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Imperial Agricultural Research.

THE augmentation of the scientific research services of the British Empire is such an immediate necessity that at the conclusion of the preliminary plenary sessions of the Imperial Agricultural Research Conference, held last October, the view was expressed in these columns that the representatives of the home government should have been in a position to state "what further financial provision the government is prepared to make, and what financial support has been promised or is expected from the dominions and non-self-governing dependencies, for the effective carrying out of the schemes submitted to the delegates for their consideration." The hope was also expressed that some definite statement of this character would be made before the break-up of the conference.

It is very unfortunate that no such endorsed statement appears in the recent Report and Summary of Proceedings of the Conference (London: H.M.S.O. 1*s*. net). The Administrative Commission which considered the proposed chain of research stations, bureaux for the interchange of information, and the recruitment, training, and interchange of workers, contented itself with making a number of recommendations regarding the machinery which should be put into operation to effect the objects in view, and with very vague and non-committal suggestions as to the methods by which funds might be raised. Some of the various sub-committees dealing with specialist subjects, for example, veterinary science, animal nutrition, animal genetics, soils and fertilisers, plant breeding, backed their proposals for the encouragement of research with estimates of their cost, but while the conference agreed with their proposed schemes of work, it was not in a position to recommend the allocation of funds for putting them into effect.

Lord Bledisloe, who occupied the chair throughout the proceedings, rightly said that the conference was noteworthy for its comprehensively representative character—albeit more reality would have been lent to it if the proportion of overseas research workers to administrative agricultural officers had been larger—that it served the useful purpose of bringing together a large number of persons for the interchange of views on the impact of scientific research upon Empire development, that it was able to reach a considerable measure of agreement upon the nature, the place, and the character of the machinery necessary for the development of the research services, and that it afforded research workers the opportunity of seeing something

of the research workers and stations in Great Britain and Northern Ireland, which in itself is a useful precursor to a fuller measure of co-operation. Nevertheless, it is permissible to ask why, apart from the actual fact of its meeting, the direct and tangible results of the conference should have been left in the air until such time as further reference could be made to the home and the overseas governments. There is surely something radically wrong with the machinery for imperial co-operation if the accredited representatives of the constituent parts of the Empire, the local governments of which have been notified of the object of a conference at least twelve months in advance, can be empowered to agree upon policy but cannot be given the necessary authority to commit their governments to any expenditure for carrying a policy into effect.

Admittedly, on the basis of the various recommendations passed by the delegates to the Agricultural Research Conference, the home government could, out of the funds at the disposal of the Empire Marketing Board, establish a chain of research stations, create bureaux for the interchange of information regarding soil science, animal nutrition, animal pathology, animal and plant genetics, and so on, and launch an energetic campaign for the training and recruitment of agricultural research workers. Doubtless it would need additional funds for these purposes, but they should be forthcoming, for the home authorities are quite aware of the value of scientific research applied to agriculture, whether in Great Britain or overseas. As Sir Daniel Hall pertinently remarked in the closing session of the conference, if the ultimate goal is to make the British Empire self-supporting in the fundamental and all-important matter of food, we must effect an extension of the area under crops and cattle by means of research. The results already achieved in this direction by means of research in Canada, the Punjab, South Africa, and the tropical colonies, amply justify an ambitious programme of research.

The ideal before the conference was, however, the organisation of co-operative research throughout the British Empire in which each constituent part of the Empire shall play its part, and unless each of the overseas governments makes a contribution to a common fund for the furtherance of this object, there is a very real danger that the delegates to the next conference, which is to be held in Australia in 1932, will find that they are as far removed from its attainment as they were in the autumn of 1927. If governments share financial responsibility for any undertaking, they will keep a critical eye on the activities of the departments or persons on whose behalf expenditure has been incurred. If the whole responsibility is borne by the home government, it will be difficult to arouse and impossible to maintain any interest of the overseas governments in the schemes recommended by their respective delegates.

Were the promotion of agricultural research a contentious issue like fiscal policy, the reluctance of governments to delegate authority to their representatives to commit them to a limited expenditure could be understood. If the scientific workers of Great Britain had no contributions to make to the progress of science as applied to agriculture in the dominions and colonies, if our agricultural research and teaching institutions were lacking vitality, or compared unfavourably with those in other parts of the Empire, there might be justification for the extreme caution displayed. Furthermore, if the overseas governments were still unconvinced that they are losing a large percentage of their agricultural produce yearly through plant and animal diseases, and are not realising to fullest extent the known potentialities of the soil, largely due to the inadequacy of their research services, their attitude could be understood. Judging, however, from the utterances of the statesmen of the dominions and India at the Imperial Conference in 1926, and those of the representatives of the non-self-governing dependencies at the Colonial Office Conference in May 1927, the Empire as a whole is completely convinced of the need for more and still more scientific investigation of the problems facing it, most of which are related to the foremost industry of the Empire, agriculture. Apparently they are also convinced of the need for co-operation in research as in other matters affecting the welfare of the peoples whom they represent. They are represented, directly or indirectly, on the Empire Marketing Board. It can only be suggested to them, that as unanimous agreement has been reached on detailed schemes for co-operation, they will use every endeavour to place the necessary funds at the disposal of their representatives on that Board without further delay.

Since the appearance of the Report and Summary of Proceedings, a memorandum has been issued by the secretariat of the conference outlining the action which has been taken on the recommendations made; nothing in it leads us to modify the views expressed above. Regarding the chain of research stations, the memorandum states that the North Queensland Station "is at the moment the subject of correspondence between the Commonwealth Council for Scientific and

Industrial Research and the Empire Marketing Board"; the Empire Marketing Board "are consulting the Government of the Union of South Africa on the proposals that the facilities of the Ouderstepoort Station should be increased to enable it to undertake the functions of a central research station in animal diseases"; the recommendation that an irrigation research station should be set up "has been forwarded to the Committee of Civil Research. That committee has formed a Sub-Committee to deal with the recommendation." The question of research stations in the Colonial Empire has been considered by a Colonial Office committee under Lord Lovat's chairmanship, and this committee recommends that until the Amani Research Institute in East Africa is thoroughly re-established no other links be forged in the chain. The recommendations relating to the creation of more central research bureaux and clearing-houses of information for the Empire have been accepted by the governing bodies of the institutions to which it is recommended they should be attached, but the British Treasury has only just "been approached in regard to the acceptance of the principle of a United Kingdom contribution towards the cost. When the question of the home contribution is determined the countries of the Empire will be asked, as a first step, to nominate representatives on the financial supervisory body."

The same note runs all through this last memorandum. Everything is to wait until the home departments or committees concerned have reconsidered the recommendations with which they are concerned, after which presumably they will have to be referred to the corresponding authorities overseas and to the British Treasury. The delay involved in this procedure is illustrated by the time taken—three years—before the recommendation of the East Africa Parliamentary Commission regarding the resuscitation of the Amani Institute was put into effect, and in the meantime the Institute was falling further into desuetude. We can only express the hope that more energetic steps will be taken to achieve some positive results before the next meeting of the conference in Australia. At the same time, we should like to suggest that the best means for ensuring that no time will be lost between passing schemes for co-operative research and putting them into effect would be to create immediately a central fund, based upon contributions of each constituent part of the Empire, and large enough to permit of immediate action being taken by an Empire Research Council upon which the Dominions, India, and the Colonies are properly represented.

The Languages of India.

Linguistic Survey of India. By Sir George Abraham Grierson. Vol. 1, Part 1: Introductory. Pp. xviii + 517. (Calcutta: Government of India Central Publication Branch; London: High Commissioner for India, 1927.) 11.12 rupees; 19*s*.

THIS year there have been completed two very notable works in the field of linguistic science: one is the "New English Dictionary," finished after seventy years of labour; the other is the great "Linguistic Survey of India," of which the last volume to be published is now before us. No scholar can work at any problem connected with the history of English without constant appeal to the Dictionary, and no scholar can work at any problem connected with the languages of India without constant appeal to the Survey. Indeed, we can scarcely recall during the last fifteen years an article or book on the history of any of these languages (and shortly it will be seen how numerous and diverse they are) in which reference has not been made to the facts set forth in the Survey, often for the first time.

The only linguistic work which can be compared with the Survey is the "Atlas linguistique de France." But the intention, the scope, and therefore the method of the Atlas are different: in it a certain number of isolated linguistic phenomena (particular words, grammatical forms, and the like) were studied in as many of the local patois of France as possible: it does not pretend in any way to provide a description of any given dialect or even of its most salient features. The author of the Survey, on the other hand, set himself the task of describing, as fully as materials or space allowed, every language and every dialect spoken over vast areas of the Indian Empire by some 300 million people.

The New English Dictionary provides us with an unrivalled history of one language; the "Atlas linguistique" supplies invaluable information concerning the distribution of linguistic phenomena over a whole dialect-area. But the Survey has given us descriptions, not of one language only, not even of the different dialects of one language, nor even of a group of connected languages (as, for example, the Romance in Meyer-Lübke's "Romanisches etymologisches Wörterbuch"), but of four separate and distinct families of languages—the Austro-Asiatic, the Sino-Tibetan, the Dravidian, and the Aryan—excluding two languages as yet unclassified; and these families are represented in India alone (or rather in that part of India with which the Survey deals) by 179 separate languages

(of which the test is mutual unintelligibility) and 544 dialects.

It may at first seem strange that so many different languages should be spoken in a country which geography and politics incline us to look upon as one. Briefly, the linguistic history of India has been this. In the prehistoric period there were spoken over northern India, probably from the mouths of the Ganges to what is now the North-West Frontier Province, languages belonging to the Austro-Asiatic family: to this belong also languages still spoken in parts of Burma and the Malay Peninsula, and by considerable populations in Indo-China. Pater W. Schmidt makes the Austro-Asiatic a part of a wider whole, the Austric, which includes Indonesian, Melanesian, and Polynesian, spoken from Madagascar in the west to Easter Island in the east, and from Hawaii in the north to New Zealand in the south. However that may be, the Austro-Asiatic branch was at one time strongly represented in India, for even to-day in widely separated districts the descendants of these languages still survive—in the Khassi and Jaintia Hills of Assam (Khāsī); in the jungle country of the Central Provinces south of the Narbada; in scattered islets along the southern face of the Himalaya as far north as the Simla Hill States (Kanāwarī). But their greatest mass is in Orissa, where the best known of the many dialects are Santālī and Muṇḍārī. This opens the way to an interesting speculation. The name for an aboriginal inhabitant of Orissa is *ōṛa*, which derives regularly from *ōḍra-*, itself recorded early in the history of India as the name of an outcaste tribe. The same word survives in many other modern languages as the designation of a caste or occupation: in Gujarat *ōḍ* is the name of a caste that dig and carry earth and build mud-houses; in the Panjab the *ōḍ* are a tribe that clear out watercourses and build houses; in Sindh *ōḍru* is a caste that build mud-walls; in Nepal, where stone has largely taken the place of mud for building, *ōṛ* has become a stonemason.

Attention has recently been directed to the discovery of the cities of the past in the valley of the Indus, the ruins of Mohenjo-daro and Harappa with their great brick buildings. Who the builders were, we do not know; nor have we as yet any clue as to their language. But that it was Austro-Asiatic is possible, or even probable. Were they the *ōḍras*, makers of mud-bricks, whose name eventually passed into the languages of the Aryan conquerors as that of a caste of mud-workers, who dug out irrigation channels and built mud-houses? It is, at least, not impossible. For J. Przyluski has recently shown that several culture words of ancient and modern India—such as those designating cloth, cotton, the bow for carding cotton or for shooting with, the plough, the peacock, the elephant, and so on—are of Austro-Asiatic origin, borrowed from the aborigines by subsequent invaders. But whatever their extent and importance in India in the prehistoric period, Austro-Asiatic languages are to-day spoken by only a few jungle tribes, small in numbers (the census of 1921 counts them as 4½ millions only) and doomed to disappear eventually before more dominant languages.

Also in prehistoric times there was in India another family of languages, the Dravidian. Whether these preceded the Austro-Asiatic or themselves entered from the north-west and pushed back the Austro-Asiatic, we cannot say. At the present day their chief mass is found in the south of the peninsula, but at one time they certainly stretched farther north. As in the case of the Austro-Asiatic languages, isolated dialects are found in the jungle country of the Central Provinces and of Bihar and Orissa, where the most northerly (Malto) actually reaches the Ganges. Most interestingly situated of all is Brāhūī, a Dravidian language spoken in Baluchistan and separated by nearly a thousand miles, and all the deserts of Sindh and Rajputana, from its nearest relative, Gōndī on the Narbada. Unfortunately, however, its position can be interpreted in two ways, for, as Sir George Grierson points out, Brāhūī may be either the rear-guard of a Dravidian invasion from the north-west or the vanguard of a movement from the south. These isolated Dravidian dialects, again like the Austro-Asiatic, are giving way before the languages of subsequent invaders; but in the south their compact mass and, in particular, their use for literature and administration have enabled them to resist the attack of their northern neighbours. Telugu, Tamil, Kanarese, and Malayalam all have literatures of considerable antiquity. For all Dravidian speakers the census of 1921 gives the number of some 64 millions.

North and east of India lies the huge mass of the Sino-Tibetan family of languages. These are divided into two sub-families, the Siamese-Chinese and the Tibeto-Burman. Of these the former have penetrated Siam, driving before them the Austro-Asiatic languages; but, except for two small dialects, Khāmtī and one of Shān, they have not come within the area of the Survey. But the other sub-family, the Tibeto-Burman, has many representatives within India proper. Throughout almost

the whole of the historical period they have been spilling over the barrier of the Himalaya or round its ends. In the east they have occupied almost the whole of Burma, and have formed or left many colonies in the valley of the Brahmaputra; while along the whole southern face of the Himalaya are spoken Tibeto-Burman dialects, extending to the extreme north-west beyond Ladakh. But they are without literature, and they do not serve as languages of administration. They are yielding, therefore, to the languages south of them, which serve both purposes—to Kashmiri, Panjabi, Hindustani, Nepali, Bengali.

Here first we meet the names of some of the Aryan languages, which are spoken by more than 230 millions in India itself. At some time during the second millennium B.C. there appeared on the north-west frontiers of India tribes who spoke a language akin to our own, and to Latin and Greek and Keltic and Slavonic, that is to say, one of the so-called Indo-European languages. Behind them were the Iranians, speaking closely related dialects. Indeed, they must at a recent period have formed a single linguistic community. This is termed Aryan or Indo-Iranian. Those that pushed on into India are called Indo-Aryan. The earliest documents that we have of their language are the hymns of the Rigveda, some of which were composed about the time of their entry into India, some perhaps earlier, some later. These, though mainly religious and sacrificial in substance, give hints of the fights that took place between the invaders and the aborigines and between different Aryan tribes. The conquest, however, proceeded steadily, and the ever-increasing extension of Aryan power was followed by an extension of Aryan speech, as it was learnt by the conquered aborigines. The language of the Vedic hymns, becoming the language of religion and of a priesthood—the Brahmans—ever increasing in authority, and with various modifications affecting its vocabulary and grammar rather than its sounds, was stereotyped eventually as the chief language of literature, named Sanskrit, 'the perfected.' But the spoken language did not, of course, stand still in this way: it changed continually from generation to generation in sounds, in grammar, in vocabulary; and, with the widening of the area over which it was spoken and the diversity of the aborigines who learnt it, greater and greater differences began to appear in the way it developed in various parts of the Indo-Aryan domain. Hence arose those forms of speech which are classified in the Survey as 38 separate languages with 402 dialects.

Lastly, on the north-west the Iranian languages have somewhat advanced their boundaries, and some, such as Pashtu and Baluchi, are spoken actually within the borders of British India.

It is, then, this huge mass of differing languages and innumerable dialects which the 18 volumes of the Survey have analysed, classified, described. The task would seem to be beyond the power of one man. Yet in Sir George Grierson was found one equal to it. The reader, lost in astonishment at this achievement, does not know which to admire the most, the depth and breadth of the author's scholarship and his vast stores of knowledge, the acuteness of his analytical power, or the application and force of will which have carried this colossal undertaking to so complete and so brilliant a conclusion. For some years Sir George Grierson had the help of another distinguished Indianist, Prof. Sten Konow, now of Oslo, from whose pen come some five or six of the volumes. But the plan and the direction and some twelve complete volumes, including this the Introduction, are Sir George's. It is an achievement without parallel in the annals of philology.

R. L. TURNER.

Scientific Fact and Fancy.

Possible Worlds, and other Essays. By J. B. S. Haldane. Pp. viii+312. (London: Chatto and Windus, 1927.) 7*s*. 6*d*. net.

THESE essays, covering a wide range of subjects —including, for example, "The Last Judgment," "Vitamins," "Cancer Research," "What Use is Astronomy"—have mostly been published before, some in popular scientific journals, others in the daily and weekly press. Those dealing with physiology, where Mr. Haldane is on his own ground, well bear re-publication, but it seems unfortunate that some articles of merely ephemeral value should have been included. At any rate, a clue to the original date of appearance would have been helpful as a reminder of the events which originally inspired them. On the other hand, some of the articles, particularly those on research, could have been enlarged with advantage.

The last ten years have seen a great increase in public interest in questions immediately affecting the welfare of children and the improvement of health in nations weakened by four years of war conditions. Among educated persons, even the least serious discuss vitamins, cures for tuberculosis and cancer, food-bacteria, and so on; and authoritative articles on such subjects published in the daily press, and reaching all classes of people,

can be of great use. But the time has come when the non-expert, more interested and better educated in science than his and her predecessor of twenty-five years ago, would like to hear more, and would be capable of understanding and profiting by more than can be covered in two or three octavo pages. This applies particularly to "Immunity," "Cancer Research," "The Fight with Tuberculosis," and "Vitamins," which could all with advantage have been enlarged from their original form and contained more detail.

The best part of the book is that devoted to various aspects of research: "Scientific Research for Amateurs," "The Future of Biology," "On Being One's own Rabbit." In the last paper the author describes how he and a colleague, in desiring to discover "what happens to a man when we make him more or less alkaline," attempted to get further than the merely preliminary work which can be done on animals. "It is difficult to be sure how a rabbit feels at any time, and indeed, many rabbits refuse to collaborate with one," so they began experiments on one another; the author in this essay traces the varying methods by which acidity and alkalinity were arrived at and the resulting symptoms. It is interesting to note that many of the latter were the symptoms of well-known diseases, and he goes on to suggest that it would be well for patients to have some understanding of their own symptoms when relating them to a medical man, and to realise, for example, that a pain near the heart is more often indigestion than heart disease. "Finally," he concludes, "since the public has begun to pay for medical research, it has a perfect right to know how its money is spent. During the last year, about one part in four million of the national revenue was employed during some weeks in keeping me awake during attacks of tetany, and in analysing blood samples drawn from me in the course of them. It has been the object of this article to suggest that one four millionth of the nation's money was well spent" (p. 119).

On the question of research for amateurs, Mr. Haldane writes:

"Until the last century, scientific research was almost entirely the work of men who earned their living by some other method or possessed private means. Until fifty years ago there was no such thing as training for research, and every researcher began his work as an amateur" (p. 162). Natural history, fallen into disrepute towards the end of last century, is coming into its own again. But while the field is narrowed, and there is less to be discovered in a broad sense, there is now even greater scope for detailed accurate observation; though research in chemistry, physics, human anatomy and so on is impossible to any but trained scientific workers, there remains an infinity of unexplored ground along the lines of animal and plant inheritance, habitat and distribution, and in meteorological and astronomical investigations, which will repay study by the amateur. All this can be done without special training and without expensive apparatus. Much valuable suggestion is given for carrying out such work.

The essays on speculative matters, particularly those dealing with religion, are probably of more interest to Mr. Haldane as a setting in order of his own thoughts on these subjects than they can be to other people. Of these, "Possible Worlds" is the most suggestive, dealing as it does with the possibility of regarding the world other than from the present human point of view, of imagining, for example, a 'dog' or 'smell' world, or a world in which our perceptions and senses are enhanced and increased.

"Meroz," a tract against the clergy in relation to the War, seems scarcely in good taste in 1928. The book as a whole, will, however, be of great value in spreading an interest in, and appreciation of, scientific research and the scientific point of view.

Leonhard Euler.

Léonard Euler et ses amis. Par Prof. L.-Gustave Du Pasquier. Pp. ix + 125. (Paris: J. Hermann, 1927.) 22 francs.

THIS is a short sketch of the life and work of Euler. In little more than 100 pages it gives us an interesting account of his early life, his first sojourn at St. Petersburg (1727–1741), his call to Berlin by Frederick the Great, when, soon after his accession, that monarch planned the formation of a new Prussian Academy and was collecting about him the men who were to set it going, among them Wolff, Maupertuis, Algarotti and Euler ("le grand algébriste," as Frederick called him in his letter to Suhm of June 14, 1740); his part in the formation and working of the Nouvelle Société Littéraire, afterwards combined with the Société des Sciences founded by Leibniz into L'Académie Royale des Sciences et Belles-Lettres de Prusse; the years of his co-operation, as director of the mathematical class, member of the directorate, and member of the literary committee, with Maupertuis the director of the Academy, and of his sole direc-

tion of the Academy while Maupertuis was in France recruiting his health; his relations with Frederick, and the circumstances in which, after the accession of Catherine the Great to the throne of Russia, he overcame the resistance of Frederick and returned (in May 1766) to the directorship of the Académie des Sciences de St-Pétersbourg, with which he had all along maintained his connexion; and lastly, his second stay at St. Petersburg, including the period of his total blindness from 1772 until he died of apoplexy on Sept. 7, 1783, while still in full possession of his intellectual powers and in the midst of labours never interrupted (he is said, between 1773 and 1782, to have written no fewer than 355 memoirs).

Applying the new methods due to Newton and Leibniz, Euler indelibly impressed his personality on the whole of mathematics; he left no branch untouched, and "he touched nothing that he did not adorn." He made great advances not only in algebra, geometry, analysis, theory of numbers and pure mathematics in general, but also in acoustics, optics, mechanics, hydrodynamics, engineering science from the theory of turbines to gunnery and the science of navigation, astronomy, the theory of the planets and comets, lunar theory, to say nothing of the calculus of probabilities and its applications to life insurance, statistics and games of chance, mathematical recreations, magic squares, etc.

Euler won the prize offered by the Académie des Sciences de Paris no fewer than fourteen times (the first time at the age of twenty). The mere bulk of his writings must, we suppose, be unapproached by any other scientific writer. Diogenes Laertius says that the output of the philosopher Epicurus was unprecedented, running to about 300 "rolls." What would he have said of Euler's, which in the collected edition (of which 23 volumes have appeared) will fill 69 volumes with about 600 large quarto pages in each?

Euler's powers of work were extraordinary, and he had the advantage of a prodigious memory. He could recite by heart the whole of the Æneid from one end to the other; and at the age of seventy he could still remember what particular lines began and ended each page of the edition from which he learnt it in his youth. Suffering from insomnia, he calculated in his head one night the first six powers of all the integral numbers up to 100; he remembered the numerical table so obtained and reeled it off several days afterwards to the great surprise of his entourage.

In Chapter iii. ("Léonard Euler à Berlin") we may read again the story of Frederick the Great's attitude towards Euler. Frederick admired him but had no sympathy for his subject. So we find Frederick writing to Voltaire about "un gros cyclope de géomètre," and, at the end, congratulating himself on "having exchanged a one-eyed geometer for one with two eyes" (Lagrange). Again we find Frederick writing: "Quoique je n'aye pas appris à calculer des courbes, je sais pourtant, mon cher Euler, que 16,000 réisdallers sont plus que 13,000," and (in letters to D'Alembert): "Un certain géomètre qui a perdu un œil en calculant, s'avisa de composer un menuet par a plus b," and "M. Euler, qui aime à la folie la Grande et la Petite Ourse, s'est approché du nord pour les observations plus à son aise. Un vaisseau qui portait ses xz et son kk a fait naufrage; tout a été perdu, et c'est dommage, parce qu'il y aurait eu de quoi remplir six volumes in folio de mémoires chiffrés d'un bout à l'autre; et l'Europe sera vraisemblement privée de l'agréable amusement que cette lecture lui aurait donné." T. L. H.

