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The British Patent System.

ON a number of occasions in recent years attention has been directed in these columns to the importance of the British patent system from the point of view of scientific men, and we have pointed out that the defects from which it suffers, whether in respect of law or of administrative machinery, ought to receive more serious consideration from the Government of the day than they have until recently obtained. It has therefore been particularly gratifying to note a number of indications that the importance of this branch of the public service is coming to be recognised more adequately. One of the pleasantest of these indications was the conferment, in the birthday honours list, of a knighthood on the Comptroller-General of Patents, Mr. W. S. Jarratt, whose appointment a few years ago gave much satisfaction to those who had been contending that scientific and technical qualifications were essential to the adequate discharge of the Comptroller's duties.

The report recently issued by the British Science Guild on the subject of the reform of the patent system has received general support from the Press and from a large number of interested bodies, but perhaps the most interesting comments yet made upon it are those that have just been issued by the General Council of the Bar, which appointed, some time ago, an extremely strong committee to review the British Science Guild report. The committee included, among others, Sir Duncan Kerly, K.C. (chairman), Mr. James Whitehead, K.C., the Hon. Stafford Cripps, K.C., and Mr. Trevor Watson; the members agree that the report of the British Science Guild "is generally excellent, and that most of its proposals are reasonable and likely to be useful". They then discuss certain of its paragraphs in detail.

The committee agrees strongly that the effect of 'paper anticipations' should be restricted, that remedies against unwarranted threats should be strengthened, and that appeals from the decisions of the Comptroller of Patents should be heard by a special judge in chambers instead of by the Attorney-General or Solicitor-General as at present. The only proposals in respect of which the committee is opposed to the Guild's recommendations are those which would extend the judicial duties of the Comptroller. It thinks that the object of these proposals—namely, the mitigation of the present high cost of patent litigation—would be better achieved by (1) resort to arbitration or (2) agreement between the parties whereby the issues to be

tried in court may be narrowed down. The latter of these alternatives commends itself strongly to common sense, but the former presents difficulties. In a highly technical industry it is often far from easy to find an expert whose interests are entirely independent of those of the parties, and it is very much more difficult to find such an expert possessed of the additional qualification of experience in the construing of patent specifications.

The recent appointment by the Board of Trade of a departmental committee, under the chairmanship of Sir Charles (formerly Lord Justice) Sargant, to consider the subjects dealt with by the British Science Guild's report, has brought the proposals for reform within the realm of practical politics. These proposals have five principal aims: (1) To diminish the grant of invalid patents; (2) to relieve the main patent system of the monopolies for small innovations which may be regarded as useful designs rather than inventions, and are protected in Germany by *Gebrauchsmuster*; (3) to mitigate the evils arising from the high cost of litigation; (4) to render more accessible to the public the information which is in the possession of the Patent Office; and (5) to improve in detail the efficiency of the patent system.

The procedure to be adopted by the Sargant Committee has now been decided, and it appears that evidence will be received from persons having a suitable *locus standi*. It is to be hoped, therefore, that the manufacturers and others whom the subject concerns will make themselves familiar with the proposals which have been put forward, in order that a widely representative body of reasoned opinion may be available to the new committee. It is gratifying to know that many organised bodies have, like the General Council of the Bar, appointed responsible committees to examine the matter from the points of view which they represent, and that at its recent meeting the Council of the British Association resolved to support the recommendations of the British Science Guild.

The growing importance of the patent system is indicated by the statistics disclosed in the Patent Office Report for 1928, which was published on May 31 last. The volume of patent business shows a rapid increase, the number of complete specifications filed during the year, namely, 24,045, being greater by 2648 than that for the previous year. The number of letters dispatched increased from 314,000 in 1927 to 331,000 in 1928, the number of patent specifications sold from 370,808 to 424,028, and the number of applications under the Inter-

national Convention from 6810 to 7971. The amount received from renewal fees increased by only £5767 to a total of £283,252, but somewhat larger increases may be expected under this head as the effect of the War period passes away.

It is remarkable that during the same period the total strength of the staff increased only from 696 to 698, while the strength of the examining staff increased by only 4 to a total of 240. The staffing question is a very grave one, for not only is the work of the Patent Office dangerously in arrear, but also the utmost difficulty is likely to be experienced in obtaining any additional examiners who may be required to implement the recommendations of the Sargant Committee. A competitive examination for technical posts in the Patent Office was held last year and failed to attract candidates: further, the cream of the examining staff is constantly being skimmed away by the offer of more lucrative appointments in industry. The problem of obtaining and keeping properly qualified recruits is one of the most urgent of those which call for early solution. It is not satisfactory that officials who to-day are entrusted with highly confidential information, should to-morrow be working for rival firms in whose employment their knowledge may be embarrassing.

On the other hand, there should be no difficulty in financing considerable improvements in the machinery of the patent system without recourse to the public purse, for the annual surplus of fees over expenditure has reached the very large amount of £147,840 out of a total revenue of £544,740; and to this surplus should properly be added the cost of maintaining the Patent Office Library, which is used by the general public and cannot be regarded as the exclusive concern of patentees. The following table is of interest in this connexion:

Year.	Complete Specifications Filed.	Surplus £.	Strength of Examining Staff.
1924	18,800	75,202	253
1925	19,434	88,540	241
1926	19,948	98,813	238
1927	21,397	112,939	236
1928	24,045	147,840	240

On the whole, it may be said that there is a better prospect now than at any other time during the past twenty-five years of bringing the patent law and machinery up-to-date. The co-operation of all who have serious contributions to make will be needed if full advantage is to be taken of the opportunity which has presented itself.

The Beginnings of Entomology.

Materialien zur Geschichte der Entomologie bis Linné.

Von Dr. F. S. Bodenheimer. Band 1. Pp. x+497+24 Tafeln. (Berlin: W. Junk, 1928.) 2 vols., £6.

ENTOMOLOGY has been called the Cinderella of the sciences. If the study of insects has for long played the part of neglected sister among kindred pursuits, it cannot be denied that of late years it has held a position second to none in respect of its bionomic, economic, and hygienic importance. Entomological history is, however, poor in comprehensive treatises. This is remarked by Dr. Bodenheimer at the outset of the present work; which, though modestly entitled "Materials for the History of Entomology", and stated by him to aim only at a survey, not an exhaustive presentation, is a monument of careful and industrious research, and goes far towards repairing the deficiency to which he directs attention.

The earliest entomology was utilitarian; the production of silk and of wax engaged the attention of the most ancient civilised races, to the exclusion of any matter of biological interest. According to Chinese tradition, silk cultivation, for the sake of clothing and of religious ceremonial, goes back to the Emperor Fu-hsi at the beginning of the third millennium B.C. The secret of silk production was rigidly kept throughout many ages; but within comparatively recent times illustrated works, professedly based on earlier treatises, have been issued by the Chinese, giving details of the whole process. Some interest in natural history is evinced by late editions of the *Erh-ya*, an encyclopædia attributed in its original form to a writer of the sixth century B.C. Recognisable figures of the dung-beetle, wood-boring larvæ, the cicada, mantis, and mole-cricket are reproduced by Dr. Bodenheimer from this work.

To the ancient Egyptians, as to the Chinese, the appeal of entomology was mainly utilitarian; though bees, and possibly wasps, appear as symbols so early as the period of the First Dynasty. A relief from the temple of Ne-user-re (about 2600 B.C.) shows the process of extracting honey from combs after fumigation, of refining, and of sealing it in a permanent receptacle. Representations of butterflies are found among Egyptian wall-paintings, some of which may almost certainly be identified as *Danaïda chrysippus*. Egyptian pharmacology contains recipes in which insects take part, while the "Book of the Dead" has many references to insects. The interest taken in the scarabæus as an emblem of the sun-god is well known; it does not

appear, however, that the Egyptians were acquainted with its metamorphoses. Herodotus in his book about Egypt mentions the use of mosquito curtains.

Little is known of the entomology of Assyria and Babylon, but there is a cuneiform record of the importation into Assyria and acclimatisation of bees for honey and wax; sculptures and seals of these nations present good figures of flies, and of locusts preserved for food. The inhabitants of Palestine were interested in insects chiefly for their useful, noxious, or troublesome qualities. Besides locusts, the raids of which are so vividly described by the prophet Joel, there are references in Isaiah to the ravages of the clothes moth; honey seems to have been known to the Israelites only from wild bees. In later times the Talmud contains natural history items of interest.

It is remarkable that among the earliest relics of European civilisation occurs the symbolising of the soul under the figure of Psyche, or the butterfly. A striking reproduction of a Mycenaean wall-painting is given by Dr. Bodenheimer, in which the death-goddess, walking in a field of asphodel, is surrounded by fluttering butterflies. With Homer we enter upon a new period. His likening of the opposed ranks of Greeks and Trojans to swarming flies, and his similes derived from bees, wasps, cicadas, the gadfly, locusts, show powers of keen observation and poetic insight. A passage in the *Iliad* proves that its author was aware that maggots of carrion were the offspring of the blowfly. In Aristotle we meet the embodiment of Hellenic thoroughness; the principles of classification, the facts of anatomy, physiology, reproduction, metamorphosis, are minutely dealt with by him in relation to insects as to other forms of life. Good natural history notes are to be found in his works; and on all these accounts the philosopher of Stagira well deserves to be known as the father of scientific entomology. Among his successors, Theophrastus has valuable entomological observations, chiefly from the point of view of injury to vegetation, while Dioscorides regarded insects chiefly as ingredients in the *Pharmacopœia*. But the biological interest started by Aristotle was never entirely lost. His facts were incorporated in later treatises; and were amplified by Pliny, the eleventh book of whose "Natural History", devoted to insects, shows him to have been more than a mere compiler. He, says our author, rather than Aristotle, gave the impulse to Gesner and Aldrovandi. But the sober-minded Romans generally went in for utility. The entomology of Cato, Varro, Columella was of the 'economic' variety, and even

Virgil's poetic and imaginative "Georgic" on bees had an ultimately utilitarian object.

With the advent of the Middle Ages the Hellenic love of observation and desire for scientific knowledge underwent a temporary eclipse. Such compilations as were produced tended rather to utilitarianism or to moral teaching. But from the beginning of the twelfth century may be roughly dated a revival of interest in Aristotle, preceded by Arabic influence which began to make itself felt at an even earlier date. Aristotelian science spread into western regions, especially Spain, through Arabs who derived it from Byzantium. A translation of Aristotle's zoological works into Arabic, with a commentary, had been made about A.D. 1000; much advance had also been effected by subsequent Arabic writers. A great name of this period is that of Albertus Magnus (1193-1280), Provincial of the Dominicans and Bishop of Regensburg, whose fine treatise "De Animalibus", with its faithful following of Aristotle, gained him the title of 'Aristotle's Ape'. The book shows evidence of original observation, and contains acute remarks on the relation of structure to function. The somewhat small portion devoted to insects, like the rest, is naturally not devoid of errors; but Dr. Bodenheimer is probably right in asserting that there is no greater biologist than Albertus between Aristotle and Réaumur.

The end of the fifteenth century witnessed the dawn of a new age in art and literature. The discovery of America, the general revival of Greek, the invention of printing and the rise of vernacular literature combined to set in motion a fresh impulse towards learning in general and the cultivation of science in particular which has gone on without a break to the present day. From this time natural science gradually disentangled itself from theological and medicinal limitations. It must be admitted that in the general revival entomology lagged somewhat behind. Its new age can scarcely be said to begin until Aldrovandi published in 1602 his "De Animalibus Insectis" in seven books, the result of fifty years' study, and the first work entirely devoted to entomology. His classification, founded on Aristotle, whose influence was still strong, is in some respects less in accordance with Nature than that of his master. But he remains a true Aristotelian, though a critic of that author's mistakes. His volumes contain excellent figures, especially of Lepidoptera, and also the first illustration of insect anatomy (the silk-gland of *Bombyx mori*).

The English physician Mouffet (1530-1604) carried on and added to the compilations of Gesner and Wotton, of which he had received the drafts

through Thomas Penn. Mouffet's figures of insects, which are mostly independent of Aldrovandi, are quite good. They were not published until 1634. Bacon made observations on insects, but had little or no direct influence on biological science; nor had his younger contemporary Descartes much interest in biology and its problems.

Harvey (1578-1657), who may be called with justice the founder of modern physiology, was the first of modern biologists to include invertebrates in his physiological researches. His wide conception of the 'ovum', which he took to include both larva and pupa, had the unfortunate result of leading to Swammerdam's theory of 'evolution', 'emboitement', or preformation of the imago in the egg. Before the close of the seventeenth century Redi had disproved by experiment the theory of spontaneous generation which had held the field since Aristotle; Malpighi had published under the auspices of the Royal Society his elaborate work on the anatomy of the silkworm; and Swammerdam had executed the admirable insect dissections illustrated in his great "Bibel der Natur". A little later the pioneer microscopists Leeuwenhoek in Holland and Hooke in England had investigated and figured the compound eyes of insects, the histology of insect muscle, the structure and action of insect wings, and parthenogenesis in aphids. Goedart, a painter who took to entomology, and Lister, physician to Queen Anne, occupied themselves with the question of insect parasites. Lister was the first to establish the true life-history of the parasitic wasps.

In 1705 Madame Merian published her finely illustrated work on the insects of Surinam. A little later came Vallisnieri, who, in spite of his dictum that "Observation is better than Speculation", firmly supported Swammerdam's doctrine of 'evolution'. But the chief name for entomology at this period until the advent of Linnæus is certainly that of the versatile Réaumur, whose volumes of "Mémoires" contain most valuable studies in insect anatomy and physiology. The succession was carried on by Roesel and Bonnet; and before the end of the eighteenth century the binary system of nomenclature, towards which the previous work of Ray and Willughby had tended, was, in the hands of Linnæus, to make identification for the first time generally possible.

At this point the present instalment of Dr. Bodenheimer's exhaustive treatise is brought to a conclusion, leaving Linnæus and his successors to be dealt with in a future volume. Much commendation is due to the author for the way in which he has carried out his laborious undertaking, of which the

present article may be taken as virtually a summary. The book is well produced and well illustrated. The only printers' errors that have come to notice are a misplacement of reference letters on Plate VII., and "Bohart" for Bobart (the Keeper of the Botanic Garden at Oxford) on p. 491.

F. A. D.

Modern Cosmogony.

- (1) *Astronomy and Cosmogony*. By Sir James H. Jeans. Second edition. Pp. x+428. (Cambridge: At the University Press, 1929.) 31s. 6d. net.
- (2) *Eos: or The Wider Aspects of Cosmogony*. By Sir James Jeans. (To-day and To-morrow Series.) Pp. 88+6 plates. (London: Kegan Paul and Co., Ltd.; New York: E. P. Dutton and Co., 1928.) 2s. 6d. net.
- (3) *Cosmology: a Text for Colleges*. By Prof. J. A. McWilliams. Pp. x+243. (New York: The Macmillan Co., 1928.) 10s. 6d. net.

(1) **T**HE publication, within a few months, of a second edition of "Astronomy and Cosmogony", replete with abstruse mathematical formulæ and priced at 31s. 6d., is a noteworthy event on which Sir James Jeans may well be congratulated. The demand for the book is a striking tribute to the clearness and wide appeal of the author's manner of exposition, as well as to the extent of his reputation as an authority on questions of cosmogony, for the present boom in matters astronomical, especially of the more speculative type, is by no means a sufficient explanation. Naturally, within so short a time, no need has arisen for drastic alteration, although there has been more modification than the mere correction of minor errors and misprints. The book has been expanded by references to various observational and theoretical results which have appeared since the first edition was written, and space has been allotted more liberally to certain problems and investigations "which", says the author, "friendly critics thought I had dismissed too briefly in the original book". We note that among the problems and investigations thus referred to are some of those mentioned in the review of the first edition which appeared in NATURE of Aug. 4, 1928. The new edition contains eight pages more than the old. This is due almost entirely to additional matter, the amount of modification of the original text being negligible. There is nothing that calls for special comment. The former point of view is maintained without

change, and the prospect it commands, though scanned in slightly greater detail in certain directions, preserves the same aspect. Sir James Jeans's methods, as well as his conclusions, are highly original, and whatever may be thought of their validity, are singularly acute and penetrating. It is too early yet to form an estimate of their final value, but we may say with confidence that no consideration of the subjects with which they deal can afford to neglect so important a contribution.

(2) It was a happy idea of the editors of the "To-day and To-morrow" series to pay some attention to Yesterday, and the choice of Sir James Jeans as historian could scarcely have been improved upon. Readers of NATURE are familiar with the general character of the cosmogony which, during recent years, he has been engaged in constructing, and they will find here a clear and summary account of it in its most up-to-date form. The book is based on the Trueman Wood lecture delivered before the Royal Society of Arts on Mar. 7, 1928, and a lecture on "Recent Developments of Cosmical Physics" at the University of London on Nov. 9, 1926. Both these lectures were reproduced in NATURE shortly after delivery. The present volume, therefore, is to be recommended on account of its compactness rather than its novelty, and also for the illustrations of nebulae and star clouds, of which six are excellently reproduced. The book is less an argument than a description, leading, as all scientific work does, to more questions than it answers. For the reasons which have led to the conclusions presented, the inquirer must be referred to Sir James Jeans's larger work on "Astronomy and Cosmogony". It is necessary to say this because, taken alone, some of the statements appear to wear an air of confidence unjustified by the grounds on which they are based. Whatever may be the reader's reaction to the views expressed, however, the reading of the book will be accompanied by unalloyed pleasure. Sir James Jeans remarks that astronomy is a subject on which "one could hardly be prosaic if one tried". We have received many proofs that this is an under-estimate of human ingenuity, but if the remark be restricted to the present author we can give it whole-hearted assent.

(3) Prof. McWilliams's book is described as "a text for colleges". Cosmology is not a subject with which we are familiar in college curricula, but it is clear from the treatment that the book is intended mainly for Roman Catholics, for the viewpoint of the Catholic Church is taken through-

out. It is impossible, therefore, for one who does not share that viewpoint to treat the discussion with much sympathy. It does not appear to us, for example, that the author presents the most significant feature of the transition from Ptolemy to Copernicus in the following brief (and only) reference to the event: "In the sixteenth century, Copernicus, a cleric and physician as well as astronomer, got out the system that is accepted to-day: thus was fulfilled the conjecture of St. Thomas that some day another system might supplant the Ptolemaic." Apart from matters of prejudice, however, the reasoning is not of the kind which is likely to convince the scientific mind. What, for example, are we to make of the following argument to prove that "the assertion that the material universe is actually infinite in extent is contradictory in itself"?—"In any *extension* we can conceive a part to be subtracted, annihilated, or removed from consideration. Now the remainder is either finite or infinite. If finite, then that finite remainder plus the finite part removed equaled infinity; which is a contradiction. If the remainder be infinite, then the void left by the part subtracted constitutes a limit to the infinite remainder; and by restoring the part we add to the actually infinite: all of which is contradictory." We can only say that those to whom such arguments appeal will find here a systematically classified text-book, each chapter of which contains a concisely worded thesis, arguments in favour thereof, a statement of possible objections with the replies thereto, and a list of references to other relevant literature. The book is clearly written and well produced.

H. D.

Hurricanes in the West Indies.

Los Huracanes en las Antillas. Por Rev. Simón Sarasola, S.J. Segunda edición, aumentada con el Apéndice: Génesis y Evolución del Huracán de 20 de Octubre de 1926 y Catálogo de Ciclones en la Isla de Cuba de 1865 a 1926, por Rev. Gutiérrez Lanza, S.J. Pp. xv + 254. (Madrid: Bruno del Amo; Habana: "La Moderna Poesía", 1928.)

THE early appearance of a second edition of this useful treatise on the hurricanes of the West Indies by the Director of the Colombian Observatory at Bogota suggests that the work has already been found serviceable in that part of the globe.

It appears that there is a suggestion of an English translation before long, which seems a highly desirable proposition in view of the number of British

colonies in the West Indies. Incidentally, such a translation would very considerably lighten the labours of an English reviewer who now asks the author's indulgence for any shortcomings resulting from unfamiliarity with Spanish.

The treatise opens with a general account of the circulation of the atmosphere and the character of cyclones, with a discussion of the different kinds of clouds, illustrated by some good photographs, among which is a thundery cumulo-nimbus of superb proportions. It then goes on to the proper subject matter more specifically, dealing with the signs of approaching hurricanes, differences in their intensity and in the frequencies of the tracks they pursue in different months of the year. It is shown how far European methods of forecasting storms based upon the principles of Bjerknes, Guilbert, Vercelli, and others are locally applicable, and a considerable amount of space is given to the theory of tropical revolving storms. The concluding part of the book discusses the correlation between hurricanes and sunspots and other indices of solar activity; but, as usual in this field, without any very decisive results.

Tropical cyclones appear to make up for their greater violence by being distinctly less frequent than those of extra-tropical latitudes, although a comparison is rendered difficult since there is no evidence of uniformity in the criteria adopted for defining a West Indies hurricane and a European gale. A catalogue at the end of the volume shows that in the single island of Cuba, eighty-five 'hurricanes' of varying intensities occurred during the sixty-two years, 1865-1926, giving an average of one or two a year, whereas the number of 'general gales' in the British Isles average about ten yearly.

As in all other regions devastated by tropical storms, the West Indies suffer most in the later summer and autumn months. Thus, out of 239 cyclones of varying intensities recorded in the West Indies between 1887 and 1923, May had 1, June 16, July 17, August 39, September 78, October 71, November 15, and December 7.

The author presents a very impartial and open-minded account of the vexed question of cyclonic genesis, and states his own views on the subject. We should like to suggest that he might here have effected to advantage some unification of ideas. Whereas he favours the view that the tropical disturbances arise from the encounter of opposing currents, he does not take kindly to Sir Napier Shaw's suggestion that polar front principles may be applicable in this region. Now hurricanes in the West Indies, as in other tropical regions, occur

just at the time of year when the migrating trade wind system, having reached its farthest position across the equator, is likely to be more heavily charged with moisture than the other trade system which it encounters. Hence there is likely to be some kind of 'front' or 'discontinuity' in the trough of relatively low pressure between the interacting trades where the cyclones form, and there is actual evidence that humidity 'fronts' in the doldrums may play a more important part in storm production than thermal fronts, which are so pronounced in temperate latitudes. (See, for example, C. S. Durst, *M. O. Geophys. Mem.*, No. 28; 1926.)

We think it should be better realised by writers on the theory of cyclones that there is nothing to warrant the assumption that these, any more than other natural phenomena, are to be explained in terms of a single cause. There must be various contributing collateral and sequential factors involved in the 'cause of cyclones'.

The appendix gives a vivid narrative of the dreadful cyclone that devastated Cuba in October 1926. The Meteorological Service issued timely warnings, and such measures as were practicable to lessen the number of fatalities were taken in the city of Habana and elsewhere. It is quite clear that cyclones in the West Indies are taken very seriously, as well they might be. A bad storm may take a day or two to pass over a district, may bring 10 to 20 or more inches of rain in twenty-four hours, and wind blowing at the rate of 100 to 150 miles per hour. There can be no question that when the area covered and time occupied by such violence of wind and rain are considered, the tropical cyclone must be regarded as the most formidable type of storm that occurs on this planet, with the possible exception of the great snow-blizzards of colder climates.

L. C. W. B.

Our Bookshelf.

The Normal and Pathological Physiology of Bone: its Problems. By Prof. R. Leriche and Prof. A. Policard. Authorised English Translation by Prof. Sherwood Moore and Prof. J. Albert Key. Pp. 236. (London: Henry Kimpton, 1928.) 21s. net.

"LES problèmes de la physiologie normale et pathologique de l'os" of Leriche and Policard was published in Paris in 1926. The two American doctors to whom we are indebted for this translation plead difficulty in excuse of defects which are indeed evident. There are, however, few obscurities which cannot be resolved without access to the original. The French title is to be preferred to the English, because it modestly

emphasises the 'problems' instead of the physiology. The work is, happily, not physiological. It is incorruptibly biological, and in this its remarkable character lies. "Areas in process of ossification are in reality regions with a sluggish circulation, with difficult interchange. The composition of the blood in the great vessels permits no deduction concerning the chemical behaviour in these areas. That is the weak point of all chemical research up to the present time. The methods are most exact, but that is not true of the object subjected to research. The problem on the whole is badly put. And when well put, the methods are no longer applicable." Bone formation is a succession of phenomena: hæmorrhage, 'differentiation' of connective tissue, œdema, resorption of bone and its deposition in the ossifiable medium present. Each of these phenomena is in itself commonplace. "What is peculiar is their juxtaposition. The essence of the process lies in a vascular congestion acting simultaneously on the connective tissue and a calcified tissue." It is an organic result. The work should be in the hands of every English surgeon, both on account of its extensive practical wisdom, and as an instruction in methods of research. It is a little distressing to see the word 'evolution' so carelessly used. The original conveys a variety of meanings.

