity of the exciting electrons ranging from 100 volts to 1800 volts, the lines of the par- and ortho-helium series are reduced in intensity with increasing velocity, in roughly the same manner, and the intensities of the two series are of the same order of magnitude. This is in complete disagreement with work on the efficiency of excitation of the two series, made by an electron impact method. Excitation by fast electrons seems to proceed in two stages, the first being the excitation of the atom to any of a continuous series of states, and the second, the falling back into one of the normal series with emission of continuous radiation. The electron may lose any amount of energy greater than the lowest excitation energy. The process is similar to that put forward by Kramers and Heisenberg to explain the scattering of light.—A. **Caress**: Synthesis of ammonia by electrons.—P. A. **Taylor**: The light intensity of the calcium chromosphere. Prof. Milne's theory of the equilibrium of the calcium chromosphere is modified to take account of the curvature of the sun and the proper inverse square law of gravity. A method is developed for the calculation of the intensity of H and K radiation as observed in a telescope pointed near the limb of the sun in terms of the height above the limb of the point towards which the telescope is directed. Comparison of the calculated intensities with eclipse observations indicates that the co-efficient of partial support is probably of order of magnitude 10^{-4}.—F. H. **Constable**: On the effect of the addition of successive small quantities of poisonous substances on the velocity of catalytic gas reactions in closed vessels. A homogeneous distribution of centres of activity is more sensitive to the initial small quantities of poison than to the increments following. The experimental results of Pease and Stewart are used to show that there is a considerable change in the mean life of the carbon monoxide molecule on the most active, and least active, centres in the hydrogenation of ethylene by a reduced copper catalyst, showing that a distribution of centres does exist in this case, and that once the most active centres are poisoned the catalyst behaves as if it were homogeneous.—H. **Jeffreys**: Wave propagation in strings with continuous and concentrated loads. The nature of wave-propagation in a light string loaded with equal particles at regular intervals is discussed. There is no phenomenon similar to conduction of heat, but only dispersion. It appears probable, however, that irregularity of structure, if any, would introduce conduction.—S. **Goldstein**: On Mathieu functions.—M. E. **Grimshaw**: A case of distinction between Fourier integrals and Fourier series.

DUBLIN.

Royal Dublin Society, May 24.—Report of the Irish Radium Committee for the year 1926. Details are given of the treatment of more than two hundred cases with radium emanation supplied by the committee during the year.—P. **O'Connor**: A universal growth inhibiter in living tissue. The fluids of each species of plant or animal contain a simple diffusible substance of a specific character which is toxic to the protoplasm of all other species. This substance is not destroyed by boiling.—W. H. **Fordham**: The Eötvös torsion balance and vertical magnetometer.

EDINBURGH.