Our Bookshelf.

The Yearbook of the Universities of the Empire, 1928. Published for the Universities Bureau of the British Empire. Pp. xiii + 866. (London: G. Bell and Sons, Ltd., 1928.) 7*s*. 6*d*. net.

WE live in a busy age, and a perception and appreciation of the necessity for economy of time has, whether we like it or not, penetrated even the serenity of the academic world. Each university publishes its own calendar, and sets out, either briefly or at length, particulars concerning its personnel, organisation, regulations, and activities. But all those separate calendars form a library of some 50,000 pages; and, as the universities come more and more to interest and influence a wider circle than their own professors and students, the "Yearbook," with its admirable condensation and presentation of essential information, satisfies more and more a very real need.

It would, however, be a mistake to imagine that the book succeeds merely in condensing and presenting uninteresting (if necessary) regulations, and tiresome strings of names and qualifications. Indeed it goes far to show how fascinating a 'yearbook' can be made. There are, for example, a few pages summarising the history of the universities which, read in conjunction with the appendices dealing with professions and careers for which university studies are a fitting preparation, form a study in evolution not to be missed by anyone who desires evidence of how university life adapts itself slowly but surely to the changing needs of civilisation.

Since each university undertakes some form of specialised work in addition to the courses common to all, the section on professional schools, specialist

studies, and post-graduation courses, has an outstanding value. There is also a list of centres of research outside the university institutions; and, in both these connexions, there is information concerning inter-university scholarships, grants for research, etc.

The 1928 edition of the "Yearbook" maintains the high standard of its predecessor (which we noticed in these columns a year ago): it would not be easy to pay it a higher compliment.

Plants of the Past: a Popular Account of Fossil Plants. By Dr. Frank Hall Knowlton. Pp. xix + 275. (Princeton: Princeton University Press; London: Oxford University Press, 1927.) 16*s.* net.

THIS book is written for readers with no special knowledge of either botany or geology, but is intended to arouse interest as well as to impart a fair amount of information. It should be successful, for it has many good points, and in any case it covers a field which no other book attempts to cover.

The first chapters are introductory; most of the remainder of the book describes the floras of the different formations from the Cambro-Silurian to the Pleistocene, one chapter being devoted to each formation. The result is that while the treatment is proportionate from a geological point of view, chapters which lack important material are loaded with detail. The British reader will find the chapters on the Tertiary especially troublesome, because they are full of the names of many unfamiliar American plants. The book ends with chapters on evolution, on the influence of man on plants, and on the formation of coal.

The author deals with a wide subject proportionately, accepts his data cautiously, and writes clearly. The general reader will find the book easy to follow, though sometimes dull. Students, on the other hand, are likely to be somewhat disappointed, because the author, in endeavouring to be simple, misses much of the interesting speculation on the evolution of plant structure, and on the changes of past climates, their place being taken by straightforward description.

The Collection and Preparation of Herbarium and Timber Specimens. By J. Burtt Davy and L. Chalk. Pp. 28. (Oxford: The Imperial Forestry Institute, 1927.)

THIS handbook is intended primarily for the use of forest officers, and should prove of value to those district forest officers and their subordinates who can give the time, amidst their multifarious duties, to the collection of specimens for local forest herbaria.

Some forest officers, as the past has shown, have neither the gift nor the temperament of the collector; but for those possessing these attributes, the preparation of this handbook should prove of great service. Not only are the lines upon which the collection of individual specimens clearly laid down, but also the inadequate resources which face the forest officer whilst on tour in the forests are borne in mind. For example, under "Drying the Specimens," after detailing the methods of placing the material in the press, the practical suggestion is made: "In very humid localities or during rainy weather, the press may be suspended endwise over a small camp fire or a portable paraffin stove, surrounded by an improvised tent of branches, grass, etc., with a hole at the top. The hot air penetrates the bundle by way of the corrugated cardboard."

The handbook may be recommended to all those who wish to collect botanical specimens which shall be serviceable for the herbarium, whilst at the same time ensuring that the results of the arduous work often entailed shall not be lost owing to subsequent bad packing and consequent irremediable damage during transit.

The Locomotive-God. By W. E. Leonard. Pp. v + 434. (London: Chapman and Hall, Ltd., 1928.) 18*s.* net.

THIS is not a cheerful book, but it will be read with zest by psychologists. The author, a man of literary and academic distinction in America, in early middle life became the victim of distressing and disabling, yet quite groundless, terrors. He could not walk more than a few hundred paces from home without panic; and he suffered besides from attacks of acute melancholia. Believing that the causes must somehow be infantile, he resolved to reach them. "I knew indeed there was something *down below*. What was it? I estimate by careful computation that my efforts to answer this question have been, up to date, equivalent to four semesters of laboratory research."

University colleagues assisted Mr. Leonard, and in the end it appeared that the first trauma had been caused by a shock received at the age of two years and four months when, straying near the metals, he had nearly been caught by a locomotive (hence the title of the book). Other distressing experiences, one in particular at the age of ten, were also unearthed, and the whole record takes the form of an autobiography, the details of which had in some cases long passed out of conscious memory. The book is far more personal than the mere medical record of a distressing case of distance-phobia, and is therefore more widely interesting. It is pervaded by a spirit of indomitable stoicism, for the suffering endured has been incredible. On this account, if for no other, the book makes invigorating reading. J. C. H.

Elektrostatische Versuche mit Anwendung des Universalelektroskops. Von Theodor Wolff. Pp. viii + 85. (Berlin und Bonn: Ferd. Dümmlers Verlag, 1928.) 2·85 gold marks.

IN this volume the author describes his universal electroscope, and gives descriptions of numerous experiments, ranging from elementary experiments in electrostatics to measurements of ionisation currents of various types, and of atmospheric potentials. The experiments described are ingenious and well thought out, and teachers wishing to arrange a course of practical instruction in electrostatics will find some useful hints.

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.*]

Light-Year *versus* Parsec.

THERE comes a time in every science when merit is acquired by the introduction of a new unit of measurement, and all will admit the occasional necessity of such in a world of expanding physical sciences. Does astronomical science need another unit of stellar distance ?

It would seem that, in general, any new unit should satisfy some or all of the following conditions :

(1) It should be urgently needed, to express a magnitude of an order not adequately represented in the existing system of units.

(2) It should be a logical unit, in that it follows customary formation for units of its type ; it should depend directly upon other units or dimensions of fundamental nature.

(3) So far as possible, it should be easy of comprehension by men of science who are not specialists in its particular province.

(4) Where it is suggested as a replacement for a unit sanctioned by long usage, it must be in every way a better and more convenient unit. Age does not imply sanctity ; it does, however, demand an improvement.

Does the word 'parsec' meet the requirements outlined above ? From the viewpoint of the purist, nothing could well be worse than this hybrid, but the nomenclature of science includes a few other verbal monstrosities, and this, in itself, is no argument against the term.

(1) The 'parsec' is equal to 3·26 times the customary unit known as the light-year ; it does not indicate a magnitude of an order different from the older unit.

(2) The light-year is a highly logical unit. In mechanics, our best definition of a length is still given by $s=vt$; that is, a length equals a certain velocity multiplied by the time. This is precisely the construction of the unit known as the light-year, and it rests upon two other units, the velocity of light, and the length of the year, which are regarded as highly fundamental.

(3) The light-year is a unit the significance of which is instantly grasped by the layman, or by the man of science in unallied fields. Which is the easier (and the more logical) ? Is it the concept of a star at such a distance that light needs 159 years to make the journey therefrom, or the concept of a star at such a distance that, as seen from the star, the semi-major axis of the earth's orbit subtends the 48·7th part of the 1,296,000th of a circumference ?

(4) While long usage does not necessarily give authority, the fact that the concept of visualising stellar distances by the time of light travel goes back at least to the year 1740, deserves thoughtful consideration. The actual term, light-year, is not nearly so old.

Aside from its ease of comprehension and its logical structure, we lose historical 'side-lights' of great interest and value by abandoning the light-year. The fact that a distant Milky Way, apparently a replica of our own stars in its integrated light, is to us as it actually was three million years ago, adds a genetic datum which is utterly lost in the distance of one million 'parsecs.'

But the term 'parsec' was introduced to make computations easier. The skilled computer will smile at this ; he cares little whether he has to take a reciprocal, or to add in any one constant log. as against any other. In fairly representative computations involving parallax and distant spiral nebulæ data, I have never yet had to use the 'parsec' unit.

The trigonometric method of determining star distances has given undue prominence to the angle subtended by the semi-major axis of the earth's orbit, an importance which will inevitably be greatly diminished by the further application of the methods of spectroscopic and dynamical parallax determination. Such probable progress will further diminish the excuse for a unit like the 'parsec.' Why use it at all ?

HEBER D. CURTIS.

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Pittsburgh, Pa.,
April 18.

Base Exchange and the Formation of Coal.

IN an article entitled "Base Exchange and the Formation of Coal" (NATURE, Sept. 24, 1927) I discussed the probable influence of base exchange between the roofs of coal seams and sodium chloride solutions on the formation of bituminous coal. I suggested that base exchange might form the connecting link between the coal seams of various geological formations. Since writing the article, I have had an opportunity of examining the roofs of bituminous coal seams of Jurassic, Cretaceous, and Tertiary ages, and they agree with those of the Carboniferous age in showing evidence of base exchange and hydrolysis. It appears, therefore, that bituminous coal always occurs under a roof which has undergone base exchange and which contains sodium as the main replaceable base. The final stage in coal formation appears to have been the bacterial decomposition of the accumulated plant material under alkaline anaerobic conditions.

The base exchange theory of coal formation affords a method by which the 'drift' and 'in situ' theories may be reconciled. If drifted material accumulated in the sea, the characteristic roof constituent would be sodium-clay. If the material accumulated by drift in fresh water and the roof were deposited in fresh water, base exchange could take place by submergence in the sea. If the material accumulated 'in situ' on land or in fresh water, a slight alteration in land level, such as geologists maintain occurred at intervals during the coal-forming periods, could result in base exchange taking place with capillary solutions of sodium chloride raised from subsoil water containing this salt. It follows, therefore, that whether the material accumulated by 'drift' or 'in situ,' the same final roof conditions have been present.

Base exchange appears also to have a bearing on the formation of petroleum. Petroleum-bearing strata are usually overlaid by shales. The fossil evidence indicates that the material from which the shales have been formed was deposited in salt water. Base exchange between the material covering the petroleum-bearing strata and solutions of sodium chloride must therefore have taken place. The subsequent hydrolysis of the sodium-clay would provide alkaline anaerobic conditions for the bacterial decomposition of organic matter.

An investigation of the bacterial decomposition of fats under a roof which has undergone base exchange and hydrolysis is now in progress. The result of such a decomposition is shown in Fig. 1.

The fat was distributed through a sand layer at

the bottom of a beaker and the sand layer moistened and inoculated with a soil suspension. A roof containing hydrolysing sodium-clay was deposited on the sand and a layer of water maintained on top of the roof. The beaker was then incubated at 30° C. The development and accumulation of gas under pressure is shown. The decomposition of triacetin results in the formation of methane alone. The decomposition of tributyrin results in the formation of a mixture of gaseous paraffins. Decompositions of other pure fats and naturally occurring mixtures of fats are in progress. The appearance of these decompositions is similar to that in the figure. Gycerol on decomposition under alkaline anaerobic conditions is converted

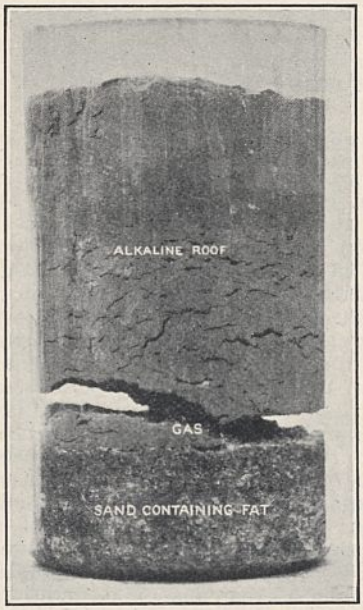

FIG. 1.

into methane, the oxygen being probably eliminated as carbon dioxide and absorbed by the alkaline roof.

From the results so far obtained, it appears that the fat is hydrolysed, the resulting glycerol being converted into methane, and the fatty acid being reduced to a corresponding paraffin. As petroleum occurs under deposits which appear to have undergone base exchange, the investigation now being carried out suggests that it may have resulted from the bacterial decomposition of animal or vegetable fats under alkaline anaerobic conditions. The close relationship that is supposed to exist between the formation of coal and the formation of petroleum lends support to the suggestion, as under the conditions indicated both would be formed by similar types of bacterial action in similar circumstances.

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Temperatures of Stars in Planetary Nebulæ.

DURING the past summer, when working at the Dominion Astrophysical Observatory in Victoria, I secured some quantitative data as regards the luminosity of planetary nebulæ. I did not have occasion to elaborate the material until this winter, which I spent in Pasadena, on my leave of absence from the University of Washington at Seattle.[1] The method consists of taking a slitless spectrogram of the nebula with its central star, and impressing on the same film on which this spectrum is taken a series of comparison spectra of varying intensities and of the same time of exposure as the nebula. The comparison spectra are obtained from a sensitometer having the daylight sky as a source, a real image of the sensitometer patches being formed at the slit of the spectrograph. The photographs yield the total intensity of each monochromatic picture of the nebular envelope in terms of the intensity per frequency unit of the adjoining star spectrum of approximately the same wave-length.

In working out our data we have taken a somewhat idealised view which leads to different independent determinations of the temperature of the central star, assumed to be a black body.

1. *Mechanism of ionisation and recombination.*—For a certain type of atom or ion, it is assumed that all the ultra-violet star light beyond the head of the series is completely absorbed, causing ionisation of the atoms or ions in the nebula. From the intensity data of the spectrum, which is assumed to be produced by the subsequent recombination, the approximate temperature of the star is derived. This method may be applied to the data for H, He, and He^+, giving independent determinations for each type. This mechanism was first applied by me to hydrogen in diffuse nebulæ (*Astrophys. Jour.*, **65**, 50 ; 1927).

2. *Bowen's secondary mechanism of electron excitation.*—It is assumed that the so-called nebulium lines are excited by the photo-electrons freed according to the first mechanism, and that the excess of energy absorbed by an atom or ion above its ionisation energy is completely given out as energy in the observed resonance nebulium lines; in other words, that a photo-electron freed from any atom or ion is only recaptured after its energy as a free electron has been completely exhausted in producing the nebulium lines. Hence the data on the nebulium lines provide another independent temperature determination which, of course, may give somewhat low values. This mechanism was put forward by Bowen (*Astrophys. Jour.*, **67**, 1 ; 1928) in order to account for the abnormal intensity of those lines which, according to his well-known identification, originate in many cases from metastable states of known ions. The images of the hydrogen lines and of the green nebulium lines are nearly coincident, apart from the somewhat larger size of the latter and, for the lower temperature nebulæ at any rate, it is likely that the photo-electrons originating from the hydrogen atoms are the main agents in exciting the nebulium lines. In the present temperature determinations the approximation has therefore been introduced that the hydrogen absorbs all the ultra-violet energy of the star beyond the head of the Lyman series, and that the electrons thus freed lose their energy completely in exciting the nebulium lines. For the lower temperatures this approximation is justified, but the higher temperatures derived from nebulium may thus come out somewhat low, so that, for example, a temperature of 70,000° derived from nebulium might be 20,000° or 30,000° low, and that from about 100,000° on, the figures obtained have only significance as lower limits.

For the three nebulæ investigated provisional results have been obtained which are as follows :—

Method.	N.G.C. 6543.	N.G.C. 6572.	N.G.C. 7009.
H	38,000°	39,000°	
He		34,000° to 41,000°	
He^+			70,000°
Nebulium	36,000°	37,000°	

In the first two nebulæ the results of different

[1] A complete account of the work will appear in the *Publications of he Dominion Astrophysical Observatory.*

methods are in very good agreement. Of the third nebula, N.G.C. 7009, the pictures are hard to measure on account of the small intensity of the star and the fact that there is a strong moonlight background which has to be corrected for. The given value of 70,000° from He^+ is fairly trustworthy on account of the sensitivity of the method in this case. The hydrogen and nebulium give values which are decidedly lower, less by roughly 20,000°, but the determinations are not accurate. This means that the He^+ is abnormally strong, as compared with nebulium and hydrogen, which, as Mr. Bowen pointed out to me, is also borne out in the abnormal place this nebula occupies in the sequence of his Table II. However, as they stand, the data show already that the assumption that the star is a black body and the luminosity caused by known physical mechanisms appears to be a fair interpretation of the facts.

The temperature determination based on the strength of the nebulium lines by Bowen's secondary mechanism may be extended so as to include a great number of cases for which data are already available. Taking into account that the photographic brightness of the central star may be assumed to vary approximately as the intensity of the wave-length 4250 A. (Brill), and that the visual brightness of the nebula is mainly due to the green nebulium lines, a table can be made relating the difference d between those quantities expressed in magnitudes with the temperature T expressed in thousands of degrees. The result is

T	35	40	50	60	80	100	150	200
d	2·4	3·3	4·4	5·3	6·6	7·5	9·0	10·1

The scale has been fixed using the results for the temperature determination due to nebulium for N.G.C. 6543 and 6572. Photographic magnitudes of the star have been determined by Curtis and total visual magnitudes of the nebula by Holetschek; these are subject to corrections according to Hubble or Hopmann, and the error in d may probably go so high as one magnitude. Values of the stellar temperature for eighteen nebulæ, including the three original, have thus been obtained. Examples are: N.G.C. 7009, 51,000°; N.G.C. 6720, 68,000°; N.G.C. 6826, 35,000°; N.G.C. 6210, 40,000°; N.G.C. 7662, 48,000°; N.G.C. 6818, 72,000°.

The first nebula is that already discussed. The second is the ring nebula in Lyra; and the others, besides the three original ones, are those common to Bowen's and the present investigation. Among the eighteen nebulæ treated there are only two that yield a temperature so high as 100,000° by this method. They are N.G.C. 6445, 134,000°, and N.G.C. 1952, 100,000°.

In the case of N.G.C. 6445, there is much obscuring matter in neighbouring regions, as Dr. Hubble informed me. The high difference in magnitude may therefore be due to partial obscuration of the star, and the high temperature should be regarded with suspicion, if not entirely discarded. Dr. Hubble informed me also that there is strong evidence that the second case, N.G.C. 1952, the Crab nebula, is an old nova, and hence that there is good reason to expect an abnormally high temperature. An error of one magnitude might make the stellar temperature for this nebula about 20,000° lower, but on the other hand, the underlying assumptions in the present work are such as to make the higher temperatures come out rather low, so that for N.G.C. 1952 it is very likely that a temperature of 100,000° is reached.

Though in planetary nebulæ such high temperatures occur, as has also been stated by Bowen, it must be remarked that the lower temperatures are of the same order as those known for ordinary O stars, and that the present treatment appears to give the much desired continuity of the temperature scale.

H. ZANSTRA.

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Pasadena, Mar. 14.

The Blubber of Whales.

THE blubber of whales does not appear to have received the attention it deserves; some writers pass it over in silence, others regard it as the mere counterpart of hair and assign to it only a non-conducting function.

Unlike the blubber of seals, which is thick at one season and thin at another, that of whales undergoes no changes in thickness except those which are incidental to age and growth. A tissue so constantly present, and subject to so little change, must be an essential one and must fulfil a very important purpose.

That the blubber has other functions besides a non-conducting one is shown by the fact that its thickness in different species is not related to the temperature of the water inhabited; for example, in the Greenland whale it is many times thicker than in the Narwhale, although both inhabit the same seas, and in the same whale it may be many times thicker than in the Saddle-back and Bladder-nose seals which also inhabit the Greenland Sea, and which, moreover, are obliged at times to go on the ice and expose themselves to a temperature below freezing point and sometimes to one below zero.

The blubber is merely the skin modified to enable its possessor to lead an aquatic life. As Bennet, the author of a whaling voyage round the globe in 1833–36, says, its most important function is doubtless a hydrostatic one; its lightness doubtless diminishing the whale's specific gravity and helping it to float, and its elasticity perhaps helping it to withstand the pressure of the water at great depths.

Whales—at any rate some of them—can rest at the surface without effort, with a small part of their bodies above water, and when extended in this manner, as Scoresby states, can sink downwards in a few seconds beyond the reach of their human enemies. These feats the whale doubtless performs with the aid of its lungs; when resting at the surface it keeps them distended, when it wants to 'settle' or sink it either expels air from them or compresses them by muscular effort, as Delage suggests. The blubber is, therefore, thick enough to buoy up the whale's body with, but not without, the aid of the lungs.

With the exception of the lungs, when in a distended condition the blubber is the only tissue of the whale that is lighter than water, and the only one that can be used at all times to diminish the specific gravity of the body. Whales probably differ but slightly from one another as regards the relative weight of their internal parts, but obviously do so as regards their external ones—their 'whale-bone,' their fins, and the outer layers of their skin. Consequently, the blubber is thickest in species in which these parts are large and heavy, and the reverse in whales in which the opposite obtains.

In the Greenland whale the parts to be buoyed up appear to reach a maximum size and weight, and the blubber which has to sustain them a maximum thickness.

In a large Greenland whale killed in the Greenland Sea in 1887, the marketable whale-bone cleaned and

dried alone weighed 25 cwt., a single plate (the longest one) weighing 9 lb. 5 oz. How much the other parts weighed is uncertain, but the following are their dimensions; namely, pectoral fin, length externally, 8 feet 2 inches; breadth, 5 feet 1 inch; caudal or tail fin, breadth from tip to tip about 24 feet; epidermis, thickness, $\frac{3}{4}$ of an inch; while the thickness of the blubber that buoyed up these parts and made it possible for the lungs to bring the body into equilibrium with the water displaced, was 15-18 inches (on the body or over the muscular parts) and yielded 25 *tons* of oil.

In the young Greenland whale the epidermis is even thicker than in the adult, and the blubber relatively thicker as well. In a calf examined by Scoresby the epidermis was $1\frac{3}{4}$ inches thick: "It was so extremely fat," says this trustworthy witness, "that we obtained a quantity of blubber from it calculated to yield six *tuns* of oil, a produce equal to that of a 'size fish' of six or seven feet bone . . . and the body when stripped of the fat, that is, the blubber, was so small as to be quite within the power of our tackles (to heave up). In another 'sucker' or 'calf,' 19 feet in length, the blubber on an average was 5 inches in thickness, the largest of the whale-bone measured only 12 inches, of which about one-half was imbedded in the gum."

During adolescence, and until the adult stage is reached, the epidermis and blubber (and consequently the yield of oil) both diminish in thickness; the first absolutely, the second only relatively.

Seven young animals captured in the Greenland Sea in 1886, with the 'sample' or longest plate of whale-bone averaging 6 feet in length, yielded only 36 tons, or on an average about the same as Scoresby's calf; and in another killed in 1888—42 feet in length, with the longest plate of whale-bone 7 feet 6 inches in length—the thickness of the epidermis was less than an inch, that of the blubber being 8 inches.

Except in early life, the weight of oil yielded by the blubber is definitely related to the length of the longest or sample plate of whale-bone and to the total weight of the marketable whale-bone—in other words, the thickness of the blubber is in proportion to the size of the animal.

ROBERT W. GRAY.

Exmouth, Mar. 24.

Photochemical Clustering.