The Economics of Rail Transport in Great Britain.

By C. E. R. Sherrington. Vol. 1: *History and Development.* Pp. xii + 283. Vol. 2: *Rates and Service.* Pp. xii + 332. (London: Edward Arnold and Co., 1928.) 12s. 6d. net each vol.

MR. SHERRINGTON'S two volumes are complementary to each other, each containing the same foreword by Sir Guy Granet and the same preface; while the first volume, after a short chapter on the function of transportation, deals with the growth of British railways, their rolling stock, locomotives, tracks, and the regulations which are part of their history, the second volume treats of the organisation and administration of railways, and their relation with the State, the public, and industry. His wide experience as a lecturer on economics and as secretary to the Railway Research Service enables him to write in an impartial yet authoritative manner, and no one interested in railways could fail to appreciate his masterly review. The history of the British railways treats of them in the four groups as we see them to-day; the review of the locomotive development is more general. As to railway administration, the trend is towards a closer study of the internal economy of railway management, and from the second volume the layman can obtain some impression of the complicated nature of the problems involved.

Regarding nationalisation, Mr. Sherrington remarks that "it is hard to visualise in the case of the railways any very great advantage in the change over under present conditions, and it certainly would tend to decrease any desire to improve efficiency"; while in his discussion on

road transport he says, "where ruthless competition for traffic not sufficient to warrant the two systems is taking place, its development should be opposed provided the rail method satisfies public wants, and can be operated more cheaply".

Matriculation Botany: a New School Course. By Mary A. Johnstone. Pp. xii + 324. (London and Toronto: J. M. Dent and Sons, Ltd.; New York: E. P. Dutton and Co., 1928.) 4s. 6d.

IN spite of the number of school text-books of botany already available which cater for the needs of candidates of matriculation standard, teachers of such pupils would be well advised to consider Miss Johnstone's manual. The author thinks that "to a large extent general knowledge of plant life is best acquired through the detailed study of the life-histories of a few specially selected plants", ecology being treated as an integral part of plant study from the beginning. Carrying out this idea, she uses the life-histories of bluebell, lesser celandine, coltsfoot, and wheat as starting-points for a thoroughly sound school course on the physiology, structure, classification, and adaptation to environment of common plants. The section on soils and the notes on common trees are also worthy of special mention.

The skilled teacher is in evidence throughout the book, and the scientific spirit is displayed in such comments as the following: "Because these are advantages they must not be assumed to be the reasons" (why certain trees are deciduous)—an example of the kind of warning of which students of botany are in constant and peculiar need. The 120 illustrations are excellent examples of the line drawings which pupils should be required to make—except in one respect: the scale of magnification or reduction is consistently not stated. It is, indeed, conceivable that unwary young readers might suppose, from an examination of the drawings of soil bacteria, that *Nitrosomonas* is not only of the general shape, but also of the size, of a tadpole! Another small fault, which should be rectified in the reprints which are sure to be called for, is the repeated reference to 'centimetres' of water on p. 259.

Dynamics: a Text-book for the use of the Higher Divisions in Schools and for First Year Students at the Universities. By A. S. Ramsey. Pp. xii + 259. (Cambridge: At the University Press, 1929.) 10s. 6d. net.

THIS book is intended primarily for students in the higher divisions of schools who intend to take an honours course of mathematics at a university, and also for university students preparing for a first honours examination. The text is based upon courses of lectures given to first-year students preparing for the Mathematical Tripos; and it is assumed that readers are already familiar with elementary dynamics, and have an intimate knowledge of the elements of the calculus.

The subject is presented with logical precision, and in a manner which is admirably appropriate to the requirements of those students for whom the

book is intended. An excellent feature is the wide range of worked examples given in each chapter; and to these are added extensive series of exercises taken either from scholarship papers or from Tripos papers. The contents of the chapters include kinematics, kinetics, dynamical problems in two dimensions, harmonic motion, motion under constraint, the law of reaction, impulsive motion, orbits, moments of inertia, energy and momentum, equations of motion, miscellaneous problems, and small oscillations.

Vorlesungen über Elektrizität. Von Prof. A. Eichenwald. Pp. viii + 664. (Berlin: Julius Springer, 1928.) 36 gold marks.

PROF. EICHENWALD'S book has been carefully written and carefully printed; the list of corrections contains only one small item. The text extends to 659 pages and contains 640 diagrams. In Great Britain it would probably have been published in two or three volumes. It is divided into three parts. The first part includes the main principles on which the sciences of electricity and magnetism are founded. The treatment is on the best academic lines, only the main mathematical theorems being given. The second part discusses electrons both in liquids and gases, radioactivity, and electric and magnetic phenomena connected with electrons. In the third part the theory of alternating currents is given, special stress being laid on oscillations and waves. The practical theory of radio communication is also discussed. In the final chapter the theory of Röntgen rays is given, and also the quantum theory. Maxwell's theory is given fairly fully, and some of the theorems of relativity. We notice that the gauss is used for the unit of magnetic force and the maxwell for the unit of magnetic flux. With the notable exception of J instead of I for current, international symbols are used.

The Preparation of Plantation Rubber. By Sidney Morgan. With a Preface and a Chapter on Vulcanisation by Dr. Henry P. Stevens. Second edition. Pp. xvi + 357. (London: Constable and Co., Ltd., 1928.) 21s. net.

INFORMATION gathered at first-hand is here given concerning the production and treatment of rubber, the main theme being its preparation for the market. Mr. Morgan, who has drawn fully upon his extensive researches on such processes as tapping, coagulation, rolling, drying, and smoking, deals with operations in the field and factory, and contributes other sections on machinery and buildings, finished rubber, and general matters; while Dr. Stevens supplies the preface and an outline of the important subject of vulcanisation. Among new matter included in the second edition, attention is directed in particular to bud grafting, cover plants, and manures. The book is well produced, generously illustrated, and full of valuable practical information which cannot fail to be of service to all who are concerned with the growing, curing, packing, manufacture, or general handling of rubber and rubber goods.

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.]

Diffraction of Electrons by a Copper Crystal.

INVESTIGATIONS of the secondary electron characteristics of a poly-crystalline copper surface have shown that maxima and minima appear in the low-voltage region of the total secondary electron curve only after the copper target has been heated at rather critical temperatures (*Phys. Rev.*, 25, 41; 1925). Accompanying the appearance of these maxima and minima, a change has been observed in the angular distribution of the secondary electrons (*Phys. Rev.*, 31, 414; 1928). These considerations, together with others (*Phys. Rev.*, 31, 419; 1928), make it appear that the changes in slope in the low voltage region of the characteristic secondary electron curve of a metal are a function of the orientation of the surface crystals, as are also the directions of the scattered electrons.

It thus appeared advisable to measure the total secondary emission from a single copper crystal under the same conditions as the angular distribution of scattered electrons. This has been done for bombarding potentials between 1 and 150 volts.

The apparatus is constructed of molybdenum to eliminate magnetic effects, and the earth's field is compensated by Helmholtz coils. A special type of electron gun is used which produces a more intense beam of electrons than the usual type for the very low voltages (*J.O.S.A. and R.S.I.*, 15, 290; 1927). The electrons strike at normal incidence the (100) face of the copper crystal which is placed at the centre of a drum. One edge of the drum is made with a slot so that electrons may pass through and into the opening of the double Faraday box, which may be rotated from the plane of the target to within 13° of the incident beam. The target may also be rotated about an axis perpendicular to its face and may be removed into a side tube where it may be heated to red heat by bombardment. The moving parts are operated by magnetic controls which are sufficiently far removed to cause no measurable effect at the target. In taking observations on angular distribution the potential of the inside Faraday box is so adjusted that electrons which have lost more than 1 volt at the target are not permitted to enter.

The total secondary electron curve shows two maxima in the low-voltage region at 3 volts and 10.5 volts respectively. Several marked changes in slope occur in the region between 10.5 volts and 150 volts. Intense electron beams are found to issue from the crystal at potentials for which the above maxima occur and at such potentials as to account for many of the changes in slope between 10.5 and 150 volts. Others may be accounted for by the diffraction beams which would be expected to leave the crystal in the direction of the normal but are outside of the solid angle of observation. It thus appears that the energy levels of the atom at most play only a comparatively small part in the production of sudden changes in slope in this region, since the electron diffraction beams apparently depend only on the positions of the atoms and not on their structure.

Now, a consideration of the wave-length of the electron and the atomic spacing of a copper crystal shows that no electron beams due to diffraction are to

be expected in the very low-voltage region in the solid angle accessible to observation, since the plane grating formula $n\lambda = d \sin \theta$ must be satisfied, and the maximum possible wave-length is obtained for $\sin \theta = 1$. Hence most of the beams in the low-voltage region have no X-ray analogues. They do occupy, however, the approximate positions to be expected by a wave of one-half the length given by the usual expression $\lambda = h/mv$, if a value greater than unity is taken for the refractive index.

Seven sets of electron beams are found to issue from the crystal in the two principal azimuths which are the X-ray analogues and require a refractive index greater than unity. In addition, 8 sets of beams are found in the (100) azimuth which may be accounted for by assuming a wave-length for the electron which is one-half that given by the formula $\lambda = h/mv$. One other weak set in this azimuth is unaccounted for by either of the above relations. In the (111) azimuth 3 sets are accounted for by the one-half λ relation. There are 4 other sets in this azimuth, 3 of which may possibly be accounted for by a one-third λ relation, while one weak set appears anomalous. In addition to the above, the 3-volt beams do not appear accurately in either azimuth and are not reproducible.

Many of the beams are remarkably strong and sharp. In the case of a 70-volt beam, the background scattering in azimuth is found under the best vacuum conditions to be only 4.3 per cent of the maximum intensity of the beam.

The sets of electron beams accounted for by the above relations, with one exception, require a refractive index greater than unity. However, the voltage differences between the electron beams and their X-ray analogues are found in general to increase with the voltage from about 6 or 7 volts for the lowest, to about 30 volts for the highest voltage in the range below 150 volts. The exceptional set, which is very weak, requires a refractive index of about unity with the association chosen.

The electron beams satisfying the $\lambda/2$ relation would also be accounted for by whole λ wave-lengths and twice the atomic spacing for a copper crystal and might thus suggest a surface gas grating having twice the copper spacing. Such plane grating beams have been observed by Davisson and Germer (*Phys. Rev.*, 30, 705; 1927) from the (111) face of a nickel crystal. The beams observed from the copper crystal, however, appear not to be due to gas, for they are space-grating beams and not surface-grating beams. Further, they are observed under the best vacuum conditions, which must be of the order of 10^{-8} mm. mercury, and only a few minutes after the crystal has been heated at red heat, that is, while it is still considerably above room temperature. A temperature effect of these beams has been observed similar to that of the whole λ beams. The beams attain their maximum intensity about one half-hour after heating. The copper crystal has been heated at red heat for several hours so that no pressure is observable on a sensitive McLeod gauge (a distance of 0.75 mm. in the top of the gauge capillary corresponds to 10^{-6} mm. mercury), while the crystal is at red heat.

If the possibility of an effect due to gas is ruled out, it appears necessary to conclude either that there are wave-lengths associated with the electron in addition to that given by the formula $\lambda = h/mv$, or that the electron waves are scattered from alternate rows of the copper atoms with different intensities, both in the plane grating and the space grating. Because of the 4-fold symmetry in azimuth, the crystal appears to be single. Since the crystal was formed by the method of melting and slow cooling in an atmosphere

of hydrogen, the possibility of contamination by copper oxide should be eliminated. The experiments will be continued with other crystals.

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Some further Observations on *Amoeba proteus*.

DR. MURIEL ROBERTSON'S paper entitled "Notes on certain points in the Cytology of *Trypanosoma raia* and *Bodo caudatus*" (*Paras.*, vol. 19, No. 4, Dec. 1927) made me resolve to re-investigate the nucleus of *A. proteus* in the various stages of its life-history by means of Feulgen's Reaction. A full account of this chemical test for chromatin, as well as a Table of Procedure, drawn up from her own experience, is given by Dr. Robertson. I had to modify this table in some respects. *A. proteus* is too heavy to remain adherent to the slide during all the drastic procedure involved in bringing about the reaction. I therefore made use of the method used on previous occasions, that is, of carrying on all the operations in a centrifuge. As it was not practicable to wash the amoebæ in running water, the liquid in the centrifuge tube was replaced by water, and this was changed five times, at 15-minute intervals.

Dr. Robertson placed no ban on acid-containing fixatives. I therefore began my experiments by using Bouin's modified formula (Duboseq Brasil, 1905). The formalin in it helped to harden the cytoplasm. It was found necessary in the case of *A. proteus* to treble the time allowed by Dr. Robertson. That this need was due to the nature of the *A. proteus* nucleus rather than to the modifications in method described above, was proved by control experiments in which flagellates and ciliates were found to be brightly coloured after normal exposure to the stain.

The interesting new fact that emerges from this study is that the whole of the karyosome of the *A. proteus* nucleus gives the reaction for chromatin just as positively as does the macro-nucleus of a ciliate. Amid the general substance of the karyosome irregular patches are more deeply stained and the chromatin 'blocks' in the periphery are also a deep red. The achromatic structures show up in marked contrast, especially when light-green is used as a counterstain. None of the cytoplasmic structures are affected by the Feulgen, with or without hydrolysis.

Consequent on the failure to obtain positive results for the karyosome of the nucleus of young, immature *A. proteus*, even after prolonged staining, non-acid corrosive alcohol and absolute alcohol were tried as fixatives, lest the failure should be due to the Bouin's fluid previously used. The results were the same; the karyosome again failed to give the reaction. The 'blocks', which are extremely small, were faintly red, and there was a diffuse red stain surrounding the blocks in the periphery. The nucleus of the young *A. proteus* would appear to contain very little chromatin, a conclusion borne out by its great affinity for plasma stains.

The colour produced by fuchsin after fixation in a non-acid fixative is much more pink and less purple.

This study has necessitated a renewed and detailed scrutiny of many cultures of *A. proteus*, and in view of the fact that a flagellate stage, followed by syngamy, has recently been described as occurring in the life-cycle of *A. proteus*, I should like to record, once more, that in spite of years of study I have failed to find any such stages. The life-cycle, in fact, would appear to be wholly asexual.

Amoeba bigemma bears a superficial resemblance to young stages of *A. proteus*. It can easily be cultivated

under the same conditions as *A. proteus*. *Amoeba verrucosa* similarly grows readily under these same conditions, and when it is young is extremely active in movement. Stained preparations of each of these could easily be mistaken for young *A. proteus* from their nuclear characters, unless the cytoplasmic characters of each had been observed before fixation of the specimen. So far as I am aware, the life-cycle of neither of these species has been worked out, and therefore the existence in them of a flagellate stage is not excluded, although in my opinion unlikely.

Cultures of *A. proteus* are liable to be attacked and even killed off by a flagellate parasite, and it is conceivable that this has been interpreted as a phase in the normal life-cycle of the amoeba.

It is of interest to note that in 1918-19 a strain of *A. proteus* was observed to contain symbiotic green flagellates. The culture was unfortunately exhausted for supplying class and demonstration material. I have never had time to investigate the matter nor to make any experiments in bringing about the conditions which induced the symbiosis. The symbiont has a nucleus, typically flagellate, of about 60 μ , and its own diameter in stained preparations is from 150 μ to 180 μ . Some of these preparations contain four symbionts in a single amoeba.

Although *Euglena nematoides* is a frequent inhabitant of *A. proteus* cultures, the amoebæ do not seem to be able to prey upon it as they do on other flagellates, at least in its active stage. Although I have often watched a conflict between the two, I have always found that the *Euglena* makes its escape.

MONICA TAYLOR.

Notre Dame,
Dowanhill, Glasgow,
May 25.

Negrito Racial Strain in India.

IN a short note in NATURE of May 19, 1928 (vol. 121, p. 793), I mentioned the discovery of a truly negrito strain among the Kadars in the extreme interior of the Cochin Hills (S. India). As a result of further investigations in the adjoining hills made this year, I was able to find 10 more individuals showing spirally curved hair, making a total of 16 (a little more than 10 per cent) out of 157 men and women measured. Of the 10 individuals found this year, 8 were Kadars, and the remaining two were a Pulayan and a Malser. The hair of all of these except two, who have very short spirals (Fig. 1a), are of frizzly type similar to that of the Melanesians (Fig. 1b), matching No. 'g' in Martin's scheme ("Lehrbuch", 2nd edition, vol. 1, p. 213). The hair of the two with short spirals would resemble 'h' rather than 'i' in the same scheme. In appearance they are without exception very dark, the skin colour varying from 29 to 34 in Von Luschan's scale, short, prognathic, having thick everted lips, short broad nose flattened at the root with the tip tilted up. The average cephalic and nasal indices of the 10 are 75.23 and 85.6 respectively, bringing them just within mesocephaly and platyrrhiny.

The presence of the Melanesian form of hair is interesting, because it definitely links up the aboriginal people of S. India with Melanesia; but of the short woolly haired type I am not so certain. I am inclined to regard it as distinct from the frizzly haired type unless the latter may be considered the result of hybridisation with the wavy-to-curly-haired type which forms the dominant element among the Kadars at present. Whatever may be the ultimate explanation of this, there is no doubt that among the aborigines of S. India there still persists in the extreme interiors a primitive element of a genuine negrito

character, as shown by its occurrence not merely among the Kadars but also among the Pulayans and the Malsers. It is not impossible that such a type exists among other aboriginal tribes of Southern and Central India in regions which have not so far been carefully explored. Dr. J. H. Hutton's discovery ("Man in



FIG. 1.—Kadars of the Cochin Hills with woolly and frizzly hair respectively.

India", vol. 7, No. 4, pp. 257-262) of spirally curved hair among a section of the Angami Nagas would extend it to the eastern frontiers and lend support to the view of the wide distribution of the negrito type at one time in India.

The results of my investigations on the Kadars of the Cochin and Anaimalai Hills will be published as soon as the details are worked out.

B. S. GUHA.

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Indian Museum, Calcutta.

Penetrating Radiation and de Broglie Waves.

BOTHE and Kolhörster have recently published a preliminary account of an experiment on the absorption coefficient of the penetrating radiation (NATURE, April 27, p. 638). They conclude that this radiation is of corpuscular rather than of gamma type. The purpose of this note is to show that their experiment may be inconclusive.

The de Broglie wave-length (de Broglie, "Ondes et Mouvements", 1926, p. 10) for an electron moving with velocity v is

$$\lambda_B = \frac{h\sqrt{1-\beta^2}}{m_0v}$$

If this electron were suddenly stopped, the wave-length of the emitted quantum would be, on the basis of Einstein's photoelectric equation,

$$\lambda_E = \frac{h}{m_0c} \frac{\sqrt{1-\beta^2}}{1-\sqrt{1-\beta^2}}$$

The ratio
$$\frac{\lambda_E}{\lambda_B} = \frac{\beta}{1-\sqrt{1-\beta^2}}$$

approaches unity for wave-lengths of the order of magnitude of those under discussion. For example, Millikan and Cameron (*Phys. Rev.* [2], 31, 921; 1928) give 0.00008 A. for the wave-length of their most penetrating radiation. If one takes $\beta = 0.99999$, then $\lambda_E = 0.000109$ A. and $\lambda_E/\lambda_B = 1.0045$.

The results of experiments (Davisson and Germer, *Phys. Rev.* [2], 30, 705; 1927; Kikuchi, *Proc. Imp. Acad. Tokyo*, 4, 471; 1928) have shown that the de Broglie wave-length of low velocity electrons can be used to explain their reflection from and diffraction in crystals. It is suggested by analogy that, in the scattering of high velocity electrons and high frequency electromagnetic radiations of the same energy, the distribution in angle and the energy re-

lations between the incident and scattered rays may be nearly identical.

If one assumes the mass of an electron and the mass of a quantum to be respectively

$$m_e = \frac{m_0}{\sqrt{1-\beta^2}}, \quad m_\gamma = \frac{h\nu}{c^2},$$

and uses the above expression for λ_E , it is seen that

$$\frac{m_e}{m_\gamma} = \frac{1}{1-\sqrt{1-\beta^2}}$$

For the velocity considered above $\frac{m_e}{m_\gamma} = 1.0045$.

From this, one may derive further grounds for extending, by analogy, the already established duality to the present case. In the scattering formula of Klein and Nishina (*Zeits. f. Physik.*, 52, 853; 1929), ν occurs only in the factor $h\nu/m_0c^2$. Therefore, if one substitute m_e for $h\nu/c^2$ the numerical result is changed only slightly for large values of β .

If the above hypothesis should be valid, the analysis of penetrating radiations at the surface of the earth into electrons or light-quanta might be impossible by means of simple scattering or absorption experiments.

It is also possible that some of the rays from radioactive substances recently classified as short wave gamma-rays may in reality be high speed beta-rays.

F. T. HOLMES.

Sloane Physical Laboratory,
Yale University,
New Haven, Conn., May 23.

Magnetic Properties of Isolated Atoms of Cobalt.

FERRO-MAGNETISM is one of the most complicated and least explained subjects. This is because in most of the experimental work what are observed are statistical phenomena from which it is difficult to arrive at a knowledge of the elementary mechanism. It was therefore thought interesting to investigate alloys of a small percentage of cobalt with platinum; namely, 10 per cent Co - 90 per cent Pt and 5 per cent Co - 95 per cent Pt, in which the ferro-magnetic cobalt atoms are not generally surrounded by other magnetic atoms, but by non-ferro-magnetic platinum atoms.

These alloys were found ferro-magnetic, the Curie point being 249° C. and 49° C. for the 10 per cent and 5 per cent alloys respectively. The magnetisation, I , at different temperatures, from that of liquid air up to the Curie point, was found for each alloy, the decrease in magnetisation near the Curie point being most rapid for the 5 per cent alloy. For small values of the applied magnetic force ($H = 0$ to 100 gauss), I increased at first with temperature, but for greater values of H it decreased steadily. The greatest values of I obtained ($H = 565$ gauss) were 364 and 254 C.G.S. units for the 10 per cent and 5 per cent alloys respectively. This corresponds to a magnetic moment per cobalt atom 25 per cent and 60 per cent greater than that calculated from the saturation magnetisation of pure cobalt, assuming the platinum atoms do not contribute to the magnetisation.

Finally, various hysteresis loops, showing the relation between I and H , were obtained. These were found to vary considerably with the heat treatment. For wires in the hard drawn state, the 5 per cent alloy gave the larger and more rectangular loops, with a coercive force as great as 100 gauss; but after annealing at different temperatures, the hysteresis was greatly reduced, the 5 per cent alloy showing a coercive force of only 20 gauss as against 28 for the 10 per cent alloy. This last result, for the annealed wires, is in accord with Heisenberg's theory of ferro-magnetism based on the resonance between the

spinning electrons of neighbouring atoms (*Zeit. f. Phys.*, 49, 619; 1928); on this theory one would expect less hysteresis as the magnetic atoms become more isolated. The theory also explains the effect of annealing in reducing the hysteresis by uniformly distributing cobalt atoms which were closely clustered in groups in the hard drawn state, and thus likewise reducing resonance phenomena.

F. W. CONSTANT

(National Research Fellow).

California Institute of Technology,
Pasadena, California, May 23.

The Atomic Weight of Arsenic.

As the International Committee on Atomic Weights has not provided a table since 1921, the British Sub-Committee published in the *Journal of the Chemical Society* of January last a revised table of atomic weights for 1929. In the report attached to this table we read that "for the nine 'simple' elements H, He, C, N, F, Na, P, As, and I the values obtained by F. W. Aston with his new mass-spectrograph are adopted in preference to those deduced from the physical or chemical data, because we are of opinion that, in these cases, Aston's method is less liable to error than any other". . . .

Dr. Aston is to be congratulated that his spectrograph allows the reading corresponding, as regards the accuracy, to that of modern atomic weights determination, namely, 1 in 10,000.

Since from the year 1927 I have been engaged on the revision of atomic weight of arsenic, based on chemical analysis, I am highly interested in the new Aston figure, $As = 74.934$, derived for this element from the mass spectrum alone. The atomic weight of arsenic, $As = 74.96$, hitherto adopted internationally, is based on the Baxter and Coffin method of converting silver arsenate into silver chloride or silver bromide by the action of hydrogen chloride or hydrogen bromide. From the chemical point of view this international value for arsenic is a little higher than the actual one. From this reason I have undertaken a new determination of this figure deduced from the analysis of the purest arsenic chloride and bromide. From the eight determinations of the ratio $AsCl_3 : 3Ag$ hitherto made, I have obtained the average $As = 74.937$ (using $Ag = 107.88$ and $Cl = 35.458$), which is in excellent agreement with the value obtained by Aston. This agreement corroborates the probability of the lower value, which was to be expected, and shows at the same time the trustworthiness of Aston's method used for the derivation of atomic weights of simple elements.

