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The Medical Profession in India.

A NUMBER of pamphlets have recently been received at the offices of NATURE, in which are put forth the views of the Indian Medical Association and of certain of its officers on some questions of current medical interest in India. The Association holds an annual meeting, the 'All-India Medical Conference'; the sixth of these took place in Lahore on Dec. 27–28, 1929. Three of the pamphlets relate to this meeting, and contain respectively the addresses of the president and chairman of the Reception Committee, and the resolutions passed at the conference. No scientific or medical papers were read, the objects of the conference being rather political or medico-political.

The president's speech opened with a short discussion of the limits of the membership of the Association; it appears that the rule is to admit practitioners "who have such medical qualifications as may be from time to time recognised by the Association suitable for such membership", and the question is, whether this should include not only persons who follow the western system of medicine, but also those who have in different parts of the country practised any other system with repute and success; the president himself would desire to see included "members who honestly believe in his own system and practises it with a sincerity of purpose" (*sic*). The main part of the address, however, appears to be essentially (whatever topics may nominally be under discussion) an attack on the Government, and more especially on the Indian Medical Service, and its tenor may be illustrated by such phrases as the following:

"Studied carelessness on the part of I.M.S. officers in discharging the responsible duties cast upon them, namely, that of developing an Indian Medical Profession, the pre-arranged method of keeping the Indian out of every opening where they could develop themselves, have been responsible for the present state of affairs"; ". . . those teachers who have developed only one form of speciality, namely, the speciality of possessing an overweening self-confidence, the speciality of rejecting all claims of the Indian practitioners to fair treatment, the speciality in belittling everything Indian"; ". . . this backdoor way of securing a few more lucrative posts for the members of the Indian Medical Service"; (after referring to the heavy Indian mortality) ". . . can nothing be done to prevent this enormous loss of man power in India? . . . It is not necessary for me to mention that the history of the Government during the past 100 years has been such that we need not look for help or inspiration from the authorities."

The resolutions passed at the conference are thirty-five in number; some deal with the Indian Medical Service; some with questions of registration; others take up questions of curriculum, or more general matters. The fourth of the pamphlets, entitled "Some Problems of the Medical Profession in India", compiled by one of the joint honorary secretaries of the Association, brings together an address by Sir Nilratan Sircar to the conference of 1928, and correspondence and other documents relative to the four subjects of the co-ordination of medical research in India, the reorganisation of the medical services, the Medical Council Bill, and the Bengal Council of Medical Registration. We may briefly consider a few of the topics raised in the conference, while leaving others aside as of too limited general interest.

The recognition of practitioners of the indigenous systems of medicine is advocated both by the president of the conference and by Sir Nilratan Sircar, who thinks that there should be chairs of Hindu medicine and of the Yunani system in the colleges; he would have us "put ourselves *en rapport* with the genuine living representatives of the ancient medical art" in order to incorporate whatever of value there may be in the indigenous practice.

It is perhaps natural at the present time, when national feeling is so strong among the educated classes, that Indians should express a belief in and seek to exploit these indigenous systems. It is, of course, true that science is one; there can be no opposed eastern and western science; all students and practitioners belong to one body;—one body, that is, in so far as, and only in so far as, all recognise the same ideals and proceed on the same basic principle. Annually at the Royal College of Physicians the Harveian orator of the year calls on his brethren, as he is bound by the terms of his office to do, to search out the secrets of Nature by way of experiment; and if a body of practitioners does this, or at least acquires a knowledge of, and accepts and bases its practice on, the results of the experimental method, won hardly and with difficulty through the ages, they are of the brothers of the true lineage and acceptable as such by the descendants of Hippocrates. But to trust to ancient authority to the exclusion or neglect of more modern methods of research and their results; or to base the whole of practice, not on the body of scientific knowledge but on some single arbitrarily selected principle, such, for example, as that of homœopathy—this is to remain outside the brotherhood of science and the fellowship of those who carry on the torch of learning.

The second principal feature of the speeches at the recent conference, the abuse of the Indian Medical Service and of Government, may be passed over briefly. The conference was held in Lahore simultaneously with the National Congress, the beginning of so much native unrest; presumably the coincidence was designed, in order that the members of the conference might also attend the Congress, and that the conference might catch its fire and take its tone from the larger assembly. Yet the conference can scarcely represent the attitude of more than a portion of the Indian medical practitioners—or at least one hopes not. Certainly a very different picture is suggested by the contents of the *Transactions of the Seventh Congress of the Far Eastern Association of Tropical Medicine*, held in British India, and mainly at Calcutta, just over two years ago (see NATURE, June 22, 1929, and Mar. 1, 1930). Though this congress was far from exclusively British Indian, the British and Indian members of the medical services and British and Indian practitioners naturally formed the bulk of the membership and contributed the majority of the papers, which contained a very large amount of work, much of it of a high order of merit; and if one may trust to the impressions gained by perusing the records of the meeting, one would say that the two races are working side by side in amity, with many personal friendships, and both producing much useful work.

All that is of practical value in these publications seems to be contained in the pamphlet on "Some Problems of the Medical Profession in India". But here too the same spirit is apparent; thus one of the contributions states that "the Government, beyond reminding us that we are illiterate, has done practically nothing to educate us"; which reads strangely to anyone who knows the enormous advances that have been made in recent years in education—elementary, secondary, and higher—by Government directly or with Government aid. Again, "in measures for improving the health and social conditions of our people" . . . Government "should not add their weight to the millstone that is already round the neck of our society"; to those who know the magnitude of the Government's endeavours for such improvement, and how they are often in advance of general opinion in India, the suggestion contained in the last sentence is so false as to be merely grotesque.