IN a paper describing experiments on the photochemical decomposition of nitrous oxide (*J. Chem. Soc.*, 1; 1928) Dr. James Younger Macdonald finds among other things that four molecules of N_2O decompose for each quantum of energy absorbed. The striking agreement between this value of $M/h\nu$ and the value obtained for M/N in the α-ray reaction suggests, according to Lind (*J. Phys. Chem.*, **32**, 575; 1928), a similarity in the mechanism of decomposition, namely, *clustering* about an excited N_2O molecule on one hand and about an ionised one on the other. This suggestion deserves consideration, especially in view of the failure of mechanism proposed by Macdonald, namely,

$$(1)\ N_2O + h\nu = N_2O'$$
$$(2)\ N_2O' + N_2O = O_2 + N_2 + 2N$$
$$(3)\ 2(N + N_2O = NO + N_2).$$

The second step, according to the best data, requires at least 80,000 calories more energy than is available. In view of this, Dr. Macdonald, who originally used a minimum value for the energy of dissociation of nitrogen, has now abandoned the special mechanism which he put forward (private communication). The clustering, however, of three molecules about an active one leading to decomposition as

$$4N_2O = 3N_2 + O_2 + 2NO$$

is very possible thermodynamically.

With Dr. Macdonald's permission to publish the contents of his letter, it may be said that other mechanisms proposed therein are pure speculations, as he himself realises. The best of them admits of differences between oxygen atoms in their effects on N_2O. Furthermore, he proposes to add H_2 to the decomposing N_2O. In the event that O atoms are formed he expects water would result from

$$H_2 + O = H_2O.$$

It is doubtful whether this reaction would go in spite of its exothermic nature to the extent of about 140,000 calories, since H_2 can be considered a pseudo-atom with a helium-like structure. Furthermore, unless radiation is emitted and the water molecule occupies a definite quantised state, the principle of conservation of energy and momentum is violated, except in the almost zero probability case, in which the relative kinetic energy of the colliding systems plus the energy of combination corresponds exactly to a quantised state of the water molecule. Therefore a third body would have to intervene in order to remove the energy. Such triple collisions would be rare in view of the atomic pressure. If the life period of the activated N_2O is of the same order of magnitude as that of other systems involving roughly similar electron jumps, then it is possible to distinguish between the *clustering* theory and Macdonald's idea of a binary collision as the first step, by working at low pressures, using a method employed by the writer in his work on hydrogen iodide (*Proc. Nat. Acad. Sci.*, **13**, 720; 1927; *J. Phys. Chem.*, **32**, 270; 1928).

One hesitates to put forward any definite and general theory regarding clustering in photochemical reactions. The examples in which agreement is found between the photochemical and α-ray yields are exceedingly few (see Lind, "Chemical Effects of Alpha Particles," second edition, p. 144, 1928). In one of these at least (photochemical decomposition of hydrogen iodide or bromide), the experimental work of the writer (*loc. cit.*) indicates that clustering is out of the question. The others involve either reaction between two different systems or else yields of less than unity. Even in the decomposition of N_2O, it is difficult to understand the survival of two impacting molecules having more than sufficient energy to decompose, since it has been shown that two N_2O molecules undergo thermal decomposition when the energy increment is only 58,000 calories (Hinshelwood, "Kinetics of Chemical Change in Gaseous Systems"). Such survival would imply electronic stability of the excited molecule until sufficient 'clustering' impacts had been undergone.

Still, cases involving survival of an excited molecule after collision are not lacking. On the other hand, much can be said for the idea of photochemical clustering in reactions involving association or polymerisation. It is important that examples of association be found for comparing the photochemical and α-ray yields; Lind ("Chemical Effects of Alpha Particles," p. 145) has studied the ionic clustering of certain unsaturated hydrocarbons. For acetylene he finds a value for $M/N = 20$. Interest is therefore attached to the yield in the photochemical polymerisation which is reported to take place (Berthelot and Gaudechon, *Compt. rend.*, **150**, 1169; 1910; Bates and Taylor, *J. Am. Chem. Soc.*, **49**, 2444; 1927).

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Negrito Racial Strain in India.

THE presence of a negrito strain in the aboriginal population of India has been suspected for a long time, but any definite evidence as to its existence has been lacking so far. Thus in the opinion of the Sarasin Brothers "no one has yet succeeded in finding pure woolly hair in India" (*Ergebnisse naturwissenschaftlichen Forschungen auf Ceylon*, **3**, 355; 1893), a view which has also received the support of Turner (*Transactions of the Royal Society of Edinburgh*, **40**, 114; 1905), Lapicque (*Revue Scientifique*, **6**, July 1906), Thurston ("Tribes and Castes of Southern India," vol. 1, Introduction, 1909), and Risley ("The Peoples of India," p. 15, 1915).

During a recent visit to the Kerala country I measured a large number (seventy) of Kadars living in the Cochin Hills (Fig. 1). The majority of this

FIG. 1.—Two Kadar men from the Cochin Hills.

people are not unlike the other jungle tribes of southern India, having a head of hair varying from wavy to curly, but in the extreme interior of the hills I was fortunate enough to find five men and one woman with undoubtedly spirally curved hair, one of whom was pure woolly with short spirals, and the rest were of the frizzy type, similar to that seen among the Melanesians. Besides their spirally curved hair, the Kadars are short (average stature, 1516 mm.), of very dark complexion (the skin colour varying from 29 to 33 in von Luschan's scale), prognathic, and have not infrequently receding foreheads. I was informed by Mr. K. Govinda Menon, Conservator of Forests of the Cochin State, and one who has known the Kadars very intimately for the last quarter of a century, that in the early years of his service he noticed at least a dozen men and women with woolly and frizzy hair, but who must have died out since.

The head measurements of the Kadars do not show them to be brachycephalic, the average cephalic index of the five men (with spirally curved hair) measured by me being only 75·06. Of these five men, however, two are mesocephalic, with 79·29 and 77·34 as their respective cephalic indexes, while the rest are in the lower grades of dolichocephaly. It is not improbable that the negrito element among the Kadars was originally brachy-, or at least mesocephalic, but in its admixture with the long-headed Vedda-like race, which forms the dominant element among the Kadars to-day, the head has become considerably elongated.

It would not be safe to assume anything more until further investigations take place, but it is just possible that the detailed analysis of the measurements to be published later may throw some light on the question. In this connexion it is interesting to note that the designs on the bamboo combs worn by Kadar women ("Die Zauberbilder Schriften der Negrito in Malakka," by K. T. Preuss, *Globus*, 1899) are strikingly similar to those of the Semangs—a negrito tribe of the Malay Peninsula with short stature, dark complexion, and medium head (Av. C.I. 79), who are not unlike the Kadars in general appearance.

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New Regularities in the Band Spectrum of Helium.

BY the work of Curtis and Fowler, the structure of the band spectrum of helium has become well known. More recently, Weizel and Füchtbauer (*Zeit. f. Phys.*, **44**, 431; 1927) added considerably to our knowledge of the spectrum by detecting a number of new bands which they could ascribe to transitions between terms with the oscillational quantum number one. Nevertheless, there appear to be in the spectrum still many lines which have not yet been arranged into bands. As the helium band spectrum is of considerable theoretical interest, we have analysed those parts not yet studied by previous investigators.

As these parts are very rich in lines, it was necessary to use high dispersion. With a suitably constructed powerful discharge tube it was possible to photograph the spectrum with sufficient intensity in the first, second, and third orders of a 15 ft. concave grating. We were able to find more than twenty new bands, and a number of parts of other bands which we hope to be able to complete in the near future. Most of the new bands have the $2p$ state as final state. The initial states have, however, a structure different from that of the terms discovered by Curtis as they cannot be represented in first approximation by a quadratic formula. This and the fact that they combine in a different way with the $2p$ terms causes the appearance of the new bands to be much different from that of the other helium bands, and bands of a similar structure do not seem to have been found either in other band spectra.

The band $2p - 3z$, for example (we designate provisionally the new terms by the last letters of the alphabet), has only a P- and a Q-branch, the R-branch being absent. The band $2p - 3x$ has a strong P- and R-branch; the Q-branch is absent or very weak. The band $2p - 3y$ has three branches which have the appearance of a Q-branch, a P-branch and a branch in which the *effective* rotational quantum number decreases by two units. Whereas many bands overlap in the more refrangible side of the spectrum and make its structure there extremely complicated, the arrangement of bands is quite open in the region between 5700 A. and 6700 A. There we have, except the bands $2p - 3d$ and $2p - 3s$ discovered by Curtis, the bands $2p - 3x$, $2p - 3y$, $2p - 3z$, and the *five* analogous bands for par-helium, which have exactly the same structure but are much fainter than the ortho-bands. The absolute values of the $3x$, $3y$, and $3z$ terms lie between those of the $3s$ and $3d$ terms. We have not yet succeeded in unravelling the structure of par-helium $2P - 3D$, but only locate its position.

Besides bands in which terms of a new type are

involved, we found new bands originating from the combination of Curtis's terms with the vibrational quantum number one and two, and could thus extend the results of Weizel and Füchtbauer. For the transition $2s - 3p$, *e.g.*, the following bands are now known $0 \longrightarrow 0$ ($\lambda 465\ m\mu$); $0 \longrightarrow 1$ (505); $1 \longrightarrow 1$ (467); $1 \longrightarrow 0$ (432); $1 \longrightarrow 2$ (505); $2 \longrightarrow 2$ (468). Of these, 465 is the main band analysed by Curtis, 505 and half of 467 were found by Weizel and Füchtbauer. Evidence was found that the discrepancy between the zero lines of the $p - R$ and the Q-branches found by Curtis is due to the slightly different vibrational frequencies of the p_a and p_b terms (especially well marked in the $2p - 3d$, $1 \longrightarrow 1$ band for the $3d_a$ and $3d_b$ terms). If it can be postulated—as theoretical considerations and the results obtained from other band spectra make probable—that the a- and b-states are exactly coincident for the vibration- and rotationless molecule, this discrepancy can be regarded as another experimental proof for the half-integer values of the vibrational quantum number.

In another note we hope to discuss the theoretical significance of the new levels. Details about the work can be found in a series of forthcoming articles in the *Zeit. f. Physik* and the Scientific Papers of the Institute of Physical and Chemical Research, Tokyo.

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New Type of Discharge in Neon Tubes.

IT was found some years ago by one of us (J. W. R.) that if a condenser of the order of a microfarad capacity was discharged through a tube containing neon at a pressure of about 10 mm. with an adjustable resistance in series, then when the resistance was reduced below a certain value there was a marked change in the character of the discharge, distinguishing clearly the new type of discharge from others obtainable in such tubes.

Further study now makes possible a brief statement of the general properties of discharges of this type.

The appearance of the tube during the passage of the heavy current discharge is quite different from that for the normal neon glow discharge, which in the tubes used amounted to a few milliamperes only. The heavy current was marked by a small bright spot or scintillation of bluish light at a single point on the surface of the cathode. In this neighbourhood the nickel spectrum could be seen. The spot was almost always either on the weld between the cathode disc and its supporting wire or on the square-cut edge of the disc. When the discharge passed a sharp click could usually be heard. Occasionally, instead of the bright spot, there was a violet flash between the electrodes, and the current recorded was about one-half the expected value. Conspicuous fluorescence of the glass usually occurred.

That some special conditions at the electrodes are necessary is shown by the fact that in some tubes when one of the two apparently similar electrodes is made cathode heavy currents are obtained, whereas with the other as cathode they are not.

It was found that the value of the current depends chiefly on the circuit conditions external to the tube, particularly the resistance and the condenser voltage. Currents of various magnitudes between 100 amp. and 1·6 amp. were measured and were found to repeat fairly well for successive discharges under any given set of conditions.

A point of clear distinction between this and the glow discharge is that a change in the area of the electrodes (over a range of at least 10 to 1) did not affect the value of the current.

The voltage across the tube at the moment of maximum current falls to a low value, about 20 volts for the smallest currents, rising to a constant value of 60 volts for all currents above 20 amperes.

After the discharge is over, the condenser is usually found to have some charge still remaining, the voltages varying from zero up to about 90 v.; with a normal neon glow discharge this voltage would be about 130 v. Where there is no resistance in circuit the final voltage is sometimes of the opposite sign to that of the original charging, indicating that the discharge was oscillatory. For this to occur in the circuit used, the effective resistance of the discharge could not have exceeded one or two ohms.

A further characteristic property of the discharge should be mentioned. If the capacity of the condenser or alternatively the charging voltage is sufficiently low, a heavy current is not obtained every time the condenser is discharged; indeed, there is a regular relation between the value of the capacity and the probability of a heavy current discharge.

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Disappearance and Reversal of the Kerr Effect.

A BEAUTIFUL confirmation of recent theories of the electric birefringence in liquids (C. V. Raman and K. S. Krishnan, *Phil. Mag.*, April 1927) is furnished by observations of the phenomenon in electric fields oscillating with radio-frequency such as may readily be obtained with thermionic valves. The Kerr effect arises from the orienting action of the field on the molecules, and the time taken by the latter to adjust themselves to a state of statistical equilibrium has naturally to be taken into account. It may be pointed out here that the orienting couple acting on the *permanent* electric moment of the molecule (assumed to be chemically polar) stands on a different footing from the couple acting on the oscillating *induced* moment in it. The couple acting on the permanent moment is purely periodic, and its effect must tend to disappear at sufficiently high frequencies. The couple on the induced moment, on the other hand, has a quasi-static part and tends to persist even at optical frequencies.

The Kerr effect expressly due to the polarity of the molecule must thus disappear at high frequencies, while the non-polar part will continue. In certain polar liquids, for example, chloroform or the higher alcohols, the Kerr effect is negative and may be considered as the resultant of a *negative polar*, and a *positive non-polar* Kerr effect. In all such cases we should expect the Kerr effect to *diminish and vanish as the frequency is increased*, and then to *reappear* at still higher frequencies.

Observations with octyl alcohol made by us confirm this remarkable prediction, the Kerr effect disappearing at 32 metres frequency and reappearing at still shorter wave-lengths. Cooling the liquid with a freezing mixture shifts the frequency of disappearance and reversal to longer wave-lengths, as might be expected.

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Mar. 5.

The *Discovery* Expedition.

By Dr. STANLEY KEMP.

IN a previous issue of NATURE (Oct. 30, 1926, p. 628) an account was given of the work of the *Discovery* Expedition up to the end of June 1926: the investigations since that date, to the conclusion of the commission on Sept. 29, 1927, form the subject of the present article.

The work at whaling stations during this period has been continued mainly under the direction of Mr. N. A. Mackintosh, and a note by him on this side of the investigations is given below. This shore work has now been in progress for two and a half seasons at South Georgia and for one season in South Africa, and the whales examined, nearly all Blue and Fin, have reached a total of 1685: never before has so large a number been the subject of scientific investigation. The task of working up the data has only just begun, but already there are indications that results of great economic importance will be gained.

Among other work at the South Georgia station reference may be made to investigations on the elephant seal and on birds by Mr. L. H. Matthews: it is hoped that papers embodying his results will be published at an early date.

As noted previously, the *Discovery* reached Cape Town after her first season's work on June 29, 1926, and she proceeded almost immediately to the Admiralty Dockyard at Simonstown for refit. Hitherto the excessive rolling of the ship had been a serious hindrance to the work, and to minimise this defect sister-keels were fitted. The keels proved very effective in reducing the extent of the roll, but they unfortunately interfered with reception from the echo-sounding apparatus, and in consequence the deep water gear could not be used. On completion of the refit, the *Discovery* left for a short cruise on the south-west coast of Africa before returning to South Georgia for the next season's

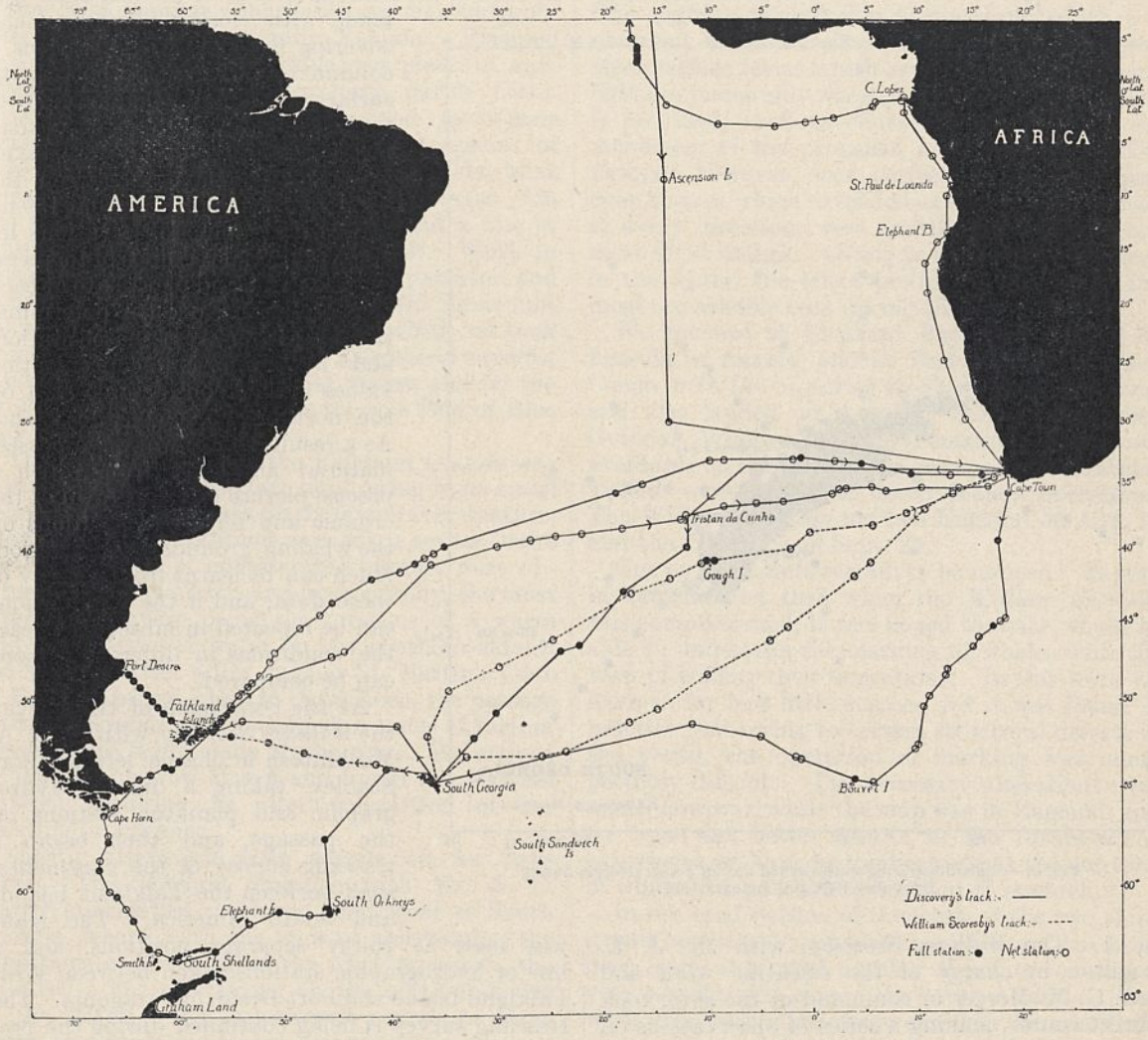

FIG. 1.—Chart of the South Atlantic, showing the tracks of the *Discovery* and *William Scoresby*.

work. Off Saldanha Bay, where two whaling stations are located, a line of planktonic and hydrographic stations was taken and a series of hauls with large closing nets was made in deep water. In order if possible to obtain some knowledge of the diurnal movements of the plankton on the whaling grounds, hauls with closing nets, towed horizontally, were made every four hours during a 24-hour period.

In the meantime the second vessel of the expedition, the *William Scoresby*, had arrived from England, and in October both ships left for South Georgia. The tracks of the two ships are shown in Fig. 1. The *William Scoresby*, with Mr. J. E. Hamilton in charge of the scientific work and Capt. G. M. Mercer in command of the ship, took a direct course, making a series of observations on the plankton during the passage. The *Discovery* attempted a more southerly route with the object of testing the theory that the entire fringe of the Antarctic continent is potential feeding ground for whales. It was our aim to proceed due south past Bouvet Island and to work to the west in high latitudes where easterly winds might be expected to prevail; but abnormal ice conditions frustrated this hope. Near Bouvet Island, which we approached within a short distance, dense pack-ice was encountered, through which it was impossible to make headway, and we were obliged to turn west while still in the track of the westerly winds. With shortage of coal the passage proved one of exceptional difficulty, and we counted ourselves fortunate when we reached Cumberland Bay on Dec. 5.

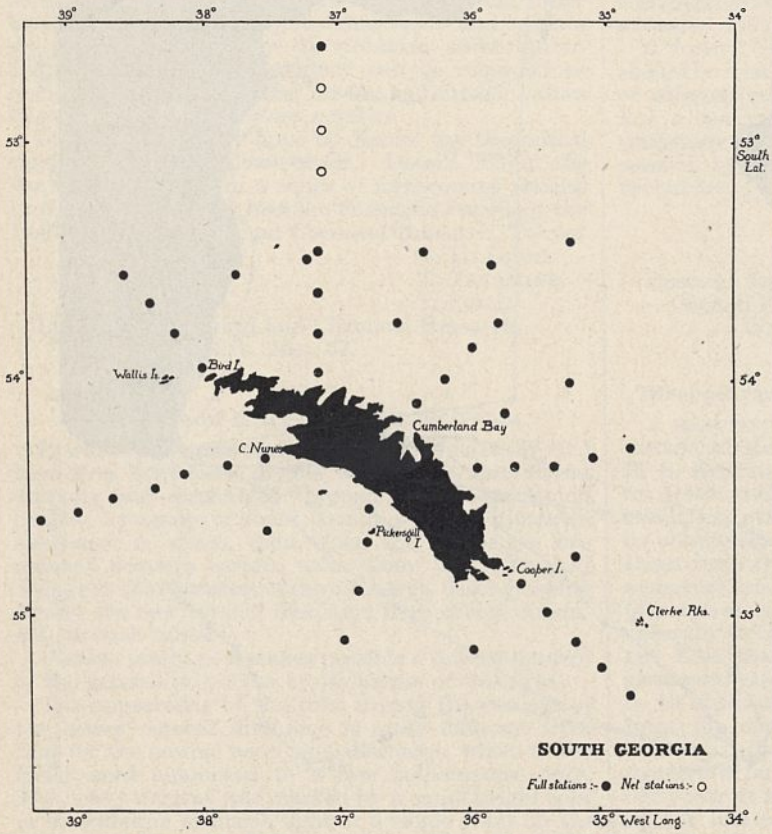

FIG. 2.—Chart illustrating work carried out off South Georgia during December 1926 and January 1927.

The *William Scoresby* had arrived earlier, and before long the two ships set about an intensive study of the conditions on the South Georgian whaling grounds. Mr. A. C. Hardy, in charge of the work on the *William Scoresby*, was in wireless touch with me throughout, and, thanks largely to the great enthusiasm of everyone concerned, the full programme, as illustrated in Fig. 2, was completed. At each of the stations a series of vertical hauls was made with closing plankton nets, covering in standardised sections a column of water from bottom to surface, and two flights of nets towed horizontally, one of coarser and one of finer mesh, were taken in the upper layers between the surface and a depth of about 150 m. The hydrographic observations include full serial readings of temperature, salinity, and phosphate at each of the stations, oxygen determinations at every alternate station, and hydrogen ion concentration values over a considerable area on the north-east side of the island. As a result of this work, we possess material and data from which a precise picture can be drawn of the organic and physical conditions on the whaling grounds at this period. Much can be learnt from a study of these data, and if the observations can be repeated in subsequent years the conditions in different seasons can be compared.