My preliminary paper concerning this matter was read before the Congress of Czechoslovak Scientists held in Prague, May 1928. After completion of the analyses of arsenic chloride and those of arsenic bromide, the definite value obtained will be published.

H. KRÉPELKA.

Institute of Inorganic Chemistry,
Charles University,
Prague, May 7.

A New Ultra-violet Band Spectrum of Hydrogen Chloride.

HITHERTO no band spectra have been found which involve electronic excitation in neutral or ionised hydrogen chloride. We have recently photographed an extended band system in the region $\lambda 2830\text{--}\lambda 3966$ from a low pressure discharge in pure hydrogen chloride gas with platinum electrodes. The bands are degraded toward long wave-lengths, and have the

characteristic widely spaced structure always observed in hydride spectra. A discharge in hydrogen gives the same band system if a small amount of silver chloride or cuprous chloride is fused on the electrodes, but not if silver bromide is used. Thus there is strong evidence that this spectrum is due to the hydrogen chloride molecule. Moreover, there are reasons, both experimental and theoretical, for believing that the emitter is singly charged, probably the HCl^+ ion. For example, the bands are obtained only from the negative glow, whereas in general the spectra of ionised molecules, such as N^+ , are relatively stronger.

Owing to the unusual intensity distribution in this band spectrum, it has not been possible to reach an assignment of vibrational quantum numbers, and thus to determine the electronic frequency. The isotope effect, which we hope to obtain by the detailed analysis of the fine structure now in progress, should prove helpful in this regard. The bands occur in pairs of constant separation, 658 cm.^{-1} , indicating that a doublet electronic level is involved. The two components of a pair have about equal intensities. The wave-numbers of the band heads may be represented by

$$\nu = \frac{28446}{27788} + 1561p - 30.3p^2 - 2573n,$$

observed values of (p, n) being $(-1, 0)?, (0, 1), (3, 1)?, (0, 0), (1, 0), (2, 0), (3, 0), (4, 0), (5, 0)$. The pair $(0, 0)$ at $\lambda 3514, 3598$ is the strongest, and the five succeeding pairs have regularly decreasing intensity. They apparently form a progression with a common vibrational quantum number in the lower state. As was pointed out to us by Dr. F. Hund, it can be shown by a correlation with the energy terms of the equivalent atom, Cl, and the separate atoms H and Cl^+ , that a transition $2\Sigma \rightarrow 2\Pi$ might be expected in HCl^+ . A preliminary examination of the rotational structure shows that it is probably compatible with such an interpretation.

BROOKS A. BRICE.

F. A. JENKINS.

New York University,
University Heights, N.Y., April 26.

Dirac Equations and Einstein Theory.

HERMANN WEYL (*Proc. Nat. Acad. of the U.S.A.*, 15, 223; April 1929) has recently developed a relativistic theory of the Dirac equation which, like that of Wigner (*Zeit. f. Phys.*, 53, 592; 1929), and that of Vallarta and myself (*NATURE*, Mar. 2, 1929, p. 317), employs the Einstein notion of an 'n-leg'. Unlike the two other theories, Weyl rejects Einstein's distant parallelism, and obtains a theory invariant under a local rotation varying continuously from point to point. That is, Weyl's theory depends solely on the $g_{\lambda\mu}$'s of Einstein's 1916 gravitational theory, and not on the ${}^*h^\lambda$ of his 1929 theory. It is perhaps interesting to remark that the same degree of invariance may be obtained by choosing as the 4-legs of the Einstein theory the Ricci principal directions. If we write $R_{\lambda\mu}$ for the 1916 contracted curvature tensor, this additional condition is expressed by the formula

$${}^*h^\mu_\nu h^\lambda R_{\lambda\mu} = 0 \quad (s \neq t). \quad (1)$$

This condition is trivial and nugatory in case the original Einstein equations $R_{\lambda\mu} = \text{const. } g_{\lambda\mu}$ are fulfilled. Since the new gravitational-electric-matter equations, whatever their final form may be, are close approximations to these, it is perhaps not too much to hope that the supplementary condition (1) not only is compatible with them, but even not too restrictive so far as terms of observable magnitude are concerned.

Thus gravitational phenomena appear to be such

as can occur even in a homogeneous Riemann space, whereas matter-electrical phenomena depend on the inhomogeneity of space. This may well have something to do with the absence of spherical symmetry in the spin inseparable from the electron.

So far as the quantities sh are concerned, the new auxiliary condition is of the second order. The new Einstein field equations will probably not be of the second order when written in terms of the $g_{\lambda\mu}$'s, but it is not clear that the Weyl equations will escape this criticism. The supplementary condition (1) leaves untouched the work of Wigner, Vallarta, and myself. Thus the Dirac equations may be treated relativistically on the basis of the Einstein 1916 theory.

NORBERT WIENER.

Massachusetts Institute of Technology,
Cambridge, Mass., U.S.A., May 8.

Diamagnetism and Crystal Structure.

PROF. EHRENFEST has suggested (*Physica*, vol. 5, p. 388, 1925) that the high diamagnetic susceptibility of bismuth is to be ascribed to the existence in the metallic crystal lattice of electron orbits of large area including several atoms within their radius. There seems good reason to extend Ehrenfest's hypothesis to the case of carbon as well, since it affords an illuminating insight into the magnetic behaviour of the different forms of this element. It is known that graphite possesses a high specific susceptibility, which according to the most recent measurements of Vaidyanathan with carefully purified samples, is -5.1×10^{-6} , that is, quite ten times larger than the specific susceptibility of diamond (-0.49×10^{-6}), the latter being practically the same as that of carbon in organic compounds as found from Pascal's additive law. The abnormal susceptibility of graphite becomes intelligible in terms of the peculiar structure of the substance and its electrical conductivity, if we assume that there are electron orbits circulating round the plane hexagonal rings of carbon in the crystal-lattice. This fits in with the known fact (observed by Honda and Owen) that the susceptibility of graphite is six or seven times greater normal to the planes of cleavage than parallel to them. Diamond, on the other hand, being a dielectric would naturally not show the abnormal susceptibility.

Careful studies made by Mr. P. Krishnamurthi of the X-ray pattern of sugar charcoal and lamp-black prove conclusively that these substances do not possess any crystalline structure. The fact that amorphous carbon has the normal susceptibility (0.51×10^{-6}), and not the high value of graphite, is therefore quite to be expected. The great diminution in the susceptibility of bismuth which occurs on fusion may be regarded as an analogous phenomenon.

Ehrenfest's hypothesis would appear to have also other fruitful applications, for example, in the explanation of the remarkable diminution in the susceptibility of graphite at high temperatures and of the dependence of susceptibility on particle size in colloidal substances. We need not, however, enter into those details here.

210 Bowbazar Street,
Calcutta, May 23.

C. V. RAMAN.

Salt Haze.

I HAVE at intervals during the last few years directed attention to the presence of salt particles in the air and their importance in facilitating the formation of fog, since in the presence of a haze of sea salt condensation would commence upon the particles long before saturation is reached.

On May 27 last I was fortunate enough to observe

a salt haze in process of generation. I was on the north bank of the Tagus at about 8 A.M., summer time. It was a bright sunny morning, with a light wind from the north-west, and looking across the river I observed a long stretch of sandy shore extending southward from the mouth of the Tagus. I had a good view along this stretch of shore, and noticed that a well-marked haze commenced along the line of the breakers and was carried seaward by the wind, extending gradually so that it partly obscured the hills in the distance. There was a clearly defined line over the breakers where the haze commenced, and it was obviously formed from the spray. On looking in the opposite direction over the land visibility was good, and practically no haze was to be seen.

Later in the day, that is about 11 A.M., in passing up the coast northward from the Tagus I saw another example of the same thing.

In a small bight or bay of the coast there was a large number of rocks projecting from the water, and these caused a good deal of disturbance and spray due to the waves; from the surface of this bay a drift of haze was quite visible passing inland. The sun was shining brightly at the time, and in this case, as well as in the first mentioned, the haze was white. In the latter case, doubtless the fine salt particles were carried inland to a considerable distance. It is possible that few of them survive the cool, still night, when the air becomes cooled and condensation on the particles must tend to bring them down.

J. S. OWENS.

47 Victoria Street, Westminster,
London, S.W.1.

Rise and Fall of the Tides.

IN NATURE of April 27, Mr. A. Mallock writes on rise and fall of the tides, and illustrates his views by three specific cases in which a constant amount of energy is continually concentrated into a diminishing mass. To quote briefly: A heavy flexible cord passes through a hole in a fixed horizontal plate. The part below the plate is given an initial oscillation and swings as a pendulum. The cord is then drawn upward through the hole. The part above the plate is stationary, and the energy it contained is transferred to the part still hanging free, the mass of which continually decreases. Hence the velocity of oscillation tends to become infinite when the length vanishes.

Surely in this case it has been overlooked that as the cord is pulled up work is being done against the centrifugal acceleration, so that the kinetic energy of the moving portion is not constant, but is continually increasing?

The case is analogous to that of a conical pendulum formed by a bob at the end of a string; if the string be shortened by any means the kinetic energy of the system is increased. The same principle occurs in two common forms of human activity; the child swinging rhythmically raises his centre of gravity while his angular velocity is great and lowers it while it is small; the skater, moving over the ice by what is known as the Dutch roll, progresses by a series of alternating curves, never lifting his skates from the ice. He rhythmically raises his centre of gravity while going round the curve (*i.e.* shortens the conical pendulum), and lowers it while reversing the curvature of his path. By this means he steadily puts energy into the moving system, without its being obvious to the non-skater how he is doing it.

L. H. G. DINES.

73 Fairfax Road,
Teddington, Middlesex, May 20.

The Late Palæozoic Glaciation.

By DR. H. DIGHTON THOMAS.

THE great continent of Gondwanaland existed in the late Palæozoic in the southern hemisphere and persisted through a long period of geological time with little modification. The deposits formed on it are found in Australia, India, South Africa, South America, and Antarctica, where beds of glacial origin generally occur at the base of the series. The fossilised remains of the flora which flourished on the continent in its early stages are found sometimes in, and generally above, the glacial horizon. Characteristic plants are species of *Gangamopteris* and *Glossopteris*. The whole floral assemblage is very different from that yielded by the Upper Carboniferous and Permian continental deposits of the northern hemisphere, in which the Pteridosperms (*e.g.* *Alethopteris*), Lycopodiales (*e.g.* *Lepidodendron*), Equisetales (*e.g.* *Calamites*), and Cordaitales (*e.g.* *Cordaites*) predominate.

Intimately linked with the problems of Gondwanaland are the questions of the age of the late Palæozoic glaciation and of the age and range of the *Glossopteris* flora. Was the glaciation in Carboniferous¹ or in Permian time? Did the first members of that flora exist contemporaneously with the latest Carboniferous flora of the northern hemisphere, or did they make their appearance later, in the Permian? For long, different opinions have been held, though in general those of British geologists have tended more and more definitely towards a belief in a Uralian age (Upper Carboniferous), both for the glacial period and for the entry of the *Glossopteris* flora. Prof. C. Schuchert has recently attempted to answer the question decisively (*Bull. Geol. Soc. America*, vol. 39, No. 3, 1928, pp. 769-886), and in doing so has performed an invaluable service in bringing together in an accessible and summarised form a mass of stratigraphical and palæontological details. In his long paper Schuchert deals with the evidence furnished by most of the important localities in the southern hemisphere and in India. To these he adds résumés of the important Russian, German, and North American horizons which bear on the problem to be solved. His conclusions briefly are that the glaciation occurred "in Middle and probably in Late Middle Permian time", and that the *Glossopteris* flora does not range back beyond that period. In these conclusions Schuchert states that he has the support of Dr. David White, the noted American palæobotanist.

Fundamentally, in making his correlations Schuchert uses as a standard the succession in the Salt Range, so that the determination of the age of the latter is of prime importance. The whole of the Productus Limestone and of the underlying beds down to the Talchir Boulder Bed he assigns to the Permian, firstly, on the evidence of Upper Permian

ammonites (*Xenaspis* and *Cyclolobus*) in the Virgal and Chideru groups, and secondly, because of "how intimately the whole of the Productus Limestone is tied together faunally". The latter statement rather overstates the case. The number of species, particularly of the Brachiopoda, that range through the Productus Limestone Series is small, and it is highly dangerous to use such long-ranged forms in correlation. The ammonites give the age for the containing beds, but are no proof of the age of those below them. They first occur in the Salt Range in the zone of *Xenaspis carbonaria*, the whole of the succession of about 800 feet below that horizon down to the glacial bed being devoid of such forms. The age of these beds can be deduced only from a consideration of their faunas, and particularly from the Brachiopoda, because of the knowledge we possess of their range in time.

From this point of view the first important fossiliferous horizon above the Talchir Boulder Bed is the Amb group of Noetling, approximately equal to the Lower Productus Limestone of Waagen; this Schuchert refers to the Basal Upper Permian. The faunal evidence will scarcely support this opinion. From this horizon Waagen described a large fauna which has to some extent been emended by Noetling and Koken. The faunal lists given by the latter, and by Waagen, show a large number of forms which occur also in the Urals and in Timan. In that classic and standard area for the Upper Carboniferous most of the forms common to the Russian area and to the Amb Series do not range above the Artinskian (Lower Permian), and the majority of them not above the *Schwagerina* zone (Upper Carboniferous). As examples, *Dielasma itaitubense*, *Hemiptychina sublævis*, *Derbya regularis*, *D. grandis*, *Rhipidomella pecosi*, and *Spirifer ravanah* may be cited. Schuchert himself draws attention to the fact that "The Amb stage is characterised below by *Spirifer marcoui*", a species which he is careful to state does not range higher than the *Cora* zone (Uralian) in the Urals. Even without considering the absence of such forms as the curious Brachiopod *Lyttonia* from the Amb fauna (which may not be an essential point in the argument) it becomes impossible to maintain for the Amb stage an age younger than Lower Permian. At the latest a low horizon in the Artinskian is indicated. Such being the case the underlying Speckled Sandstone, including the *Eurydesma* and *Conularia* zones—important for the correlation of the Australian and South African successions—and the Talchir Boulder Bed are of high Carboniferous (Uralian) age.

Some confirmation is given by the recently described fauna from the Umaria coalfield of Central India. Above a slight unconformity on the Talchir Boulder Bed occur thin marine, fossiliferous bands which are stated to pass up into the Barakar Series of continental origin. The fauna is not a rich one, but its importance from its position above the

¹ The boundary between the Carboniferous and the Permian is here taken at the top of the *Schwagerina* zone and not, as drawn by Schuchert, at its base.

glacial horizon is obvious. Cowper Reed placed its age as Permo-Carboniferous and directed attention to its affinities with an Upper Carboniferous fauna. It is doubtful if he implied by the use of the term 'Permo-Carboniferous' a definite Lower Permian age as Schuchert takes it to mean; it is more probable that he meant that the fauna might be either Upper Carboniferous or Permian in age, but that it is difficult to determine which from the evidence. Even accepting a Lower Permian age for the fauna, it is difficult to see why Schuchert should reject such a determination, and state that the Talchir stage is Middle Permian, largely because the Barakar stage is stated to be Middle Permian. The marine evidence is far more trustworthy than a correlation made through the fact that the beds pass up into the Barakar Series. Ultimately the latter has to be correlated with marine successions, since our standards are founded on them. From the evidence of the marine beds in the Umaria coal-field a Carboniferous age for the Talchir stage is not improbable. In the Indian Peninsula the latter stage, as well as the succeeding Karharbari stage, yields *Gangamopteris* and *Glossopteris*, so that there is strong indication that the establishment of the *Glossopteris* flora occurred at least in Lower Permian time, if not actually in the Carboniferous. The occurrence of *Gangamopteris* in Kashmir in no way invalidates this. The beds yielding them lie below the Permian Zewan beds, but the plant-bearing horizons occur at a distance of 400 feet at least below the base of the Zewan series.

The *Eurydesma* and *Conularia* faunas of the Salt Range are repeated in New South Wales and in South-West Africa, in both cases above glacial beds. If these faunas are reliable guides they indicate an Upper Carboniferous age for the Lower Marine Series of the Hunter River in New South Wales, and for the Upper Dwyka Shales of South-West Africa. Such an age has been accepted by Dr. Du Toit and Prof. Gregory among others. The latter has directed attention elsewhere to the Carboniferous, as opposed to the Permian, aspect of the fauna of the Lower Marine Series of the Hunter River succession. Thus not only are the glacial beds at the base of that series proved to be of Upper Carboniferous age (an opinion shared with Prof. Sir T. W. Edgeworth David), but also the *Glossopteris* flora to have appeared in the Australian area at a similar time—leaves of *Gangamopteris* occur in places in some of the beds which comprise the Lower Marine Series. An easy correlation can be effected between the Seaham Harbour Glacial Beds of New South Wales and the Bacchus Marsh Beds of Victoria, the Glacial Boulder Beds of Tasmania, etc. The Greta Coal Measures, with abundant *Gangamopteris*, most probably represent the top of the Carboniferous development in New South Wales, the Upper Marine Series still faunally close to the Carboniferous probably marking the beginning of the Permian.

On the Irwin River in Western Australia glacial beds are known to occur below marine horizons which are themselves overlain by Coal Measures. If these latter are correctly correlated with the Greta Coal Measures of Eastern Australia, then

the glacial beds which occur far below them in the sequence are also of Upper Carboniferous age. Of the fauna of the marine beds in the Irwin River area the most important member, in some ways, is *Paralegoceras jacksoni*, the only Cephalopod so far recorded from there. Its affinities (and by the kindness of Sir Edgeworth David the writer has had the opportunity to examine several specimens) are with Upper Carboniferous forms, and as far as one may rely on this species it supports an Upper Carboniferous age for the bed which yields it in large numbers and for the glacial beds below. The rest of the fauna shows some anomalies, as Sir Edgeworth David has indicated. It is unfortunate that Schuchert does not consider this glacial occurrence.

Before leaving the question of the Australian beds, attention might be directed to the alleged presence of the ammonoid, *Agathiceras*, in New South Wales and in W. Australia. As importance is often attached to this in making correlations (and Schuchert himself mentions the occurrence), it is not beyond the point to state that some time ago Dr. Spath and I examined the specimens in the British Museum (Natural History) sent over as that species. They could all equally well be Bellerophontids. A few months ago I received a letter from Dr. F. W. Whitehouse, of Queensland University, stating that he had published a note in Australia some three years or so ago to the effect that the so-called *Agathiceras micromphalum* is a Bellerophontid.

Reference has already been made to some evidence for an Upper Carboniferous age for the Dwyka Conglomerate of South Africa. The occurrence of the fish *Palæoniscus*, and of the crustacea *Anthropalæmon* and *Pygocephalus*, in the Upper Dwyka Shales does not invalidate this, as Dr. Du Toit has pointed out. Dr. A. W. Rogers has expressed a similar view. Of great interest is the discovery of remains of the *Glossopteris* flora beneath the tillite at Strydenburg and at Vereeniging. Prof. Seward and Mr. T. N. Leslie described the flora from the latter place—the *Glossopteris* and *Gangamopteris* leaves were associated with genera common in beds in the northern hemisphere, *Lepidodendron*, *Cordaites*, *Sigillaria*, and *Psymphyllum*. These hardly demonstrate an horizon as high as Middle Permian, to which Schuchert assigns the Dwyka Tillite. The flora and the invertebrates together indicate an Upper Carboniferous age not only for the glaciation but also for the first members of the *Glossopteris* flora, an interpretation accepted by Prof. Seward. Du Toit has well said of another occurrence, "It might be remarked at the outset that the majority of the members of the *Glossopteris* flora are of little or no value in establishing the absolute age of the beds. Recent work has been showing more and more that certain genera and species thereof had a long range in time. . . ." The Ecce beds (2000-6000 ft. thick), which succeed the Dwyka Series, are, in Schuchert's view, of Basal Upper Permian age. It is an amazing, though not necessarily incredible, development for such a small period of time.

By means of the Upper Dwyka Shales, and more particularly from the "White Band", which yields the marine reptile *Mesosaurus tenuidens*, we can date the glacial deposits of South America. It is generally admitted that that band and the Iraty Black Shales of the Paraná Basin are contemporaneous, so that, granted that the "White Band" is Upper Carboniferous in age, the Iraty Black Shales, which yield species of *Mesosaurus*, are also of that age. But beneath them occur the Rio Bonito Coal Measures, with a typical lower Gondwana flora, including *Gangamopteris obovata* and *Glossopteris* spp., while lower down still are the Itarare Beds with a basal glacial horizon. Du Toit has also adduced evidence for a Carboniferous age for the glaciations in the San Juan area of Argentina, in which region he believes that the *Glossopteris* flora, if not actually occurring with

elements of the Northern Carboniferous flora, occurs in beds which are only slightly later than those yielding *Cardiopteris*, *Rhacopteris*, etc. This glaciation and that of Barreal, where a glacial tillite is overlain by beds with a marine fauna shown by Cowper Reed to be of early Uralian age, receive scant reference by Schuchert.

Prof. Schuchert has performed an arduous task in compiling his lengthy work, and he deserves the thanks of all those who are interested in the problem with which he attempts to grapple. We may differ from him, and contend that the evidence he adduces is more in accord with a Uralian age for the late Palaeozoic glaciation and for the first appearance of the members of the *Glossopteris* flora. But at least his arguments will stimulate renewed interest and thought on one of the big problems of the stratigrapher and of the palaeobotanist.

The Hormones of the Sexual Glands.¹

THE influence of the ovaries on other tissues is an established fact; less is known of the effect of other glands upon the ovaries, but evidence is accumulating that the maturity and periodicity of function of the female sexual glands depend on influences from other tissues or glands of the body. Grafting experiments have shown that an ovary from an immature animal inserted into the tissues of an ovariectomised adult reaches maturity sooner than it would have done in its original environment: a mature organ grafted into an immature produces no observable effects and becomes functionless. A. Lipschütz has obtained similar results when an ovary is grafted into a castrated male: if the animal—guinea-pigs were used—is an adult, hormonal effects, as shown by hypertrophy of the mammary glands, set in after 1½-3 weeks, but if the animal engrafted is not fully grown there is a latent period of about six weeks: ovaries from the same female may show these different latencies if grafted into males of different ages (*Jour. Biol. et Med. Exper.*, No. 6, p. 1; 1926). The grafted ovaries, however, do not usually show their normal periodicity, but enter into a state resembling prolonged œstrus.

Y. Tamura, working with mice, has, however, found evidence in some cases of the development of corpora lutea in grafted ovaries, the appearance of which suggested that they had been developed some time after the operation (*Proc. Roy. Soc. Edin.*, vol. 47, p. 148; 1927). He also found that the presence of the testis did not affect the vitality of the ovarian graft. That ovarian regulation is at any rate partly somatic is further shown by the fact that removal of one gland leads to hypertrophy of the other, showing that some bodily factor limits the number of follicles which can come to maturity at any one time. In this connexion it may be mentioned that T. Tadokoro, M. Abe, and S. Watanabe have found differences between the proteins of certain tissues in male and female animals of various species (*Jour. Facult. Agricult., Hokkaido Imp. Univ.*, vol. 23, p. 1; 1928).

¹ Continued from p. 915.

Recent work indicates that the anterior lobe of the pituitary and also the thyroid glands exert a definite influence on the ovary. It has long been known that the former influences both bodily and sexual growth, and also that it hypertrophies during pregnancy; recent evidence suggests that at least two, if not three, different principles may be secreted by this gland, a growth-promoting, one hastening ovulation and sexual maturity, and one inhibiting ovulation by stimulating the development of lutein tissue. Precocious maturity in rats and mice can be provoked by injection of macerated aqueous suspensions of fresh anterior lobes, œstrus setting in after about three days: acid extracts produce this effect in concentrations which have no effect on growth in an adult.

The same hormone occurs in human placenta and the urinary secretion of pregnant women: experiments on filterability and adsorption indicate that it possesses a smaller molecule than the growth-promoting principle. On the other hand, alkaline extracts of less fresh glands produce growth together with luteinisation of the ovary: the follicles develop into corpora lutea without ovulation, and with enclosure of the ova; further ovulation is prevented. This luteal tissue sensitises the uterus to stimuli, produces mammary overgrowth, and, developed during pregnancy, results in prolongation of this condition. There is some evidence that the eosinophil cells of the anterior lobe of the pituitary are concerned with the stimulus to growth, whilst the basophils are in relation with the gonads (H. M. Evans and M. E. Simpson, *Jour. Amer. Med. Assoc.*, vol. 91, p. 1337; 1928). It is to be noted that the hormones of the pituitary act through the ovary; in the absence of the latter none of the effects upon the secondary sex characters are observed. The exact relationship between the anterior pituitary and the cyclic function of the ovary is not known, nor whether the secretion of hormones from the former is periodic.