Royal Society, June 6.—Ethel D. **Currie**: Jurassic and Eocene Echinoidea from Somaliland. The collection, which belongs to the British Museum, comprises 14 Jurassic and 18 Eocene species. The Jurassic specimens, which are apparently all Bathonian, are from Bihendula and Ida Kabeitah in north central Somaliland and Biyo Dader in western Somaliland. New species of Acrosalenia and Echinodiadema are described and also a new genus, Farquharsonia, which has certain resemblances to Archæodiadema, Hemipedina, and Orthopsis. The fauna is European in affinities and implies a connexion between the Somaliland sea and the European sea of that time. The Eocene echinoids, collected in north central and eastern Somaliland, are from a lower cherty limestone and an upper white chalky limestone. The 11 species from the cherty limestone include a new species of Pericosmus, and are Lower Eocene. The 7 species from the upper white limestone, which include a new Linthia and a new Opissaster, are Middle Eocene. The author correlates the lower cherty and upper chalky limestone with the Auradli and Allahkajid limestones of Somaliland, thus reversing the supposed order of these two limestones.—A. **Calder**: A case of partial sex-transformation in cattle. A cow, following cystic degeneration of both ovaries, assumed the secondary sexual characteristics of the male.—W. O. **Kermack** and W. T. H. **Williamson**: The stability of suspensions (ii.). The rate of sedimentation of kaolin suspensions containing colloidal silicon dioxide. When kaolin suspensions contain a small quantity of colloidal silicon dioxide, the normal effect is one of weak protection, but under certain conditions an abnormally rapid rate of sedimentation occurs owing to the precipitation of a film of insoluble material over the surface of the particles. Under other conditions the abnormal rate of sedimentation, due to the formation of a film of this kind in the absence of silicon dioxide, disappears in its presence.—Amy M. **Fleming**: The peripheral innervation of the uterus. The work is a study of the part played in directing the activities of the uterus by the nerve structures which lie outside the central nervous system. It involved an anatomical study of the distribution of these nerve structures in lower animals and a physiological and pharmacological investigation of their mode of action. No evidence was obtained that the ganglia lying beside the cervix have any direct action, and the interaction of antagonistic drugs, while indicating the evidence of an intra-uterine control, failed to afford clear evidence of separate augmentory and inhibitory mechanisms.—W. L. **Ferrar**: On the consistency of cardinal function interpolation. A function $f(x)$ is obtained by interpolating from a set of values at $x=n$. The values $f(n-\lambda)$ are used to build up a new interpolation function $\phi(x)$. Under appropriate conditions $\phi(x)=f(x)$. The work is related to Titchmarsh's series inversion formulæ.—W. H. **Lang**: Contributions to the study of the Old Red Sandstone flora of Scotland. (vi.) On *Zosterophyllum Myretonianum*, Penh., and some other plant remains from the Carmyllie Beds of the Lower Old Red Sandstone; (vii.) On a specimen of Pseudosporochnus from the Stromness Beds. Zosterophyllum is characterised by peculiar branchings with a backwardly directed division, giving the appearance of an anastomosis of two parallel stems, and axes with radially arranged, stalked, reniform appendages. The appendages suggests that they may be rather flat sporangia, but no spores have been demonstrated. The plant had a thick cuticle and an epidermis, possibly with stomata. There is a central vascular strand, composed of tracheides with annular thickening bands, traversing the linear axes. Zosterophyllum is the most ancient vascular plant known from British rocks. The indications are that it can be placed in the Rhyniaceæ. Certain branched linear axes of a wholly different structure are described. Linear spore-masses are enclosed in some cases by an investment of this construction. A specimen recently added to the Stromness Museum provides a record of the occurrence of *Pseudosporochnus Krejčii*, known from the Middle Devonian of central Europe, in the Middle Old Red Sandstone of Scotland.—Sir Thomas **Muir**: The theory of orthogonants and latent roots from 1881 to 1918.

PARIS.

Academy of Sciences, May 16.—The president announced the deaths of Gustave André and of M. Tschermak.—A. **Lacroix** and F. **Blondel**: The existence in the south of Annam of a peperite resulting from the intrusion of a basalt into a diatomaceous sediment. There are two current views as to the origin of peperites, one (Julien) regarding them as formed by materials projected from basaltic volcanoes falling into lakes and cemented by calcite, the other (A. Michel-Levy) as resulting from the intrusion of a basaltic magma into limestone deposits. A detailed study of the Annam peperites is in agreement with the latter view.—Maurice **Hamy**: An empirical rule concerning the magnification of a telescope. A proof of the empirical rule that twice the aperture of the objective measured in millimetres gives the maximum useful magnification.—A. **Bigot**: The conditions of deposit of the upper Bathonian in the region of Caen.—Henry F. Osborn was elected *correspondant* for the section of mineralogy.—L. **Leau**: Method of recurrence or of complete induction applicable to space.—A. **Kovanko**: Suites of functions of class 1.—Louis **Breguet**: The maximum flying distances possible without descent and the transport capacity of aeroplanes of the future on long flights.—Thadée **Peczalski**: The action of salts on metals. The phenomena described explain various facts observed in the thermo-ionic emission of incandescent metals covered with a layer of salts, especially the known fragility after long heating and the increase of the electronic emission.—F. **Bedeau** and J. de **Mare**: The direct standardisation of a wavemeter as a function of the harmonics of a tuning-fork.—St. **Procopiu**: The influence of mechanical actions and of alternating currents on the discontinuities of the magnetisation of iron.—D. **Chalonge** and M. **Lambrey**: The structure of the ultra-violet absorption band of ozone.—G. **Colange**: The influence of temperature on photographic impressions. Researches on the optical properties of the upper atmosphere necessitated a knowledge of the influence of low temperatures on photographic plates. Experiments have been carried out on the law relating photographic density and temperature between 15° C. and −60° C.