At the conclusion of this survey the *William Scoresby*, with Mr. N. A. Mackintosh in charge, left for Port Stanley, taking a line of hydrographic and plankton stations on the passage, and then began a trawling survey of the continental shelf between the Falkland Islands and South America. The trawl was used at thirty separate positions, and a line of hydrographic stations taken between West Falkland Island and Port Desire in Patagonia. The trawling survey is being continued during the present season, and an account of the results obtained cannot usefully be given until it is completed.

The *Discovery*, after dredging and trawling for a short time on the South Georgian coast, left for the South Orkneys, arriving after a slow and very rough passage, during which only two stations could be taken. At the South Orkneys great numbers of icebergs were encountered, and on the further passage to the South Shetlands one was found which was 35 miles long; another, reported by the whaling community, was said to have exceeded 100 miles in length. All these bergs appear to have come from the Weddell Sea.

We reached Deception Island, the centre of the South Shetland whaling industry, on Feb. 26, and after a few days steamed south to Melchior Harbour in Schollært Channel and to Port Lockroy in Wiencke Island—both in the Palmer Archipelago. We passed through Bismarck Strait and made plankton observations at a station situated in latitude 64° 58′ S., but were unable owing to bad weather to undertake any hydrographic work. Some trawling and dredging was done in the sheltered channels among the islands, where the fauna was found to be one of very great richness. A large species of *Umbellula* was abundant, together with another remarkable alcyonarian probably belonging to the family Xeniidæ. Elasipod and other peculiar holothurians were plentiful, and, among cephalopods, a very large purple *Cirroteuthis* was taken: amphipods and pycnogons occurred in great quantity. Several species of *Cephalodiscus* were found, and with them what appear to be some early developmental stages. On the return passage to Deception Island a line of stations was taken in Gerlache Strait. Work in this area ended with two lines of full plankton and hydrographic stations across Bransfield Strait (not shown in Fig. 1), in the course of which we took immense numbers of larvæ of *Euphausia superba*, the euphausian which in these waters and on the evidence obtained constitutes the sole food of Blue and Fin whales.

The return passage to the Falkland Islands was taken by way of Cape Horn, and owing in no small degree to a spell of particularly favourable weather, good series of observations were made across Drake Strait. Results of considerable interest were obtained in both plankton and hydrography, the most significant feature being the presence of a warm mid-water layer of water on the southern side of the Strait. After a few days at St. Martin's Cove in Hermite Island, close to Cape Horn, the passage to the Falklands was continued, a series of further observations being made on the way. We arrived at Port Stanley on May 6 and found the *William Scoresby* awaiting us after completion of her trawling programme.

Shortly afterwards both vessels left for Cape Town. The *William Scoresby*, with Mr. A. C. Hardy in scientific command, first went to South Georgia, where, with the view of ascertaining the conditions at the close of the whaling season, she repeated a line of stations on the north-east side of the island. Her subsequent course to Cape Town was made via Gough Island, where a party landed, and throughout the passage systematic observations were made on the plankton. The *Discovery* took a direct course via Tristan da Cunha —a second visit to the islanders proving impossible by reason of weather conditions—and made a similar series of plankton investigations on the way.

Soon after her arrival in Cape Town, the *William Scoresby* sailed for England, while the *Discovery*, after a brief period in dock, cruised up the west coast of Africa. The line of stations off Saldanha Bay was repeated, and throughout the passage until arrival at St. Vincent plankton observations were continued. The plankton throughout this passage was of very considerable interest. Among cœlenterates, siphonophores of great beauty were taken, some belonging to the genus *Crystallodes*, and a mysterious form, which defied the zoological knowledge on board but has since been identified as 'Semper's larva.' At some positions cymbuliid pteropods were found in astonishing numbers, and a small fresh-water prawn (*Atya*) was caught in the open sea many miles off the mouth of the Congo river. Fish and crustaceans, often provided with great numbers of luminous organs, were abundant. One night a remarkable luminescent effect was observed, due to a ctenophore of the genus *Deiopea*. Most surface forms which are capable of producing light luminesce only when some mechanical stimulus is provided, such as contact with the ship, the movement of the propeller, or a rough sea. The *Deiopea*, however, on a perfectly calm night, and over an area which extended as far as could be seen in every direction, were emitting momentary but most vivid flashes. Owing to the numbers present in the water, the effect produced was one of the most remarkable seen during the voyage.

We touched at Elephant Bay and St. Paul de Loanda in Angola, and at Port Gentil in French Congo, with the object of visiting whaling stations, and also landed on Annobon Island in Spanish Guinea. Whaling has unfortunately proved unprofitable on this part of the coast, and the stations visited were found to have ceased operations. The *William Scoresby* reached England on Aug. 14 and the *Discovery* on Sept. 29.

One or two points remain to be noticed. It may be remembered that when the *William Scoresby* was commissioned, it was hoped that she would be able to undertake the marking of whales with the view of tracing their migrations. In this work we have so far had little success, for it was found in practice that owing to certain structural defects in the vessel, the operation of marking was unexpectedly difficult. The necessary alterations were made, however, while the ship was in England, and we hope for better results in the future. The experience we have had indicates that the marking of whales is a practicable method of research.

In the brief outline of the work of the two ships it will be noticed that plankton observations have been made at a great number of points covering a very considerable part of the South Atlantic. This work has been done to a carefully standardised programme and in working up results the hauls may be regarded as strictly comparable if the assumption is made that the plankton is uniform over comparatively large areas. To ascertain the truth of this theory was one of the objects for which the 'continuous plankton recorder' was invented by Mr. Hardy (see NATURE, Oct. 30, 1926), and with this instrument records of plankton extending over nearly 2400 miles of our course have been taken. We have also on several occasions made continuous hauls over long distances with surface nets. Both methods show an almost startling lack of uniformity in the plankton, and teach us that it

is only by working on broad lines that results of real value can be obtained.

Opportunities for survey work were limited, but Lieut.-Commdr. J. M. Chaplin made the utmost use of all that came his way. Harbours in South Georgia and the South Shetlands were surveyed, and numerous corrections made in our charts of these little-known regions.

It will be seen that in the second season's work we have been more successful than in the first—a result due in no small measure to the efficient help given by the *William Scoresby*. We have made a detailed survey of the conditions on the whaling grounds of South Georgia, with some work on the same lines in Bransfield Strait and off Saldanha Bay in South Africa. We also have a considerable number of observations on plankton and hydrography in the region bounded by Cape Horn, the Falkland Islands, South Georgia, and the South Shetlands, and plankton material obtained on a system of comparable hauls over a much more extensive area.

My thanks are due to Commdr. J. R. Stenhouse, Capt. Mercer, and to all officers and men for their continuous efforts to carry on the work, often in the face of very considerable difficulty, and to the scientific staff, both on the ships and at the shore station, for their enthusiastic support in every programme that was attempted.

In the course of the work a great number of hydrographic observations have been made, and very large zoological collections obtained, and this material is being studied, with particular reference to its economic value, by those of the scientific staff who are now in England. The systematic treatment of some of the zoological collections is being undertaken by specialists, and the publication of results will shortly begin.

The *William Scoresby*, with Mr. D. D. John and Capt. H. de G. Lamotte respectively in scientific and executive command, is again at work in South Georgia, and the shore station, with Mr. F. C. Fraser in charge, has been reopened. It is expected that most of the scientific staff at present in England will leave for further work in the south towards the end of this year.

Work at the Whaling Stations.

By N. A. Mackintosh.

The previous description of the work of the marine station at Grytviken (included in the article in NATURE, Oct. 30, 1926) dealt mainly with the observations made there at the whaling station from February 1925 until March 1926. Since that period a further 455 whales were examined at Saldanha Bay, Cape Colony, from June to October 1926, after which work was resumed at South Georgia, where 490 whales were examined between November 1926 and April 1927. The material and data obtained are now being studied in England.

As was previously explained, it was desirable that work should be continued in South Africa during the southern winter in order that observations should extend over the whole year. Records of the lengths of fœtuses obtained at South Georgia clearly indicate that both pairing and parturition take place for the most part during the southern winter, and it was therefore hoped that the work at Saldanha Bay would lead to a more accurate knowledge of the breeding of whales. Observations on the adult females taken there were very instructive, but it was not possible to examine nearly as many as was desirable, since the vast majority of whales taken in this locality are immature. Evidence of œstrus taking place at this time of year was, however, found, and several very small fœtuses were collected. Three of these measured 20 mm. to 30 mm., and one, a Sei whale embryo, measured 2 mm. to 3 mm.

As at South Georgia, the catches at Saldanha Bay consisted almost entirely of Blue and Fin whales, other species being practically negligible. Between 80 and 90 per cent of the Blue and Fin whales we examined were, however, immature, and both the abundance of whales and the proportion of adults remained roughly constant during the period we were there. During the final season's work at South Georgia, whales were caught throughout in large numbers, Blue whales being specially abundant.

An interesting comparison can now be made between the whale 'populations' of South Georgia and the south-west African coast. At the latter locality we have two classes of whales—the small immature whales which are abundant, and the large and fully mature whales which are comparatively scarce. The number of intermediate sized whales is very small. At South Georgia the whale community is quite different and much more complex. The population is more representative, but undergoes important changes during the season through the arrival and departure of different 'sets' or herds of whales which may differ in respect of sex, age, condition, etc. The constitution of the whale community may also differ from season to season. In view of these fluctuations, it is necessary to exercise caution in drawing conclusions from such estimations as the percentage of immature whales caught, the ratios of pregnant and lactating females, etc., as one cannot assume that the catches are representative samples of the whole stock.

A further study of the lengths of fœtuses which have been examined indicates that the period of gestation is about 10 months. The uncertainty regarding the rate of growth in the earliest stages of gestation, however, is the principal difficulty in making a precise estimation of the length of this period.

It appears that birth mostly takes place early in the southern winter, and a study of the lengths of young calves occurring in different months suggests that the nursing period lasts for five or six months, mostly in the winter. The young Blue whale appears to be weaned at a length of about 15 or 16 metres, and the young Fin whale at a somewhat shorter length. Growth is thus very rapid during the nursing period, but there are indica-

tions that it slows down very considerably after weaning.

It may be mentioned that external parasites which are rare on Blue and Fin whales at South Georgia, are abundant on those taken at the Cape, *Pennella* being particularly plentiful. Many of the whales examined at Saldanha Bay were also notable for the numerous and peculiar scars which are found on the body, mostly towards the tail. These are in the form of clean, cup-shaped holes in the blubber, and in the majority of whales they are found in all stages of healing. Old scars are quite common in this position on whales at South Georgia, but the unhealed pits are very rare.

The Problem of Artificial Production of Diamonds.

THE relations between the allotropic forms of carbon constitute one of the most baffling problems in chemistry. The hardness and incompressibility of the diamond point to its structure as being an exceedingly stable one, and the examination by X-rays proves it to have the tetrahedral lattice which accords with the known chemical properties of the carbon atom. On the other hand, graphite has its atoms arranged in sheets made up of hexagons, the carbon atoms in that plane being actually closer than in the diamond (1·42 instead of 1·53 Angstrom units), but the sheets are widely separated, their distance being 3·41 A., so that the structure is a loose one, corresponding with the easy cleavage. Graphite is readily produced from diamond at high temperatures, but the converse change has presented the greatest difficulties, graphite having shown itself under all conditions to be the more stable modification. It has been supposed that the atoms of carbon in the two substances differ in their electronic structure, the atom in diamond having four 2_1 orbits, and that in graphite only three 2_1 orbits and one of the 2_2 form, an arrangement which is consistent with the two space lattices and also with the great difference in electrical conductivity between the two modifications. It is doubtful whether specimens of graphite have ever been obtained quite free from other elements, and Prof. H. E. Armstrong has maintained that it always contains hydrogen, which is the cause of its open structure.

The diamond is found in Nature under conditions which afford little clue as to its genesis, but as it is converted into graphite by heat in the laboratory, it has seemed probable that it has been formed under a high pressure, and most attempts at its artificial production have started from this assumption. Of these, the most famous were those of Prof. Henri Moissan. Moissan's most successful experiments were made by melting pure iron with sugar charcoal in an arc furnace, and plunging the crucible containing the molten mass into cold water. The pressure produced by the rapid chilling of the outer crust was relied on to bring about the conversion of the carbon, so that it would crystallise from its solution in iron as diamond, and not, as usual, as graphite. The iron was successively treated with nitric and hydrochloric acids, with oxidising mixtures, and with fused potassium hydrogen fluoride to remove all minerals except diamond, and after the operation minute crystals were found, some of which had the optical properties of diamond and yielded carbon dioxide on combustion. Molten silver was also used as a solvent, with similar results. Sir William Crookes, working with the residues found in a bomb in which cordite had been exploded, the pressure being calculated to reach 8000 atmospheres, obtained similar crystals after the same chemical treatment. Crookes arrived at the conclusion that carbon, if sufficiently heated under a pressure of 2350 atmospheres, would be liquefied, behaving in this respect like arsenic, and should then crystallise on cooling.

Sir Charles Parsons carried out extensive experiments on this subject, the results of which were communicated in his Bakerian Lecture of the Royal Society for 1918. The main conclusions were :

1. That carbon, if melted or vapourised under a pressure of 15,000 atmospheres does not crystallise, as predicted by Moissan and Crookes.
2. That Moissan's supposition that great pressure was produced by quenching molten cast iron is erroneous.
3. That if the crucible, instead of being quenched, were subjected to a pressure of 100 tons per in.^{2} in a steel die under a press, less crystal residue was obtained.
4. That impurities in the iron, such as silicon, aluminium, magnesium, and chromium, greatly increase the amount of crystalline residue, whilst commercially pure iron melted and carburised with graphite yielded practically no residue.

All attempts to produce diamond by the rapid compression and adiabatic heating of acetylene and other substances (as by firing rifle bullets into cavities which they fitted closely), without the use of iron as a solvent, failed to give a crystalline residue.

The method of analysis adopted was that used by Prof. Moissan. Great uncertainties are involved, as there are no chemical reagents which can be relied on to dissolve every crystalline substance formed at such high temperatures other than diamond. Some of the minerals are extremely resistant to acids, even after prolonged boiling, whilst fusion with alkalies cannot be used, as it destroys diamond. The only certain test is that of combustion, microscopical examination being uncertain in view of the hardness and transparency of some of the spinels and carbides. When the crystals are very minute, all that can be done is to place them in a silica boat and heat in a current

of oxygen, watching for a luminous flash when combustion occurs.

According to Prof. Le Chatelier, Moissan's supposed discovery has not been generally accepted in France, but at the time of the Bakerian Lecture his authority was such that Sir Charles Parsons accepted the statement that diamonds had been obtained, although he found it necessary to correct a number of details in the original account. Crookes also, speaking with high authority, confirmed the statements of Moissan, and described crystals which he regarded as being undoubtedly diamonds. He found one crystal, in particular, to show octahedral planes with dark boundaries due to a high index of refraction. He was able to distinguish such crystals with ease from those of carborundum, which are doubly refracting, but optical appearance alone would not serve to distinguish them from minerals of the spinel group. Unfortunately, although Moissan states in his book on the electric furnace that he prepared many artificial diamonds, no microscopical slides containing them are known to exist. The sketches reproduced by Crookes in his little book on diamonds only indicate that the crystals are of octahedral form and of high refractive index.

In view of the doubts which have been expressed as to Moissan's results, Mr. H. M. Duncan, who was associated with Sir Charles Parsons in his experiments, has repeated very carefully the various analytical processes, and his observations have been placed at our disposal by Sir Charles Parsons. It is found that spinels formed at a high temperature from magnesia and alumina, for example, are exceedingly resistant to repeated treatment with concentrated hydrofluoric and boiling sulphuric acids, and being colourless and crystallising in the regular system, they may readily be mistaken for diamonds. When a residue containing crystals of this kind is placed in a platinum boat and heated in a stream of oxygen in a tube of transparent silica, flashes are often observed, but the crystals of spinel are found to be unchanged. The flashes are to be attributed to carbon dust, which is often present in the air to such an extent that when an apparently clean boat is placed in the tube, many flashes are still seen.

Whenever Moissan's experiments with cast iron have been repeated, although many particles resembling diamond in appearance have been obtained, they have never withstood the combustion test. In order to prove that the methods adopted for removing foreign substances are not too severe, five very small fragments of boart have been placed in a platinum dish, and their size and appearance under the microscope noted, after which they were mixed with 15 gm. of iron filings and about a gram of graphite. The mixture was then subjected to chemical treatment until the whole of the iron and graphite had been removed. Microscopical examination showed that the particles of boart had not been destroyed, so that had similar particles been present in any of the residues from cast iron fusions they would not have been lost.

When repeating the experiments, the most characteristic residues were selected for combustion, and a blue pencil used to mark the position of each small crystal in the silica boat under the microscope, before placing it in the combustion tube. After heating at 900° in oxygen, which had been previously filtered through cotton wool, the boat could be again placed under the microscope. In one of these tests, five very characteristic crystals, photographs of which had been exhibited by Sir Charles Parsons at the Royal Society soirée in 1918, were tested in this way, and were found to be unburnt.

It is possible that Moissan's residues had become contaminated during the long period of their preparation. It is stated that in order to obtain sufficient material for a quantitative combustion test, no less than 80 ingots were made and dissolved. As the extraction with successive reagents is a most tedious process, there was ample opportunity for accidental contamination with carbon in the course of the operations.

Sir Charles Parsons and Mr. Duncan have also repeated the experiments of other workers who have claimed to have produced diamonds by artificial processes, but in every case the results have been negative. The conclusion seems inevitable that diamonds have not yet been produced in the laboratory, and that investigators have been misled into regarding as diamonds various transparent, singly-refracting minerals which happen to be very resistant to chemical reagents.

When graphite is heated to very high temperatures under pressures as great as 15,000 atmospheres, it remains perfectly soft, and there is no indication of the production of a new phase. This was confirmed by the experiments of Sir Richard Threlfall, published in 1908. The pressure produced in quenching molten cast iron in water or lead is not remarkably high, being limited by the yielding of the iron shell under stress, and the supporters of Moissan's views have therefore supposed that the action was not one of pressure, but of crystallisation from a solvent, which might be expected to give the less stable phase, whilst prolonged heating would convert it into the more stable graphite. Success had been claimed by Friedlander for experiments in which fused olivine was used as the solvent, but a repetition of the fusions, described in the Bakerian Lecture, gave negative results, and with such a solvent the chance of producing crystals which might be mistaken for diamond on a casual inspection is evidently great. Inconclusive experiments were made by O. Ruff in 1917, which showed that minute diamonds introduced into heated hydrocarbons under high pressure did not increase in size, but minute crystals which might have been diamonds were obtained from carbon in metallic solvents. The sources of error in all such observations having been detected, it must be admitted that the origin of the diamond in Nature remains an unsolved problem.

C. H. D.

Obituary.

DR. W. B. BLAIKIE.

WALTER BIGGAR BLAIKIE, LL.D., who died on May 3, was an extremely well-known figure in Edinburgh circles. Born in 1847, the son of a remarkable mother, his death severs a link with a past period. Educated at Edinburgh Academy, and the Universities of Edinburgh and Brussels, he began life as a railway engineer in the Public Works Department in India. He returned to Edinburgh after his marriage and joined the firm of T. and A. Constable, printers, with whom he remained associated until his retirement a few years ago.

In each of these very different professional tasks Blaikie showed the same remarkable vitality and intellectual energy. In particular he raised the productions of Constable's to a very high stage of artistic excellence. He was also warmly interested in the infirmary and other good works in Edinburgh. But besides, his activity overflowed into two channels in special, Scottish history and astronomy. In matters of history he was a recognised authority on special points and local history; in particular his "Itinerary of Prince Charles Edward" shows infinite pains in verifying details. In astronomy his interest was direct and original, especially in what he could himself create, preferably with his own hands. He devised numerous ingenious methods of prosecuting 'astronomy without a telescope.' He used to draw, print, and issue annually to his friends a book of monthly star maps, showing the position of the moon and planets, with tabular particulars. These issues were supplemented in different years by appendices on such subjects as the names of the stars, the fables of the constellations, etc., the product of a considerable amount of accurate, original work.

Perhaps the best of all Blaikie's devices was a graphical method of solving many common cases of spherical triangles, by means of two circular discs, engraved on celluloid, with two nests of coaxial circles, and rotatable about a common centre. By means of this, for example, the hour angle of a known star can be read at once from the usual observed data of a theodolite without engaging in any calculations. Blaikie preserved all his life a singularly boyish activity, so that, though actually he died at an advanced age, he never seemed to his many friends an old man. R. A. S.

PROF. WILHELM VON BRANCA.

THE eminent geologist and palæontologist, Prof. Wilhelm von Branca, died in Munich on Mar. 12, aged eighty-three years. Descended from an old Lombardy family, he was born in Potsdam on Sept. 9, 1844, and graduated as Ph.D. at Heidelberg in 1876. He began his academic career as *docent* in the University of Berlin in 1881, and his first professorship of geology and palæontology was in Königsberg in 1887. He succeeded Quenstedt in Tübingen in 1890, and was next for a short time at the Agricultural High School at Hohenheim. Finally, he succeeded Dames in Berlin in 1899, and remained there until his retirement in 1917.

Branca's earliest researches were in vulcanology, and he continued to be actively interested in the study of extinct volcanoes until 1894, when he published his well-known account of 125 'volcano-embryos' in Würtemberg. In stratigraphical geology, he added much to our knowledge of the Jurassic formations. In palæontology, he will be remembered for his researches on the initial chamber and the development of the suture lines in cephalopod shells, and for his memoirs on the ganoid fish Lepidotus and various other extinct vertebrates. As director of the geological-palæontological institute in the University of Berlin, he encouraged the systematic collection of fossils, and he was largely responsible for organising the expedition to German East Africa (now Tanganyika Territory) which made so many important discoveries of Dinosauria.

Branca was also an inspiring teacher, beloved by his numerous pupils, and throughout his career he exerted an important influence on the promotion of geological science in Germany.

WE regret to announce the following deaths:

Henri Bosmans, of the Jesuit College of Saint-Michel, at Brussels, author of many papers relating mainly to fifteenth, sixteenth, and seventeenth century mathematicians, whose works are not generally accessible, on Feb. 3, aged seventy-six years.

Dr. C. G. Cumston, president in 1925 of the International Congress of the History of Medicine and author of "An Introduction to the History of Medicine," on April 14, aged fifty-nine years.

Prof. Julius Hirschwald, who occupied the chair of mineralogy at the Technische Hochschule in Berlin from 1877 until 1921, aged eighty-three years.

Dr. John P. Munson, head of the department of biology at the Washington State Teachers' College, distinguished for his work in comparative cytology, on Feb. 27, aged sixty-eight years.

Mrs. Flora Wambaugh Patterson, formerly mycologist in charge of the pathological collections, U.S. Bureau of Plant Industry, on Feb. 5, aged eighty years.

Prof. W. W. Payne, of the observatory of the National Watch Company, Elgin, Ill., and founder of *Popular Astronomy*, on Jan. 29, aged ninety years.

Dr. E. C. Schroeder, superintendent of the Experiment Station of the Bureau of Animal Industry, United States Department of Agriculture, who had made important contributions to our knowledge of animal diseases, on Jan. 24, aged sixty-two years.

Mr. W. C. Tait, of Oporto, Portugal, author of "The Birds of Portugal" and a pioneer in the introduction of the eucalyptus tree in Portugal, aged eighty-three years.

Dr. Willard P. Ward, of Savannah, Georgia, known for his work on the metallurgy of manganese, on Jan. 17, aged eighty-two years.

Dr. Theodor Zincke, professor of chemistry in the University of Marburg from 1875 until 1913, author of a large number of publications, particularly in the field of aromatic chemistry, on Mar. 17, aged eighty-four years.

News and Views.