The thyroid also has an influence upon the gonads,

but whether direct or secondary to its coincident effect upon the general metabolism of the body is not known. G. R. Cameron and A. B. P. Amies have shown that the administration of the dried gland to mice and guinea-pigs leads to a prolongation of œstrus, especially in the latter, and also to prolongation of the whole cycle in the mouse (*Austral. Jour. Exp. Biol. and Med. Sci.*, vol. 3, p. 37; 1926). Feeding fowls with thyroid produces changes in the plumage, which in males takes on a henny character (F. W. R. Brambell, *Proc. Roy. Irish Acad.*, vol. 37 B, p. 117; 1926; M. Nevalonny, *Bull. de l'école supér. d'agronomie*, Brno, 1928); but Brambell considers that this effect is not physiological but due to the toxic results of the dosing, which produces hyperthyroidism. Apart from this change in type thyroid feeding has the same effects in both sexes. B. Zawadowsky (*Jour. biol. méd. expér.*, vol. 5, p. 344; 1927) has found that testicular degeneration in cocks and failure of egg-laying in hens follows the administration of thyroid, again presumably a toxic effect.

It may be remarked in passing that the secretions from both the anterior lobe of the pituitary and the thyroid gland are essential for growth and maintenance of normal health: and any derangements will presumably affect the gonads just as the other tissues of the body; on the other hand, alterations of the œstrous rhythm may occur independently of other obvious bodily changes, suggesting that these glands may have a specific influence on the gonads or that the latter are more sensitive to their stimulation than the somatic tissues of the body.

THE TESTIS.

The male sexual gland is responsible for the development of the secondary sexual characteristics, as the ovary is in the case of the female. Like the latter organ, it consists of cells from which the specific sex cells are developed and also of interstitial cells which lie between the seminiferous tubules: it is generally held that the latter are the source of the hormone responsible for the appearance and maintenance of the secondary characters, since an organ in which the tubules have degenerated, such as an autotransplant, can still produce an internal secretion. Testes always become functionless, so far as regards the formation of spermatozoa is concerned, when removed from the scrotum, either by transplantation or by fixation in the abdomen, and the same phenomenon is observed in naturally undescended organs, as in the case of unilateral cryptorchism in a rat described by W. P. Kennedy (*Jour. Anat.*, vol. 61, p. 352; 1927). The degeneration appears to be caused by the higher temperature to which the organ is exposed.

On the other hand, some authors consider that the function of the interstitial cells is nutritive rather than internal secretory, basing their opinion on the histological appearances of these cells and on the presence in them of lipid granules which are not specific in nature and may also occur in cells of the tubules which give rise to the spermatozoa (M. Parížek, *Publ. Biol. de l'école vét.*, Brno, vol. 2, p. 293; 1923; S. Morgenstern, *Jour. médico-biol.*,

Fasc. 4, p. 29; 1925). In this case the internal secretion of the testis must presumably come from the external layer of cells of the seminiferous tubules which usually survive in a degenerated organ.

The influence of the male gonads on metabolism has been followed after both castration and also the injection of testicular extracts. In general, the results obtained so far have been rather inconclusive since they are irregular and slight in degree. T. C. Shen and K. H. Lin have found no appreciable difference between the nitrogen excretion in the urine of eunuchs and normal men: creatine was found in one case, and the daily output of creatinine was variable in another, whereas normally creatine is absent and the creatinine excretion constant (*Chinese Jour. Physiol.*, vol. 1, p. 109; 1927). Castration has no effect upon the level of the blood calcium (L. Perelman, *Jour. médico-biol.*, Fasc. 3, p. 52; 1925).

V. Korenchevsky has investigated the effects of castration and injection of extracts of testis and prostate upon the metabolism of rabbits and dogs in a series of papers (*Brit. Jour. Exp. Path.*, vol. 6, pp. 21, 74, and 158; 1925; *Biochem. Jour.*, vol. 19, p. 772; 1925; vol. 22, pp. 482 and 491; 1928). The development of obesity after castration does not always occur: when it does it is accompanied by a decrease in both the nitrogenous and non-nitrogenous metabolism: there is little change in the metabolism if obesity fails to develop. It is possible that these differences are due to variations in the response of the other internally secretory glands to absence of the testes. Injection of prostatic extracts increases the nitrogen output in castrated but not in normal dogs, and a similar result was observed in the rabbit. Injection of testicular extracts decreases the nitrogen metabolism. Experiments on thyroidectomised animals indicated that the prostatic extracts acted on the metabolism by stimulating the thyroid gland: whilst the effect of testicular extracts is similar to that produced by injections of insulin, so that part at any rate of the influence of the former is due to the presence of the latter hormone in the extracts, as confirmed by examination of their blood-sugar reducing power.

In the last two papers Korenchevsky has examined the influence of lipid extracts and of watery extracts fractionated at various reactions: atrophy of the secondary sexual organs in rats was not prevented by injecting these extracts, and the effects on the metabolism of rabbits were usually an increase in the nitrogen metabolism, provided that the thyroid gland was present. It is doubtful how far these results can be ascribed to the presence of a specific hormone in the extracts: maintenance of the secondary sexual organs in a functional condition in the castrated animal would appear to be a true index of the presence of a specific principle, and this has not yet been accomplished.

In conclusion, a few words may be said on the subject of rejuvenation. A critical investigation of Voronoff's experiments on the improvement of livestock has been presented by F. H. A. Marshall, F. A. E. Crew, A. Walton, and W. C. Miller (Ministry

Agric. and Fisheries, Board of Agric. for Scotland). The investigators concluded that the methods of experimentation were not sufficiently critical to enable an answer to be given to the question of whether testicular grafting can improve the fertility of old stud bulls or the production of wool by the offspring of grafted rams. In any event the economic importance of such experiments for Great Britain is probably only slight. It is necessary to bear in mind that a testicular graft, to give satisfactory rejuvenation, must not only maintain the

secondary sexual organs and characteristics in full function and exert the normal influence of the testis upon the cells of the body, but also stimulate the subject's own organ sufficiently to enable it to produce living spermatozoa: the former effect can be produced by secretions from the graft, but only the subject's own testis can render him fertile. Testicular grafting is a useful method of investigating scientifically the secretory function of the testis: its usefulness as a practical measure must still be considered not proven.

Obituary.

PROF. GEORG KASSNER.

DR. GEORG KASSNER, emeritus professor of pharmaceutical chemistry and chemical technology, died at Münster on Mar. 30, 1928, at seventy-one years of age. From the *Chemiker-Zeitung* we learn the following particulars of his life. A native of Lüben in Silesia, Kassner studied at Basel, Zurich, and Breslau, and received his first appointment in 1884 at Breslau under Prof. Poleck. In 1891 he was appointed professor of pharmaceutical chemistry and chemical technology at the University of Münster, where for thirty-five years he directed the training of students of pharmacy. He also took an active interest in municipal affairs, and served for fifteen years on the Town Council. In his teaching Kassner laid stress on the use of volumetric methods of analysis, and his methods were adopted in many other institutes.

The work which Kassner had begun at Breslau led to a method of preparing oxygen from the air by means of calcium plumbate. One of the chief disadvantages of this method was the fact that it involved the use of carbon dioxide, and when Linde's liquid air process was discovered Kassner recognised its superiority. But, being convinced that further progress in the economical production of oxygen from air would be on chemical lines, he set to work to devise improvements, and in 1911 he succeeded in finding an inexpensive method of preparing both oxygen and nitrogen from air by means of plumbosan, a mixture of sodium plumbite and sodium manganate. This process works at 400° C., a much lower temperature than was needed for his older process, and, moreover, the use of carbon dioxide was eliminated.

During the War, Kassner discovered in the double compound of barium metaplumbate and barium manganate a useful catalyst for the atmospheric oxidation of ammonia to nitric acid at 500° C. In addition to the work on lead compounds, he published numerous papers on other chemical subjects.

DR. E. F. J. LOVE.

THE University of Melbourne has suffered a loss in the death, on Mar. 8, of Dr. E. F. J. Love, formerly senior lecturer in natural philosophy. A brother of Prof. A. E. H. Love, he was born in Weston-super-Mare in 1861; he became a scholar of St. John's College, Cambridge, and, after a short period as lecturer in physics in Birmingham under Prof.

Poynting, he was appointed to Melbourne in 1888. While he maintained a close interest in all branches of physics, his main interest centred in geodesy and thermodynamics. In 1893 he published an account of a measurement of g at Australian stations, and at the time of his death he was secretary of the geodesy committee of the Australian National Research Council. Dr. Love was president of Section A of the Australasian Association for the Advancement of Science in 1907; when he spoke on the thermodynamics of the voltaic cell, and during his teaching work in the University of Melbourne he came to be recognised as an authority on thermodynamics. Acoustics was another interest, and during the last few years he has applied the results of Sabine to the remedying of some local halls that had been acoustically defective. He was president of the Victorian branch of the British Astronomical Association from 1899 until 1903. At the end of 1927 he retired from active teaching duties, and he then presented to the University a valuable collection of scientific periodicals and works on geodesy.

WE regret to announce the following deaths:

Prof. Henri Andoyer, professor of astronomy at the Sorbonne in Paris since 1903, and an associate of the Royal Astronomical Society, on June 12, aged sixty-six years.

Prof. Franz Keibel, director of the anatomical and biological institute, Berlin, and a member of the Prussian Academy of Sciences, author of the "Normentafeln" of vertebrate development, and with Franklin P. Mall of "Handbuch der Entwicklungsgeschichte der Menschen", on April 27, aged sixty-seven years.

Prof. Charles Moureu, professor of organic chemistry at the Collège de France and an honorary fellow of the Chemical Society, aged sixty-six years.

Mr. Robert Ridgway, member of the National Academy of Sciences, curator of the division of birds in the U.S. National Museum since 1876, who was a past president of the American Ornithological Union and an honorary member of the British Ornithological Union, on Mar. 25, aged seventy-eight years.

Dr. Charles E. de Medicis Sajous, professor of applied endocrinology in the graduate school of medicine of the University of Pennsylvania, and president in 1917 of the American Association for the Study of Internal Secretions, on April 27, aged seventy-six years.

Mr. M. R. Oldfield Thomas, F.R.S., for many years assistant in charge of Mammalia, British Museum (Natural History), on June 16, aged seventy-one years.

News and Views.

WE have received from Dr. W. G. Woolnough, geological adviser to the Australian Commonwealth Government, some comments on the leading article in *NATURE* of Mar. 2, dealing with the place of biology in school science. This article, while stressing the unfortunate consequences of the neglect of biology in the schools curricula, pointed out that unless biology was approached through the medium of physics and chemistry the discipline of exact and critical thinking that these sciences confer might be seriously weakened. Dr. Woolnough believes that "it is the very inexactness of the 'biological' sciences which trains those habits of observation as opposed to manipulation, and which brings out the faculty of discrimination which is the essential of true scientific research". But this is only true provided the student has already some basis of observational and manipulative training on which to develop his faculty of discrimination; the whole point of the article was to show that physics, chemistry, and mathematics could not be displaced from this service by biology.

THAT this is so is well shown by the actual illustration given by Dr. Woolnough in support of his views. After much experience in teaching microscopical petrology he has found the heuristic method most effective. The meaning of such terms as refractive index, double refraction, cleavage, etc., is demonstrated to the students, who are then encouraged to make their own discoveries, aided only by a simple tabular guide and their text-books. But this method is only effective because the working material can be relied on not to 'play tricks' with the young student. Cleavage and double refraction, for example, are definite physical phenomena: a doubly refracting crystal does not suddenly change its mind and become opaque for a few days, whereas superficially erratic behaviour of this order is a commonplace in biology. Had his duties been connected with biological instead of non-biological instruction—with, say, mycology instead of petrology—he would have been brought up against this essential difference. It is precisely because exact physical science is the foundation of Dr. Woolnough's teaching methods that he is able to use the method at all.

CORNWALL has produced many distinguished engineers and men of science, but none more worthy than Humphry Davy. It was therefore very fitting that Penzance should do honour to her most distinguished citizen, who was born just opposite the spot where his statue now stands, and where the celebration was carried out. At noon on June 8 the mayor and council of Penzance and the following: Sir Humphry Davy Rolleston, Col. R. Humphry Davy and his wife, and R. Davy (descendants of the family); Sir Ambrose Fleming, representing the Royal Institution; Dr. J. Symons (president), E. H. Davison (secretary), and members of the Royal Geological Society of Cornwall; J. C. Tregarthen (president), J. R. Paull (secretary), and members of the Royal

Institution of Cornwall; H. Jenner and W. L. Fox (past presidents), E. W. Newton (secretary), and members of the Royal Cornwall Polytechnic Society; W. E. T. Hartley, principal, University College, Exeter, and others met at St. John's Hall, and walked in procession to the statue, where a platform had been erected, and in the presence of many thousands several speeches were made.

THE Mayor of Penzance, Mr. W. G. Goodfellow, said in the course of his remarks: We are met here to-day to do honour to the memory of one of the illustrious sons of this borough. Of the three learned societies of Cornwall responsible for arranging these celebrations, two of the presidents are Penzance men, born near this spot, as also was the case with Sir Humphry Davy himself. Dr. Symons and Mr. Tregarthen then laid a wreath of laurel on the monument. Dr. Symons, speaking on behalf of the three learned societies of Cornwall, said that a former mayor, Dr. Richard Pearce, on the occasion of his laying the foundation stone of the present Market House in 1836, remarked that the site of the assembly would ever be considered as memorable. It was here that the greatest philosopher of the age first devoted himself to that science which rendered his name immortal; "Humphry Davy was born in the house just below, where he resided with his parents until they removed to Varfel, Ludgvan, when he was six years of age". It is somewhat a remarkable coincidence that the laying of this wreath should have devolved upon two who were born within a few yards of his birthplace, and who are now the presidents of two of the Royal societies of Cornwall. Mr. J. C. Tregarthen, speaking on behalf of the scientific societies of Cornwall, thanked the Mayor for the civic welcome and said that Davy's almost last words were: "I have added some little to the quantity of human knowledge, and I have endeavoured to add something to the quantity of human happiness". A public meeting was held in the Pavilion in the afternoon, at which the speakers were Sir Humphry Davy Rolleston, Sir Ambrose Fleming, and others.

MR. R. A. WATSON WATT announced in his Symons Memorial Lecture to the Royal Meteorological Society (see *NATURE*, April 6, p. 545) that current weather maps were to be broadcast from Daventry (5XX), and a specimen synoptic chart as received by wireless was reproduced in our columns. Arrangements have been completed by the Meteorological Office, Air Ministry, the British Broadcasting Corporation, and Messrs. Wireless Pictures (1928), Ltd., for the experimental issue from Daventry (5XX) of such weather maps by the Fultograph process between 2 o'clock and 2.25 p.m. on Tuesdays and Thursdays, and transmission commenced on June 18. The map will be prepared by the Meteorological Office and is similar in form to those published in the Press. It shows the conditions over the British Isles and the neighbouring sea areas, and is not only of interest to many who receive the official forecasts and like to visualise the conditions on which they are based, but

should also be of great value to those who have sufficient knowledge of the weather to be able to base forecasts for their own locality upon it. The great difficulty in the past has always been to get weather maps delivered quickly enough for practical use to be made of them. Wireless transmissions will overcome this difficulty, and though during the experimental period the 7 A.M. weather map will not be broadcast before 2 P.M., should the experiment prove successful it may be possible to arrange for an earlier transmission.

THE publication of two volumes of the Annual Report of the Bureau of American Ethnology within a short period of one another emphasises the extent and value to anthropological science generally of the researches which are being carried out under official auspices in the United States. In the interests of research workers in other parts of the world it is to be regretted that publication of these reports is much delayed. Early publication of a record of results is most desirable even if that means postponement of comparative study. In this matter the promptness with which the British Museum has published the results of its investigations in Honduras is worthy of much praise and also emulation by other official institutions. In the present case the forty-second Annual Report, which was the earlier to appear, carries us only to 1925. Much important work has been done since then. The forty-first Report, which has only just appeared, covers the work of five years from 1920 to 1924. Although it must be recognised that the permanent value of these volumes lies in the "Accompanying Papers", in which members of the staff record the result of their investigations, yet the brief introductory reports of the chief, Dr. W. J. Fewkes, are of the greatest interest to those in other countries who wish for an authoritative survey of the general trend of investigations in American archaeology and ethnology. In the present instance in the years under review there has been a great increase in popular interest in the aborigines, and this has strengthened a movement to preserve as national monuments important ancient sites of aboriginal culture. It is also to be observed that a sense of responsibility towards the Indian is growing, a gratifying if somewhat belated sentiment.

It is interesting to note how, in the years covered by the forty-first and forty-second Annual Reports of the Bureau of American Ethnology, the area covered by the work of the Bureau is being extended to wider fields. A beginning has been made in examining and attempting to preserve such vestiges of the ancient culture of Alaska as have survived. Within the United States themselves, the south-western area, not unnaturally in view of its cultural importance, for long almost absorbed the resources of the Bureau. Now, however, attention is being turned to the south-east. To the forty-second Report Mr. John R. Swanton contributes two papers dealing with the Creek Indians and one in which he reviews the information relating to the aboriginal culture of the south-east to be found in the writings of the early English, French, and Spanish writers, as well as the

material collected by himself. The late Mr. William E. Meyer, a lifelong student of Indian antiquities and culture, though not a professional archæologist, is the author of a study of Indian trails of the south-east. A paper by the same author on two prehistoric villages in middle Tennessee is included in the forty-first Annual Report. The Gulf area, which falls within this south-eastern zone, is peculiarly important for American ethnology, as the earliest inhabitants appear to have been a brachycephalic type such as is found nowhere else in America. A third extension which will be of much moment for the work of the Bureau in the future arises from its responsibility for work in Hawaii. As a result of a preliminary survey of the Hawaiian material, made when the Pan-Pacific Congress was held at Honolulu, it has been pointed out that the study of Hawaiian culture involves an extension to Samoa and other parts of the Pacific—a suggestion which has already borne fruit, for since the date of this report much valuable work has been done by American investigators in the Pacific. This emphasises the reflection from which we started, that early publication of these reports is greatly to be desired.

THE Faraday Society is arranging a general discussion on "Molecular Spectra and Molecular Structure", which will be held at the University of Bristol on Tuesday and Wednesday, Sept. 24 and 25. A general introduction to the subject will be given by Prof. W. E. Garner and Prof. J. E. Lennard-Jones. The subject will be discussed in three sections, namely, band spectra in the visible and ultra-violet, which will be specially introduced by Prof. O. W. Richardson; the Raman effect, to be introduced by Sir C. V. Raman; and infra-red spectra, which will be introduced by Prof. C. Schaefer in respect of solids, Prof. J. Lecomte in respect of liquids, and Sir Robert Robertson in respect of gases. Papers have already been promised by Mr. S. Barratt, Prof. G. B. Bonino, Prof. J. Cabannes, Prof. W. E. Curtis, Prof. P. Daure, Prof. I. W. Ellis, Prof. V. Henri, Prof. E. Hulthén, Dr. R. C. Johnson, Prof. V. Kondratjew, Prof. E. F. Barker and Prof. C. F. Meyer, Dr. A. M. Taylor, and Mr. F. I. G. Rawlins. In addition, contributions are expected from Prof. R. T. Birge, Dr. H. A. Deslandres, Prof. F. Hund, Prof. R. S. Mulliken, and Prof. R. W. Wood.

As in the case of recent successful discussions arranged by the Faraday Society, all the papers will be issued in advance proof, and the authors will be invited to devote a few minutes only to directing attention to points which they deem to merit special discussion, so that there will be adequate time for a lively general discussion. By the kindness of the Council of the University of Bristol, members and visitors will be accommodated at the newly opened Wills Hall. Particulars of arrangements can be obtained from the secretary of the Faraday Society, 13 South Square, Gray's Inn, W.C.1. Cheap railway facilities will also be obtainable for those attending the meeting. In view of the exceptionally large number of guests from abroad who will be attending this meeting, it is expected that there will be a

correspondingly large attendance of British workers. The Society extends a cordial invitation to all those interested, whether they are members of the Society or not, and in particular invites research students to be present.

THE dangers attaching to ignorant treatment and working of different types of land are well known to the practical agriculturist. The subject was discussed (*Daily News Bulletin*, Science Service, Washington, D.C.) by Mr. Paul Redington, chief of the Bureau of Biological Survey, when speaking at the banquet of the Third New England Forestry Congress held in Hartford, Conn. After alluding to the fact that much of their forest land is more profitable for producing wood and game animals, Mr. Redington expressed the opinion that in the present era of agricultural depression through over-production it is a mistake to increase the area of farm lands by draining and breaking up of swamps and shallow lakes. "Too largely", he said, "in the past such areas have been looked upon as something merely to be drained to get rid of the water and make the land available for the production of farm crops and live stock. In many instances this has reclaimed land that was utterly unsuited for such production, and at the same time it has destroyed it for uses to which it might have been more profitably devoted. So long as there is more land available than is needed for agricultural and live-stock production, which is the case in the United States, extensive drainage projects are, in my opinion, misdirected effort." From a different viewpoint the caution applies with equal force to Great Britain. We are not in the position of having more land available than is required for agricultural purposes; but it is not in doubt that considerable areas of undeveloped lands in the country will not respond to expensive drainage operations and become thereby of value for agricultural purposes. The first step in the treatment of much of this land is by way of afforestation. Drainage works with the latter object in view are comparatively inexpensive and will not involve the larger scale and excessively costly operations (with probable disaster as their outcome) which are now being announced in some quarters as a panacea for unemployment.

IN the May issue of the *Journal of Chemical Education* C. A. Kraus and S. T. Arnold describe the results of an investigation into the training which chemists should have before entering chemical industry. They visited a number of industrial and research laboratories in the United States and collected representative opinions from research directors and works managers. From a collation of these opinions, it appears that graduates who propose to adopt an industrial career should have a thorough knowledge of general analysis, particularly quantitative, a sound working acquaintance with fundamental organic chemistry, facility in the use of English, and a reading knowledge of foreign languages, especially German. Training in industrial chemistry and in engineering was not stressed, but it was felt that the student should have a reasonably good equipment in mathe-

matics and physics, emphasis being laid upon the importance of thermodynamics. There was little demand for a knowledge of the latest developments of academic chemistry, but the desirability of a year's post-graduate research was urged by practically everyone. Stress was also laid upon personality. It would be interesting to know the views of English industrial chemists upon this matter, since a large number—probably the majority—of graduates in chemistry at British universities enter the chemical industries, and it is clearly of great importance to the country as a whole that they should reach their maximum efficiency as quickly as possible. Incidentally, the foremost position assigned to analytical chemistry may be commended to the attention of science masters in the schools, where there is a noticeable tendency to cut down analysis to a minimum.

REFERENCE was made in our issue of Dec. 17, 1927, p. 890, to the Belgian National Fund for Scientific Research, which was inaugurated at the centenary celebrations held that year of the famous Cockerill Works at Seraing. According to the *Times* of June 12, within a year a sum of no less than £640,000 was given by some 1200 subscribers, and grants have been made to 30 engineers and scientific workers to enable them to carry on original investigation under their employers. Subsidies have also been allocated to research students. The romantic story of the Cockerill firm, which employs several thousands of workmen, begins with the Lancashire mechanic, William Cockerill (1759-1832), who after some adventures in Russia and Sweden settled in Belgium in 1799 and entered into a contract to supply spinning machines, thus introducing into that country an industry of which England had previously had a monopoly. It was his sons, Charles, James, and John who in 1817 founded the factory at Seraing, John, in 1835, becoming the sole proprietor. He died of typhoid fever while on a visit to Russia in 1840, but in 1867 his remains were removed to Belgium. Owing to the German occupation, the centenary of the works could not be celebrated in 1917, but on the one hundred and tenth anniversary of their establishment important gatherings were held, and it was then that the King of Belgium made the appeal for the creation of the National Research Fund.

A PRELIMINARY programme has been issued for the one hundred and tenth annual meeting of the Swiss Society of Natural Sciences. The meeting will be held at Davos on Aug. 29-Sept. 1, under the presidency of Dr. W. Schibler, and the proceedings will be divided up among seventeen sections. The programme includes lectures by Dr. W. Mörkofer, of Davos, on problems of meteorological radiation research; by G. Bener, of Chur, on mountain road construction and science; by Prof. R. Staehelin, of Basle, on the physiology of high altitudes; by Prof. E. Guyénot, of Geneva, on the hypothesis of morphological territories in biology; and by Prof. R. Doerr, of Basle, on the submicroscopic forms of life. Excursions to the Swiss National Park, to one of the institutes for the study of the physiology of high

altitudes, to the Davos observatory, and to other places of interest, are being arranged. All correspondence should be addressed to the secretary, Dr. W. Mörikofer, Observatoire physico-météorologique, Davos-Platz. The titles of communications for the sectional meetings should be sent in by June 30.