The results already obtained are sufficient to show the necessity of working at a constant temperature when making measurements of photographic photometry. A temperature variation of 5° C. introduces an error of $\frac{1}{15}$ in the comparison of the intensities of two sources of light.—A. Grumbach: Photovoltaic elements containing glycerol.—Mlle. Suzanne Veil: The magnetic behaviour of the modified hydroxides in the presence of hydrogen peroxide. From the observations given both from the magnetic and chemical point of view, treatment with warm water appears to paralyse the activity of nickel hydroxide. Experiments with ferric hydroxide lead to similar conclusions.—J. Cournot, J. Bary, and E. Perot: Coating aluminium, magnesium, light alloys, and ultralight alloys.—J. B. Fournier and Fritsch-Lang: The inalterability of commercial iron, copper, and zinc by liquid hydrogen sulphide. These metals are unchanged by prolonged immersion in liquid hydrogen sulphide and show no trace of corrosion or alteration.—Pariselle and Laude: The manganese hydrate carried down by alumina from an ammoniacal solution.—Albert Kirrman: The ethylenic organomagnesium compounds.—Ch. Courtot and G. Vignati: Researches in the fluorene series.—P. Blanchet: A new layer carrying many fossils of the intra-Alpine Tithonic.—J. MacLaughlin: Measurements of the large ions at Paris. After discovering the large ions, Langevin put forward a theory concerning them of great importance in the physics of the earth. Two series of measurements of the large ions, carried out at Paris since 1925, confirm generally the views of Langevin. The present paper gives some of the first results of these measurements.—Malmgrön and Běhounek: Measurements of the electrical conductivity of the atmosphere in the region of the North Pole. An account of experiments carried out during the voyage of the dirigible *Norge* from Kingsbay (Spitsbergen) to Teller (Alaska) in the course of the Amundsen-Ellsworth-Nobile polar expedition.—E. Chemin: The development of the spores and the parasitism of *Harveyella mirabilis*.—A. Guilliermond: The cytology and sexuality of *Spermophthora Gossypii*.—St. Karasiewicz: The influence of sodium carbonate and calcium chloride on the acidity of the juice of *Zea Mais*.—L. Maume and J. Dulac: The variation of antitoxic power as a function of ionisation.—René Souèges: The embryogeny of the Leguminoseæ. The last stages of the development of the embryo in *Trifolium minus*.—Maurice Fontaine: The influence of high pressures on the imbibition of the tissues.—Ch. Oberling: The existence of a neuro-muscular *housse* at the level of the glomerular arteries in man.—E. Lacroix: The texture of the shell of *Textularia sagittula*.—P. Nottin: The hydrolysis of starch by sulphuric acid. The experimental results given accord best with the view that sulphuric acid directly decomposes the amylaceous material into several products, glucose, maltose, other reducing substances and non-reducing glucides. The theory of successive reactions passing through a series of intermediate products is not confirmed.—Marc Romieu: A new histochemical reaction for the lecithines. The iodophil reaction. Lecithin gives a strong brown coloration when treated with a solution of iodine in potassium iodide. This resembles the brown colour produced by glycogen. It is probable that glycogen and lecithin may have been confused in earlier work.—L. Meunier, P. Chambard, and H. Comte: The pancreatic digestion of wool.—E. Wollman and Achille Urbain: Bacteriophagy and filtrable tumours. The fixation reaction in the Rous sarcoma.—C. Levaditi and A. Klarenbeek: The prophylaxy of the trypanosomiases by ingestion of moranyl (309 Fourneau or 205 Bayer). Moranyl administered to the rabbit *per os*, exercises a profound and lasting prophylactic action with regard to *Trypanosoma Nagana*. Comparative traits made with *T. gambiense* have furnished analogous results.

SYDNEY.