THE British Association has issued the preliminary programme of its meeting to be held in Glasgow on Sept. 5-12, under the presidency of Sir William Bragg, who in his address will deal with modern developments of the physical sciences and their relation to national problems. The subjects of the presidential addresses and discussions in the various sections include the reflection of electrons by matter, the photography and measurement of radiation, ancient geography in modern education (by Prof. J. L. Myres), the nature of skill (by Prof. T. H. Pear), the influence of engineering on civilisation (by Sir William Ellis), the archæology of Scotland (by Sir George Macdonald), and increasing returns and economic progress (by Prof. Allyn Young). Dr. Cyril Norwood will give the presidential address in the education section, which also will hold a discussion on broadcasting in the service of education, opened by Sir John Reith. One of the customary evening discourses will be given by Prof. E. A. Westermarck, on the study of popular sayings; this will be the Frazer Lecture in social anthropology, which is due for delivery in Glasgow, and to which members of the Association will, by the courtesy of the University authorities, be admitted. The other evening discourse will be given by Prof. F. G. Donnan under the title of "The Mystery of Life," the subject being considered from the viewpoint of physical chemistry. The delegates of corresponding societies, under the presidency of Dr. Vaughan Cornish, will discuss the preservation of scenic beauty in town and country. All the meetings, except those in the evening, will be held in the University, an unusually convenient arrangement. The Lord Provost and Corporation of Glasgow will give a reception and dance in the City Chambers, and the local committee a reception in Kelvingrove Art Galleries. Ample opportunity will be provided for visits to places of scientific interest in the country around Glasgow, and for studying the manifold economic interests of the city and the Clyde area, with their many outstanding examples of the value of applied science in industry and social conditions.

THE Royal College of Physicians has been celebrating this week the tercentenary of the publication of William Harvey's "De Motu Cordis," which was referred to in these columns on Mar. 31 (p. 507). In his Lumleian lectures before the Royal College of Physicians delivered in the spring of 1616, Harvey had explained his discovery of the circulation of the blood, but his views met with so much criticism that he was deterred from publishing an account of his work until 1628, when his little book, in Latin, was published from the press of William Fitzer, of Frankfort. This event marked the veritable birthday of modern physiology and scientific medicine. In honour of Harvey's memory, delegates from all parts of the world have gathered in London. H.M. the King received the company on Monday morning, May 14, and, in reply to the address by Sir John Rose Bradford, president of the Royal College of Physicians, remarked that we honour Harvey not as the author of a fundamental discovery alone, but as one who "discerned and taught that the true method of scientific progress is by observation and experiment." On Monday afternoon the delegates were formally welcomed at the Royal College of Physicians, addresses were presented on behalf of universities and scientific bodies, and the president conferred honorary fellowships of the College on Lord Balfour, Sir Ernest Rutherford, Prof. I. P. Pavlov (of Leningrad), and Prof. K. F. Wenckebach (of Vienna). This distinction has only been conferred in the past by the College very occasionally. After this ceremony, addresses on Harvey and his work were delivered by Sir Charles Sherrington, Prof. A. Chauffard (of Paris), and Prof. F. Keibel (of Berlin). The celebrations during the week included visits to University College, London, where demonstrations of Harvey's work were arranged. We hope to give a fuller account of the proceedings in a later issue.

THE recent celebrations commemorating the two-hundredth anniversary of the birth of John Hunter recall that his brother, Dr. William Hunter, F.R.S., was born on May 23, 1718, having thus a seniority of ten years. William was born at Long Calderwood, Lanarkshire, and after studying at Glasgow and Edinburgh he entered at St. George's Hospital, London. Thereafter his career was one of distinction and authority, though marked by conflict with his distinguished younger brother, with whom at one time he was a co-lecturer on anatomy at the Great Windmill Street School. In 1747, William had become a member of the Corporation of Surgeons, but, applying in 1756 to the Court of Assistants to be disfranchised, his request was granted, subject to the payment of forty guineas. He did not pay the fee, and shortly afterwards, when admitted a licentiate of the College of Physicians, he was ordered by the Court to pay a fine of twenty guineas for joining the College of Physicians without the consent of the Court. Hunter became physician extraordinary to Queen Charlotte in 1764, and, in 1768, first professor of anatomy to the Royal Academy. He was elected a fellow of the Royal Society in 1767 (also the year of his brother's election), and he contributed papers to that body. There is a three-quarter length portrait of Hunter, by Zoffani, in the apartments of the Royal College of Surgeons, but none in the National Portrait Gallery.

IN the early part of 1780, William Hunter, in a communication to the Royal Society, claimed the credit for an anatomical discovery made by his brother John twenty-five years previously. The latter dealt with the assertion in a caustic manner, avowing that his silence might be misinterpreted into an acknowledgment that he had intentionally claimed what was not his due. "I am as tenacious as he is of anatomical discovery," he wrote to Sir Joseph Banks, "and I flatter myself as tenacious also of truth." He then recounts the mode and incidents of the discovery, recording that "Dr. Mackenzie had injected the

subject, and being unable as I conceived to explain an Appearance which he had found in dissecting it, sent for me. I came to him and having examined it further, explained the appearance in question then for the first time to my own satisfaction and that of Dr. Mackenzie; on the evening of the same day, full of my discovery, I came to Dr. [William] Hunter, and brought him with me to Dr. Mackenzie's to see and judge of the Explanation which I had given, and Dr. Mackenzie agreed to. This is my state of the fact upon which I grounded my belief of myself being the author of this anatomical discovery." William Hunter died on Mar. 30, 1783.

SIR JAMES WALKER, who delivered the Arrhenius memorial lecture before the Chemical Society on May 10, instead of speaking with the historian's detachment of one who, although so human and genial a personality, was an outstanding figure in contemporary science, chose to present a delightfully intimate sketch of the life and work of a close friend and one-time fellow student. Arrhenius was of course a pioneer of modern physical and biological chemistry. In selecting the conducting power of solutions for early investigation, he was doubtless influenced by the contemporary researches of Van 't Hoff, Raoult, Kohlrausch, and Ostwald, and by the theories of Grotthus, Clausius, Hittorf, and Helmholtz, but his choice was primarily due to a recognition of the potential value of a method for determining the molecular weight of substances which are not volatile without decomposition. His first measurements of electrolytic conductivity were directed to this end, but he soon recognised that the state of the conducting salt is a matter of primary importance. In his memoir, the record of experimental results was followed by an exposition of the germ of the later theory of electrolytic dissociation, although a precise account of the nature of the active (electrolytic) and inactive (non-electrolytic) portions was not then given. The important statement was made, however, that the active portion increases with dilution. In correlating theoretical considerations with experimental data, Arrhenius's next step was to show that "the molecular conductivity of the active part of an acid (in dilute solution) is constant and independent of the nature of the acid," and hence "the better the solution conducts electricity, the greater is its active part." Final formulation of the theory of electrolytic dissociation followed during the period 1886–1890, while Arrhenius was working with Ostwald in Riga or Leipzig, with Kohlrausch in Würzburg, with Boltzmann in Graz, or with Van 't Hoff in Amsterdam.

ARRHENIUS was indebted to Van 't Hoff for the nucleus which determined the crystallisation of his theory, for the application of the equation $PV = iRT$ to dissolved substances led to experimental values of i which for aqueous salt solutions were greater than unity. Arrhenius immediately realised that the value of i reflected the number of ions produced by the salts, and in a letter to Van 't Hoff in March 1887 he was able to state positively that the 'active molecules' are the dissociated molecules, and that (in opposition to Clausius's view) at extreme dilutions all salt molecules are completely dissociated. Arrhenius's work on other physico-chemical subjects, however, also merits recognition. He investigated, for example, the viscosity of pure liquids and solutions, the phenomena of conduction in hot gases and flames and of diffusion in aqueous solution, and studied also the velocity of hydrolysis of esters and the inversion of sugars. Although offered the chair of chemistry at Giessen in 1891, Arrhenius preferred to remain in his native country, and was appointed chief of the laboratory of physics at the Högskola at Stockholm, being designated professor in 1895; again refusing a foreign post, he became, in 1905, the director of the new Nobel Institute for Physical Chemistry. The stormy period of his career was now over, and until his death on Oct. 2, 1927, he was in Sweden a scientific oracle. His interest extended even to cosmic and meteorological problems, and in the beginning of the present century he directed his attention to serum therapy, contributing to the foundations of the new study of immunochemistry. Sir James Walker remarked that the character of much of Arrhenius's work is explained by his union of an aptitude for scientific speculation with an extraordinary facility for dealing with figures. Sweden can, he said, boast of many eminent names in science, of which two—Linnæus and Berzelius—are of the first magnitude; since the death of Berzelius she has had none to rank with these save that of Arrhenius.

THE subject of the discourse by Prof. Doris MacKinnon, delivered at the Royal Institution on Friday, May 11, was the intimate association of living organisms of different kinds for mutual benefit, especially those associations in which at least one of the partners is an animal. The phenomenon of luminescence in certain marine animals has recently been discovered to depend on the presence within the animal's body of captive bacteria having the power to emit light. In the colonial ascidian, *Pyrosoma*, these bacteria are intra-cellular, whereas in the cuttle-fishes they live in the cavity of the so-called accessory nidamental glands. In both these animals there are elaborate devices for ensuring that the developing young receive their bacterial supply from the parent. The majority of the other known associations have probably to do with food capture and with its digestion: and the very different methods in which green plants, fungi, bacteria, and animals feed, have to be borne carefully in mind. The green marine worm *Convoluta* is a good example of the more intimate sort of symbiosis associated with nutrition. Here the obligate partner is a minute green plant living in the worm's tissues and supplying it throughout most of its life with carbohydrates and fat in return for shelter and carbon dioxide. Many insects living on plant-juices or on blood are provided with pockets in the gut which contain yeasts or bacteria. Since here again precautions are taken to insure the infection of the next generation, it seems possible that these micro-organisms are not

'parasites,' but helpful symbiotes that somehow assist in the preparation of food for digestion. In one case, the wood-eating termites, that constantly harbour enormous numbers of tricho-nymphid flagellates in their guts, it has been shown experimentally that the host cannot get on without its guests.

IN an address on currency and credit delivered at the Royal Institution of Great Britain on May 4, the Right Hon. Reginald McKenna, chairman of the Midland Bank, referred to controversies relating to the proper constitution and functions of a central bank. He showed that the quantity of money in circulation varies with gold movements into and out of the country. The effect of these movements, however, can be counteracted or intensified by the buying or selling of securities on the part of the Bank of England, and indeed the Bank may go further and increase or diminish the amount of money on its own initiative. To give the Bank greater freedom in the exercise of these powers, proposals have been made to modify its constitution. This is a debatable question, as on one hand the Bank has behind it since 1844 a fine record of disinterested and public-spirited work, but on the other hand, with the present constitution of the Bank, important movements in gold supplies, wholly unconnected with monetary conditions in Great Britain, may react on trade and employment through their effects on currency and the price level. It might be argued that trade considerations should be taken into account in determining Bank policy, though Mr. McKenna admitted that a policy of leaving well alone has a great deal to recommend it, in view of the esteem in which the Bank is justly held. These questions, he pointed out, have a direct bearing on national prosperity, and are more worth public inquiry than some of the subjects which at one time or another have engaged the attention of Royal Commissions.

FURTHER particulars of the arrangements which have been made by the Society of Chemical Industry, in association with the Institution of Chemical Engineers, for the visit to Canada and the United States of America, and for the annual general meeting of the Society to be held in New York, are now available. Sailing from London on Aug. 10 in the s.s. *Megantic*, the visitors will reach Quebec nine days later, and full use will be made of facilities for night travelling to visit and inspect some of the most important and interesting cities and industrial plants. Thus, Aug. 20 will be spent at Shawinigan Falls; on the following day, a glimpse of Montreal and Ottawa will be afforded, and Aug. 22 will be devoted to the gold mines at Kirkland Lake. On Aug. 23 the International Nickel Company's refineries at Port Colborne will be visited, followed by a three days' stay at Niagara Falls, an important electro-chemical and electro-metallurgical centre. Monday, Aug. 27, is reserved for a visit to Akron, Ohio, a great rubber manufacturing centre, and the next day for an inspection of a modern glass factory, the U.S. Bureau of Mines laboratories, and the Mellon Institute of Industrial Research at Pittsburgh. Thereafter follow visits to the E. I. du Pont de Nemours Company's dye works at Wilmington, Del., and to the famous Edgewood arsenal. During a three days' stay at Washington, D.C., visits will be paid to various U.S. Government scientific departments and laboratories, New York being reached in the evening of Sunday, Sept. 2.

THE annual meeting of the Society of Chemical Industry begins on the following day, Sept. 3, with informal and social meetings, and continues in business and technical session—with due provision for pleasurable social intercourse—on Sept. 4 and 6; Sept. 5 is entirely devoted to an industrial trip by boat, and to the Messel Medal award and address by Dr. R. A. Millikan, whilst on Sept. 7 there will be an excursion up the Hudson River, details of which are not yet available. By leaving New York on Sept. 8 by the s.s. *Celtic*, England is reached on Sept. 16. The total cost of the trip, excluding expenses incidental to the stay in New York, but covering tourist class steamship accommodation in both directions, single berths on trains, all meals and hotel accommodation up to arrival in New York, is £77, 2*s*., with corresponding additions should superior arrangements be desired. Some members may prefer to visit only New York for the meetings; the cost of travel (tourist cabin) with hotel and other expenses for Sept. 2-8 will be about £60 in that case.

IN a recent speech at Birmingham, Sir Samuel Hoare dealt with air tragedies, and in particular with those that have arisen from high-speed and trans-Atlantic flights. After directing attention to the tremendous progress that has been achieved in aviation since an independent Air Force was created ten years ago, he stressed the cost that must be paid in human life for these advances and dealt with the question whether it is worth while. "Does the pursuit of speed," he asked in reference to Lieut. Kinkead's death, "justify the sacrifice?" If it were only the pursuit of speed, no world's record would be worth it, he said, but just as many of the improvements in the motor-car are directly attributable to motor racing, so a definite advance in aeroplane design and in engine improvement results from high-speed flying. While paying tribute to the daring spirits that undertake trans-Atlantic flights, however, he denied that the effort is a wise one or that it serves a sufficiently useful purpose. On grounds of practicability, he does not consider it desirable to attempt either to prohibit these flights directly, or on grounds of expediency to impose such restrictions as will make them possible.

NINE new members were elected to the National Academy of Sciences of the United States at the meeting held on April 25, and Science Service of Washington, D.C., has issued some particulars of them: Dr. John August Anderson, astronomer at the Mt. Wilson Observatory in California, is known specially for his invention of a new type of earthquake recorder, in collaboration with his colleague, Dr. Harry O. Wood. Prof. William Mansfield Clark, of the Johns Hopkins University Medical School, has been largely responsible for the development of hydrogen ion concentration determination in the United States; he worked on the chemistry of cheese while in the

bureau of dairy chemistry of the U.S. Department of Agriculture and later he was with the U.S. Hygienic Laboratory. Mr. Arthur Keith, of the U.S. Geological Survey, is an authority on the geology of the Appalachian Mountains. Mr. Charles Franklin Kettering, a vice-president and director of the General Motors Corporation, and head of the General Motors research laboratory, perfected and put on the market the 'Delco' lighting system; he developed the tetra ethyl anti-knock fuel for motor-cars and also perfected the 'Delco' ignition system. Dr. Alfred L. Kroeber, professor of anthropology at the University of California, is one of the leading authorities on the languages of the American Indian. Dr. Rudolph Ruedemann, State palæontologist for New York, is distinguished for his work on the fossils and geology of the Ordovician and Silurian of New York, and on pre-Cambrian continents. Prof. Philip A. Shaffer, professor of biochemistry at the Washington University Medical School, St. Louis, has carried out important investigations on human metabolism. Dr. George Malcolm Stratton, professor of psychology in the University of California at Berkeley, has investigated the psychology of vision and related subjects. Dr. Lewis Madison Terman, professor of psychology at Stanford University, California, is the author of the Stanford Revision of the Binet-Simon tests, and has done important work on intelligence measurement in children and others. Dr. Joseph S. Ames, provost of the Johns Hopkins University, was elected treasurer of the Academy, while Dr. W. B. Cannon, of the Harvard University Medical School, and Mr. Gano Dunn, a distinguished engineer of New York, were elected members of council. Dr. George K. Burgess, director of the U.S. Bureau of Standards, was elected chairman of the National Research Council, succeeding Mr. Gano Dunn.

MR. WILLIAM H. WRIGHT, astronomer of the Lick Observatory, Mount Hamilton, California, has been awarded the Henry Draper medal of the National Academy of Sciences. It will be remembered that Mr. Wright is to give the George Darwin Lecture of the Royal Astronomical Society on June 8 on the photography of planets.

RECENT appointments to scientific and technical departments made by the Secretary of State for the Colonies include two agricultural chemists, Mr. D. Manlove and Mr. W. A. Watson. Both are appointed to the Agricultural Department, Nigeria, chiefly for work on the products of the oil palm. The expansion of the inspection staff of the Nigerian Agricultural Department is continued, and six new produce inspectors are appointed: Messrs. J. R. Brown, D. W. P. Irons, L. J. Jackson, J. K. Peile, F. S. Philip, and N. W. Hardwick.

THE following have been elected foreign members of the Linnean Society of London: Thore Gustafsson Halle, chief of the Palæobotanical Department, Naturhistorika Riksmuseum, Stockholm; Robert Almer Harper, professor of botany, Columbia University, New York; Axel Johan Einar Lönnberg, Chief of the Vertebrate Department, Naturhistoriska Riksmuseum, Stockholm; Thomas Wayland Vaughan, director of the Scripps Institution of Oceanography, La Jolla, California; and Friedrich Zschokke, professor of zoology, University of Basle.

THE Council of the Royal Geographical Society has received a radio message from Captain Wilkins at Green Harbour, Spitsbergen, thanking the Society for the award of the Patron's Medal, and offering for the Museum of the Society the small British flag which he has carried through more than 15,000 miles of Arctic flying. The Council has gratefully accepted this gift, which will be placed beside the Union Jack flown by Sir Edward Parry on his sledge journey to Lat. 82° 45′ North a century before. Captain Wilkins will receive his medal at the anniversary meeting to be held on June 18; it is expected that both he and Lieutenant Eielson will be guests of the Society at the anniversary dinner on the same evening.

THE Empire Cotton Growing Corporation, Millbank House, 2 Wood Street, Millbank, S.W.1, announces its intention to award in June next not more than twelve studentships as follow: (*a*) research studentships to enable graduates with a leaning towards research to receive training in research under leaders in their subject, and (*b*) advanced study studentships to enable those holding them to receive specialised instruction in equipment for agricultural posts in cotton-growing countries. Both classes of studentship are of two kinds, namely, senior and junior. Each studentship will be tenable for one year, and of the value of £250, plus a further sum for travelling and other expenses. Forms of application can be had upon application to the Secretary of the Corporation. The latest date for their return is June 5.

A PUBLICATION grant of £2500 is receivable by the Royal Society from H.M. Government during the current year. The grant is available for assisting the publications of other scientific societies, as well as for assisting the separate publication of books, memoirs, etc., of a scientific nature. Applications for grants will be adjudged by the Council of the Royal Society at its meeting early in July, but should be received before the council meeting of June 14. Applications from societies will be received by the secretaries of the Royal Society; those from individuals must be brought forward by members of Council.

THE British Empire Cancer Campaign announces that an International Conference on Cancer has been convened to be held on July 16-20 in London at the house of the Royal Society of Medicine. Doctors, surgeons, pathologists, and radiologists from all parts of the world whose work has been closely associated with inquiry into the causes and cure of cancer will attend, whilst the Royal Society and the principal universities, medical schools, and scientific bodies of Great Britain are sending delegates. Sir John Bland-Sutton, Bart., past president of the Royal College of Surgeons and a vice-chairman of the Grand Council of the British Empire Cancer Campaign, will preside, and Sir Richard Garton, chairman of the Finance Committee, has been elected honorary

secretary of the International Conference. H.R.H. the Duke of York, president of the British Empire Cancer Campaign, and H.R.H. the Duchess of York will receive the delegates and their wives at a reception to be held at Lancaster House (London Museum), which has been lent by the trustees for this purpose, on July 18.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An assistant lecturer in the Department of Navigation of the Cardiff Technical College—The Principal, Technical College, Cardiff (May 26). Two physicists with electrical engineering experience for research work under the Safety in Mines Research Board—The Under Secretary for Mines, Establishment Branch, Mines Department, Dean Stanley Street, S.W.1 (May 29). An assistant to the Leeds City Analyst—The Town Clerk, 26 Great George Street, Leeds (June 6). A lecturer in electrical engineering in the University of British Columbia—H. Vickers, 54 High Street, Connah's Quay, Chester (June 8). A head of the department of pure and applied physics, a lecturer in municipal and sanitary engineering, and an assistant lecturer in municipal and sanitary engineering, each at the Manchester Municipal College of Technology—The Registrar, College of Technology, Manchester (June 9). A lecturer in electrical engineering at Loughborough College — The Principal, Loughborough College, Leicestershire (June 18). A part-time professor of dietetics at St. Thomas's Hospital Medical School—The Academic Registrar, University of London, South Kensington, S.W.7 (June 22). An assistant lecturer in the zoological department, the University, Birmingham—The Secretary, University, Birmingham (June 30). An assistant lecturer in metallurgy in the University of Birmingham—The Secretary, University, Birmingham (June 30). The George Henry Lewes studentship of the University of Cambridge—Prof. Barcroft, Physiology School, Cambridge (July 10). A junior assistant under the directorate of metallurgical research, Research Department, Woolwich—The Chief Superintendent, Research Department, Woolwich, S.E.18. A chief lecturer in building at the Huddersfield Technical College — The Director of Education, Education Offices, Huddersfield. A geography master at St. Dunstan's College, S.E.6 — The Headmaster, St. Dunstan's College, Catford, S.E.6. An assistant lecturer in education in the Department for the Training of Teachers, of the University of Reading—The Registrar, The University, Reading. A woman teacher of physiology at the Chelsea Polytechnic—The Secretary, Chelsea Polytechnic, Manresa Road, S.W.3. Civilian education officers in the R.A.F. Educational Service for teaching engineering subjects—The Secretary, Air Ministry, Gwydyr House, Whitehall, S.W.1.

Our Astronomical Column.

NOVA PICTORIS.—A photograph of this star, taken at Johannesburg, was shown at the meeting of the Royal Astronomical Society on May 11. Dr. Jackson noted that from examination of the plate, the Greenwich observers considered it probable that the rings round the star were not objective, but arose from the fact that the star, being probably red (as is the rule with novæ on their decline), did not give a sharp image on the plate, being somewhat out of focus. In fact, similar rings were seen round the images of red stars on the Franklin Adams plates. However, the Johannesburg observers stated that the rings were expanding at the rate of a second a day, which, if confirmed, would be evidence of their reality. Dr. Wood was evidently alive to the possibility of optical rings, since he stated that he examined other images on the plates of the Nova without finding similar rings.

RECENT SOLAR ACTIVITY.—Since the beginning of May the sun's disc has offered a number of spots for observation. Of these, the most interesting has been a very long stream of spots nearest the centre of the disc on May 8. The stream originated when on the invisible hemisphere, but its maximum development evidently occurred when turned earthwards. The longitudinal distance between the centres of the leading and following spots reached a maximum of 16°, or more than 100,000 miles. About this time the aggregate area of the stream exceeded 1500 millions of square miles. A single spot of this size would have been easily seen with the naked eye, but as the stream was drawn out into a number of component spots, it was a difficult object for naked-eye vision. This is the largest group of spots seen since February (NATURE, Mar. 3, p. 335).