THE Annual Report of the Imperial Institute for 1928 is a record of many useful activities in the investigation of agricultural and mineralogical problems, the answering of inquiries, and the promotion of various educational projects. Among the investigations there may be mentioned the examination of Tasmanian stringybark pulp, which showed its value in the manufacture of artificial silk; tests which prove that Indian hemp is equal to European hemp in its resistance to fresh and salt water; the suitability for brick and tile making of clays from various parts of the British Empire, and the examination of many mineral specimens. These are only a few examples of the kind of work which now engages the Imperial Institute, and they show its importance in research into the economic value of various parts of the British Empire.

A DESCRIPTIVE pamphlet on the Hudson Bay Region, with many illustrations and maps, has been issued by the Natural Resources Intelligence Service of the Canadian Government. The forthcoming completion of the Hudson Bay railway to Churchill, in providing a new route to a vast region, revives interest in the resources of this part of Canada. After physical and historical introduction, the pamphlet continues with a description of the forests, minerals, water-power, and game. Gold, silver, and copper-zinc ores have been located and in some places are being worked. The pamphlet, which contains no exaggerated claim for this part of Canada, is an interesting example of the way in which lands that were formerly little known were assumed to be of no value, but are now proving relatively attractive and at any rate not unworthy of considerable attention.

THE seventh congress of the Far Eastern Association of Tropical Medicine, held at Calcutta in December 1927, was the subject of an article in NATURE of Mar. 3, 1928. The *Transactions* of the Congress are now in course of publication (Calcutta: Thacker's Press and Directories) in three large volumes, each of approximately 1000 pages, of which the first has already been received. The growth of the work done by successive congresses may be traced by the size of the *Transactions*, which has gradually increased in successive issues; those of the congress held in Hong-Kong in 1912 were contained in a single volume of 399 pages, while those of the sixth congress held in 1925 in Japan required two volumes and 2313 pages. The present volume comprises the proceedings of Sections I. and II.—the subjects of medicine and dermatology, pathology, surgery, ophthalmology, gynaecology and diseases of pregnancy, mental hygiene and psychiatry, radiology, dentistry, State medicine, general and special hygiene, and maternity and child welfare. Eighty-seven papers, many of

great interest, with the discussions which followed their reading, are contained in the present volume, which is illustrated by 61 plates, mostly in half-tone. The editor, Lieut.-Col. J. Cunningham, is to be congratulated on the result of his labours. The two volumes still to appear, which will contain the papers on such subjects as plague, cholera, leprosy, tuberculosis, bacteriology, protozoology, malaria, kala-azar, medical entomology, helminthology, diseases of nutrition and deficiency diseases, immunology and chemotherapy, and rabies, promise to be even more interesting than the present one to the general scientific reader.

A NEW volume of that comprehensive work entitled "Nauka Polska" (Polish Science), published by J. Mianowski, Warsaw, for the Institute for the Encouragement of Scientific Works, has recently been issued. This quarto volume of nearly 700 pages is the result of the collaboration of seventy-five leading scientific workers, who have reported upon the means of organising and developing education and research in science subjects in Poland. Much attention has evidently been devoted to a consideration of the immediate and future needs of the scientific institutions in the nation's various centres of learning, but public attention is also directed to the progress already made during the past decade. "Nauka Polska" not only includes the natural and physical sciences and their numerous subdivisions, but also gives an account of work in Poland on psychology, criminology, aerodynamics, technology, geography, ethnology, philology, architecture, etc. Interest has hitherto been most concentrated on the applied sciences, such as the technology of the metals. It will be recalled that the president of the country, Prof. I. Moscicki, is himself a distinguished chemist and was formerly director of the Chorzow Fixation of Nitrogen Industry in Polish Silesia. Until recently it was not possible to form an opinion of the extent of the scientific work which was being conducted in Poland since investigators published their results in Russian or German journals. Whilst this is no longer the case, one difficulty remains, namely, the fact that researches appearing in Polish publications only become known to scientific workers abroad through the various abstracting journals.

THE Herbert Spencer lecture delivered at Oxford on May 14, 1929, by Dr. C. S. Myers had for its subject "Psychological Conceptions in Other Sciences" (London: Oxford University Press. 2s. net). The speaker is thus reversing the conventional practice of interpreting the 'higher' sciences in the language of the 'lower'. There is a growing belief among physicists that it is impossible to predict what an individual atom or electron will do or which of the possible jumps of a quantum will occur next. The psychologist, whose chief preoccupation has been with the individual, even when that individual was recognised as part of a group, has found mechanism everywhere, yet prediction with regard to the individual impossible. Dr. Myers in the lecture inquires how far knowledge of the mental world is helpfully applicable to the material world. He

reviews various problems, such as the distinction between primary and secondary qualities, estimation of weight and appreciation of colour, the intensity of sensations, and shows how, with the development of knowledge, ideas of the 'absolute' have been gradually replaced by those of the 'relative'. Physics also has progressed along a similar path, and in place of the older notions of substance and absoluteness is finding itself occupied more and more with structure and entities in themselves unknowable and unimaginable. The lecture is very interesting and suggestive and the point of view original. It should prove stimulating to all scientific workers who are interested in the more ultimate problems of knowledge.

THE Huxley Memorial Lecture for 1930 of the Imperial College of Science and Technology will be delivered by Prof. Graham Wallas, emeritus professor of political science in the University of London, on Monday, May 5, 1930, at 5.30 P.M.

A SMALL earthquake was recorded at Kew Observatory on June 10. The first tremors reached the Observatory at 23 h. 7 m. 51 s. G.M.T. The shock originated near the Arctic Ocean about 200 miles from the Norwegian coast and about 250 miles from Tromsø, near latitude 71° N., longitude 9° E. A large earthquake was recorded at the Observatory on June 17. The first tremors arrived at 23 h. 7 m. 37 s. G.M.T., and the epicentre is estimated to have been about 12,000 miles away.

THE Albert Medal of the Royal Society of Arts for the current year has been awarded by the Council, with the approval of the president, the Duke of Connaught, to Sir Alfred Ewing, Principal and Vice-Chancellor of the University of Edinburgh, "for his work on magnetism and his services to technical education". The Medal was founded in 1863 as a memorial to Prince Albert, and is awarded each year "for distinguished merit in promoting arts, manufactures, and commerce".

At a meeting of the executive committee of the Imperial Botanical Conference (1924), held in London on Jan. 18 last, it was decided to arrange a short Imperial Botanical Conference to be held immediately before the International Botanical Congress in 1930. The Imperial Botanical Conference, which it is intended should last only one day, will meet in London on Friday, Aug. 15, 1930, at the Imperial College of Science and Technology, South Kensington, S.W.7. The agenda before the conference will be purely of a business nature. The proposal to hold a further Imperial Botanical Conference in 1935, on lines similar to that held in 1924, will be discussed, and, if necessary, the appropriate organisation for convening the conference will be arranged. Reports of the committees which have dealt with the resolutions of the 1924 conference will be received.

THE January-March issue of *The World's Health* (Vol. 10, No. 1), the organ of the League of Red Cross Societies, is presented to readers in quarterly form as an experiment. A survey of the present position of leprosy is commenced in this number, with articles on leprosy in Japan, Siam, and Columbia.

THE Medical Directory Guide to "British Spas and Climatic Health Resorts" for 1929, edited by Dr. R. Fortescue Fox, has been issued by Messrs. J. and A. Churchill, 40 Gloucester Place, W.1, price 1s. Information is given of the medicinal waters and spas of Great Britain and of marine and inland health resorts, with the clinical indications which may influence the choice of a particular spa or resort for a patient.

THE monthly publication of the Air Ministry known as the *Marine Observer* fills an important place in meteorological research with its copious notes supplied by observers at sea on various phenomena, and its abundant charts and illustrations. A feature of recent numbers has been the general articles compiled at the Air Ministry on various aspects of marine meteorology. These are valuable chapters, not only to sailors, but also to students. The May issue contains a long article on the formation, occurrence, and prediction of fog, and another article on the local winds of the Mediterranean and Black Seas. The April number had an account, illustrated by many charts, of the distribution of ice in the western North Atlantic, with special reference to the work of the United States *Marion* expedition in Davis Strait in the summer of 1928.

WE have recently received copies of a number of *Leaflets* issued by the Ministry of Agriculture and Fisheries, which have been rewritten in order to bring them up-to-date with advances in knowledge. The *Leaflets* deal with various pests affecting agriculture and serve to keep the farmer and grower advised as to the best practical measures for controlling such enemies. Apple capsids are of particular interest because they have only become serious pests during the present century, and a good deal of research has been, and is still being, concentrated upon them. The latest *Leaflet* on the subject was rewritten in August 1928 and revised in January 1929 in order to bring to public notice the results of recent practical researches. Other *Leaflets* deal with onion fly, slugs and snails, insecticides, and kindred subjects.

A CATALOGUE of books on chemistry and chemical technology has been issued by Messrs. H. K. Lewis and Co., Ltd., 136 Gower Street and 24 Gower Place, W.C.1. It contains particulars of a large number of books arranged under a very convenient system of classification.

MESSRS. Francis Edwards, Ltd., 83 High Street, Marylebone, W.1, have just circulated a handsome illustrated catalogue (New series, No. 2) of some 1000 books, pamphlets, and engravings relating to North America, which should be of interest and value to geographers and historians. The catalogue contains facsimile reproductions of the title-pages of many of the works listed; also bibliographic notes on some of the volumes.

MESSRS. C. BAKER, 244 High Holborn, London, W.C.1, have sent us a copy of the new issue of their classified list of second-hand scientific instruments (No. 94). This list is now sent out twice a year only. As usual,

the list contains a comprehensive selection of microscopes and microscope accessories, and there is a large section on surveying instruments, which, it may be noted, are let out on hire. Arrangements can also be made for hiring other apparatus. Other sections deal with projectors, telescopes of various kinds, and various physical apparatus.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A junior assistant at the Forest Products Research Laboratory, Princes Risborough—The Secretary, Department of Scientific and Industrial Research, 16 Old Queen Street, Westminster, S.W.1 (June 25). A geologist in the Geological Survey Office, Department of Industry and Commerce, Irish Free State—The Secretary, Civil Service Commission, 45 Upper O'Connell Street, Dublin (June 26). A junior lecturer in the department of pathology of the University of Liverpool—The Registrar, The University, Liverpool (June 27). A head of the school of engineering at The Polytechnic, Regent Street—The Director of Education, The Polytechnic, Regent Street, W.1

(June 28). An assistant lecturer in machine drawing and design in the engineering department of the County Technical College and School of Art, Newark—The Secretary, County Technical College and School of Art, Newark (June 29). A number of junior assistants at the National Physical Laboratory—The Director, National Physical Laboratory, Teddington (June 29). A wireless engineer under the Government of Nigeria for the Posts and Telegraphs Department—The Crown Agents for the Colonies, 4 Millbank, S.W.1 (quoting M/1267). An assistant lecturer in the department of biology of the Huddersfield Technical College—The Director of Education, Education Offices, Huddersfield. A lecturer in chemistry and physics in the school of pharmacy of the Merchant Venturers' Technical College, Bristol—The Superintendent, Merchant Venturers' Technical College, Bristol. A lecturer in building and civil engineering at the Royal Technical College, Salford—The Secretary for Education, Education Office, Salford. An assistant in the mechanical engineering laboratory of University College, London—The Secretary, University College, Gower Street, W.C.1.

Our Astronomical Column.

THE TOTAL SOLAR ECLIPSE OF MAY 9.—Dr. Baade, of Bergedorf Observatory, was stationed at Sogod in the Philippine island of Cebu. He reports in *Astr. Nach.*, 5630, that cirrostratus clouds interfered with the photography of the outer corona; but very successful plates of the inner corona were obtained, which show its structure clearly. Rev. T. E. R. Phillips exhibited at the meeting of the Royal Astronomical Society on June 14 some prints of the corona obtained by Dr. R. Waterfield at Iloilo, Philippines. The extension shown on these was about one solar radius, but the negatives showed it a good deal further. There appeared to be much less extension of the corona near the sun's poles than elsewhere; this is a familiar feature at sunspot minimum but less common near maximum.

THE FUTURE OF THE SUN.—The above is the title of the first of three articles by Dr. Harold Jeffreys on geology and the related sciences to appear in the *Realist*; the first is in the June issue. Dr. Jeffreys notes that the hypothesis of the contraction of a great rotating mass of gas with an accompanying shedding of equatorial rings (originally propounded by Laplace and developed by Roche, Helmholtz, Kelvin, Lane) was held by many astronomers up to the beginning of this century; it was gradually discarded on two grounds; it gave an insufficient time-scale, and there were grave dynamical difficulties in connexion with the moments of momentum of the sun and planets.

Part of the contraction hypothesis was held until the year 1924; the dwarf stars were supposed to be those that had contracted beyond the point of continuing to have a purely gaseous constitution, so that by Lane's law their temperature would now decline. Eddington then concluded by theoretical reasoning that the rate of radiation of energy should depend almost wholly on the mass of the star. On plotting the stars of known mass he found that both giants and dwarfs lay on the same curve, and that the state of perfect gas continued much longer than was previously supposed, owing to the stripping off of the outer rings of electrons in the stellar atoms. A strong confirmation of the correctness of this conclusion was

afforded by the demonstration of the great density of the companion of Sirius, which at the same time gave a proof of the shift of spectrum lines in a strong gravitational field which Einstein had predicted.

The energy of stellar radiation is now ascribed to the conversion of the stellar matter into light and heat; the details of the process are still obscure, but it is conjectured that colliding protons and electrons may cease to exist as matter, becoming simply radiation. The energy in the atom is so great that the possible life of the stars is extended from a few million years to many millions of millions. The former contradiction between the estimated past duration of the sun and that of the earth has thus been completely removed.

THE OPACITY OF STELLAR ATMOSPHERES.—The Bakerian Lecture at the Royal Society was delivered on June 6 by Prof. E. A. Milne on the subject of the opacity of stellar atmospheres. He notes that the problem involves the study of the property of layers of gas, given the amount of the energy flux, and the intensity of the gravitational field: it is further necessary to consider the effect of changing temperature in comparing the different spectral types, and the effect of absolute magnitude in comparing different stars of the same spectral type. It is pointed out that there is no sharp boundary between photosphere and reversing layer, but that one merges into the other. The solution of the problem depends largely on study of the contours of spectral lines, that is, on the determination of their intensities at different distances from the centre of the lines. The method is applied to a zinc triplet in the spectra of Capella (bright component) and the sun, which are taken as a typical giant and dwarf of type G0. The absorption coefficient κ is found to be 300 for the sun and 60 for Capella. Miss Payne found $\kappa = 150$ for A-type stars, which is in satisfactory accordance. Once κ is known the number of atoms above the photosphere can be calculated on certain assumptions for the different elements. It is shown that the dependence of κ on the electron pressure P is confirmed by the fact that observation indicates an effect depending on absolute magnitude for stars both at low and high temperatures.

Research Items.

SEX AND INFANT MORTALITY.—The difference in the mortality of the sexes during infancy is one of the most significant indications available of the constitutional factor in disease. During infancy the environment is uniform for both sexes, so that variation in the mortality rate between males and females may be attributed to variation in the sex response to environmental factors. From this point of view, Dr. Harry Bakwin has analysed the infant mortality throughout the United States registration area for the ten-year period 1915–1924 inclusive (*Human Biology*, vol. 1, No. 1, 1929). Male mortality far exceeded female: under one year of age, to every 100 female deaths there were 130 to 134 deaths of males. The difference is not confined to the first year, but is most marked at birth and decreases with age until in the fourth year the death-rate is about equal for the two sexes. But there are two exceptions to the gradual decrease: on the third day of life the mortality difference between the sexes is more marked than at birth, and it is also more marked during the second month than during the first. Since 1900 there has been a fall in infant mortality, but it would appear that relatively more females than males have benefited, for coincident with the common fall there has been a rise in the sex mortality ratio. There are seasonal differences in the ratio, as well as regional differences, England, Wales, and Scotland having a high ratio, whereas it is low in Italy, Japan, Jamaica, and Spain. In rural communities, moreover, the ratio is lower than in city areas.

A PRE-ISLAMIC GOD OF ARABIA.—In the *Indian Antiquary* for May, Ch. Muhammed Ismail figures and describes an image of the god Wadd sculptured on a stone now in the Prince of Wales's Museum of Western India and formerly in the possession of the Bombay branch of the Royal Asiatic Society. The importance of this image is that out of a large number of Arabian sculptures and stones with inscriptions mentioning the god Wadd, this is the only one of which the words purport to say that it is the image of the god Wadd. Owing to a misreading, a decipherment by James Bird in 1844 failed to identify it. Wadd was the most important of the pre-Islamic gods of Arabia, that is, of the peace-loving and commercial citizens of Himyar and Saba, who differed widely from the wild Bedouin. All ancient Arabs wore talismans bearing his name, and temples were dedicated to him as the god of love and happiness. His image has been described by an Arab commentator as that of a tall man wearing a loin cloth with another cloth over it, a sword hanging round his neck, and with a bow and a quiver, in front of him a lance with a flag attached to it. The present figure differs. The god is shown as a short man wearing a kilt. On his head is a close-fitting cap with a long tassel which seems to represent a strand of hair. Bedouins who come to Aden from the hinterland still shave the lower parts of the head, but keep a tuft or sometimes a long strand of hair on the crown. The author comments on the neglect of Arabian antiquities by the Indian Government in Aden and its hinterland, which is under its jurisdiction, but notes that, stimulated by Sir John Marshall's interest in field work, the Aden Historical Society is taking up this important subject.

ADAPTATIONS OF THE PELVIS IN MARSUPIALS.—The marsupials show so wide a range of habits that a comparative study of the pelvis in relation to function has, in the hands of Herbert Oliver Elftman, afforded some clear evidences of special adaptation (*Bull.*

Amer. Mus. Nat. Hist., March 1929). Much of the adaptation is associated with locomotion. Thus in arboreal forms there are largely increased muscles of adduction and a more open acetabulum allowing greater freedom of motion of the femur. Leaping forms, with their exaggerated hind limbs, require an elongated post-acetabular portion of the pelvis to provide leverage for the hamstrings, the ilium has an outward flare, and there is a large ilio-sacral angle. Fossorial adaptation depends on the particular method of digging employed by the animal, but in general the ischium is long, the iliacus attains great size and is thus partly responsible for the broadness of the ilium. The shape of the pelvis, however, is also associated with other than locomotor factors. The gross form is determined by its relation to the viscera. Its width is influenced by the width of the trunk. The size of the sacro-iliac angle and the position of the sacro-iliac joint are conditioned by the size of the erector spinae muscle and the necessity for an adequate pelvic outlet. The marsupial bones assist the abdominal musculature in the support of the viscera and protect the pouch from distortion during the contraction of these muscles.

DIFFERENTIATION *IN VITRO* OF CARTILAGE AND BONE.—Dr. Honor B. Fell (*Archiv. f. exp. Zellforschung*, 7, 1928) records the results of observations on the differentiation *in vitro* of cartilage and bone. Cultures of embryonic limb-cartilage from 8-day fowl embryos were made by the ordinary coverslip technique. The explanted limb-cartilage enlarged greatly during cultivation, and in several specimens differentiated into epiphysal and diaphysal regions. After 10–12 weeks' growth *in vitro*, a proportion of the explants were in a healthy condition. Cultures of undifferentiated limb-bud mesenchyme from 3-day fowl embryos exhibited chondro-genesis although the tissue was spreading over the surface of the coverslip. Cartilage thus formed *in vitro* sometimes remained in a healthy state during three months' cultivation but underwent no differentiation into epiphysal and diaphysal regions. After 3–4 weeks' cultivation, ossification was observed in several cultures and the progress of bone deposition followed in the living explants.

INTERRELATIONSHIPS OF THE ECHINODERMATA.—An exhaustive discussion of the major systematics of Echinodermata, based on anatomical, embryological, and palaeontological evidence, is offered by Prof. D. M. Fedotov, of the Russian Academy of Sciences (*Travaux du laboratoire zoologique et de la Station biologique de Sébastopol*; Série 2, No. 12, Leningrad, 1928). Pelmatozoa are regarded by the author as the group which has given rise to other Echinodermata. The sea-lilies are derived by him from Cystoidea, while a discussion of the anatomical, embryological, and palaeontological evidence on sea-urchins leads him to the conclusion that this group stands quite isolated amongst other classes of the Eleutherozoa, there being no definite grounds for suggesting a relationship between sea-urchins, star-fishes, and holothurians; the origin of sea-urchins was probably in the Cystoidea Diploporita. Star-fishes and ophiurs the author believes to have originated from the Edrioasteroidea, though there is no direct evidence in favour of this view. Holothurians are an exceedingly ancient group, dating back perhaps to Palaeozoic times, and originated independently from sea-urchins, star-fishes, and ophiurs, but still must be considered as belonging to the Eleutherozoa.

ALIENS IN THE FLORA OF VICTORIA.—In an interesting note on the naturalised aliens in the flora of Victoria (*Proc. R. Soc. Victoria*, 41; 1928) Prof. A. J. Ewart states that in 1909 the number of aliens recorded was 363 and in 1928, 461. This rate of increase, slightly more than five per year, has been maintained with remarkable uniformity for the past sixty years. The aliens include the clovers, trefoils, medicks, most of the more valuable pasture grasses, and some garden plants that have run wild. Less than a hundred of the aliens are serious weeds, and few of them so serious a menace as the native bracken on newly cleared forest land. The transport of fodder is probably responsible for the relatively high proportion of aliens contributed by South Africa, which include some of the worst weeds. Prof. Ewart considers that owing to the competition of imported aliens and the pressure of settlement, probably less than half of the original flora (about 3000 species) will survive within fifty years, and many originally widespread plants will be confined to special localities. Were it not for the disturbing factors introduced by man, the spread of the aliens might have been used as a test of Willis's age and area hypothesis. Among the interesting cases cited are: the evening primrose (1887) has covered less ground than the foxglove (1917); the musk weed, *Myagrum perfoliatum* (1916), has become more abundant than the horehound, *Marrubium vulgare* (1870); and the stinkwort, *Inula graveolens* (1893), rapidly overtook the stinkweed *Gilia squarrosa* (1887), both in area and abundance. Even taking species of the same genus, it appears that the time factor is of far less importance in determining the area covered by a species than its suitability to new habitats, its means of distribution, its aggressiveness, and its resistance to foes and injurious agencies. "It seems probable that the age of a species is one of the least important of the factors governing its distribution, and that in only few cases can a relation be traced between the age of species and the area they cover at the present day."

JAPANESE HEPATICS.—The first part of what should prove an important series of papers upon the Hepaticæ of Japan, by Yoshiwo Horikawa, has appeared in the *Science Reports* of the Tôhoku Imperial University, vol. 4, No. 1, series 4. The author points out that more than 500 species are already reported for Japan, of which no less than 65 per cent are endemic. In the present contribution, species of two very interesting genera are described, *Makinoa* and *Schiffneria*. In the case of *Makinoa*, it is interesting to note that the constriction of the thallus, at the point where the sexual organs are developed at the close of the season, enables the different annual increments of growth to be distinguished. In this way six or seven years' growth contributions can sometimes be separated in the same specimen. Field observations of this kind upon the age of patches of liverwort seen growing in Nature are not very common.

THE KARAKORAM RANGE.—The *Records of the Survey of India*, vol. 22, contains Major K. Mason's account of his explorations in 1926 in the Shaksgam and Upper Yarkand valleys and the Aghil Ranges, with a map on a scale of 1 inch to 4 miles. The report contains a full illustrated account of his travels and a number of appendices on geology, natural history, etc. In discussing the nomenclature of the area, Major Mason points out that the term in general use, Karakoram Range, is a misnomer and that it means literally 'black gravel', and was first applied to the high pass on the route between India and Yarkand. From this pass the term came to be applied to the iciest range of mountains outside polar regions, on

which the actual pass does not lie. Accepting the usage, however inappropriate it may be, Major Mason proposes to use the term Karakoram-Himalayas to the whole mountainous area and to distinguish within it three main ranges. Of these the southern he proposes to call the Kailas-Karakoram, the second he terms the Mustagh-Karakoram, and the most northerly the Aghil-Karakoram. To the north-east of this last range lies the Aghil 'Red' Range, which, however, Major Mason was unable to visit. The merits of this nomenclature are discussed at length in the report.