Linnean Society of New South Wales, Mar. 30.—E. W. Ferguson: Medical and veterinary entomology in Australia (Presidential address). Only certain groups of insects are concerned in the transmission of disease, insects whose life-history comes into close association with man or animals. These insects nearly all belong to the orders Diptera, Siphonaptera, Hemiptera, and Anoplura. (*a*) Diptera (Flies). The mosquitoes carry in Australia three distinct diseases, malaria, dengue fever, and filariasis. Tabanidae: no disease has been definitely traced to this family, but owing to their biting habits they are suspect. Muscidae: the common house-fly is responsible for the spread of typhoid, infantile diarrhœa, and dysentery. All flies are not enemies, for many are useful in destroying other insects. (*b*) Siphonaptera (Fleas). The Indian rat flea, an introduced species, is the vector of plague from rat to rat and from rat to man. The stickfast flea has been the cause of economic loss in poultry in Western Australia. (*c*) Hemiptera (Bugs). The common bed bug has been introduced but is not known to carry any disease in Australia, which is fortunately free from other blood-sucking species. (*d*) Anoplura (Lice). The three louse-borne infections of man do not now exist in Australia. Hymenoptera (bees, wasps, and ants) though not disease-carrying insects, are of interest from two points of view: (1) many will attack human beings, inflicting severe stings, and (2) several are parasitic on flies of economic importance.—J. R. Malloch: Notes on Australian Diptera. No. x. A new subgenus of Sapromyza is described, and also new species of Mycodrosophila (1), Leucophenga (1), Drosophila (6), Gitonides (1), Desmomelopa (1), Sapromyza (5), Homoneura (3), and Tapeigaster (1).—Miss May M. Williams: The anatomy of *Cheilanthes vellea*. *Cheilanthes vellea* is one of the few xerophytic ferns. The stem stele is a dictyostele. The petiolar stele, as it leaves the stem stele, is a simple adaxially curved anarch structure, but later three protoxylem groups appear. The pinnule has a reduced lacunar system, but a well-developed palisade. The stomata are confined to the lower surface of the pinnule and are protected by the inrolled margin of the pinnule together with a covering of hairs which grow out from the lower epidermis. The root is diarch. The apices of stem, leaf and root, and also the development of the sporangia, conform with those typical for leptosporangiate ferns. The sori are superficial and continuous, with a false indusium which is simply the inrolled margin of the pinnule. The number of spores does not exceed twenty.—John Mitchell: A new Deltopecten from the Illawarra district, N.S.W. The new species resembles *D. obliquatus*. It occurs in the Upper Marine beds, Permo-Carboniferous.—John Mitchell: The fossil Estheriæ of Australia. Part I. Only two species of Estheriæ have previously been recorded from Australia, namely, *E. Coghlani* Cox from Sydney, and *E. mangaliensis* Eth. Junr. from Ipswich. Eleven new species are described, and a new name is given to the species hitherto recorded as *E. mangaliensis*. These forms range back to the Upper Permian, when the species were of larger size than those obtained from the later Triassic formations.—G. D. Osborne: The geology of the country betwen Lamb's Valley and the Paterson River. The main portion of the area consists of a somewhat dissected plateau.—

C. Barnard: Note on a dicotyledonous fossil wood from Ulladulla, N.S.W. The specimen was obtained from the 'Silica' beds (Lower Tertiary) at Bannister Head, near Ulladulla, and is a piece of silicified wood. In structure the wood is that of a typical dicotyledon, and shows a very close agreement with that of the Saxifragaceæ, in which it is tentatively placed.—C. T. Musson and the late J. J. Fletcher: On a case of natural hybridism in the genus Grevillea (Proteaceæ). The flora of the higher portion of the Blue Mountains includes two species, *G. laurifolia* Sieb. and *G. acanthifolia* A.C., the plants of which differ markedly in many respects. Though belonging to different plant associations they frequently grow quite near each other under conditions that are often ideal for tempting birds to pass directly from the flowers of one species to those of the other. When these conditions prevail, certain rare and little known forms possessing intermediate characters are sometimes found.

Official Publications Received.

BRITISH.

British Museum (Natural History). Picture Postcards. Set E49: Mimicry in Insects, Series No. 1. 5 cards in colour. 1*s*. Set E50: Mimicry in Insects, Series No. 2. 5 cards in colour. 1*s*. (London: British Museum (Natural History).)

Experimental Researches and Reports published by the Department of Glass Technology, the University, Sheffield. Vol. 9, 1926. Pp. iii+324. (Sheffield.)

Transactions of the Royal Society of Edinburgh. Vol. 55, Part 2, No. 12: The Structure of the Disturbed Deposits of Møens Klint, Denmark. By Dr. George Slater. Pp. 289-302+1 plate. 2*s*. Vol. 55, Part 2, No. 13: The Disturbed Glacial Deposits in the neighbourhood of Løustrup, near Hjørring, North Denmark. By Dr. George Slater. Pp. 303-305+2 plates. 2*s*. 6*d*. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.)

Journal of the Institute of Actuaries Students' Society. Vol. 3, No. 1. Pp. 72. (London: C. and E. Layton.) 3*s*.

The Opening of the Safety in Mines Research Station, Buxton, by the Viscount Chelmsford, 14th June 1927. Pp. 4+12 plates+32. (London: Safety in Mines Research Board.)

The Kent Incorporated Society for Promoting Experiments in Horticulture. Annual Report (Thirteenth Year) 1925. 2: Supplement. East Malling Research Station. Pp. 160+20 plates. (East Malling.) 5*s*. 6*d*.