In the interim, a few other fairly large spots have appeared, but were not of special interest. The largest of these were nearest the centre of the disc on Mar. 18 (lat. 14° N.), Mar. 19 (lat. 8° N.), and April 19 (lat. 16° S.) respectively. Particulars are appended of the recent large group.

No.	Date on Disc.	Central Meridian Passage.	Latitude.	Maximum Area.
2	May 2·14	May 8·4	14° S.	1/650 of hemisphere.

At the meeting of the Royal Astronomical Society on May 11, Mr. Evershed showed photographs illustrating the violent disruption of a large solar prominence of the type not usually subject to sudden changes. This prominence was photographed by Mr. Evershed at his observatory at Pitch Hill on May 8 and 9, the disruption and subsequent disappearance of the prominence taking place on the morning of May 9 at the sun's east limb.

COMETS.—Dr. Carrasco obtained a photograph of Giacobini's comet on Mar. 26·8472 U.T., from which he derived the position R.A. (1928·0) $6^h\ 5^m\ 2^s$, N. Decl. 14° 50′ 24″ (*I.A.U. Circ.*, No. 203). Dr. A. C. D. Crommelin has obtained the following parabolic elements from the observations of Mar. 17, 26, 28:

T	1928 Mar. 27·4335 U.T.
ω	345° 27·11′
Ω	196 20·45
i	2 49·71
log q	9·99769

Dr. Carrasco obtained similar elements, but the above give a better representation of the middle place.

Ephemeris for 0^h:

	R.A.	S.Decl.	log r.	log Δ.
May 20	$16^h\ 58^m\ 6^s$	14°33′	0·1269	9·5316
28	16 53 32	14 53	0·1544	9·6219
June 5	16 49 40	15 15	0·1814	9·7047
13	16 47 0	15 40	0·2074	9·7812
21	16 45 50	16 6	0·2325	9·8530

The small inclination suggests possible periodicity. However, the observations are satisfied better by a parabola than by an ellipse.

Research Items.

NORTH AMERICAN INDIAN STATISTICS.—A study of the population of America north of Mexico, which was begun by the late Mr. James Mooney as a contribution to the "Handbook of American Indians," but grew beyond limits suitable for that publication, has been published as No. 7, vol. 80, of the *Smithsonian Miscellaneous Collections*. It was still incomplete at the time of the author's death in 1921, but was sufficiently advanced to warrant publication. The territory is divided into fourteen areas. The figures show the relative strength of the tribes and an approximate estimate of losses and gains, with notes on the causes, epidemics and other, responsible for the decline. In the North Atlantic States, including New York, New England, New Jersey, and Pennsylvania, as well as part of Quebec, at the time of first colonisation, about 1600, the Indians probably numbered about 55,000. They are now reduced to about 22,000, of which number about 18,000 are Iroquois. In the South Atlantic States—Delaware, Maryland, Virginia, and the Carolinas—leaving out the Cherokee territory, there are not to-day twenty full-bloods keeping their own language, though there are about 1000 mixed bloods. It is estimated that in the early seventeenth century they numbered 52,000. Decline was noted so early as 1607. In the Gulf States the numbers have fallen from 114,000 to 62,700, though this latter figure includes large numbers with white admixture. Of the remaining regions the largest decrease is shown in the southern plains, where the population has fallen from 41,000 to 2861, and in California from 260,000 in 1769 to 18,797 in 1907. The figures for the whole area, including Alaska and Greenland, are: early figure, 1,153,000; latest figures, 406,000. The early figure, it will be noted, includes the first estimate or calculation for each area, but is not composed of synchronous figures, some belonging to the seventeenth century, others to the eighteenth or even early nineteenth centuries.

ANTLERS CARRIED BY FEMALE DEER.—Except in the case of the reindeer, it is the exception for the female of any species of deer to carry antlers. Interest, therefore, attaches to three recent records, collected by Joseph Dixon, of such abnormality in the case of the Rocky Mountain mule deer (*Jour. Mammalogy*, vol. 8, 1927). Other accounts of horned does in this species have been given by woodsmen and hunters, but though heads were occasionally preserved, the authenticity of the statements could not be tested. The present records come from one general region. In each case the antlers were well developed, but although all the deer were shot about the same season of the year, two had clean, hard, regularly forked horns, while in the third the antlers were gnarled and malformed and remained in full velvet. The last was evidently an old individual, and in this case senile degeneration of the ovaries may account for the abnormality, but the others were young individuals, and "there was no evidence noted that would lead one to believe that their reproductive organs were aberrant." It is a pity that opportunity was not taken to settle the questions aroused by the abnormal antler development, by critical examination of the reproductive organs.

NORTH AMERICAN SHORE BIRDS.—The United States National Museum has issued at intervals a series of volumes describing with great thoroughness the life-histories of related groups of wild birds frequenting the sea or inland waters. The seventh and latest of the series, by A. C. Bent, describes the "Life-histories of North American Shore Birds" (*Smiths. Inst., U.S. Nat. Mus., Bull. 142*). Under the head of each species the author has collected all the essential information regarding its migrations, breeding range, courtship, nesting, behaviour, plumages, and so forth, so that to each of the forty-one species of waders described in this first instalment, goes the goodly allotment of an average of some 8½ pages of print. To the British reader the volume is of special interest, since many of the species are migrants familiar on our shores during the winter months, and others nest in Great Britain as well as in North America; moreover, the group dealt with includes some of the most remarkable of migrants, 'globe-spanners,' which range from the Arctic almost to the Antarctic circle.

FISH MORTALITY IN FRESH WATER.—Major R. B. Seymour Sewell, in his "Investigations regarding an Epidemic of Fish Mortality in the tank in the Indian Museum Compound" (*Jour. As. Soc. Bengal*, vol. 22, 1926, Art. 25), gives a general account of the mortality of animal life in the tank on Feb. 16 and 17, 1926. The mortality among the fish is for the most part confined to the members of the carp family, which respire through the gills only. Post-mortem examination of fishes indicated that death was primarily due to asphyxia, either from insufficient oxygen or from excess of carbon dioxide in the water of the tank. A gas analysis of the surface water, taken on the morning of Feb. 17, showed 8·3 c.c. of carbon dioxide, 3·2 c.c. of oxygen, and 13·8 c.c. of nitrogen at N.T.P. per litre. Thus the percentage of carbon dioxide in the deeper layers of the tank must have been very near the lethal concentration of 10 c.c. per litre, especially as there was no wind and an insufficient temperature gradient to create a circulation in the tank. Hence it would appear that the epidemic was due to a rise in the carbon dioxide content, assisted by a reduction in the amount of free oxygen, both changes being brought about by the meteorological conditions. It is suggested that either by periodic introduction of water weeds and green algæ, or by circulating the water by artificial means or by treating the water with lime, such occurrences of mortality in tanks may be prevented. Dr. B. Chopra (*ibid.*, Art. 26) records that the fishes in the Indaw River in Upper Burma die in large numbers three or four times a year. This is said always to follow a heavy fall of rain on the hills, the water of which is collected by the Namtig stream. During the rainy season the Namtig brings down an exceptionally large quantity of water, some of which forces its way up the Indaw. The deadlock caused by the upstream of Namtig water and the downstream from the lake, brings about the fish mortality. Death is probably due to the water being fouled, preventing respiration. In spite of the periodic mortality every year, the stock of fish living in the river does not appear to be affected.

VARIABILITY IN CYCLOPS.—Z. Koźmiński (*Bull. Internat. Acad. Polonaise Sc. et Lettres*, Classe des Sciences Math. et Nat. B, No. Suppl. I., 1927) records in 114 pages and 19 plates detailed observations on the variability of Cyclops of the *strenuus* group. 640 specimens from varied sources were examined, carefully measured, and compared. He concludes that within the group *strenuus-insignis* four species are distinguishable—*scutifer*, *vicinus*, *strenuus*, and *insignis*, for which and for their *formæ* he provides full diagnoses, and adds notes on their ecology, local and seasonal variations, and on their geographical distribution.

THE DIGESTIVE ENZYMES OF A HOLOTHURIAN.—E. Sawano has investigated the digestive enzymes of a holothurian *Caudina chilensis* (*Sci. Reports Tohoku Imp. Univ.*, Sendai, Japan, vol. 3, No. 2, January 1928), and finds evidence of the presence of lipase, butyrase, amylase, invertase, maltase, ereptase, tryptase, and rennet. Examination for cellulase, lactase, pepsinase, and tyrosinase yielded negative results.

ERYTHRÆA SCILLOIDES.—This small but beautiful plant is one of the species selected for descriptive treatment in *Curtis's Botanical Magazine*, vol. 152, Part 2. Its chief interest lies in the fact that it is one of the latest additions to the flora of Great Britain, having been noticed for the first time on the cliffs at New Port Bay, Pembrokeshire, South Wales, in 1918. The nearest other localities in which it is found are in the Cherbourg Peninsula, and in the Monts d'Arré in Brittany. The species, one of the Gentian family, is described very fully and critically, and illustrated by a hand-coloured and lithographed plate.

MILDEW ON COTTON GOODS.—Various species of *Aspergillus* responsible for a large proportion of the cases of mildew on cotton goods have been worked out and identified by George Smith (*Jour. of Textile Institute*, vol. 19, No. 3). The forms have all been isolated in pure cultures in the laboratory, and the morphology and characteristics of each species are described. Species of *Aspergillus* described in this paper are divided into two conventional groups: first, those which have been identified as causal agents in actual cases of mildew damage of yarns and cloths; and secondly, forms which have been found to occur commonly as spore infections on commercial yarns, but have not so far been found growing on cotton goods. It is considered that the presence of living spores of such species on cotton constitutes a probable source of trouble. For each species or group, the variations in dimensions and colonial characteristics recorded are those noted in the actual strains isolated from cotton goods, and are not necessarily so wide as those cited in systematic works on the Aspergilli. In all, seventeen species are described, of which only one, *A. effusus*, has not been otherwise encountered on cotton goods.

THE FOCAL DEPTH AND ORIGIN OF EARTHQUAKES.—As the late Prof. Omori showed, the distance of the origin of an earthquake from a neighbouring station is given by the duration of the preliminary tremor recorded there. If the distance of the epicentre is also known, it is a simple matter to calculate the depth of the focus. Mr. K. Suyehiro, of the Earthquake Research Institute, Tokyo, has recently determined the focal depths of 17 earthquakes, all of them with epicentres less than 100 km. from Tokyo (*Proc. Imp. Acad.*, Tokyo, vol. 4, pp. 41-44; 1928). He finds that the earthquakes fall into two classes, the focal depth ranging in one from 25 km. to about 50 km., and in the other from 55 km. to 95 km. These earthquakes were also recorded by a new form of seismographic analyser recently erected in the laboratory of the Institute. The instrument is strongly damped and its period is adjusted to agree with the usual period of vibration (0·3 sec.) of the ground below. As the instrument after disturbance rapidly comes to rest, it is easy to detect the number of separate shocks in an earthquake. In the first class, each earthquake shows several groups of waves, in one case as many as eleven, while those of deeper origin had only one or two groups. This seems to suggest that, in the upper and more brittle layer, the initial movements start in succession or in different places; while in the lower stratum, a single movement as a rule takes place throughout the focus.

POSITIVE ION KINETICS.—The curious fact that some positive ions suffer very few effective collisions in passing through a gas has been confirmed by G. P. Harnwell in an investigation described in the April number of the *Physical Review*. The experimental tubes used were very similar to cylindrical thermionic valves, but the ordinary filaments were replaced by small troughs containing material which emitted the ions of potassium or of cæsium when it was heated. For speeds corresponding to accelerating potentials of fifteen hundred volts or less, the singly charged atoms of these two elements produced no detectable ionisation of the five gases that were studied. The free paths for transfer of kinetic energy proved to be many times what would be expected from the kinetic theory of gases, when the impinging particles were treated as elastic spheres, and although a closer agreement between theory and experiment could be obtained by an appropriate assumption about the force of attraction between ions and molecules, the similarity of the phenomena to those found with protons of comparable velocities, where the fields are presumably less complex, seems to indicate that there is some fundamental explanation that is valid in both instances. The analogous Ramsauer effect for slow electrons has been already accounted for by the wave mechanics.

THE MEASUREMENT OF CAPACITANCE.—Maxwell's method is the one that has been most commonly used for the absolute measurement of capacitance (capacity). It was first used by J. J. Thomson in 1883, who proved the accurate formula for computing the capacitance. In a valuable paper by H. L. Curtis and C. Moon, of the U.S. Bureau of Standards (No. 564), a very thorough investigation is made of the accuracy of the method, and an appreciative account is given of the work of preceding investigators. In order to determine experimentally the accuracy that can be obtained, two independent Maxwell bridges were set up and used to measure the same capacitance. The bridges were entirely distinct, using different resistances, galvanometers, and batteries. A rotating commutator was used on one bridge and a vibrating commutator on the other. With the former the balance was made by adjusting the speed and determining the frequency of the charge and discharge by means of a chronograph. With the latter the adjustment was made by a resistance and by determining the rate of vibration of the commutator by comparison with a pendulum. The experiments extended over several months, various anomalous results having to be investigated. The final value of the capacitance as found by the first bridge method was 0·249236, and by the second 0·249242. This shows a difference between the results of 2·5 parts in 100,000. The authors conclude that even with excellently designed and carefully adjusted apparatus, there may be an error of 3 parts in 100,000 when measuring a capacitance of 100,000 by Maxwell's method. They recall that Glazebrook showed in 1890 that the method was not suitable for measuring any condenser which had absorption, that Orlich was the first to point out the importance of earthing the bridge, and that Russell showed that ballistic galvanometers when used with a mutual inductance do not always integrate correctly.

THE VOLUMETRIC ESTIMATION OF SULPHURIC ACID.—In the *Chemiker-Zeitung* of April 21, Dr. O. Nydegger directs attention to the fact that the benzidine method of estimating sulphuric acid deserves far more attention than is usually paid to it; he claims that if properly carried out the errors due to the appreciable solubility of benzidine sulphate in water and to its tendency to adsorb benzidine hydrochloride, can be reduced to a maximum of 0·5 per

cent. Investigation has shown that the presence of small quantities of iron, nitric acid, and other substances in the solution have no effect upon the results, so that the method is particularly suitable for the rapid estimation of sulphur in iron pyrites.

THE BUDDE EFFECT WITH BROMINE VAPOUR AND AIR.—In 1871, Budde observed that chlorine expands on exposure to light, but later workers have claimed that this effect does not take place with dry chlorine. An investigation of the Budde effect with mixtures of pure bromine vapour and air is described by E. Brown and D. L. Chapman in the *Journal of the Chemical Society* for March. Their results indicate that mere removal of water from such mixtures has no detectable influence upon the increase of volume which occurs on exposure to light. This conclusion is not in agreement with recent work of Ludlam, and also Lewis and Rideal, who state that no Budde effect can be observed with bromine vapour which has been thoroughly dried.

SPECTRUM OF THE GLOW OF PHOSPHORUS.—The spectrum produced by passing a discharge through phosphorus pentoxide vapour was recently investigated by H. J. Emeléus and R. H. Purcell (*Jour. Chem. Soc.*, 788; 1927), who found that it partially corresponded with the ultra-violet band spectrum of the glow of phosphorus. R. C. Johnson has pointed out that these measurements also correspond below 3000 A. with the band spectrum of the singly ionised oxygen molecule, and it therefore appears possible that the ultra-violet emission from glowing phosphorus is due to oxygen. In view of the fact that ozone is produced at the same time, this suggestion is of considerable interest, and the available evidence is discussed by Emeléus and Purcell in the *Journal of the Chemical Society* for March. They conclude that, owing to lack of sufficient knowledge of the spectra concerned, the origin of the spectrum of glowing phosphorus must still be regarded as unsettled.

AN ATTEMPT TO PREPARE TRIATOMIC HYDROGEN.—According to a number of investigators, hydrogen can exist in an active form which is said to be capable of reducing certain elements, such as sulphur and nitrogen, to their hydrides, and, unlike monatomic hydrogen, is not completely destroyed by passage through glass wool. Wendt and Landauer claim that its formation in a closed system is accompanied by a decrease in pressure, and this observation has led to the assumption that this active form is triatomic hydrogen. In the *Journal of the American Chemical Society* for March, H. M. Smallwood and H. C. Urey describe a series of experiments to produce this substance. The methods employed include the combustion of oxygen in hydrogen, the passage of hydrogen over heated metals, and the effect of corona and vacuum discharges on hydrogen. The latter method was investigated in great detail, but it was found to be impossible to obtain a product which would definitely reduce sulphur to an appreciable extent. The experiments all gave negative results, and it is suggested that previous workers have failed to carry out adequate blank tests. Smallwood and Urey conclude that the existence of triatomic hydrogen has not yet been established, and that if it does exist its preparation is very difficult.

GASES IN BRASS INGOTS.—The work described in a paper, read at the spring meeting of the Institute of Metals by G. L. Bailey, on "The Influence of Gases on the Soundness of Brass Ingots," consisted in the production of ingots of brass and bronze which were treated, prior to pouring, with nitrogen, hydrogen, and sulphur dioxide and were then allowed to solidify over a fairly wide range of time. It was shown that a bronze containing 5 per cent of tin was very nearly sound after treatment with nitrogen, except in the case of the ingot poured in the warm, dry, sand mould. With more rapid chilling the rate of solidification played no very important part. Ingots of the bronze through which hydrogen had been bubbled were slightly less sound than those which were treated with the nitrogen, except in the case of the most slowly cooled ingot, which contained again about 10 per cent of cavities. Brass containing 30 per cent of zinc proved to be practically completely sound after both the nitrogen and hydrogen treatment, except, again, in the case of the slowest cooling in dry sand. Sulphur dioxide rendered the casts only very slightly more porous. It is concluded that whatever be the conditions of casting, 70:30 brass is not liable to unsoundness due to gases. The spherical cavities, of varying size and unequal distribution, frequently found in brass ingots, are attributed not to the evolution of dissolved gas, but to the mechanical entrapping of gases within the mould during pouring. This view is supported by the fact that the use of low casting temperatures is followed by an increase in the number of spherical cavities, and that with very low casting temperatures large cavities of entrapped air can be produced. The results suggest that molten brass has very little solubility for gases. Even, however, if such gases are occluded, it appears that they will remain in solution after solidification. Very slow rates of solidification, however, cause the casting to be unsound, but probably for other reasons connected with the dressing of the mould.

THE ACTION OF FUSES.—It is well known to electricians that if the current through a carbon arc is increased, the length of the arc being kept constant, then, at a certain value of the current, the arc suddenly begins to hiss and there is a sharp drop in the voltage and a sudden rise in the current. If a graph of the voltage and the current is drawn, there is a discontinuity in the curve. For values of the current between definite limits it is impossible to maintain an arc of a given length. In a paper by P. D. Morgan, read to the Institution of Electrical Engineers on Mar. 22, on the rating of fuses, a somewhat analogous phenomenon was described in connexion with the melting of fusible wires. For example, in one of the experiments tinned copper wires No. 19 S.W.G. of given length were fixed in succession between two terminals, and the times taken for them to melt with given currents were observed. It was noticed that when the current was greater than 70 amperes, the wire always melted in less than 30 seconds; but when the current was not greater than 69·3 amperes, the wire always took at least five minutes to 'blow.' For currents lying between these somewhat narrow values there appear to be two times of operation, the short time being less than 30 seconds and the long time never being less than four minutes. For smaller values of the current the curve connecting the 'blowing' current and the time of operation is a perfectly definite 'smooth' curve. Similar discontinuities were noticed over the whole range of wires tested. The phenomenon is due apparently to the oxidation of the wires. Above a certain temperature, oxides form quickly on the surface. These have a better emissivity than the bright wire, and the improvement is so appreciable that the temperature of the wire actually falls. This fall in temperature is accompanied by a change in brightness which is clearly visible to the eye. There is a decreased resistance, and since the current is maintained constant, a consequent fall of potential across the ends of the wire. Suggestions are made for improving the methods in use for rating fuses.

Problems in the Physiology of the Cerebral Hemispheres.[1]

THE function of the nervous system is to maintain dynamic equilibrium within the organism and between the organism and its environment. In the latter case the equilibrium is, in the higher animals, extremely complex and is achieved mainly by means of the hemispheres. These continuously analyse and synthesise events occurring in the environment, and in correspondence with its changes establish temporary connexions between events, whether simple or complex, and various activities of the organism, in particular those of the skeleto-muscular system, which is preponderantly concerned in reacting to environmental changes and is likewise itself highly differential and integrative in its response.

At present the physiology of the hemispheres exists only in outline—as a framework consisting of a limited number of known factors, such as excitation and inhibition, their two-directional movement in the form of irradiation and concentration, and their mutual induction. The working out of the innumerable details of their intimate mechanism is a colossal problem of the future. A few of the latest investigations carried out by the author and his co-workers (*i.e.* subsequent to the publication of the author's book, "Conditioned Reflexes") are here summarised.

(1) The development of new temporary connexions between external agencies and definite reactions of the organism (development of conditional reflexes) depends on the coincidence in time of the action of these agencies upon the receptor mechanisms of the organism, with the various activities of the organism evoked either by external stimuli effective since birth, or by external stimuli which have become established as such after birth, or finally by changes in the internal condition of the organism (automatic stimuli). The formation of the connexion is then a physiological law.

In order to become a firmly established, powerful, conditioned stimulus the external stimulus *must* begin to act slightly before the particular activity of the organism, and *may* even cease a few seconds before the beginning of the activity. If, on the other hand, the given activity constantly begins before the stimulus, either no connexion is established, or if any is established it is weak, and survives only for a short time, and the specialised excitatory effect of the stimulus is invariably replaced by general inhibition. The biological significance of this fact is not yet clear. Where the stimulus begins to act before the given activity of the organism and continues during that activity, the reflex tends to increase in strength and stability. The mechanism underlying these phenomena cannot yet be expressed in terms of the general properties of the cortical tissue.

(2) The analysing activity of the nervous system is founded in the first instance on the peripheral receptor organs, which constitute not only a receptive mechanism but also an analysing apparatus of the organism. To the peripheral points of the analyser separate points correspond in the cortex (the primary and simplest cortical mosaic). A good proof of this is that by applying definite external stimuli belonging to the same analyser, for example, different auditory stimuli, it is possible to produce various disturbances or fatigue at different strictly localised cortical points. In this manner a very delicate method is opened up for investigating the construction of the cortical parts of the analysers, and it is possible to distinguish special areas in the cortex corresponding to the different analysers (visual, auditory, etc.) from certain other cortical elements of those analysers, which are dispersed probably over the whole mass of the cortex of the hemispheres. Not only are these dispersed elements incapable of performing any higher synthesis and analysis, but they have a very low degree of vitality, as evidenced by the rapidity of their transition into an inhibitory state under the influence of external stimuli.

(3) The conditions determining the characteristics and the magnitude of the excitatory and the inhibitory effects of conditional stimuli are bewilderingly complex and are only gradually being classified.

It is obvious that the magnitude of the positive effect is directly related to the amount of energy applied to the receptor organ. The phenomenon of summation of weak stimuli comes out clearly. The limit of normal excitability and the optimum strength of stimulation are also definite. In the case of very strong stimuli and of the summation of medium stimuli, the excitatory process rapidly changes into an inhibitory one. Of course the strength of stimulus is a relative quantity, varying greatly with individual differences of nervous system.

Since most probably the points between which the new connexions are established are in the cortex, it follows that the variations in the effect of conditioned stimuli will be dependent on the mutual relation between the different cortical points corresponding to the different conditioned stimuli, and also between the different points of those areas of the hemispheres which are affected by the unconditioned stimulus. For example, the conditioned stimuli based on food and acid respectively, both become connected with the chemical analyser of the hemispheres, and therefore, if in the experiments both sets of conditioned stimuli are used, their effect will be determined not only by the interrelation of the points corresponding to the stimuli, but also by the relation existing between the alimentary and 'acid' points of the chemical analyser.