OIL WELL 1½ MILES DEEP.—Some idea of the astonishing progress of petroleum production-engineering methods is obtainable from a record set up by an oil company operating in West Texas, U.S.A., which succeeded in drilling a successful oilwell to a depth of 8523 ft. below surface. Not only does this represent a wonderful engineering feat, but at one period a measured production of 1125 barrels of oil, and an estimated production of some 12,500,000 cubic ft. of gas, indicate the discovery of pools of no mean consequence. The well formed part of the deep test programme at Big Lake oilfield, and was brought in towards the end of last year. In this region of Texas, known as 'West Texas', a thick Permian limestone, marl, and anhydrite series is exploited principally, but the depth of this particular well leads to the inference that Pennsylvanian beds (Upper Carboniferous) have been penetrated. It is noteworthy that of the 8523 ft. drilled, 2339 ft. represents 'open hole,' 5½ inch casing being set at 6184 ft. There is no reason why drilling should not be carried deeper so far as these data go, but the very high rock-pressure at such depths would tend to exert a controlling influence, while the natural flow of oil and gas in the quantities stated implies similarly high fluid pressure. The temperature of the oil (flowing) was 49° F. The question has often been raised concerning the economic depth of ordinary drilling, attempts having been made to state a maximum beyond which cost of drilling and control would outweigh values yielded by the oil obtained; where pumping costs have to be added, the problem is further complicated. It would seem, however, that deep well drilling is an accepted policy to-day, and if in the future (when oil prices appreciate) the location of deeply buried pools, in fields already exploited for their shallow production, becomes a matter of necessity, there is little doubt that this record will be broken, if it has not already been in the case of other previously projected deep wells.

EINSTEIN'S UNIFIED FIELD THEORY.—Mr. G. C. McVittie, in the June issue of the *Proceedings of the Royal Society* (No. A, 794), has provided a supplement to Einstein's somewhat abstract account of the new theory by showing in detail how it can be applied to a simple case. For an electrostatic field uniform in direction and nearly constant in magnitude, but with a slight exponential change of strength as we go along the field, it is possible to obtain exact solutions of the gravitational and electromagnetic equations of the older general relativity theory. These solutions are then substituted in the corresponding equations of the new unified theory. As a result it is found that the new equations are satisfied to the first order but not to higher orders. This shows clearly to what extent Einstein's new equations differ from his old ones. It will be recalled that in a letter to *NATURE* of May 4, p. 678, Prof. Levi-Civita outlined a modification of Einstein's new theory, with the object of obtaining exactly, and not merely to the first order, the older equations on a unified basis. Mr. McVittie would perform a useful service if he would exemplify Levi-

Civita's theory by applying it to the simple case mentioned above.

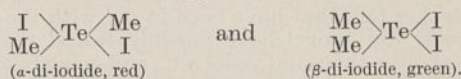
RADIO-INTENSITY MEASURING APPARATUS.—The utility of high frequency radio transmission systems and their extending use has created a demand for an instrument capable of measuring the strength of the magnetic field at any point. J. Hollingworth and R. Naismith read a paper on May 1 to the Wireless Section of the Institution of Electrical Engineers describing a portable apparatus suitable for measuring the absolute strength of the field produced by these currents. An instrument suitable for measurements of this kind can rarely be made by merely altering the electric constants of apparatus suitable for low frequencies. Resistance, capacity, and inductance are no longer constants at high frequencies. The set consists of a detector valve and a control valve. One stage of audio-frequency amplification follows the detector, and a two terminal thermionic valve allows a galvanometer to be used for the signal comparison. A separate heterodyne is used to obtain the audio-frequency. The instrument is capable of measuring the intensity of the magnetic field over a radio band of 5 to 12 megacycles per second. Without batteries it weighs about sixty pounds, and so can be carried in a light car. The authors use an aerial connected to one end of a high resistance, the other end being earthed. The discussion of high frequency measurement, aerial effective height, and wave attenuation all come into the problem. The method adopted, therefore, is to subject the instrument to searching tests for internal self-consistency and then test it out of doors on local transmissions. The results enable the experimenter to determine whether the instrument is reasonably accurate or not. Experimental results are given showing the kind of accuracy obtainable. The work carried out by the authors is part of the programme of the Radio Research Board.

BORIC ACIDS.—Various compounds of boric anhydride with water in different proportions have been described, but the only two boric acids definitely known in the solid state were orthoboric acid, $B_2O_3 \cdot 3H_2O$, and metaboric acid, $B_2O_3 \cdot H_2O$. By means of vapour pressure determinations in the series $B_2O_3 \cdot nH_2O$ and measurements of the weights of water lost in passing from one part of the system to another, L. F. Gilbert and M. Levi have been able to show that probably there are eight compounds of the type $nB_2O_3 \cdot H_2O$, where $n=1, 2, 3 \dots 8$. This work is described in the *Journal of the Chemical Society* for March, and an approximate value for the heat of hydration of boric anhydride to orthoboric acid is given. This value differs considerably from previous ones, which are thought to be inaccurate.

EXPERIMENTS WITH CAREFULLY DRIED SUBSTANCES.—The *Proceedings and Transactions of the Nova Scotian Institute of Science*, vol. 17, Part 2, contains an account by D. McIntosh of attempts made to prepare carefully dried substances by employing low temperatures. A mixture of carbon monoxide and oxygen may be dried by cooling in a solid carbon dioxide-ether mixture, as was shown by Girvan, and after being kept in the freezing mixture for some hours cannot be exploded by an electric spark. The gas explodes, however, at about -50° , when there is about 1 molecule of water present in 40,000 molecules of gas. A similarly treated mixture of nitrous oxide and carbon monoxide always explodes at -80° . Other experiments on intensive drying by cooling were not successful, probably on account of the difficulty of removing the water film from the glass surface of the

apparatus. Thus, the reaction between hydrobromic acid and ammonia could not be inhibited, although the vapour pressure of the water was reduced to one-thousandth of a millimetre.

NON-EXISTENCE OF ISOMERISM AMONG THE DIMETHYLTELLURONIUM DIHALIDES.—Two forms of dimethyltelluronium dihalides were obtained by Vernon and from them two distinct bases, and he accordingly postulated the existence of two series (α and β) of isomeric compounds. He concluded that the tellurium atom had a planar distribution of valencies and suggested formulæ of the type



More recently this isomerism has been explained by assuming, from the electronic point of view, that the halogen-tellurium linkages are non-equivalent (see *NATURE*, April 6, p. 547). In the *Journal of the Chemical Society* for March, H. D. K. Drew gives an account of a re-examination of the dimethyltelluronium di-iodides and dibromides, and the two bases. He concludes that the members of the β -series are not isomeric with the α -compounds. The α -compounds appear to be of normal type, are in general non-polar, and the tellurium atom in them probably has a tetrahedral distribution of valencies. The β -compounds are complex substances resembling salts, but having the same empirical formulæ as the members of the series.

PRESERVATION OF TIMBER.—At the Glasgow meeting of the British Association, a paper was read by Prof. Percy Groom on the "Antiseptic Preservation of Timber" (published in *Empire Forestry Journal*, vol. 7, No. 2, 1928). In his paper, Prof. Groom correctly states that the antiseptic preservation of timber is "usually regarded as merely a means of decreasing the damage done to timber by fungi (and insects), but when properly applied it can result in a positive increase of the available supplies of commercial timbers and thus be equivalent, in effect, to increase of production, and may thereby become closely linked with forestry." The author deals briefly with the losses incurred in the British Empire by decay to timber due to want of adequate preservation and the increased supplies which would result from a better economic utilisation of the available amounts. Such questions have received a great deal of attention at the Research Institute at Dehra Dun, where the first commencement in this line of research in the British Empire was made. Prof. Groom deals with his subject in a highly informative manner, and his paper should be studied by all interested in timber and its utilisation. What, from the practical utility point of view, may be considered a side issue but one of considerable scientific interest, is the author's reference to the interaction of fungi and insects in the destruction of timber, a line of research which promises to be of considerable interest. Prof. Groom's theme did not include this study, but it is alluded to as follows: "The destruction of timber by fungi that cause rot and by insects that burrow into wood may be lessened by a *septic sanitation*, that is to say, by the adoption of measures designed to decrease the production of spores or eggs and to render the external conditions unfavourable to the activity of these organisms". Prof. Groom states that a combination of sanitation and antiseptic treatment gives the best economic results, but his paper is confined to the latter and omits a consideration of insects. His remarks on this subject are of interest.

The South-Eastern Union of Scientific Societies.

CONGRESS AT BRIGHTON.

THE thirty-fourth annual congress of the South-Eastern Union of Scientific Societies was held at Brighton on June 5-8, Sir Arthur Keith occupying the presidential chair in succession to Sir Martin Conway.

In his address Sir Arthur took as his subject "The Pre-Roman Inhabitants of Southern England." His endeavour was to trace the people of southern England from the coming of the Beaker folk about the beginning of the second millennium B.C. to the time of the arrival of the Romans. The remains of the Beaker folk that have been found with the aid of the pick and shovel have possibly traced that race up to about a thousand years B.C., and going backward from Roman times, the folk that Sir Arthur called the 'pit-diggers' have possibly been traced back to 600 years B.C. Between these two dates there is a wide interval of which we seem to have no records, and it is this interval that archaeologists are endeavouring to fill in. Southern Englishmen of pre-Roman times have been disinterred from time to time from the Downs of chalk, which show that they all had certain well-defined common cranial characteristics, and they all have affinity to the Beaker folk who began to invade England from central and north-western Europe some 2000 years before the Christian era.

From the remains that have been found at Blackpatch, near Worthing, it is possible to infer what was the mode of life of these folk. These early Downsmen grew their corn and ground it. They domesticated certain cattle, such as the ox, the sheep, and the pig, and were no longer purely hunters. They had looms. The red deer they hunted, and used the antlers as effective mining tools. They fabricated flint implements of the same patterns as those from the neighbouring mines of Cissbury.

Speaking of the finds of Beaker folk in the neighbourhood of Brighton, Sir Arthur first of all referred to the skeleton of a woman who had been laid to rest in a grave that was cut into when a trench was made for carrying a cable to a golfing club-house on the east of Brighton. The body was laid on its side with the limbs folded on the body. There was also here the crouched skeleton of a child some two months old. The oval pit in which they had been laid had been completed by covering it with a layer of flint cobbles. Unfortunately there was no grave furniture, no coin, shard, metal, or ornament to show the date at which the woman and child "ceased to breathe the fresh air of the South Downs". Although her skull was of the long type, there were certain features that showed affinity to the Beaker type, a type that is known by its flat vertical occiput, its strong face with rugged features, the eyebrows being usually very prominent and the forehead receding. The type is still frequently seen in England, and it was stated that men of the type are often leaders in communities, Darwin himself reproducing its features.

There appear to be two circumstances which give a clue to the identification of the Beaker people, the crouched position in which they are buried, and the covering of the grave with flint-nodules. Another burial was uncovered in north Brighton in which a woman was buried in a similar position, and although she was long-headed there were traces of Beaker ancestry. She is known as the Maycroft skeleton. Another crouched burial was laid bare at Moulscombe pit, to the north of Brighton, where a male counterpart of the Beaker woman was found. Another burial was discovered when the Ditchling Road was extended to the north, when a male skeleton was disinterred,

but his skull was somewhat wider and his face shorter than the Moulscombe man. In this case a beaker was found, of the kind used in England in the early part of the second millennium B.C., and with it was a barbed flint arrow-head under the skull. Several other graves have been found of a similar nature.

Sir Arthur then referred to the ancient flint-mines of Blackpatch and the barrows nearby, whence the skeletons proved to be the same folk as the Brighton people. One proved to have had a remarkable head. It was not the typical Beaker head, for it was both long and wide, being 195 mm. by 155 mm., and it has been thought that it represented a cross between long-headed and round-headed stocks. The graves were destitute of grave furniture, and the men were probably the miners who dug the flint-mines close at hand. A crouched burial of a man with all the characters of the Beaker breed was taken from a barrow on the heights above St. Catherine's Point in the Isle of Wight. On the Downs at Nunwell, 12 miles to the north, a skeleton was found in 1881, and the contents of this grave are preserved in the Carisbrooke Museum. With it was buried a lugged pot-like vase, which was thought by Mr. Crawford to have been fabricated in the upper valley of the Rhine, possibly towards the end of neolithic times. The trail of the Beaker-men has been traced through Belgium into England and along the Kentish Downs, and in all cases the resemblance is great. Sir Arthur raised the question as to whether the Beaker folk practised child-sacrifice. It may be that by coincidence a child died at the same time as the adult with which it was buried, but in quite a number of cases a child was buried with the adult, and this has been found to have been the case at Brighton, on Dunstable Down, in Belgium, and at Worbarrow. Did the Beaker people sacrifice children to give youth to their dead, or was an adult sacrificed to guard the child in the realms to which it had gone? The Beaker blood appears to have been swamped as time went on by that of the ancient natives of England.

Mr. Hadrian Alleroft, in addressing the Archaeological Section, asked the question as to what was the earliest church, and adduced evidence to show that a church was at first an open-air enclosure, and was not a building at all. It was really a burial-place, and a walled-in church was later than the burial-ground in which it stood. The Scottish Christianity from Ireland was introduced after the withdrawal of the Romans, and for many centuries looked with disfavour upon any church building of any kind. The circular place of burial would enclose a few beehive-huts for the monks, but no reference can be found that in the earliest days there was any place for united worship. A Christian must be buried before the enclosure could become consecrated ground, and if Nature failed to provide this, the early Christians obtained a voluntary sacrifice of a human life. In the case of the founding of the monastery at Iona St. Oran volunteered to go to heaven, and was buried on the spot selected for the monastery.

The excavations at Blackpatch, near Worthing, made by Mr. J. H. Pull and Mr. C. E. Sainsbury, were described by the former. The position of this prehistoric site is on the borders of an old road running along a spur of the Downs $2\frac{1}{4}$ miles west of Findon, at between 300 and 400 feet, O.D. Here was found a mine-field containing a closely grouped series of pits sunk through the chalk until a seam of good flaking flint was reached in the zone of *Actinocamax quadratus*. Many of the shafts were cleared

and low horizontal galleries were found at their base radiating therefrom. Close at hand were open-air hearths, sunken hut floors, and a series of round barrows, and these barrows have yielded valuable evidence of the Beaker-men who excavated the flint.

Following the address by Mr. A. D. Cotton, of Kew Gardens, on "The Importance of the Study of Systematic Botany", a paper was read by Dr. Geo. Morgan on wood-nodules on trees, in which he made a clear distinction between sphaeroblasts, or hard knobs of wood existing independently of the inside wood of a tree, and burrs or irregular excrescences from the layers of the wood. Sphaeroblasts or woody tumours appear to be in the vegetable kingdom a parallel to the tumours in the animal kingdom known as dermoids.

Dr. G. P. Bidder took "Death" as the subject of his presidential address to the Zoological Section. He held that death was biologically a new thing relatively, and that senescence and natural death were not necessary attributes of life. There is no such quality of protoplasm as inherent or intrinsic senescence. That part of a living body that is not converted into protected spores, gemmules, or eggs is the body that undergoes the process of natural death.

There is reason to believe that the female plaice and certain anemones do not die, except by accident.

The distribution of certain Sussex birds and insects was dealt with by Mr. A. F. Griffiths. Mr. Reginald Smith gave a public lecture on "Early British Art", and showed that before the Romans came over, the Britons had achieved a decorative art of the highest order. It had its origin in classical art, chiefly of the Greeks of the age of Pericles, moulded by Roman influence later. The artistic but warlike Celts had made a Greek settlement on the Rhine about 440 B.C., and as at this time this country was called Britain, it was perfectly correct to speak of Celtic art in relation to British discoveries round about that period.

In the Geological Section, Mr. Henry Dewey gave an address on "The Denudation of the Weald", and Mr. Edward A. Martin read a paper on "The Brighton Pleistocene Cliff-Formation". The presidential address to the Regional Survey Section was read on behalf of Prof. H. J. Fleure, and dealt with various aspects of regional work, and this was followed by a paper by Mr. David Edwards, the Brighton Surveyor, on "Town and Regional Planning".

The Congress included a reception by the Mayor, Alderman H. J. Galliers, and a number of excursions were made to places of interest in the county.

The Strangeways Research Laboratory, Cambridge.

THE trustees of the Strangeways Research Laboratory, Cambridge (Sir Humphry Rolleston, Prof. H. R. Dean, Prof. Malcolm Donaldson, and Sir Charles J. Martin), have issued an attractive little pamphlet setting out briefly the history of this remarkable institution. Beginning in 1907 in a small house as a research hospital with three beds for the study of rheumatoid arthritis, it has gradually developed into a research institute devoted entirely to the study of tissue culture both in its general biological and its more strictly medical aspects. Though still small and not too well endowed financially, it has now taken a leading place among the research laboratories. This remarkable achievement has been brought about through the lovable personality, the selfless devotion, and the patient, persistent, careful work of the late Dr. T. S. P. Strangeways, who died two years ago. Neither academic distinctions nor scientific honours came his way, but no scientific man could wish for a finer reward than to have his name associated with an institution such as this laboratory.

Although radium is being used more and more extensively in the treatment of cancer, its use is still almost entirely empirical, for until recently little was known of its mode of action on either the normal or the malignant cell. This was one of the problems which had engaged the attention of Dr. Strangeways during the last few years of his life, and by applying radium to cells cultivated *in vitro* and following the subsequent effects under the microscope in the living cell, he and his pupils have succeeded in obtaining

information which has thrown a new light on this obscure problem, and has revealed the inadequacy of some of the *a priori* conceptions current among clinical radiologists.

The beautiful kinematograph films of Dr. Canti, which many of our readers may have seen and admired, were made in collaboration with the Strangeways laboratory. This and other work is being continued, and it comes rather as a shock to find from the trustees' report that up to the present neither the director nor any research worker has received payment from the funds of the institution. "This gift of service has in most cases been rendered possible only by the aid of fellowships or research grants from other sources. The tenure of benefactions of this kind is, however, limited to a few years, and if the excellent work which is being carried out at the Strangeways Research Laboratory is to continue and the foundation remain in its present form—a monument to the unselfish enthusiasm of its originator—its income must be increased sufficiently to enable it to provide salaries for a small permanent staff."

The staff consists of five research workers, with Miss Honor Fell as chief of the laboratory. This year a course of instruction in the technique of tissue culture will be given at the laboratory on July 9–Aug. 10. Since only a limited number of applicants can be received, notification from those wishing to take the course should be sent not later than June 30 to Dr. H. B. Fell, Strangeways Research Laboratory, Cambridge.

Sugar Beet in England.

THE progress of the sugar beet industry in England has been followed with the closest attention since 1924, but the interest naturally increases with the approach of the end of the term of years during which the Government subsidy is in operation. The question which confronts the English farmer is not whether the crop can be grown in England, but whether it can be grown *profitably* when faced with the competition of the open market. Experiments of various

kinds have been carried out in different parts of England to make a thorough investigation as to the best methods of cultivation, manuring, and harvesting, and at the same time the continental procedure has been closely studied in order to make the best possible use of their longer experience. It seems generally clear that profits can be made at the present time (about £5 per acre being quoted as an average from one area for last year), but the closest co-operation must be

built up between the growers and the factories, and costs still further decreased, before the industry can safely be regarded as self-supporting. Improvements made by the farmer will be of little avail if the crop is not marketed economically.

A comprehensive review of the situation is given in the "Report of the Second Sugar Beet Conference", held at Harper Adams College, and also in an article by E. C. Pretyman in the *Journal of the Royal Agricultural Society*, vol. 89. It seems generally agreed that beet can be grown on a number of soils, but that the best crops are obtained on a deep soil: there must be no deficiency of lime. Seed should be sown plentifully on a carefully prepared seed bed in late April or early May, a dressing of dung if possible having been given to the preceding crop or in the previous autumn, though artificials can usually be applied with advantage instead. Early singling is of the greatest importance, the distance between the plants not exceeding ten inches; the spacing between the rows should be the smallest possible to allow of thorough cleaning. Lifting should take place as soon as the crop is ripe, usually from mid-October to mid-November, in order to obtain the maximum sugar content. In this respect the continental farmer is at an advantage, in that his crop matures earlier than in England.

As regards harvesting implements, the ordinary lifting plough appears to be as suitable as any 'looseners' employed on the Continent, and the fundamental factor on which economic marketing depends seems to be efficient organisation of harvesting operations, rather than on the introduction of expensive machinery. Labour is the chief item in the grower's costs. Generally speaking, this is both more plentiful and cheaper in Germany and Belgium than in England, a large proportion of the work being done by well-organised gangs of labourers which travel

round the country. If the beet is grown 'in shift', that is, in place of the ordinary root crop such as mangolds, the farmer in England has probably no need to obtain outside labourers, and in this way his costs are kept low. On the other hand, his acreage and therefore his returns are also limited, and if at some distance from a factory transport introduces heavy charges. Co-operation alone provides a solution to these problems.

The question of improving the percentage sugar content in the beet is as yet imperfectly understood, but an increase in tonnage lies more in the farmers' hands and is certain to bring in a larger return. Returns can also be appreciably increased by an intelligent use of by-products; in fact, the financial success of the beet crop may depend on it. The tops, as well as the wet or dry pulp available at a low price from the factory, are valuable as cattle food, and the continental farmers invariably make full use of them for this purpose. Reduction in factory costs is all-important for the success of the industry. Heavy expense is incurred owing to the factories lying idle except during a few months in the autumn and winter, and if the extraction process could be continued throughout the year, an appreciable reduction in costs could be made. A new system is now on trial at the Eynsham factory with the view of achieving this by means of subjecting the beet to a drying process. It is claimed that the dried slices or 'cosettes' can be stored without undergoing deterioration or loss in sugar content, but the method has still to be proved before any far-reaching claims can be made for it.

The future of the industry in England cannot yet be predicted, but there seems no reason why it should not prove successful if every effort is made to reduce costs to a minimum, and to secure the closest co-operation between the grower and the factory.

Jubilee of the Hellenic Society.

ON June 24 the Society for the Promotion of Hellenic Studies will celebrate the fiftieth anniversary of its foundation. On the afternoon of that day a commemorative meeting will be held in the Stationers Hall, Ave Maria Lane, at 3 P.M. The chair will be taken by Mr. Arthur Hamilton Smith, president of the Society, who will deliver his presidential address. Prof. Gilbert Murray has promised to speak, and addresses and greetings from friendly and allied bodies will be presented. In the evening of the same day a festival dinner will take place at the Criterion Restaurant, at which Mr. A. Hamilton Smith will preside. The guest of the evening will be Lord D'Abernon, who will propose "The Prosperity of the Society", a toast in which he will be supported by Sir James Frazer. The reply has appropriately been entrusted to Mr. George Macmillan, honorary secretary of the Society from 1879 to 1919, and now honorary treasurer, to whom the Society has been deeply indebted throughout its history for his unceasing activity on its behalf.

When the Hellenic Society, as it is familiarly, if incorrectly, called, was founded in 1879, the extent and character of the influence it was to exert in humanistic studies could scarcely have been foreseen. Not only was the trend of the political situation at that time obscure; it was also necessary that those who controlled the Society should be at some pains to define its activities in order to remove an impression from the mind of the public to whom it hoped to appeal, that its aims were not exclusively literary. Accession to its numbers was rapid and influential.

At the second annual meeting the council was able to announce a membership of nearly four hundred, while the first page of the original candidates' book reads like a scholars' roll call with such names as Canon Seddon, Dr. Donaldson, J. R. Green, J. E. C. Welldon, Rev. J. A. Magrath, and Robinson Ellis, to name a few only. In regard to the scope of its activities, there is no side of the life and art of ancient Greece on which it has not touched, but above all it has earned the undying gratitude of the scholar and historian by the way in which, both as a body and through its individual members, it has fostered research in the prehistory of the Eastern Mediterranean.

Within the years of the life of the Society, Sir Arthur Evans, always one of its most prominent members, has revealed an entire civilisation second to none in importance in the history of human culture. More directly, perhaps, is gratitude due for the active interest taken by the Society in the foundation of the British School of Archaeology in Athens, the practice ground of a distinguished line of British archaeologists and scholars. The foundation of such a school was the subject of discussion in the council from the early days of the Society. This bore fruit in the opening of the School in 1886. Fittingly enough one of the two memorial volumes to be issued in connexion with the anniversary deals with the excavation of the sanctuary of Artemis Orthia at Sparta carried out by the School, and is edited by Prof. R. M. Dawkins, a former director. The second volume, by Mr. George Macmillan, is a history of the Society.

University and Educational Intelligence.

CAMBRIDGE.—The Ministry of Agriculture and Fisheries has informed the secretary of the School of Agriculture that a grant not exceeding £3000 has been sanctioned by the Empire Marketing Board for the provision of buildings to investigate the use of B.C.G. vaccine in the protection of calves against tuberculosis.