Discovery Expedition. First Annual Report, 1926. Pp. 10+3 plates. (London: H.M. Stationery Office.) 1*s*. 6*d*. net.

Norman Lockyer Observatory. Director's Annual Report, April 1, 1926–March 31, 1927. Pp. 8. (Sidmouth.)

The Official Guide to Twickenham. Fourth edition. Issued by Authority of the Twickenham Corporation and the Twickenham and St. Margaret's Chamber of Commerce. Pp. 72. (London and Cheltenham: Ed. J. Burrow and Co., Ltd.)

Annual Report of the Calcutta School of Tropical Medicine, Institute of Hygiene and the Carmichael Hospital for Tropical Diseases, 1926; also a Brief History of the School and a Report for the Years 1920–1925. Pp. vi+152+27 plates. (Calcutta: Bengal Government Press.)

Memoirs of the Queensland Museum. Vol. 9, Part 1, April 28th. Pp. 126+17 plates. (Brisbane: Anthony James Cumming.)

Review of Agricultural Operations in India, 1925–26. By Dr. D. Clouston. Pp. v+152+10 plates. (Calcutta: Government of India Central Publications Branch.) 2.6 rupees; 4*s*. 3*d*.

Union of South Africa: Department of Agriculture. Bulletin No. 12: The Financial Side of Dairy Farming. By E. W. Sampson. Parts 1-5. Pp. 43. 6*d*. Bulletin No. 15: A Simple and Successful Septic Tank. By E. J. Van Meerten. Pp. 11. (Pretoria: Government Printing and Stationery Office.)

The Ross Institute and Hospital for Tropical Diseases (Incorporated), Putney Heath, London, S.W.15. Annual Report and Accounts for 1926. Pp. 36. (London.)

Malaria-Control in Malaya and Assam: a Visit of Inspection, 1926-27. By Sir Ronald Ross. Pp. 31. (London: Ross Institute and Hospital for Tropical Diseases.)

Empire Cotton Growing Corporation. Report of the Sixth Annual General Meeting. Pp. 18. (London.)

The Journal of the Institution of Electrical Engineers. Edited by P. F. Rowell. Vol. 65, No. 366, June. Pp. 553-652+xxx. (London: E. and F. N. Spon, Ltd.) 10*s*. 6*d*.

Quarterly Journal of the Royal Meteorological Society. Vol. 53, No. 222, April. Pp. 97-200. 7*s*. 6*d*. Supplement to Vol. 53: The Meteorology of Solar Eclipses. By E. W. Barlow. Pp. 24. 2*s*. 6*d*. (London: Edward Stanford, Ltd.)

British Museum (Natural History). Picture Postcards. Set F18: British Orchids, Series No. 3. 5 cards in colour. 1*s*. Set F19: British Orchids, Series No. 4. 5 cards in colour. 1*s*. Set F20: British Orchids, Series No. 5. 5 cards in colour. 1*s*. Set F21: British Orchids, Series No. 6. 5 cards in colour. 1*s*. (London: British Museum (Natural History).)

Journal of the Royal Microscopical Society. Series 3, Vol. 47, Part 2, June. Pp. 14+97-207. (London.) 10*s*. net.

Natural Science in Adult Education. Paper No. 8 of the Adult Education Committee. Pp. vi+54. (London: H.M. Stationery Office.) 6*d*. net.

Committee on Bird Sanctuaries, Royal Parks, England. Report for 1926. Pp. 15. (London: H.M. Office of Works.)

FOREIGN.

U.S. Department of Agriculture. Farmers' Bulletin No. 1521: Propagation of Game Birds. By W. L. McAtee. Pp. ii+57. (Washington, D.C.: Government Printing Office.) 10 cents.

Department of Commerce: U.S. Coast and Geodetic Survey. Serial No. 376: Geodetic Level and Rod. By D. L. Parkhurst. (Special Publication No. 129.) Pp. 12. (Washington, D.C.: Government Printing Office.)

Proceedings of the American Academy of Arts and Sciences. Vol. 62, No. 3: The Ants of the Canary Islands. By William Morton Wheeler. Pp. 93-120+3 plates. 75 cents. Vol. 62, No. 4: The Ants of Lord Howe Island and Norfolk Island. By William Morton Wheeler. Pp. 121-153. 50 cents. (Boston, Mass.)

Ministry of Public Works, Egypt: Physical Department. Meteorological Report for the year 1921. Pp. xv+162. (Cairo: Government Publications Office.) 40 P.T.