(4) The accumulation of observations upon the normal and pathological activities of the hemispheres gives grounds for distinguishing various types of nervous system. There is the excitable type, which always displays partial or complete failure when confronted by difficult relations between the excitatory and inhibitory processes, and if the experiments are continued, ends by developing an abnormal and extremely protracted weakening of the inhibitory activity, attended by an exaggerated general excitation. At the other extreme stands the inhibitable type, which very easily becomes subjected to inhibition by stimuli either unusual or slightly stronger than usual, and, when confronted by comparatively difficult relations between the excitatory and inhibitory processes, passes into a state of complete inhibition for prolonged periods of time.

In between can be placed the well-balanced type which, successfully and without any signs of abnormality, establishes in all cases a balance between the opposed nervous processes. This type comprises two varieties of animal, differing greatly from one another in external appearance—the stolid animal, always quiet, and the animal which is lively under ordinary conditions, but becomes drowsy with surprising rapidity under monotonous conditions. The latter variety has some difficulty in obtaining a balance between the two processes. This grouping of the types of nervous system corresponds closely to the ancient classification of temperaments; the excitable type—choleric temperament; the inhibitable type—melancholic; the quiet, balanced type—phlegmatic; the lively balanced type—sanguine.

[1] Abstract of the Croonian Lecture delivered before the Royal Society on May 10, by Prof. I. P. Pavlov, For. Mem. R.S.

The University of Liverpool.

THE University of Liverpool has just been celebrating its twenty-fifth anniversary, and in the city were gathered representatives from all branches of civic life and from many universities to take part in the rejoicings and to bring messages of goodwill and encouragement. A service of thanksgiving and of dedication was held in Liverpool Cathedral on the afternoon of Thursday, May 10, and was conducted by Dr. David, Bishop of Liverpool. In the evening the University Association entertained the delegates from the universities, the representatives of civic authorities, and those who on the following day were to receive honorary degrees. In a publication issued for the occasion, a brief record was given of the work and progress of the University of Liverpool from its foundation in 1907.

On the afternoon of May 11, Lord Derby, Chancellor of the University, presided over a large gathering in St. George's Hall, and conferred honorary degrees on twelve people of eminence in academic and civic life. Representatives of every department of the university and civic life of Lancashire and Cheshire attended, accompanied by delegates from the American University Union, the University Colleges of Exeter, Southampton, and Nottingham, King's College, London, and the Universities of Reading, Bristol, Queen's University, Belfast, Leeds, Birmingham, Wales, Manchester, London, Durham, Trinity College, Dublin, Edinburgh, Aberdeen, Glasgow, St. Andrews, Cambridge, and Oxford. Having welcomed the visiting representatives, Lord Derby paid high tributes to the late Sir Alfred Dale and Dr. Adami, former vice-chancellors of the University, and to the many benefactors whose munificence has made the University a growing reality. The Vice-Chancellor (Dr. Hetherington), speaking of the faith of those who laid the foundations of the University, welcomed the presence of some who saw and some few who shared in that endeavour, expressed the indebtedness of the University to these teachers who have won for it recognition in the world of scholarship and letters, and to those who have served it in the care of its affairs. Above all others, he recalled in faithful remembrance those who gave themselves in battle that the foundations of the University might not be moved.

Prof. Campagnac, as Public Orator of the University, presented the following recipients of honorary degrees to the Chancellor, and in each case delivered a brief eulogy of their work :—

Doctor of Letters.—The Earl of Crawford and Balcarres (Chancellor of the University of Manchester), Emeritus Prof. Oliver Elton (University of Liverpool), Prof. T. Percy Nunn (Principal of London Day Training College, and professor of education in the University of London).

Doctor of Science.—Prof. John E. Littlewood (professor of mathematics in the University of Cambridge), Prof. Robert Robinson (professor of organic chemistry, University College, London).

Doctor of Laws.—Vice-Chancellor William MacBride Childs (The University of Reading), The Right Hon. H. A. L. Fisher (Warden of New College, Oxford, and formerly Minister of Education), Prof. John W. Gregory (professor of geology in the University of Glasgow), Miss Emma G. Holt (founder of the Liverpool University Hall), Sir Edwin L. Lutyens (in recognition of his services to British architecture), Sir Archibald Salvidge (leader of the City Council of Liverpool).

Doctor of Engineering.—Emeritus Prof. John A. Fleming (for forty-two years professor of electrical engineering in University College, London).

Speaking of them individually, Prof. Campagnac said that the Earl of Crawford had directed his disciplined taste and lent his strong advocacy to preserving what Nature and human effort had produced of fair and lovely in our land. For twenty-five years Prof. Elton, as head of the Department of English Literature, had been to many generations of students, guide, philosopher, and friend, the pattern of exact scholarship, the model of just criticism, and the unbending champion of University liberty. By nature and vocation a teacher of teachers, Prof. Nunn had astounded all by the variety of his learning, in letters, philosophy, mathematics, and music, and by his supreme perfection in administration. The researches in which Prof. Littlewood delights fill the uninitiated with wonder and dread, and provoke, in his peers, reverence and admiration. The learned revel in Prof. Robinson's synthesis of flower pigments and have admired the fertility of his genius. Of the Vice-Chancellor of the University of Reading, he said that in the development of that institution he had acted with courage and wisdom, and had satisfied modern needs by freely interpreting a venerable tradition. As scholar, teacher, historian, and philosopher, the Right Honourable H. A. L. Fisher had shone, but above all he had been the champion of youth, resolute to ensure their inheritance in liberty and discipline. In presenting Miss Emma G. Holt, Prof. Campagnac said that the establishment of colleges in which piety and learning might be sought in cloistered leisure was of old the beneficent labour of royal and generous ladies. Miss Holt had taken up and embellished this tradition by providing in Liverpool a hall which, in beauty and fitness for its purpose, challenges the glory of these houses. As a traveller, Prof. J. W. Gregory had fared far east and west, north and south, over the world and in the realms of thought. His scientific instinct had had the nature of prophecy, and his anticipations boldly made in many fields of inquiry had been fulfilled in as many regions of knowledge ascertained by his labours. In East Africa and Australia, in Chinese Tibet and along the Himalayan system, he had conducted explorations, the results of which are of great social and political importance. He has illuminated some of the most difficult social and racial problems. To the success of Sir Edwin Lutyens in planning a new capital city in India was added the fact that to him Britons had turned when at the heart of their Empire a memorial of the men who had fought and died for home was needed. In presenting Sir Archibald Salvidge, Prof. Campagnac spoke of the encouragement and generous support which the University had received from the City of Liverpool, and of the University's pride in a man for whose heart its prosperity is a passion, and by whose courage, enterprise, and unremitting labour the city has been promoted and advanced. As in great measure responsible for the introduction to this country of the telephone, the incandescent electric lamp, and radio telegraphy and telephony, and as the inventor of such cunning instruments as the thermionic valve, the University sought to honour Emeritus Prof. J. A. Fleming.

In the evening the University, the civic representatives, the honorary graduates, and the University delegates were the guests of the Lord Mayor of Liverpool (Miss Margaret Beavan) at a reception at the Town Hall.

The celebrations ended on the afternoon of Saturday, May 12, with a garden party at the University Sports Grounds at Allerton, at which the Christie Sports were also held.

University and Educational Intelligence.

CAMBRIDGE.—The honorary degree of LL.D. is to be conferred upon the Right Honourable Sir John Simon, P.C., M.P.

W. H. McCrea, Trinity College, has been elected to the Sheepshanks exhibition in astronomy.

The General Board of Studies has issued a report giving details of the scheme for carrying out the statute passed by the recent Statutory Commission, which gives University teaching officers a right to be excused from teaching duties during one term in seven. There are financial difficulties in granting this leave generally with full stipend, but the Board hopes that it will be possible to grant two terms' leave of absence with stipend once in every period of seven years. A significant development in University teaching is indicated in the transfer of Mr. W. S. Farren's lectureship from the Department of Engineering to that of Aeronautics.

A syndicate, consisting of the Vice-Chancellor, Sir Henry Miers, Sir William Pope, Sir Ernest Rutherford, Sir William Bragg, Dr. Thomas, Dr. Spencer, Dr. Rastall, Mr. Thirkill, Dr. Harker, Mr. Nicholas, and Dr. Rideal, has been appointed to consider the position of mineralogy in the studies of the University. A second syndicate has been appointed to consider plans for the new University Library.

Mr. L. E. S. Eastham, lecturer in advanced and economic entomology, has been appointed to represent the University at the International Congress of Entomology to be held at Ithaca, New York, next August.

Messrs. J. S. Fry and Sons, Ltd., Bristol, offer a post-graduate studentship of £300 a year for two years, tenable at Peterhouse, for research in moral science, law, history, modern languages, economics, and English. The studentship is open to members of any university in Great Britain or Ireland.

MANCHESTER.—The Edmund Mills Harwood Memorial Scholarship, value £50 per annum for three years, is being offered by the Municipal College of Technology. It will be tenable in one of the university engineering courses in the College. Information concerning the scholarship and forms of application are obtainable from the Registrar of the College until June 15.

OXFORD.—On May 8, two rival schemes for the extension of the Bodleian Library came before Congregation. The first scheme, which contemplated the building of a large new library at a distance of not more than three-quarters of a mile from the present Bodleian Library, was advocated by Sir Michael Sadler, Master of University College, and Mr. E. L. Woodward. The second plan, which proposed an addition to the Library by building on the site owned by the University on the north side of Broad Street, was supported by Prof. H. W. C. Davis and Dr. A. E. Cowley, Bodley's Librarian. After a speech by Mr. Falconer Madan, a former Bodley's Librarian, who opposed both projects, the two schemes were rejected, the former by a large majority. There is little doubt that a paper put out by the late Warden of Wadham and the Provost of Worcester, urging that Congregation should declare its mind on the general policy of the future of the Bodleian before descending to points of detail, contributed largely to this result.

On June 16, Convocation will proceed to the election of a Chancellor of the University in succession to the late Viscount Cave. It is understood that there will be no official opposition to the nomination of Lord Grey of Fallodon to the vacant office, but nominations will be received at the University Registry up to June 7.

A LIMITED number of grants-in-aid are being offered by the Salters' Institute of Applied Chemistry to young men and women employed in chemical works in or near London who desire to extend their education for a career in chemical industry. The latest date for the receipt of applications by the Director of the Institute, Salters' Hall, St. Swithin's Lane, E.C.4, is June 9.

THE Board of Education is again prepared to receive applications for full-time studentships from teachers desiring financial assistance in order to attend approved full-time courses of advanced instruction or research at universities or other institutions at home or abroad. The amount of grant cannot exceed £100 for an academic year. The Board is prepared to consider proposals for carrying out research involving travel or the practical study of industrial conditions connected with the teaching of technical subjects. Teachers must have had not less than five years teaching experience and may be serving in any type of a school or institution recognised by the Board. Applications for the year 1928–29 should be made as soon as possible, and in any event not later than June 30. Further information and application forms can be obtained from the Board of Education, Whitehall, London, S.W.1.

THE report of the Principal of the University of London (Dr. Franklin Sibly), read on Presentation Day (May 9), records 9119 admissions to the University in 1927–28, compared with 3852 in the last year before the War. Of these, 6545 entered through the ordinary matriculation examination and 426 as graduates of other universities. In 1927 there were 3325 candidates for first degrees and 529 for higher degrees, these figures showing slight decreases compared with the previous year. Of the candidates for degrees, 2283 were internal and 1571 were external, contrasting with 900 and 907 respectively for the last year before the War. The roll of internal students now comprises 9556 names. The outstanding event of the past year was the completion of the purchase of the Bloomsbury site for the new University buildings. New scientific developments include the institution of a chair of dietetics, at present a part-time appointment; and a chair of highway engineering. The Vice-Chancellor (Sir William Beveridge), in an eloquent address on the same occasion, referred to the reconstitution of the University now in progress, which, he expected, would be completed in a year's time. "On the old examining university," he said, "had been successfully grafted a new teaching and researching university." The new constitution will give to the Colleges of the University for the first time an organic place in its structure and government. Development of the Bloomsbury site awaits only the passing of the Bill now before Parliament for closing the streets and making the site "a self-contained plot," and he promised that the new buildings would be worthy of the greatest city in the world—the University dared not build anything "mean or cramped or ugly." That enclosure of great courts and green spaces and great libraries and halls of learning in a market-place of nations would be a thing of beauty to which the thoughts of all its children of all races from all lands would turn continually, a visible sign to all men of the academic faith—of the learning that knew no frontiers, of the contemplation that alone gave eyes to action, of the calm that should be the centre of man's being.

Calendar of Customs and Festivals.

May 20.

THE DIVINE SACRIFICE IN MEXICO.—On the first day of the fifth Aztec month, a date of which the exact incidence is uncertain, though it has been fixed conjecturally at various times between Easter and May 20 by different authorities, the festival of Toxcatl, the most important of the Mexican year, took place. The great god Tezcatlipoca was sacrificed in the person of his human representative, a man who had been feasted and worshipped during the whole of the preceding year, and was now succeeded by another who enjoyed divinity for a like period and was then sacrificed in his turn. Twenty days before the god was to die, his costume was changed and four brides were given him. On the last day he embarked with his retinue in a canoe, was ferried across the lake and slain by a priest on a stone altar on the summit of the pyramidal temple. His heart was cut out and offered to the sun. This was said to be a sacrifice for rain, but the names of his brides, for example, "The Goddess of Flowers," "The Goddess of the Young Maize," suggest a general renewal of fertility.

This was one only of a number of occasions on which a man was sacrificed, after living as a god. A human representative of Huitzilopochtli was sacrificed in May after leading dances in which the maidens were decked with maize ears. At Cholula, in February, the merchants sacrificed a slave who was the god Quetzalcoatl, after a ceremonial lasting forty days. The victims of human sacrifice were not men only. Women were also made to personate a female deity and were then sacrificed; for example, the Goddess of Salt, Huixtocihuatl, the sister of the Rain Gods, was personated for ten days by a woman who wore her clothes and led the dancers, until on the last night she danced to the point of exhaustion and was sacrificed in the morning in the same manner as the men by having her heart cut out.

May 21.

ST. BARIND (sixth century), patron of Kilbarron, Co. Donegal, is said to have been the first European to discover America. He gave St. Brendan an account of his adventures on the Western Ocean before the latter set out on his seven years' voyage in search of the Land of Promise. References to a legendary country lying to the west of Ireland are frequent in early Irish tradition.

The story of the voyage of Brendan, extremely popular in the Middle Ages, includes many marvels—visits to an Island of Birds, an Island of Sheep, and an Island of Fruits, an encounter with a sea monster so huge as to be mistaken for an island, fire-drakes, and the like. The parallels to be found in the voyages of Sindbad and other early travellers are obvious. It has therefore been suggested that incidents of an oriental origin have been grafted on to an Irish version of the Land of the Blessed. The description of the Island of Fruits suggests that the West Indies may have been reached, and the story of the island of which the inhabitants cast molten iron at the voyagers might well be an account of a violent volcanic eruption in that area.

May 26.

ST. AUGUSTINE (A.D. 605).—After the conversion of the Saxons to Christianity by St. Augustine, bitter racial quarrels broke out between Saxon and Briton, of which the occasion was the divergence between the ancient British and the Roman churches in the date of celebrating Easter. One incident is said to have given rise to the medieval legend current on the Continent that Englishmen had tails. Fisher folk of Dorset attacked St. Augustine and his followers and drove them from their territory, fastening fish-tails to their robes. Another version attributed tails to the men of Kent only, because they had cut off the tail of Becket's horse.

ST. BECAN (sixth century).—A native of Munster of great sanctity, who was the object of a cult in the parish of Killardry, Co. Tipperary, where, near the church of Kilpeacon, is Peacawn's Well. It is surrounded by a ring of stones, and nearby are a few stones known as 'the Altar,' with an associated legend. This well was much visited by pilgrims until 1830.

MAY MARRIAGES.—The popular belief that May marriages are unlucky is widespread, being found in most European countries. It was also the view of the Romans, who extended the period of ill-luck to the first half of June. The aversion is sometimes explained as due to the connexion of the month with the Virgin Mary; but this must be regarded as an attempt to justify the retention of a pagan observance. Other periods have also been regarded as unlucky or as forbidden; for example, Lent, and the period between the Rogation Days and the first Sunday in Trinity; August in Sicily and France, and July in Sardinia; between Passover and Pentecost among Jews. Marriage in the month of Moharram in Morocco and Egypt might entail death or madness.

Certain days were also to be avoided. Marriage on the Sabbath was forbidden among the Jews, on Friday in the Mohammedan world; while in popular belief certain days of the week were to be avoided; among others, Thursday in England because of its connexion with Thor, Tuesday and Friday in Italy because curses are peculiarly efficacious on those days. Yet among Teutonic peoples Tuesdays and Thursdays were favourite days for weddings, because they were connected with the deities Ziu and Donar. The Romans did not marry on Kalends, Ides, and Nones, or on the *Dies Parentales* (Feb. 13-21).

Friday is almost universally regarded as unlucky in Christian countries. The avoidance in the north of Scotland of a waning moon, which will lead to a barren marriage, or a falling tide, is due to an obvious association of ideas; while the Irish disinclination to marry in harvest, as the time of binding, points to the widespread popular belief in the efficacy of the knot in the magical prevention of consummation.

Among people of lower culture, marriage is regarded as a time of peculiar danger, and it is a widespread practice to secure by means of consultation of omens that it shall take place at an auspicious time. On the other hand, the occasions on which marriage is regularly avoided are those which are regarded as especially critical, that is, when the powers of evil are peculiarly potent. The Moslem's belief that an evil spirit may enter into the body of the woman at consummation serves to indicate how such an idea becomes operative. Witches, too, may interfere by the knotting of a string, causing impotence, or otherwise. For this reason marriage is avoided in Macedonia between Christmas and Epiphany. The month of May, although the month of fertility and growth, is also the month of the witch. It is the time when the powers of evil are peculiarly active, and the fire festivals of Beltane are called into operation to neutralise and drive them away. At such critical seasons primitive wisdom counselled continence.

Societies and Academies.

LONDON.

Physical Society, April 27.—**Will C. Baker**: Experiments with mercury jets and the phenomena exhibited at their impact with steel and glass. As a light sphere is retained in a vertical jet of fluid in virtue of the change of momentum of the fluid produced by its adhesion to the sphere, it was thought that a steel sphere would not be retained in a vertical mercury jet, as there is no 'wetting' of the steel by that fluid. Experiment showed that a given bicycle ball might or might not be retained by such a jet, as the speed of the jet (at a given angle of incidence) rose above or fell below a critical value for that ball. Conditions were simplified by the use of cylindrical and of plane surfaces of steel, and an approximately constant time of adhesion between mercury and steel was found for various speeds of impact. This led to the explanation of the phenomenon in terms of the well-known instability of jets.—**E. P. Perman** and **W. D. Urry**: The elastic constants of glass. The coefficients of compressibility of soda-glass and Jena 16^{III} glass have been determined at six temperatures ranging from 30° C. to 80° C. From experiments on the effect of external pressure only, Poisson's ratio has been determined, and hence the modulus of rigidity and Young's modulus.—**G. Eric Bell**: A valve-maintained high-frequency induction furnace and some notes on the performance of induction furnaces. In Part 1 the electrical design is given of a valve-operated high-frequency induction furnace; in Part 2 a theory of the behaviour of induction furnaces in general is developed.

Society of Public Analysts, May 2.—**A. L. Williams**: Locust kernel gum and oil. Locust kernel gum has recently been used as a thickening agent for sauces. Its reactions with tannin, borax, and Fehling's solution are the most characteristic. So little as 1 per cent. of the gum may be separated from sauce or jam by treatment with tannin. The constants of the kernel oil have been determined (iodine value, 98·4). The oil gave a negative result in the antimony trichloride test for vitamin A.—**W. R. Schoeller** and **E. F. Waterhouse**: Investigations into the analytical chemistry of tantalum, niobium, and their mineral associates. (12) Observations on the pyrosulphate hydrolysis method. The pyrosulphate hydrolysis method does not effect a quantitative separation of the earth acids from zirconia. At best, a decrease in the quantity of zirconia co-precipitated is achieved, at the cost of slightly incomplete earth acid precipitation.—**F. W. Toms** and **C. P. Money**: The separation of lead tetra-ethyl from solution in petroleum spirit. The method depends on the separation of lead ethyl sulphinate on passing sulphur dioxide into 'ethyl petrol,' and conversion of the deposit into lead sulphate.—**B. S. Evans** and **S. G. Clarke**: New precipitation method of determining vanadium and its application to steel analysis. The method is based on the precipitation of vanadium as ferrocyanide and eventual determination of the vanadium present by titration with potassium permanganate. Vanadium ferrocyanide is insoluble in mineral acids of quite high concentration. In applying the process to steel analysis, the iron is quantitatively converted into ferrocyanide by reducing it from the ferric condition in alkaline citrate solution in the presence of cyanide, and the resulting ferrocyanide then acts as the reagent for the vanadium.—**P. Houseman**: The examination of liquorice mass. Stick liquorice adulterated with starch is now extensively sold in England, and a test to detect this adulteration has been devised. Occasionally the added starch is boiled so as to destroy the individuality of the granules, but usually it is possible to discover a few granules that have escaped disintegration.

PARIS.

Academy of Sciences, April 11.—**A. Lacroix**: The composition of the basaltic lavas of Indo-China.—**Charles Nicolle** and **Charles Anderson**: The presence in Morocco of the spirochæte of recurrent Spanish fever. The Spanish and Moroccan varieties of spirochæte must be considered as belonging to the same species: the Moroccan strain is perhaps somewhat more virulent to the guinea-pig than the Spanish.—**R. Coenen**: The mean geodesic curvature.—**G. Vranceanu**: Some tensors in the non-holonome varieties.—**Edward Stenz**: Observations of solar radiation and of atmospheric opacity made at Jokkmokk during the solar eclipse of May 29, 1927.—**Ch. Jacquet**: Experimental researches on the magnetisation of the volcanic rocks of the Department of Puy-de-Dôme.—The coefficients of magnetisation determined varied from 9·2 to less than 3 (magnetite, 92·7). Determinations of the variation of the magnetisation with the temperature showed that all the specimens examined the magnetisation of which was above 4 units, gave a Curie point of 550° C., near that of magnetite. The enclosures gave 580° C., exactly that of magnetite.—**H. Ollivier**: Research on the thermal variation of the magnetic rotatory power, in the case where the magnetisation coefficient is positive and independent of the temperature. For sodium bichromate, the paramagnetism of which is constant, the Verdet constant, referred to the unit of mass, does not vary between 7° and 61° C. by a quantity exceeding the error of experiment.—**A. Boutaric** and **F. Banès**: The immunity of the granule in colloidal solutions. The results of experiments described agree with the views of A. Lumière in that they prove a certain analogy between living cells and colloids in the sol condition, and between flocculated colloids and dead cells.—**Daniel Bodroux**: The condensation of cyclohexene with some aromatic hydrocarbons in the presence of aluminium chloride. Toluene and cyclohexene in presence of aluminium chloride give cyclohexyltoluene. The replacement of the toluene by other aromatic hydrocarbons gives analogous products.—**L. Palfray** and **B. Rothstein**: Some derivatives of quinite. A description of the preparation of acetate and benzoates of quinite.—**R. Morquer**: The systematic value of the genera *Dactylium* and *Diplocladium*, especially *Dactylium macrosporum*.—**A. Sartory**, **R. Sartory**, and **J. Meyer**: The influence of radium on the production of the zygospores in *Mucor spinosus* (*Zygorhynchus spinosus*). Zygospores were produced in cultures under the influence of the radium radiation: in the absence of radium, no zygospores were obtained by cultivation in the same culture medium.—**E. Brumpt**: The study of autofecondation in the aquatic mollusc *Bullinus contortus*.—**J. B. Abelous** and **H. Lassalle**: The humoral origin of the modifications of excitability of the nervous system in the course of the Wallerian degenerescence of a severed nerve.—**Emile F. Terroine** and **Mme. Hélène Sorg-Matter**: The influence of the magnitude of the consumption of thermogenesis on endogenous nitrogen metabolism.—**Georges Lakhovsky**: The action on living beings of oscillating circuits.—**Em. Perrot** and **P. Bourcet**: A new method of estimating crystallised digitalin.