Dr. Marshall has been reappointed reader in agricultural physiology.

Mr. F. P. Ramsey, King's College, has been reappointed University lecturer in mathematics.

The electors to the Isaac Newton Studentships give notice that an election to a studentship will be held early in the Michaelmas Term, 1929. These studentships are for the furtherance of advanced study and research in astronomy.

EDINBURGH.—Sir Alfred Ewing, who is retiring from the principalship of the University, and Lady Ewing have received warm testimony of the esteem in which they are held in Edinburgh. On June 11 a portrait of Sir Alfred was presented to the University and a replica to Lady Ewing at a large gathering of subscribers in the Upper Library Hall. The presentations were made by the Lord Provost, and Sir John Gilmour, Lord Rector of the University, accepted one of the portraits on behalf of the University. The portraits, by Mr. Henry Lintott, R.S.A., represent Sir Alfred in his robes as Vice-Chancellor. On June 14, at a great gathering in the M'Ewan Hall, gifts from the students were presented to Sir Alfred and Lady Ewing, who, on leaving the hall, were accorded a great demonstration and were drawn in a decorated carriage by way of Princes Street to their house in Moray Place. On June 18 the members of Senatus entertained Sir Alfred at dinner in the Senate Hall. Lady Ewing has also received a gift from the wives of the members of the staff of the University.

The resignations are announced of Dr. R. Stewart MacDougall, reader in agricultural zoology, who has been responsible for the teaching in agricultural and forest entomology since 1906, and of Dr. John Stephenson, lecturer in zoology (invertebrates) since 1920 and formerly professor of zoology and principal of Government College, Lahore.

MANCHESTER.—The Council has accepted a gift of £1500 from Messrs. Benger's Food, Ltd. This amount, together with a previous gift of £500 from the same source, is to be devoted to the furnishing and equipment of the new laboratories for pharmacological and pharmaceutical chemistry, which will bear the name of the "Benger Laboratories".

The Grisedale scholarships for biological research, previously of £100 each, will in future be combined in one annual scholarship of £200. In the present year two scholarships of £200 will be offered, and application must be made to the Registrar not later than June 22.

DR. LEWIS F. RICHARDSON, who is in charge of the Physics Department, Westminster Training College, London, has been appointed Principal of Paisley Technical College.

THE Royal Commission for the Exhibition of 1851 has made the following appointments to the five Senior Studentships offered for award in 1929:—On the recommendation of the University of Cambridge: Mr. F. P. Bowden (Tasmania), for research in physical chemistry; Mr. C. S. Hanes (Toronto), for research in plant physiology; Mr. M. L. E. Oliphant (Adelaide), for research in experimental physics; Mr. B. Woolf (Cambridge), for research in biochemistry, all at the University of Cambridge. On the recommendation of the Imperial College of Science and Technology:

Dr. W. F. Whittard (London and Cambridge), for research in geology and zoology at the Imperial College of Science and Technology.

THE National Congress of Parents and Teachers in the United States, which had in 1928 a membership of 1,279,000, is engaged in a strenuous campaign for promoting child welfare through the stimulation of parental interest and sense of responsibility. In the December issue of *School Life* an account is given of one of its activities known as 'the summer round-up of the children', the essential features of which are: (1) A physical examination on or before May 1 of all children who will be due to enter school for the first time in the following autumn; (2) the application during the summer of appropriate treatment for remediable defects; and (3) a second inspection in the autumn to ascertain the extent to which the defects have been corrected. The aim, of course, is to ensure for as many children as possible a fair start on their school career. Begun in 1925, this enterprise has been successful, whilst maintaining the closest relation and most helpful co-operation with the regular health agencies, in securing the personal activity of the parents. Clearly the parents thus early aroused to the need of preventive and corrective measures are likely to continue to take an intelligent interest in such matters—and this view has been abundantly confirmed. An investigation made after the first of these 'round-ups' indicated that less than 3 per cent of the children examined were not in need of remedial treatment. The campaign has the support and co-operation of the United States Bureau of Education, the American Medical Association, and other important bodies, and numerous doctors, dentists, and nurses give their services freely in the examinations.

THE Report on the work of the Department of Petroleum Technology of the Sir John Cass Technical Institute for the session 1928-29 has just been issued. While differing but little from that of the previous session, in so far as the schedule of work and organisation is concerned, it is clear that steady progress is being maintained, and that the particular body of men for whom the courses are specially designed, namely, those engaged in clerical and administrative branches of the industry, is deriving a considerable benefit therefrom. The necessity for co-operation between industry and educational authorities has been sufficiently voiced ever since the War; in a recently published Board of Trade report, this policy is re-emphasised, and each great industry is enjoined to "make its own educational needs the subject of thorough and systematic examination". While the oil industry as a whole can certainly be acquitted of any charge of neglect on this score, the Sir John Cass Institute has gone more than half-way in giving practical expression of the desire of the academic world to do its share. There can be no possible excuse for any non-technically trained man in the industry who desires to widen his knowledge and thus to better himself, if he does not take full advantage of such instruction as is here provided. The chief subjects covered during the session were general technology of petroleum, chemical and physical properties, methods of examination of oils, and the applications of engineering. It is satisfactory to note that two most important subjects were included in the work of this session: "Developments in Lubrication" and "Geophysical Methods as applied to Oil-finding". This in itself is sufficient testimony to the thoroughly modern character of the curriculum and, incidentally, significant of the value attaching to the policy adopted by the Governors for the past eight years, that of keeping in close touch with prominent men in the industry in its several specialised branches.

Calendar of Patent Records.

June 23, 1789.—General Henry Seymour Conway, nephew of Sir Robert Walpole, and Secretary of State from 1765 until 1768, was granted a patent on June 23, 1789, for utilising the waste heat from coke-ovens and conveying it through pipes "for the working of steam engines, the baking of bread, meat, or other food, the calcining and fusing of ores and metals, the making of brass and steel, as also for the purpose of warming rooms, staircases, large buildings, and for heating water".

June 24, 1738.—The patent granted to Lewis Paul on June 24, 1738, includes the earliest example of cotton-spinning by roller-drawing, the specification describing a process in which the prepared sliver having been passed through one set of rollers, "a succession of other rowlers, cillinders, or cones, moving proportionately faster than the first, draw the sliver into any degree of fineness which may be required". There is, however, very little evidence to show that this part of the invention was ever put into practical operation, and the main credit for the introduction of roller spinning must be given to Sir Richard Arkwright.

June 24, 1856.—The system of interlocking railway points and signals was the invention of John Saxby, of the L. B. & S. C. R., and was patented by him on June 24, 1856. The advantages of the new system were at once recognised and it was generally adopted. Works were started by Saxby first at Haywards Heath and then in London, and branch factories were opened in Brussels and Paris.

June 25, 1761.—An early attempt at the manufacture of the parts of watches by machinery was made by George Sanderson, watchmaker, of Exeter, who was granted a patent for his invention on June 25, 1761. On the same date, June 25, a year later, a second patent was sealed to Sanderson for a "lunar and calendar watch-key", in which a calendar mechanism in the key was caused to advance one day by the act of winding the watch. According to Britten, keys on this plan were made by Etienne Tavernier of Paris at the end of the eighteenth century.

June 26, 1799.—The first self-acting carding-machine for making wire cards for preparing wool and cotton was patented by Amos Whittmore and Clement Sharp of London on June 26, 1799. The machine bent and cut the wires, pricked holes in the leather, and inserted the teeth into the holes by one operation, but the cards produced by it were too coarse to supersede the hand-made cards in Great Britain, where the art had been brought to great perfection. The inventors therefore took their machine to America, where it proved very successful owing to the lack there of efficient card-makers. Afterwards, the patent was acquired by the American, J. C. Dyer, who so greatly improved the machine that he was able to reintroduce it into Great Britain and to establish a considerable trade. His improved machine was patented in 1811.

June 27, 1838.—The successful production of seamless brass and copper tubing is due to Charles Green, of Birmingham, whose patent for the process was granted on June 27, 1838. The invention, similar to John Wilkinson's earlier process for making lead tubes, consisted in drawing a thick tubular ingot, the internal diameter of which was approximately the same as that required for the finished tube, until it had been reduced to the requisite thickness. The inventor proposed to use on his drawbench four rollers arranged at right angles, the periphery of each being hollowed out so that when brought together a complete circle was formed.

Societies and Academies.

EDINBURGH.

Royal Society, June 3.—W. C. M'Intosh: On abnormal teeth in some mammals, especially in the rabbit. In the Primates the chief irregularities are the development of extra molars, the narrowing of the tip of the lower jaw so that the incisors and canines are crushed from their normal positions, asymmetry of the muzzle, gaps between the teeth, and bulging of the rows of grinders internally or externally. In the Carnivora, gaps between the incisors in the maxilla and mandible, displacement and duplication of canines and duplication of incisors are found. In forms suffering from peridontitis salivary calculi occasionally occur. Displacement of a canine may be accompanied by an aperture in the hard palate into which the tooth fits. About twenty Rodents other than rabbits have been found with abnormal teeth, amongst which striking cases exist in the beaver, hare, and the brown rat, the right mandibular incisor in the former making more than a circle and penetrating the soft parts. In the teeth of the sperm whale the dentine and cement may be diseased and abraded. The folding of the root of the small tusk of the female dugong is noteworthy. In the Ungulates and marsupials numerous abnormalities present themselves. Special attention was devoted to the rabbit, abnormal teeth in which were described in about 100 cases and grouped temporarily into (1) those with the upper incisors more or less symmetrically curved outward; (2) upper incisors deflected to one side; (3) upper incisors curved into the mouth. The old view of such dental abnormalities being due to external injury must be abandoned, since in every group congenital causes or diseases were usually at the root of the abnormalities.—Ian Sandeman: Bands in hydrogen related to the Fulcher system. The $3^3S \rightarrow 2^3S$ system of Richardson and Das is extended, the band previously given as the null band (0, 0) now being taken as (2, 0), while two additional vibrational levels are added on the infra-red side.—J. A. V. Butler and W. O. Kermack: The action of salts of polynuclear bases on colloidal suspensions and on the electro-capillary curve. In small concentrations, salts of 5:6-benz-4-carboline and its derivatives effect precipitation of colloidal gum benzoin and other negatively charged lyophobic colloids, but when higher concentrations are used no precipitation occurs and the colloidal particles acquire a positive charge. Experiments on the precipitation of colloidal gum benzoin by mixtures of benz-carboline and gelatin indicate that the presence of the gelatin tends to decrease the adsorption of the benz-carboline. Benz-carboline sols, present in low concentration ($M/20,000$), exercise a marked effect on the electro-capillary curve of mercury, the depression being maximum on the positive side of the maximum of the primary, that is when the mercury is positively charged relative to the solution. The results indicate that benz-carboline ions undergo marked adsorption even on a positively charged surface.—Sir Thomas Muir: The theory of skew determinants and paffians from 1891 to 1919.

DUBLIN.

Royal Irish Academy, June 10.—R. Lloyd Praeger: Report from the Fauna and Flora Committee on recent additions to the knowledge of the fauna and flora of Ireland. The report deals with recent progress in our knowledge of a large number of Irish animal and plant groups, and where a previous comprehensive report has been published, it gives a detailed account of all additions.—R. Lloyd Praeger:

Semperviva of the Canary Islands area, with special reference to hybrids. The paper was mainly the results of four months' work in the Canary Islands in 1927, and dealt especially with the occurrence of numerous hybrids among the species of *Sempervivum* which form so marked a feature of the vegetation of that region.—J. Kaye Charlesworth: The glacial retreat in Iar Connaught. The glaciers of the ice-centre of Iar Connaught overrode the western part of the Central Plain of Ireland, and on their retreat deposited the marginal accumulations about Lough Corrib and Lough Mask. On the inner side of these moraines there lies a wide zone devoid of moraines. This zone is followed by the central area of the submontane and cirque moraines of the local glaciation of Iar Connaught. They probably denote a new advance of the ice.—J. J. Drumm, R. J. P. Carolan, and Hugh Ryan: The constitution of iso-catechin tetramethyl ether. Iso-catechin tetramethyl ether was prepared from chloro-catechin tetramethyl ether by indirect hydrolysis. It consisted of colourless crystals melting at 121°-122°C., whereas catechin tetramethyl ether melts at 146°-147°C. The preparation of iso-catechin tetramethyl ethyl ether and of iso-catechin tetramethyl methyl ether are also described. Both of these are optically active but differ markedly from catechin tetramethyl ethyl ether and catechin tetramethyl methyl ether respectively in optical activity and melting point. The racemic form of iso-catechin tetramethyl ether and of iso-catechin tetramethyl methyl ether could not be obtained by the reduction of the respective ethoxy- and methoxy-pyrylium colour bases, which latter, together with chloro-catechin tetramethyl ether were first produced by Drumm (*Proc. R. I. Acad.*, 36, B. 5 (1923), p. 46). The work is in agreement with that of Freudenberg (*Annalen d. Chemie*, 1925, 446, 87) who has shown that in the preparation of the chloro-catechin tetramethyl ether of Drumm (*loc. cit.*) a pinacolone transformation takes place involving a wandering of the veratryl group with consequent formation of an $\alpha\beta$ -diphenyl propane derivative; catechin itself being an $\alpha\gamma$ -diphenyl propane derivative.—J. J. Drumm, Sheila M. Maguire, and Hugh Ryan: -3.4-Dimethoxybenzyl-3.5-dimethoxycoumaranone. The previous work of Drumm, MacMahon, and Ryan (*Proc. R. I. Acad.*, 36 B (1924), p. 154) had shown that the reduction of veratrylidene -3.5-dimethoxycoumaranone by means of hydrogen in presence of platinum black gave rise to a dihydro compound, in the formation of which latter compound it was assumed the veratrylidene double bond was reduced, leaving the carbonyl group untouched. It is now shown that in the above reduction the carbonyl group is unaffected, for on treatment with phenyl magnesium bromide, a colourless crystalline carbinol is obtained, melting at 82°-83°C. This carbinol on bromination in the ordinary way yields a monobromo derivative melting at 115°C.

PARIS.

Academy of Sciences, May 13.—Guido Ascoli: The approximate representation of functions.—J. Delsarte: The Fredholm transformations rendering invariant a quadratic functional.—Coulomb: A formula of quantic algebra.—Fahir Emir: A new determination of the thickness of a film of oleic acid in the state of saturation on water and of the saturation pressure of this film. The experimental results given agree well with those of Marcellin as regards the thickness of the saturated film, but the figures for the saturation pressure are definitely lower. The causes of the difference are discussed. The film has the same thickness on distilled water and on weak (N/20) hydrochloric acid.—Pierre Auger: The theory of a

photo-electric effect. The formula recently deduced by A. Sommerfeld gives a distribution formula in good agreement with experiment.—Mme. and M. Lemarchands: The constant of equilibrium in double decompositions in aqueous solution. A study of the reversible reaction $\text{BaSO}_4 + 2\text{HCl} = \text{H}_2\text{SO}_4 + \text{BaCl}_2$. From the equilibrium constants at 18°C. and 100°C. and the application of the van 't Hoff equation, a figure for the heat of reaction is found which agrees within the limits of experimental error with the direct thermochemical determination.—H. Colin and A. Chaudun: The concentration of the sugar and velocity of hydrolysis in acid solution.—Mlle. Suzanne Veil: The ferromagnetic properties of the ferrites.—Ch. Bedel: Some conditions of solubility of silicon in hydrofluoric acid. Hydrofluoric acid in the presence of oxidising agents (potassium permanganate, chromic acid, ferric chloride, hydrogen peroxide) dissolves silicon readily. The nature of the metal forming the containing vessel also exerts an influence on the rate of solubility.—Swigel Posternak and Théodore Posternak: The configuration of inactive inosite.—Georges Mignonac and Odd W. Rambeck: The action of cyanogen chloride, bromide, and iodide on the sodium compound of ethyl malonate. The syntheses of ethane tetracarboxylic acid and ethylene tetracarboxylic acid. The cyanogen halides do not react similarly. Sodium ethyl malonate, in ether solution, gives mainly ethylmalonic ether with cyanogen chloride: replacement of the latter by cyanogen bromide gives a mixture of the ethyl ethers of ethylene tetracarboxylic acid and ethane tetracarboxylic acid. The latter substance is the sole product when cyanogen iodide is used.—Mme. Ramart-Lucas and F. Salmon-Legagneur: The comparative stability of isomers from their absorption spectra. (Dehydration of glycols, isomerisation of ethylene oxides.)—L. Royer: The corrosion of a crystal of dolomite by an active isotropic liquid. A comparison of the corrosion figures of dolomite produced by active and by inactive organic acids shows that the result is affected by both the optical symmetry of the crystal and by that of the acid.—Jean Chevrier: The daily variation of the electrical potential of the air and of electrical loss during the month of September 1928 at the Observatory of Ksara (Liban).—Paul Becquerel: The latent life of pollen grains in a vacuum at -271°C. Pollen grains (*Antirrhinum*, *Nicotiana*) after drying over caustic baryta, were placed in a tube from which the air was removed as completely as possible with a Langmuir condensation pump and then sealed up. The tubes were placed in liquid helium (temperature -269° to -271°·7 C.) for seven hours and kept for five months. The germinating power remained unaltered by this treatment, although similar grains preserved in dry air for seven months lost their germinating power.—Raymond-Hamet: Pharmacological applications of the technique of the kidney transported to the neck.—René Fabre and Henri Simonnet: The physical and biological study of the dextrorotatory sterol isolated from beer yeast. The slight curative effect (anti-rachitic) observed with irradiated zymosterol is regarded as probably due to traces of ergosterol left in the product in spite of careful purification.—Edouard Chatton and Mme. M. Chatton: The conditions of conjugation of *Glaucoma scintillans* in lethobacterial cultures. The direct and specific action of certain zygoen agents.—H. Péneau and G. Tanret: A dextrorotatory sterol of yeast, zymosterol. Details of the method of preparation from yeast, purification, analysis, physical and chemical properties. The alcohol is not simply isomeric with ergosterol as it contains two hydroxyl groups and has the formula $\text{C}_{27}\text{H}_{40}(\text{OH})_2$.—H. Jacotot: The preparation of a

hyperactive serum against cattle pest.—V. Zernoff : An attempt at serotherapy in *Galleria melonella*. The injection of the blood of vaccinated larvæ produces a curative effect, and this curative property of the blood of vaccinated larvæ may be preserved for several days *in vitro*.

ROME.

Royal National Academy of the Lincei, Mar. 3.—G. Fubini : The canonical pencil.—G. Armellini : The horizontal diameter of the sun in 1927 and 1928. Measurements of the horizontal diameter of the sun during its passage of the meridian, made at the Campidoglio Observatory by various observers, give the following mean values for the past few years : 1924, 16' 1.03"; 1925, 16' 0.63"; 1926, 16' 1.02"; 1927, 16' 1.54"; 1928, 16' 1.58".—A. Comessatti : Galois' curves (2).—G. Scorza-Dragoni : Integrals of the equation, $y' = f(x, y)$.—G. Krall : Local limitations of dynamic effort.—A. Wundheiler : A generalised displacement in Riemannian spaces. In a paper published last year, Gerhard Thomsen described applications of a new notion of parallelism in Riemannian spaces, termed the Fermi parallelism. The latter is defined by certain properties, which lead to a formula worked out by Thomsen in the particular case when the displaced vector is orthogonal to the curve of transport. In the present paper the general formula for this displacement is derived.—G. Vitali : The centres of curvature of the geodesics of a variety. It is shown that, if P is a point of a variety V_n of n dimensions, in which the σ_2 of V_n has $n + \nu$, $\nu = (n + 1)/2$ dimensions, the centres of curvature in P of the ∞^{n-1} geodesics of V_n issuing from P are situate on a hyper-sphere K passing through P of the linear space S_ν of ν dimensions lying in σ_2 and perpendicular to V_n .—F. Lamberti : Two particular dynamic equations of a linked material system.—Gabiella Armellini Conti : Colorimetric observations made during the total eclipse of the sun on June 29, 1927. A series of photographs, taken at Ringebu (Norway), of a polychrome screen exposed to the sun's light confirm the red coloration of the light apparent during the eclipse.—L. Martinuzzi : The electrical characteristics of meteorites (the hypothesis of an electrical origin of their luminosity) and a limiting value for the density of the ions in the upper atmosphere. Burgatti (1927) has advanced the view that the luminosity of meteorites may be of electrical origin. A simple calculation, made on the basis of certain assumptions, of the electrical charge necessary to a meteorite in order that bombardment of the ions present in the zones traversed may render it luminous, leads to somewhat high values for this charge and hence for the corresponding potential. Taking into account the fact that the charge should be negative, the values found are not easily explained, since, as Burgatti pointed out, it would be more reasonable to expect that meteorites would become positively charged by photoelectric action; nothing is, however, known concerning the distribution of potential in the universe. The necessary value calculated for the number of ions per c.c. agrees well with the number required for Heaviside's reflecting layer.—E. Amaldi and E. Segrè : The theory of the Raman effect. The mechanism of the Raman effect proposed by Smekal and generally accepted would indicate that Raman lines corresponding with very intense infra-red bands should be also very intense. Observations have failed to confirm the existence of any such relationship, and it is now shown that the experimental results are in complete accord with the theories of Schrödinger and Dirac, and that with any Raman line there corresponds, not necessarily

an infra-red absorption band, but simply the difference between two terms; only when, by chance, such two terms combine directly will an infra-red line exist.—L. Fernandes : Investigations on sulpho-salts (8). Persulpho-salts.—G. Malquori : The system $\text{Fe}(\text{NO}_3)_3 - \text{KNO}_3 - \text{HNO}_3 - \text{H}_2\text{O}$ at 25°.—F. de Carli : The double carbonate of cobalt and potassium. The double salt, $\text{CoCO}_3, \text{K}_2\text{CO}_3, 4\text{H}_2\text{O}$, may be completely dehydrated by heating it at 120° in a current of carbon dioxide. Measurement of the dissociation tension at various temperatures, and application of Nernst's approximate formula, give for the heat evolution corresponding with the equation, $\text{Co} + 1\frac{1}{2}\text{O}_2 + \text{C} = \text{CoCO}_3$, the value 169.43 or 163.13 Cal., according as the heat of formation of CoO is taken as 63.80 or 57.59 Cal. Calorimetric determination gives the value 173.31 Cal.—A. Pieroni : Naphthophenoxanthones. $\alpha\beta$ -Naphthophenoxanthone cannot be obtained by the general reactions serving for the preparation of the $\beta\beta$ - and $\beta\alpha$ -isomerides, possibly owing to the ready elimination of the carboxyl in the α -position of the naphthalene nucleus, but is formed when α -benzoyl- β -naphthol is heated with aluminium chloride for 2 hours at 150°; it crystallises in golden-yellow needles melting at 173°, and its solution in sulphuric acid is yellow and shows an intense green fluorescence.—T. G. Levi : 1 : 3 : 5-Dithioazine (formothialdine). This, the first member of the thialdine series, has not previously been described. It may be obtained, together with trithioformaldehyde, by treating aqueous formaldehyde solution with sulphur or, better, ammonium hydrogen sulphide.—Giulia Martinez : Heulandite from Monastir.—R. Grandori : Symbiotic micro-organisms in the egg of *Pieris brassicae* L.

VIENNA.

Academy of Sciences, Feb. 28.—A. Haas : Stefan's law and the theory of light quanta. The number of light quanta emitted is proportional to the third power of the temperature, whilst the average energy of the single light quantum is proportional to the temperature itself.—R. Bortsch : The determination of stresses in discs with arbitrary boundaries.—A. Dadies and K. W. F. Kohrausch : Studies on the Raman effect (1). The Raman spectrum of organic substances (fatty acids and their esters).—R. Weiss and A. Kratz : A new synthesis of cumarine derivatives (2).

Mar. 7.—A. Kailan and A. Schachner : The velocity of esterification of fatty acids with ethylene-glycolic hydrochloric acid.—W. J. Müller : The theory of passivity phenomena (5). The influence of covering films on the potential of a metal.—G. Koller, H. Ruppertsberg, and E. Strang : The condensation of *o*-amino-benzaldehyde with keto-dicarboxylic acid esters and di-keto-carboxylic acid esters.—R. Dworzak and K. Hermann : Cyclic acetals (2).—W. Schmidt : The structure of the wind. To obtain the simultaneous wind velocities at a series of adjacent points a new method of observation was worked out. Light pressure plates in great numbers were brought together and photographed kinematographically. The experiment was made on an area of 10 × 10 metres.—F. Hölzl : The alkylation of tri- and tetra-cyano-cadmium acids.—K. Funke and H. Wolf : Researches on perylene and its derivatives (23rd communication).—A. Pongratz : 24th communication.—A. Zinke and W. Hirsch : 25th communication.