Statens Meteorologisk-Hydrografiska Anstalt. Årsbok, 8, 1926. ii: Nederbörden i Sverige. Pp. 159. (Stockholm.) 5 kr.

CATALOGUES.

Planetable Surveying Equipment. Pp. 12. (London: Cooke, Troughton and Sims, Ltd.)

Mathematical Models according to the Collection of Messrs. Weiner and Treutlein. Pp. 20. (Manchester and London: G. Cussons, Ltd.)

Clinical Pathology and the Use of Stains: with Price List of Standard Microscopic Stains. Second Impression. Pp. 16. (London: The British Drug Houses, Ltd.)

Diary of Societies.

MONDAY, JUNE 27.

ROYAL IRISH ACADEMY, at 4.15.

TUESDAY, JUNE 28.

ROYAL DUBLIN SOCIETY, at 4.15.—J. Wilson: Lord Morton's Quagga-Horse Hybrid: Was it a Hybrid?—J. Reilly and G. Pyne: A Modified Micro-method for Molecular Weight Determination.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—Prof. V. Gordon Childe: The Ægean and the Danube Valley in the Second Millennium B.C.

WEDNESDAY, JUNE 29.

INSTITUTION OF MINING ENGINEERS (in Lecture Theatre of the North of England Institute of Mining and Mechanical Engineers, Newcastle-upon-Tyne), at 10.30 A.M.—G. Raw: Notes on the Overhead Koepe Winding Plant at the Murton Colliery of the South Hetton Coal Company, Ltd.—K. C. Appleyard: The Cleaning of Coal by Means of Pneumatic Separators, with Special Reference to the Sutton Steele and Steele Process.—W. D. Lloyd and Dr. J. N. Williamson: Experiments on the Reversal of Mine Ventilation.—Prof. H. Briggs, with an Appendix by Dr. J. Morrow: An Attempt at the Rationale of Faulting and Subsidence.—S. Walton-Brown: The Driving of Narrow Places.—J. I. Graham and A. Shaw: The Composition of Firedamp.—The following papers will be submitted for further discussion:—Miners' Nystagmus, Dr. F. Fergus; Miners' Nystagmus, Dr. J. S. Haldane and Dr. T. L. Llewellyn; The Construction of Flame Safety-lamps, Dr. R. V. Wheeler and D. W. Woodhead.

ROYAL SOCIETY OF ARTS (Annual General Meeting), at 4.

THURSDAY, JUNE 30.

ROYAL SOCIETY, at 4.30.—A. V. Hill, K. Furusawa, and J. L. Parkinson: The Dynamics of 'Sprint' Running.—A. V. Hill, K. Furusawa, and J. L. Parkinson: The Energy used in 'Sprint' Running.—T. S. P. Strangeways and Honor B. Fell: A Study of the Direct and Indirect Action of X-Rays upon the Tissues of the Embryonic Fowl (communicated by Sir William Hardy).—R. G. Canti and F. G. Spear: The Effect of Gamma Irradiation on Cell Division in Tissue Culture *in vitro* (communicated by Sir Frederick Andrewes).—And other papers.

RÖNTGEN SOCIETY (at Royal Society of Medicine), at 8.—Sir Humphry Rolleston, Bart.: Protection and Other Radiological Problems (Mackenzie Davidson Memorial Lecture).

INSTITUTION OF MINING ENGINEERS (in Lecture Theatre of the North of England Institute of Mining and Mechanical Engineers, Newcastle-upon-Tyne), at 9.45 A.M.

FRIDAY, JULY 1.

GEOLOGISTS' ASSOCIATION (at University College, Gower Street, W.C.1), at 7.30.—Sir John S. Flett: The Geology of the Edinburgh District (Lecture).

INSTITUTION OF MINING ENGINEERS (at Newcastle-upon-Tyne).

SATURDAY, JULY 2.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS (North-Western District Meeting) (at Town Hall, St. Anne's on Sea), at 10.30 A.M.

PHYSIOLOGICAL SOCIETY (at Oxford).

ROYAL SOCIETY OF MEDICINE (Disease in Children Section) (Provincial Meeting at Royal Alexandra Hospital for Sick Children, Dyke Road, Brighton).

CONFERENCE.

JUNE 30 TO JULY 2.

NATIONAL ASSOCIATION FOR THE PREVENTION OF TUBERCULOSIS (at British Medical Association House, Tavistock Square, W.C.1).