LENINGRAD.

Academy of Sciences (*Comptes rendus*, 1928, A, No. 1).—**V. Ipatiev**, **N. Orlov**, and **B. Dolgov**: The

preparation of certain α-ω-diphenylparaffins. Diphenylpropane may be obtained by hydrogenating dibenzylketone under pressure in presence of nickel at 210° C., using Ipatiev's high-pressure apparatus. Diphenylbutane may be prepared by hydrogenating unsaturated diphenylparaffins (diphenylacetylene and diphenylbutadiene) under pressure at 210° C. Diphenylpentane can be prepared by hydrogenating dibenzylacetone obtained by distilling calcium salts of phenylacetic and phenylpropionic acids.—**P. P. Sacharov**: The hereditary transmission of the size and weight of flies resulting from inanition. The reduction in size and weight of larvæ, pupæ, and adult house flies resulting from inanition is not hereditary, since the progeny of the smallest flies was larger than that of the normal ones.—**P. Kobeko** and **I. Kurchatov**: The validity of Faraday's law for currents due to ionisation by collision. It has been shown that in an electrical field exceeding 2×10^6 volts/cm., new charges arise due to collision; it has not been ascertained, however, whether the newly formed charges are ions or electrons. The most direct way to solve the question was to test the application of Faraday's law in such conditions. The results of the experiments by the authors show that Faraday's law holds within the limits of errors, and that consequently the charges liberated by the mechanism of collision are ions and, especially in the case of glass, the most mobile, the sodium ions.—**P. Schmidt**: Three rare cat-fishes of the Magdalena River (South America, Columbia). *Doras crocodili* Humb. et Val. is redescribed fully, and *D. longispinis* Steindachner referred to it as a synonym; measurements of *Trachycorystes magdalenæ* Steind. and *Pimelodina flavipinnis* Steind. are given.—**P. Tartakovskij**: The scattering of electrons in a thin aluminium foil. Scattering of electrons by the surface of a crystal is accompanied by interference of phase waves. A diagram analogous to a röntgenogram is obtained containing several maxima the significance of which has not been discovered.

Official Publications Received.

BRITISH.

Memoirs of the Department of Agriculture in India. Entomological Series, Vol. 10, No. 3: A Contribution to our Knowledge of South Indian Braconidae. Part i: Vipioninae. By Dr. T. V. Ramakrishna Ayyar. Pp. 27-60f+plates 5-14. 14 annas; 1s. 3d. Entomological Series, Vol. 10, No. 5: The Use of Hydrocyanic Acid Gas for the Fumigation of American Cotton on Import into India; Experiments on its Lethal Power for the Mexican Boll-Weevil (*Anthonomus grandis*), and for the Grain-Weevil (*Sitophilus oryzae*); on the Extent to which it is absorbed by Cotton and Jute respectively; and on a Practical Method for Satisfactory Fumigation on a large Scale. By A. James Turner and D. L. Sen. Pp. vi+69-166. 2 rupees; 3s. 9d. (Calcutta: Government of India Central Publication Branch.)

Agricultural Research Institute, Pusa. Bulletin No. 173: Occurrence of Trichomonad Flagellates in the Blood Stream of Fowls. By Hugh Cooper and Amar Nath Gulati. Pp. 9+1 plate. (Calcutta: Government of India Central Publication Branch.) 3 annas; 4d.

Journal of the Indian Institute of Science. Vol. 11A, Part 1: i. Studies on Invertase, Part 1: Preparation and Purification of the Enzyme, by B. N. Sastri and Roland V. Norris; ii. Note on a Simple Method for Concentrating Enzyme Solutions, by B. N. Sastri. Pp. 15. Vol. 11A, Part 2: The Bleaching of Lac. By M. Venugopalan. Pp. 17-22. Vol. 11A, Part 3: Contributions to the Study of Spike-Disease of Sandal (*Santalum album*, Linn.); Part i. Diastatic Activity of the Leaves. By M. Sreenivasaya and B. N. Sastri. Pp. 23-29. Vol. 11A, Part 4: A Micro-method for the Determination of Enzyme Activity. By B. N. Sastri and M. Sreenivasaya. Pp. 31-39. (Bangalore.)

Air Ministry: Meteorological Office. International Meteorological Organization: Commission for the Exploration of the Upper Air. Report of the Meeting in Leipzig, August 29-September 3, 1927. (M.O. 300.) Published by the Authority of the Meteorological Committee. Pp. iv+107. (London: H.M. Stationery Office.) 3s. 6d. net.

Transactions of the Royal Society of Edinburgh. Vol. 55, Part 3, No. 28: Schist Geology; Braemar, Glen Clunie and Glen Shee. By E. B. Bailey. Pp. 737-754+1 plate. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.) 2s. 6d.

Bishop's Stortford College. Report of the Proceedings of the Natural History Society, 1927. Pp. 20. (Bishop's Stortford.)

A Report on the Public Museums of the British Isles (other than the National Museums). By Sir Henry Miers to the Carnegie United Kingdom Trustees. Pp. ii+213+8 plates (Dunfermline: Carnegie United Kingdom Trust.)

A Report on American Museum Work. By Dr. E. E. Lowe. Pp. 50+12 plates. (Dunfermline: Carnegie United Kingdom Trust.)

The Scottish Forestry Journal: being the Transactions of the Royal Scottish Arboricultural Society. Vol. 42, Part 1, March. Pp. 34+27. (Edinburgh.) 7s. 6d.

Journal of the Chemical Society: containing Papers communicated to the Society. April. Pp. iv+749-1060+viii. (London: Gurney and Jackson.)

Research Association of British Paint, Colour and Varnish Manufacturers. Review of Current Literature relating to the Paint, Colour and Varnish Industries. No. 1, Jan.-Feb. Pp. 31. (Teddington: Paint Research Station.)

Experimental Researches and Reports published by the Department of Glass Technology, The University, Sheffield. Vol. 10, 1927. Pp. iii+186. (Sheffield.)

Proceedings of the Cambridge Philosophical Society. Vol. 24, Part 2, April. Pp. 171-356. (Cambridge: At the University Press.) 7s. 6d. net.

Journal of the Marine Biological Association of the United Kingdom. New Series, Vol. 15, No. 2, April. Pp. 365-781. (Plymouth.) 12s. 6d. net.

Colony and Protectorate of Kenya. Agricultural Census: Eighth Annual Report, 1927. Pp. 44. (Nairobi: Department of Agriculture.)

Index to the Quarterly Journal of the Royal Meteorological Society. Vols. 27-51, 1901 to 1925. Pp. 71. (London: Edward Stanford, Ltd.) 2s. 6d.

Indian Journal of Physics, Vol. 2, Part 3, and Proceedings of the Indian Association for the Cultivation of Science, Vol. 11, Part 3. Conducted by Prof. C. V. Raman. Pp. 267-398+plates 6-12. (Calcutta.) 3 rupees; 4s.

General Guide to the Durban Museum. By E. C. Chubb. Third edition. Pp. 72. (Durban.) 6d.

The Mining Institute of Scotland. Jubilee, January 1928. Pp. 26. (Glasgow.)

Union of South Africa. Report of the South African Museum for the Year ended 31st December 1927. Pp. ii+13. (Cape Town.)

Board of Education. Syllabus of the Science Scholarships Examination, 1929. Pp. 23. (London: H.M. Stationery Office.) 3d. net.

Stonyhurst College Observatory. Results of Geophysical and Solar Observations, 1927; with Report and Notes of the Director, Rev. E. D. O'Connor. Pp. xxii+48. (Blackburn.)

County Council of the West Riding of Yorkshire: Education Committee. Summer Vacation Course for Teachers, Bingley Training College, August 1st to August 15th, 1928. Pp. 24. Summer Vacation Courses in Physical Training and Swimming to be held at the Grammar School, Ilkley, 30th July-11th August 1928. Pp. 8. (Wakefield.)

Annual Report of the Council of the Yorkshire Philosophical Society for the Year 1927, presented to the Annual Meeting, February 13th, 1928. Pp. 41+12. (York.)

Society of Chemical Industry: Chemical Engineering Group Proceedings, Vol. 8, 1926. Pp. viii+127. (London.) 10s. 6d.

The Quarterly Journal of the Geological Society. Vol. 84, Part 1, No. 333, April 30th. Pp. xlviii+178+12 plates. (London: Longmans, Green and Co., Ltd.) 7s. 6d.

FOREIGN.

Scientific Papers of the Institute of Physical and Chemical Research. No. 131: Experimental Studies on Form and Structure of Sparks, Part i. By Torahiko Terada and Ukitirô Nakaya. Pp. 19+5 plates. 35 sen. Nos. 132-134: Meñanismo de Sapiĝo de Celulozesteroj de Altaj Fatacidoj, de Iĉiro Sakurada; Sapiĝo de Celulozacetato per Alkalio, de Iĉiro Sakurada; Pri Sapiĝo de Celulozacetato dum la Hidratigado, de Iĉiro Sakurada. Pp. 21-61. 50 sen. No. 135: Experimental Studies on Form and Structure of Sparks, Part ii. By Torahiko Terada and Ukitirô Nakaya. Pp. 63-82+plates 6-8. 30 sen. No. 136: The Reversal of Helium Bands. By Toshio Takamine and Taro Suga. Pp. 83-91+plate 9. 20 sen. No. 137: The Effect of Hydrochloric Acid on the Oxidation of Stannous Chloride by Air. By Susumu Miyamoto. Pp. 93-102. 20 sen. No. 138: Experimental Studies on Form and Structure of Sparks, part iii. By Torahkio Terada and Ukitirô Nakaya. Pp. 103-129+plates. 10-14. 40 sen. (Tokyo.)

Nebraska Geological Survey. Bulletin 2, Second Series: The Fusilinidae of the Pennsylvanian System in Nebraska. By Carl O. Dunbar and G. E. Condra. Pp. 130+15 plates. (Lincoln, Nebr.)

Journal of the College of Agriculture, Hokkaido Imperial University, Sapporo, Japan. Vol. 19, Part 3: Protease and Amylase of *Aspergillus oryzae*. By Kokichi Oshima. Pp. 135-244. Vol. 19, Part 4: Embryological Studies in *Oryza sativa* L. By Shinichi Terada. Pp. 245-260+plates 6-9. Vol. 20, Part 4: Chemismus der kombinierten Tannin-Chrom-Gerbung, von Prof. Dr. G. Grasser und Dr. Hirose; Kleinere Experimental-Untersuchungen aus dem Institute für Gerberei-Wissenschaft, von Prof. Dr. Georg Grasser. Pp. 203-232. (Tokyo: Maruzen Co., Ltd.)

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 32: Researches on Cellulose Acetate and its Solution. i. Composition of Cellulose Acetate Lacquer for Aeroplane Dope. By Katsumoto Atsuki and Ryo Shinoda. Pp. 49-69. 0.37 yen. No. 33: Researches on Cellulose Acetate and its Solutions. ii. Stability of Cellulose Acetate. By Katsumoto Atsuki. Pp. 71-89. 0.33 yen. No. 34: Researches on Cellulose Acetate and its Solution. iii. Stabilizer for Cellulose Acetate. By Yoshio Tanaka and Katsumoto Atsuki. Pp. 91-101. 0.23 yen. No. 35: Researches on Cellulose Acetate and its Solution. iv. On the Acetylation of Cellulose. By Katsumoto Atsuki and Ryo Shinoda. Pp. 103-113. 0.23 yen. No. 36: Researches on Cellulose Acetate and its Solution. v. Relation of Temperature and Time of Ripening to the Viscosity of Cellulose Acetate. By Katsumoto Atsuki and Ryo Shinoda. Pp. 115-125. 0.23 yen. (Tôkyô: Kôseikai Publishing House.)

Bulletin of the Earthquake Research Institute, Tokyo Imperial University. Vol. 4. Pp. 234+65 plates. (Tokyo.)

The Science Reports of the Tôhôku Imperial University, Sendai, Japan. Second Series (Geology), Vol. 11, No. 2: The Triassic Fauna of Rifu, near Sendai. By Hisakatsu Yabe and Saburô Shimizu. Pp. 101-136+plates 10-14. (Tôkyô and Sendai: Maruzen Co., Ltd.)

Bulletin of the American Museum of Natural History. Vol. 56, Art. 6: Geographical Report of the Crocker Land Expedition, 1913-1917. By Donald B. MacMillan. Pp. 379-435. (New York City.)

University of California Publications in American Archaeology and Ethnology. Vol. 23, No. 7: Notes on the Akwa'ala Indians of Lower California. By E. W. Gifford and R. H. Lowie. Pp. 339-352. (Berkeley, Calif.: University of California Press: London: Cambridge University Press.) 25 cents.

Mitteilungen der Naturforschenden Gesellschaft Bern aus dem Jahre 1927. Pp. xlvi+376. (Bern: Paul Haupt.)

Meddelande från Lunds Astronomiska Observatorium. Ser. 1, Nr. 114: On the Influence of the Accidental Errors in the Proper Motions on the Velocity Distribution. By L. Hufnagel. Pp. 31. (Lund.)

The Rockefeller Institute for Medical Research: Organization and Equipment. Pp. 25+2 plates. (New York City.)

Comité international des Poids et Mesures. Procès-verbaux des séances. Deuxième série, Tome 12, Session de 1927. Pp. vii+121. (Paris: Gauthier-Villars et Cie.)

Bulletins et mémoires de la Société d'Anthropologie de Paris. Série 7, Tome 8, 1927, Fascicule 1-2-3. Pp. xviii+138. (Paris.)

Ministère de l'Instruction publique et des Beaux-Arts. Enquêtes et documents relatifs à l'enseignement supérieur. 122: Rapports sur les Observatoires astronomiques de Province et les Observatoires et Instituts de Physique du Globe. Année 1926. Pp. 95. (Paris: Imprimerie Nationale.)

CATALOGUES.

Pictorial Perfection in Photography. Pp. 36. (London: Burroughs Wellcome and Co.)

The Photo-electrical Recording Photometer. Second edition. (Mess 469/II.) Pp. 7. (London and Jena: Carl Zeiss.)

Artificial Sunlight Apparatus. (Bulletin No. 94.) Pp. 48. Muller Hot Cathode Tubes. (Bulletin No. 95.) Pp. 16. (London: Watson and Sons (Electro-Medical), Ltd.)

Catalogue of Secondary and Higher Text-Books. Pp. iv+228. (London: G. Bell and Sons, Ltd.)

Advantages, Applications and Technology of Nickel Cast Iron. (Series B, Paper No. 3.) Pp. 8. (London: The Bureau of Information on Nickel, Ltd.)

Diary of Societies.

SATURDAY, MAY 19.

MINING INSTITUTE OF SCOTLAND (jointly with National Association of Colliery Managers (Scottish Branch) and Association of Mining Electrical Engineers (West of Scotland Branch)) (at Royal Technical College, Glasgow), at 3.—W. Maurice: Electric Mine Lamps and Better Mine Lighting.—Discussion on paper by J. A. B. Horsley on Design and Maintenance of Flame-Proof Enclosures, with Special Reference to Coal Face Machinery.

PHYSIOLOGICAL SOCIETY (in Department of Physiology, University, Cambridge), at 3.—L. J. Henderson: The Capillary Circulation in Active Muscle.—U. v. Euler and G. Liljestrand: Effect of Adrenaline, Sympathol, Tyramine, Ephetonine, and Histamine on Gas Exchange and Circulation in Man.—G. Stetla: The Concentration of Inorganic Phosphate in Living Muscle.—H. Dryerre: The Effect of Histamine upon the Cardio-Inhibitory Fibres of the Vagus.—G. P. Crowden and M. G. Pearson: The Effect of Cold on the Adrenaline Content of the Supra-renal Glands. (Preliminary communication.)—B. P. Wiesner: Reactivation and Relative Age.—T. R. Harrison, C. S. Robinson, G. Syllaba, and A. Blalock: The Changes in Oxygen Capacity of Blood during Exercise in Man in Normal and Rare Atmospheres.—Dr. W. Cramer: On Temperature Regulation and the Adrenal Gland.—S. Wright: Further Observations on Depressor Reflexes.—J. and D. M. Needham: Protein Metabolism in the Dogfish Egg.—W. E. Dixon and J. C. Hoyle: The Comparative Action of Adrenaline and Nicotine on the Pulmonary Circulation.—H. Florey and A. N. Drury: Mucus Secretion by the Colon.—Dr. E. K. Rideal and C. G. L. Wolf: Oxidations by Special Charcoals.—Dr. G. V. Anrep and H. Häusler: Effect of Arterial Resistance, Heart Rate, Temperature and Ventricular Fibrillation on the Coronary Circulation.—Dr. G. V. Anrep, W. Pascual, and R. Rössler: Respiratory Variations of the Heart Rate.—Kathleen Culhane and Dr. G. W. F. Underhill: Some Factors affecting the Response of Rabbits towards Insulin.—Dr. A. S. Parkes: The Rôle of the Corpus Luteum in the Maintenance of Pregnancy.—J. A. Campbell: Carbon Dioxide and Oxygen Tensions in the Bladder.—A. Hemingway: The Effect of Carbon Dioxide on the Heart.—G. P. Crowden and M. G. Pearson: The Effect of Morphia on the Adrenaline Content of the Supra-renal Glands.—Demonstrations:—Helicoid Structure of Muscle, O. W. Teigs.—Co-ordination of Movements in Animals with Amputated Limbs, A. Bethe.—The Production of High Blood-Pressure in Dogs, H. D. Rolleston and W. E. Dixon.—The Action of Chloroform on the Central Nervous System, W. E. Dixon.—Oestrus and Pseudopregnancy in the Ferret, J. Hammond and Dr. F. H. A. Marshall.—The Effect of Changes of the Heart Beat on the Coronary Circulation, Dr. G. V. Anrep and H. Häusler.—A Modified Cannula for Coronary Perfusion, R. Rössler.—A Method for Measuring the Oxygen Consumption of the Tortoise Heart, W. Pascual.—An Approximate Method of Determining the Total Lung Ventilation of Small Animals, H. Taylor.—Precocious Puberty induced by (*a*) Oestrin; (*b*) Anterior Pituitary Extract, Dr. A. S. Parkes and G. F. Marrian.—The Vascular Reaction in Response to Fear of the Denervated Colonic Mucosa in the Dog, H. Florey and A. N. Drury.—Improvements in the Thermal Method for following the Velocity of Rapid Processes, Dr. F. J. W. Roughton.—A Method of Measuring the Oxygen Dissociation Curve of Hæmoglobin applicable both to Dilute and Concentrated Solutions, W. H. Forbes and Dr. F. J. W. Roughton.—(*a*) A New High Speed Electrical Recording System; (*b*) The Shape of the Action Potential Wave Accompanying a Single Sensory Impulse, B. H. C. Matthews.—(*a*) Impulse Discharges in Single Motor Nerve Fibres; (*b*) Sensory Impulses from the Heart, Dr. E. D. Adrian and D. L. Bronk.—A Schema for Studying the Pulse-Wave, J. C. Bramwell.—Records of the Korotkow Sounds, J. C. Bramwell, G. L. Brown, and R. Ellis.—The Effect of Frequent Bleedings on the Spleen of the Rabbit, T. C. Shen.

MONDAY, MAY 21.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.—H. P. Adams: English Hospital Planning.

ROYAL SOCIETY OF MEDICINE (Odontology Section) (Annual General Meeting) (at Royal College of Surgeons), at 8.—Sir Frank Colyer: The Pathology of the Teeth of Elephants.

ROYAL GEOGRAPHICAL SOCIETY (at Æolian Hall), at 8.30.—Dr. J. C. Shattuck: A Journey in Liberia and the Eastern Congo.

MEDICAL SOCIETY OF LONDON, at 9.—Sir Archibald Garrod: Lessons on Rare Maladies.

TUESDAY, MAY 22.

ILLUMINATING ENGINEERING SOCIETY (Annual Meeting) (at Home Office Museum, Horseferry Road, Westminster), at 6.—D. R. Wilson: Presidential Address.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—J. A. Chubb: The University of Chicago Epigraphic Expedition, Luxor, Egypt. The Photo-Drawing Process of Recording Ancient Egyptian Scenes and Hieroglyphs.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—Prof. J. L. Myres: Ancient Greek Physical Types.

INSTITUTION OF MINING AND METALLURGY (Special Meeting in Cornwall) (continued on May 23 and 24).—Annual Meeting, to be followed by a discussion on The Illuminating Engineering Movement at Home and Abroad.

WEDNESDAY, MAY 23.

ROYAL SOCIETY OF MEDICINE (Comparative Medicine Section) (Annual General Meeting), at 5.—Dr. J. P. McGowan: Aplastic Anæmia.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—Prof. P. G. H. Boswell: The Geological Features of the New Mersey Tunnel (Lecture).

FOLK-LORE SOCIETY (at University College), at 8.—Miss Sona R. Burstein: The Harrowing of Hell.

BRITISH PSYCHOLOGICAL SOCIETY (Medical Section) (at Royal Anthropological Institute), at 8.30.—Prof. B. Malinowski: The Melanesian Medicine-Man and his Patient.

THURSDAY, MAY 24.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS (East Midland District Meeting) (at Council Offices, Hinckley), at 11.15 A.M.

FRIDAY, MAY 25.

PHYSICAL SOCIETY (at Imperial College of Science), at 5.

INSTITUTE OF CHEMISTRY AND SOCIETY OF CHEMICAL INDUSTRY (East of Scotland and Glasgow and West of Scotland Sections) (Joint Meeting at St. Andrews), at 6.30.—Principal Sir James C. Irvine (Address).

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—A. C. Egerton: Engine Knock and Related Problems.

SATURDAY, MAY 26.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS (at Neville Hall, Newcastle-upon-Tyne), at 3.—R. White: The Use of Carbon Monoxide Masks in Mines.

PUBLIC LECTURES.

MONDAY, MAY 21.

UNIVERSITY COLLEGE, at 5.30.—Prof. Ross G. Harrison: Modern Trends in the Study of Animal Development.

THURSDAY, MAY 24.

UNIVERSITY COLLEGE, at 2.30.—Sir Flinders Petrie: Recent Discoveries (also on May 25, at 5.30, and May 26, at 3).

INSTITUTE OF PATHOLOGY AND RESEARCH, ST. MARY'S HOSPITAL, at 5.—Prof. R. H. A. Plimmer: Some Recent Researches on Vitamins.

IMPERIAL COLLEGE—ROYAL SCHOOL OF MINES, at 5.15.—Dr. E. M. Kindle: Types of Sedimentation on the Atlantic Coast of N. America. (Succeeding Lectures on May 29 and 31.)

CONGRESSES.

MAY 19 TO 23.

CONGRESS OF RADIOLOGY OF THE UNION OF S.S.R. (at Kiew).—Subjects of Discussion:—The Consequences of the Changes of Elements of Cells under the Influence of Radiation. Classification and Radiodiagnosis of Diseases of Joints. Functional and Anatomical Changes of the Gastro-intestinal Canal after Operative Intervention. X-ray-therapy of Diseases of the Circulatory System. Temporary Sterilisation with X-rays. Radiodiagnosis of Intestinal Diseases.

MAY 25 TO 27.

FRENCH SOCIETIES OF OTO-NEURO-OPHTHALMOLOGY (at Marseilles).