Mar. 14.—W. J. Müller and K. Konopicky : The anodic behaviour of aluminium. An inquiry arising out of the surface passivity of aluminium.—R. Wegscheider : The photochemical transformation of *o*-nitro-benzaldehyde.—E. Späth and N. Polgar : The

quaternary bases in *Berberis vulgaris*. Besides berberin there is also palmatin, iatrorrhizin, columbamin, and berberrubin.—E. Späth and G. Papaionou: Phenol bases in the bark of *Angostura*; synthesis of galipolin.—R. Dworzak and J. Pierri: Studies on *a*-bromo- and oxy-aldehyde.—C. Doelter: Blue rock salt.—F. Hochstetter: Contributions to the developmental history of the human brain.—K. Fritsch: Observations on flower-visiting insects in Styria, 1909. *Helleborus niger* had many visitants on sunny days in its natural localities, *Prunus avium* was visited by *Macroglossa luciformis*. Other observations supplementary to Knuth's work.—G. Ortner: Measurement of strong polonium preparations by means of the charge transported by the emitted α -particles.—F. Hölzl, Th. Meier-Mohar, and F. Viditz: Alk-oxonium-hexa-cyano-cobaltates.—K. Menger: (1) A partition theorem for rational and irrational dimensional assemblages. (2) The nowhere dense partial assemblages of *Rn*. (3) Deducing the concept of dimension from postulates.—E. Deussen: The composition of iron fluoride.

Official Publications Received.

BRITISH.

Malayan Forest Records, No. 6: Mangrove Forests of the Malay Peninsula. By J. G. Watson. Pp. viii+275. (Kuala Lumpur, F.M.S.: Conservator of Forests.) 3 dollars; 7s.

Commonwealth of Australia. Second Annual Report of the Council for Scientific and Industrial Research for the Year ended 30th June 1928. Pp. 38. (Canberra, F.C.T.: H. J. Green.) 1s. 8d.

Memoirs of the Punjab Irrigation Research Laboratory. Vol. 1, No. 2: A Statistical Examination of the Sensitivity of a Water Table to Rainfall and Irrigation. By Bernard Howell Wilsdon, with R. Partha Sarathy. Pp. 24. (Lahore: Government Printing Office.) 1 rupee; 1s. 6d.

Report of the Botanical Survey of India for 1927-28. Pp. 8. (Calcutta.)

Tanganyika Territory. Report of the Department of Agriculture for the Year ending 31st March 1928. Pp. 57. (Dar es Salaam.) 2s. 6d.

Miscellaneous Publications of the Royal Alfred Observatory. No. 7: The Cyclone Season 1927-1928 at Mauritius. By R. A. Watson. Pp. 4+47 charts. (Mauritius.)

The Research Association of British Paint, Colour and Varnish Manufacturers. Technical Paper No. 1: Tung Oil; a Review of the Possibilities of Production within the British Empire, with a Complete Bibliography of the Literature relating to Tung Oil from 1917-1927 excluding Patents. By Dr. L. A. Jordan. Pp. 40. (Teddington.)

Journal of the Marine Biological Association of the United Kingdom. New Series, Vol. 16, No. 1, May. Pp. 363. (Plymouth.) 12s. 6d. net.

Journal of the Royal Statistical Society. New Series, Vol. 92, Part 2. Pp. 163-321+xii. (London.) 7s. 6d.

Transactions of the Optical Society. Vol. 30, No. 3, 1928-29. Pp. iv+101-140. (London.) 10s.

Seale-Hayne Agricultural College, Newton Abbot, Devon: Department of Plant Pathology. Fifth Annual Report for the Year ending September 30th, 1928. (Pamphlet No. 30.) Pp. 40. (Newton Abbot.)

Annals of the Natal Museum. Edited by Dr. Ernest Warren. Vol. 6, Part 2, May. Pp. 171-336+plates 12-22. 19s. net. Vol. 5, Index. Pp. v+449-458. (London: Adlard and Son, Ltd.)

Falmouth Observatory. Report of the Joint Observatory Committee to the Royal Cornwall Polytechnic Society and the Falmouth Town Council for the Year 1928. Pp. 5. Meteorological Notes and Tables for the Year 1928, also Table of the Mean Magnetic Declination at Falmouth, from 1888 to 1928. By W. Tregoning Hooper. Pp. 7. (Falmouth.)

Air Ministry: Aeronautical Research Committee. Reports and Memoranda. No. 1208 (Ae. 359): A Dash-Pot for use in Spinning Experiments on a Model Aerofoil. By T. H. Fewster. (T. 2691.) Pp. 2+1 plate. 4d. net. No. 1209 (Ae. 362): Wool-Tufts: a Direct Method of discriminating between Steady and Turbulent Airflow over the Wing Surfaces of Aircraft in Flight, applied to explore the Region of Effect of the Slot on a Bristol Fighter Wing. By Flight-Lieut. J. A. G. Haslam. (S. and C. 273.) Pp. 6. 4d. net. No. 1214 (Ae. 373): On a Method of delaying the Opening of an Autotrot (Wind Tunnel Experiments). By F. B. Bradfield and R. A. Fairthorne. (T. 2719.) Pp. 6+4 plates. 6d. net. No. 1212 (Ae. 371): Preliminary Tests on the Effect on the Lift of a Wing of the Position of the Aircscrews relative to It. By F. B. Bradfield. (T. 2716.) Pp. 10+4 plates. 9d. net. (London: H.M. Stationery Office.)

Harper Adams Agricultural College, Newport, Salop. Some Cattle Diseases—Contagious Abortion, Tuberculosis, Mastitis (Garget): Report of Conference held at the College on Tuesday, April 9th. Pp. 24. (Newport, Salop.)

Gold Coast Survey. Tables for use in the Department. Pp. 46+2 plates. (Accra.)

Journal of the Chemical Society: containing Papers communicated to the Society. May. Pp. iv+853-1111+x. (London.)

Proceedings of the National Laboratory of Psychical Research. Vol. 1, Part 2: Short-Title Catalogue of Works on Psychical Research, Spiritualism, Magic, Psychology, Legedmain and other Methods of Deception, Charlatanism, Witchcraft and Technical Works for the Scientific Investigation of alleged Abnormal Phenomena from Circa 1450 A.D. to 1929 A.D. Compiled by Harry Price. Pp. 165-422+32 plates. (London.) 15s. net.

The National Benzole Association. Sixth Report of the Joint Benzole Research Committee of the National Benzole Association and the University of Leeds. Pp. ii+212. (London.)

Proceedings of the Geologists' Association. Edited by A. K. Wells. Vol. 40, Part 1, May 22. Pp. 104. (London: Edward Stanford, Ltd.) 5s.

The Royal Society for the Protection of Birds. Thirty-eighth Annual Report, January 1st to December 31st, 1928; with Proceedings of Annual Meeting, 1929. Pp. 108. (London.) 1s.

The National Physical Laboratory. Inspection by the General Board, June 18th, 1929. Pp. 15. (Teddington.)

Rothamsted Experimental Station, Harpenden. Investigations in Progress in the Laboratories and Experimental Fields, 1929-30. Pp. 12. (Harpenden.)

Empire Cotton Growing Corporation. Report of the Administrative Council of the Corporation to be submitted at the Eighth Annual General Meeting, on June 3rd, 1929. Pp. 55. (London.)

Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich; read at the Annual Visitation of the Royal Observatory, 1929 June 1. Pp. 17. (Greenwich.)

South Australia: Empire Forestry Conference, 1928. Forestry Handbook. Prepared by E. Julius and A. L. Pinches. Pp. 146. (Adelaide: Harrison Weir.)

The Indian Forest Records. Silviculture Series, Vol. 13, Part 8: Volume and Outturn Tables for Blue Pine (*Pinus excelsa*, Wall.). By H. G. Champion, Ishwar Das Mahendru and Parma Nand Suri. Pp. iv+46. (Calcutta: Government of India Central Publication Branch.) 1.2 rupees; 2s.

Department of Education: National Library of Ireland. List of Scientific and Technical Periodicals in Dublin Libraries. Pp. vi+147. (Dublin: Stationery Office.) 5s. net.

Proceedings of the Royal Society. Series A, Vol. 124, No. A794, June 4. Pp. 243-477. (London: Harrison and Sons, Ltd.) 8s.

Philosophical Transactions of the Royal Society of London. Series A, Vol. 228, A.663: A Photographic Investigation of Flame Movements in Carbonic Oxide-Oxygen Explosions. By Prof. William A. Bone and Reginald P. Fraser. Pp. 197-234+11 plates. (London: Harrison and Sons, Ltd.)

The Strangeways Research Laboratory, formerly the Cambridge Research Hospital. Pp. 16. (Cambridge.)

Transactions and Proceedings of the New Zealand Institute. Vol. 59, Part 4, December 1928. Pp. iv+663-1024+xii. (Wellington, N.Z.)

The Indian Forest Records. Silviculture Series, Vol. 14, Part 2: Denudation of the Punjab Hills. By B. O. Coventry. Pp. v+30+7 plates. (Calcutta: Government of India Central Publication Branch.) 1.4 rupees; 2s. 3d.

Journal of the Indian Institute of Science. Vol. 12A, Part 5: Studies on Soil Actinomyces. i. Introduction, by V. Subrahmanyam and Roland V. Norris; ii. Their Mode of Occurrence in the Soil, by V. Subrahmanyam. Pp. 53-68. (Bangalore.) 1 rupee.

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 11: The Tasmanian Grass Grub (*Oncopera intricata*, Walker), a Preliminary Report on its Life History and Methods of Control. By Gerald F. Hill. Pp. 43 (6 plates). (Melbourne: H. J. Green.)

South Australia: Department of Mines. Mining Review for the Half-Year ended December 31st, 1928. (No. 49.) Pp. 93+8 plates. (Adelaide: Harrison Weir.)

FOREIGN.

Reprint and Circular Series of the National Research Council. No. 87: Final Report of the Committee on Scientific Problems of Human Migration. Pp. 21. (Washington, D.C.: National Academy of Sciences.) 30 cents.

The Danish *Dana* Expeditions, 1920-22, in the North Atlantic and the Gulf of Panama. Oceanographical Reports edited by the *Dana* Committee, No. 5: The Fishes of the Families Astronesthidae and Chauliodontidae. By C. Tate Regan and Ethelwynn Trewavas. Pp. 39+7 plates. (Copenhagen: Gyldendalske Boghandel; London: Wheldon and Wesley, Ltd.) 10s.

Mellon Institute of Industrial Research. Bibliographic Series. Second Supplement to Bulletin No. 2: A List of the Books, Bulletins, Journal Contributions and Patents by Members of the Mellon Institute of Industrial Research during the Calendar Year 1928. By Lois Heaton. Pp. 11. (Pittsburgh, Pa.)

Sudan Government: Wellcome Tropical Research Laboratories, Khartoum. Report of the Government Chemist for the Year 1928. (Chemical Section, Publication No. 59.) Pp. iv+39. (Khartoum)

Agricultural Experiment Station, Michigan State College of Agriculture and Applied Science. Technical Bulletin No. 96: A Local Farm Real Estate Price Index. By F. M. Thrum. Pp. 31. Special Bulletin No. 180: The Soils of Michigan; Grayling Sand. By M. M. McCool and A. G. Weidemann. Pp. 24. Special Bulletin No. 185: Roadside Marketing in Michigan. By H. P. Gaston. Pp. 49. Special Bulletin No. 188: Pollination of Orchard Fruits in Michigan. By Roy E. Marshall, Stanley Johnston, H. D. Hootman and H. M. Wells. Pp. 38. Special Bulletin No. 189: The Marketing of Michigan Milk through Creameries, Cream Stations, Condenseries and Cheese Factories. By F. T. Riddell and J. T. Horner. Pp. 36. (East Lansing, Mich.)

Classified List of Publications of the Carnegie Institution of Washington. Pp. 202. (Washington, D.C.: Carnegie Institution.)

Carnegie Institution of Washington. Fourteenth Issue. Pp. 63. (Washington, D.C.: Carnegie Institution.)

Proceedings of the United States National Museum. Vol. 74, Art. 6: Notes on some Oriental Sapromyzid Flies (Diptera), with particular reference to the Philippine Species. By J. R. Malloch. (No. 2751.) Pp. 97+6 plates. Vol. 74, Art. 7: A Revision of the Wood-Warbler Genus *Basiluterus* and its Allies. By W. E. Clyde Todd. (No. 2752.) Pp. 95. Vol. 75, Art. 11: A Contribution to our Knowledge of the Anatomy of the Fresh-water Mussels of the District of Columbia. By Lucy Reardon. (No. 2782.) Pp. 12+5 plates. (Washington, D.C.: Government Printing Office.)

Annuaire de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique, 1929. 95^e année. Pp. 155+4 planches. (Bruxelles: Maurice Lamertin.)

Annuaire de l'Observatoire Royal de Belgique. 97^e année, 1930. 1^p. 160. (Uclée.)

Annales de l'Observatoire Royale de Belgique. Troisième série, Tome 2, Fascicule 2: Catalogue de 419 étoiles de comparaison pour la planète Eros à son opposition de 1930-1931. Par F. Moreau, G. Beq, L. de Clerck et J. Verbaandert. Pp. 77-102. (Uclée.)

Journal de la Société des Américanistes de Paris. Nouvelle série, Tome 20. Pp. xxxii+589. (Paris.)

Ministère de l'Instruction publique et des Beaux-arts. Enquêtes et documents relatifs à l'enseignement supérieur. 123: Rapports sur les Observatoires astronomiques de Province et les Observatoires et Instituts de Physique du Globe. Année 1927. Pp. 108. (Paris.)

Publications of the Far Eastern State University. Série 7, No. 12: Adsorption as a general Characteristic of Coal and Peat; the Condition of Genesis, Occurrence, Gas Contents, Superficial Alteration, Spontaneous Combustion, Coke Formation and Hydrogenation. By Prof. B. P. Pentegoff. Pp. 32. In Russian, with Summary in English. (Vladivostok.) 50 kop.

Report of the National Research Council for the Year July 1, 1927-June 30, 1928. Pp. iii+95. (Washington, D.C.: Government Printing Office.)

Department of Commerce: Bureau of Standards. Research Paper No. 64: Prism Refractometry and certain Goniometrical Requirements for Precision. By L. W. Tilton. Pp. 909-930. 10 cents. Research Paper No. 65: A new Determination of the Melting Point of Palladium. By C. O. Fairchild, W. H. Hoover and M. F. Peters. Pp. 931-962. 10 cents. (Washington, D.C.: Government Printing Office.)

Department of Commerce: Bureau of Standards. Visitors' Manual of the National Bureau of Standards; a Brief Account of its History, Functions and Laboratory Facilities. (Miscellaneous Publication No. 93.) Pp. ii+13. (Washington, D.C.: Government Printing Office.)

Publikationer og mindre Meddelelser fra Københavns Observatorium. Nr. 61: Asymptotische Lösungen im restringierten Dreikörperproblem (Problème Restreint). Von Elis Strömgen. Pp. 55+1 Tafel. (København.) Bulletin of the American Museum of Natural History. Vol. 58, Art. 7: The Adaptive Modifications of the Arboreal Tadpoles of *Hoplophryne* and the Torrent Tadpoles of *Staurois*. By G. K. Noble. Pp. 291-334+plates 15-16. (New York City.)

United States Department of Agriculture. Technical Bulletin No. 111: Fish Oil as an Adhesive in Lead-Arsenate Sprays. By Clifford E. Hood. Pp. 28. (Washington, D.C.: Government Printing Office.) 10 cents.

Japanese Journal of Geology and Geography: Transactions and Abstracts. Vol. 6, Nos. 3-4. Pp. iii+63-147+9-26+7+plates 13-27. (Tokyo: National Research Council of Japan.)

Proceedings of the United States National Museum. Vol. 75, Art. 16: A newly found Meteoric Stone reported by W. B. Lang from Peck's Spring, Midland County, Texas. By George P. Merrill; with Chemical Analysis by F. A. Gonyer. (No. 2787.) Pp. 2+1 plate. Vol. 75, Art. 17: A new Nematode, *Sincosta aberrans*, new Genus, and new Species from a Rodent. By Glenwood C. Roe. (No. 2788.) Pp. 3+1 plate. (Washington, D.C.: Government Printing Office.)

Sveriges Geologiska Undersökning. Ser. Ca, No. 13: Nordmarks Malmtäkt; Geologisk beskrivning. Av Nils H. Magnusson. Summary: The Iron and Manganese Ores of the Nordmark District. Pp. 98. (Stockholm.) 7.00 kr.

Publications de l'Observatoire de Genève. Rapport sur les concours de réglage de chronomètres de l'année 1928. Pp. 81. (Genève.)

Treasury Department: United States Public Health Service. Studies on Oxidation-Reduction. 13: Preparation of Indophenols which may be used as Oxidation-Reduction Indicators. By H. D. Gibbs, W. L. Hall and W. M. Clark. (Supplement No. 69 to the Public Health Reports.) Pp. iii+85. 10 cents. 14: Equilibrium Potentials of 2,6-Dibromobenzenone Indophenol-2'-Sodium Sulphonate, 2,6-Dibromobenzenone Indophenol-3'-Sodium Sulphonate, 2,6-Dichlorobenzenone Indo-2'-Chlorophenol, and 2,6-Dimethylbenzenone Indophenol. By Wallace L. Hall, Paul W. Preiser and Barnett Cohen. (Supplement No. 71 to the Public Health Reports.) Pp. iii+26. 10 cents. (Washington, D.C.: Government Printing Office.)

CATALOGUES.

A Catalogue of Important and Rare Books on Botany, Agriculture, Forestry, Fruit-Culture, Gardens and Gardening, Herbaria, Early and Modern Medicine and Surgery, Tobacco. (No. 426.) Pp. 142. (London: Bernard Quaritch, Ltd.)

Art and Literature, including a selection from the Library of Sir Edmund Gosse. (No. 446.) Pp. 20. (Cambridge: Bowes and Bowes.)

Botany and Horticulture. (Catalogue No. 169.) Pp. 56. (London: Dulau and Co., Ltd.)

Diary of Societies.

FRIDAY, JUNE 21.

ROYAL SOCIETY OF MEDICINE (Otolaryngology Section) (at Cambridge), at 2.—L. Yates: The Evolution of the Sense of Hearing.—J. S. Tucker: Localisation of Sound.—S. Hett, Dr. A. G. Wells, and Dr. Murray Levick: Ionisation as a Treatment for Middle-ear Suppuration.—At 4.30.—Dr. A. A. Gray: The Application of the Principles of Maximum Stimulation to Clinical Otolaryngology.—G. Wilkinson: Demonstration of a Model Resonator, Designed to Illustrate the Mechanism of the Cochlea. ROYAL SANITARY INSTITUTE (at North-East Coast Exhibition, Newcastle-upon-Tyne), at 2.30.—Dr. H. G. Davison and others: Discussion on The Problem of Feeding the Premature Infant.—Dr. E. F. Murray and others: Discussion on The Need for a Maternity Service.—Dr. H. H. Evers and others: Discussion on The Importance of Ante-Natal Supervision.—At 4.30.—D. Boyd and others: Discussion on Eliminating the Tuberculous Cow: Administrative Results at Berwick-upon-Tweed.—D. W. Henderson and others: Discussion on Hygienic Milk Supplies.—C. H. Westwater and others: Discussion on Clean Milk in the Northern Counties.—At 8.—Prof. L. E. Hill: Smoke Pollution (Public Lecture).

ROYAL SOCIETY OF MEDICINE (Obstetrics Section), at 8.—G. F. Gibberd: The Use of Animal Bladders for the Induction of Premature Labour.—Prof. Cleland and Drs. Dawson, Wallace and Hackett: Difficult Labour in Australian Aboriginal with Post-mortem Measurements of the Pelvis.—C. D. Read and F. Roques: Some Results of the Surgical Treatment of Pelvic Endometriomata.

ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE (Annual General Meeting) (at 11 Chandos Street, W.), at 8.15.—Induction of New President, Dr. G. Carmichael Low.—Dr. J. F. C. Haslam: Some Health Problems of British Guiana.—Presentation of the Manson Medal to Sir Ronald Ross, and the Chalmers Medal to Major A. C. Sinton.

ASSOCIATION OF ECONOMIC BIOLOGISTS (Annual Field Meeting) (at Cambridge) (continued on June 22).

SATURDAY, JUNE 22.

ROYAL SOCIETY OF MEDICINE (Otolaryngology Section) (at Cambridge), at 9.30 A.M.—M. Vlasto: The Chorda Tympani Nerve in Otolaryngology.—C. S. Hallpike: Some Observations on Bone Conduction.—A. R. Tweedie: Demonstration of Apparatus for Control of Conversation Test.

ROYAL SOCIETY OF MEDICINE (Disease in Children Section) (at Nottingham), at 3.

PHYSIOLOGICAL SOCIETY (at Plymouth).

MONDAY, JUNE 24.

ROYAL GEOGRAPHICAL SOCIETY (Anniversary Meeting) (at Eolian Hall), at 3.—Presidential Address, Annual Report, and Presentation of Medals, etc.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.30.—Presentation of Royal Gold Medal.

TUESDAY, JUNE 25.

ROYAL DUBLIN SOCIETY, at 4.15.—Report of the Irish Radium Committee for the Year 1928.—H. A. Cummins, Violet C. E. Kennelly, and M. Grimes: A Study of Fungi found in Milk.—P. A. Murphy: Some Insect Vectors of Virus Diseases in Plants.—I. P. W. Renouf: A Hydrographical and Biological Study of Lough Hyne, Co. Cork.—J. Reilly: (a) An Investigation of the Polysaccharides, Part I. Inulin; (b) The Cryoscopic Constants of Acetamide.—J. H. J. Poole: A Suggested New Type of Sensitive, Suspended Needle Galvanometer. ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—Miss Beatrice Blackwood: The Indians of British Columbia.

INSTITUTE OF MECHANICAL ENGINEERS (at Manchester) (continued on June 26-28).

WEDNESDAY, JUNE 26.

ROYAL SOCIETY OF ARTS, at 4.—Annual General Meeting. EUGENICS SOCIETY (at Royal Society), at 5.15.—Dr. M. C. Buer: Health and Prosperity in the Early Nineteenth Century.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—R. O. Roberts: The Geology of the District around Abbey-Cwmhir (Radnorshire)—Dr. C. A. Matley and Dr. A. Heard: The Geology of the Country around Bodfean (South-Western Carnarvonshire)—Dr. G. H. Mitchell: The Petrography of the Borrowdale Series of the Kentmere Area (Westmorland).

THURSDAY, JUNE 27.

ROYAL SOCIETY, at 4.30.—Lord Rayleigh: A Photoelectric Method of Measuring the Light of the Night Sky; with Studies of the Course of Variation through the Night.—Prof. J. C. McLennan, M. W. Perrin, and H. J. C. Ireton: The Action of High Speed Cathode Rays on Acetylene.—T. E. Stern, B. S. Gosling, and R. H. Fowler: Further Studies in the Emission of Electrons from Cold Metals.—And other Papers.

ROYAL SOCIETY OF MEDICINE (Urology Section), at 8.30.

FRIDAY, JUNE 28.

PHYSICAL SOCIETY (at Imperial College of Science), at 4.45.—Dr. Teresa J. Dillon: The Relation between Hydrogen Pressure and Filament Resistance in a Tube containing Glowing Tungsten.—Dr. Frances Lowther: The Band Systems of Titanium Oxide.—F. E. Smith: The Absolute Measurement of Sound Intensity.—A Demonstration of an Apparatus for the Measurement of Electrical Resistance at High Temperatures will be given by Dr. J. L. Haughton.

FRIDAY, JULY 5.

GEOLOGISTS' ASSOCIATION (in Architectural Theatre, University College, Gower Street), at 7.30.—Christopher T. A. Gaster: Chalk Zones in the Neighbourhood of Shoreham, Brighton, and Newhaven, Sussex.—H. G. Smith: Some Features of Lamprophyres, near Sedburgh, Yorkshire.

PUBLIC LECTURE.

WEDNESDAY, JUNE 26.

UNIVERSITY OF BIRMINGHAM, at 4.30.—Dr. C. Singer: The Modern Spirit in Medicine (II.).

CONFERENCE.

JUNE 24 TO 27.

BRITISH PHARMACEUTICAL CONFERENCE (in Dublin). Monday, June 24, at 8 P.M.—Reception at the Mansion House. Tuesday, June 25, at 10 A.M.—Chairman's Address. Reading of Science Papers. At 2.15.—Delegates' Meeting. Wednesday, June 26, at 10 A.M.—Science Meeting. At 11 A.M.—Delegates' Meeting. At 2.30.—Science Meeting. Thursday, June 27, at 10 A.M.—Closing Session