For the rest, there is much criticism of the

decision of Government to establish, in accordance with the findings of the Fletcher Commission, an Imperial Medical Research Institution at Dehra Dun, where the buildings of the recently displaced Forest Department would be available. It is pointed out that Kasauli (where the present Central Research Institute is situated) is too isolated intellectually, though it has a good climate for research, being in the Simla Hills at a height of 6000 feet; Calcutta, or Bombay, on the other hand, though doubtless the climate is not so suitable or agreeable, have the advantage of being large centres of population, with universities, hospitals, and laboratories where research is going on in other branches of science, where team work would be possible, and clinical material available; but Dehra Dun has the advantages of neither, with the disadvantages of both. It is quite possible that the contention is sound; it was announced in the House of Commons a short time ago that the question of the locality of the new Institute is to be reconsidered by the Government of India.

The remaining questions—such as those of the relations of the military and civil branches of the I.M.S., the reservation of posts for the I.M.S., the All-India Medical Council Bill, and the Bengal Council of Medical Registration—are too strictly medico-political, and too complicated and thorny, to interest the majority of the readers of NATURE. It may briefly be added that a new situation has recently arisen through the decision of the General Medical Council to withdraw its recognition of the medical degrees of Indian universities as qualifying for registration in Great Britain. The controversy began in the limited opportunities (owing to Indian customs such as that of purdah) for obstetric instruction in India, and has lasted more than ten years; for some time past the recognition given to these degrees has been conditional, and been renewed for short periods; it now lapses entirely. The matter can scarcely remain where it is; but it is not yet apparent what are to be the next steps taken in India.

Botanical Exploration of Krakatao.

The Problem of Krakatao as seen by a Botanist. By C. A. Backer. Pp. iv + 209. (Weltevreden: Visser and Co.; The Hague: Martinus Nijhoff, n.d.) n.p.

"VOLCANIC action", according to Sir Archibald Geike's "Textbook of Geology", "embraces all the phenomena connected with the expulsion of heated materials from the interior of the earth to the surface." The materials may, no doubt, have been pent up for some time in a simmering condition before the actual eruption, and in the case of a real volcano it is scarcely possible to predict when the eruption may occur.

The book recently published by Mr. C. A. Backer may be likened to what has been quoted above, but in this case the occurrence was timed to coincide with the opening of the Pan Pacific Science Congress held in Java last year. Mr. Backer has much to say that is of great interest and value in connexion with the Krakatao problem. It is, however, unfortunate that he has written his account with so much acrimony, not unrelated, it would appear, to the fact that he was "Formerly", as he states on the title page, "Government Botanist for the Flora of Java". His book deserves careful study, coming as it does from so critical a botanist, whose knowledge of the flora of Java exceeds that of any other worker in this field. It is therefore much to be regretted that it is marred by the aspersions which he has cast on distinguished botanists, both dead and living, whose contributions to the Krakatao eruption history have come to be regarded as classics. Why Mr. Backer severed his connexion with the Buitenzorg Herbarium, where he was botanist for so many years, we do not know, but it is to be regretted that he has chosen the medium of a scientific work as a vent for the eruption in print of his own pent-up feelings.

Mr. Backer's book has been published forty-six years after the eruption of 1883, and unfortunately none of the botanists and others who visited the Island in the earlier years are now living. Though it will be agreed that much more might, and should, have been done in the way of detailed and prolonged investigation in the years immediately following the eruption, it is unnecessary to cast reflections on the investigations which Treub, Penzig, Raciborski, Boerlage, Clautriau, Valeton, Golenkin, Ernst, and others carried out at various times, since it is due to them alone that we possess such knowledge as we have of the state of affairs on the Island between the years 1886 and 1906.

The main contentions with regard to the problem of Krakatao put forward by Mr. Backer are that all vegetable life was not destroyed by the eruption of 1883, and that, except for the littoral flora, we know "nothing at all" about the manner in which the new vegetation has appeared. Treub was the first botanist to visit the Island—in 1886, three years after the eruption. His visit was a brief one, and it is undoubtedly most unfortunate that an earlier

and detailed visit was not made, and that the mountain itself was not then, or during any subsequent visits, fully explored by a botanist. There is good reason to assume that the ash covering on the steep south-east mountain slopes was not very thick. On the lower slopes and on the shore, however, the ash covering was deep, and no doubt it was of so high a temperature that all the plants on and near the shore were destroyed. Tropical rains must certainly soon have removed the lighter ash deposits on the higher mountain slopes, and if, as Mr. Backer brings good evidence to show, the fine ashes which fell back on the summit were quite cooled down in falling from a great height, it is conceivable that plants with rhizomes and underground parts were able to recover and afterwards to refurnish the higher parts of the Island, while seeds and fruits may also have survived. Treub, of course, stated, from his examination of the lower parts of the north-west side of the Island near Zwarte Hock, that every living thing had been destroyed; yet in 1888 he records that he could distinguish plants growing near the top of the cone (some 800 metres in height), from the vessel on which he was sailing.

It certainly is an unsolved problem, if Treub's observation was correct, how such plants could have originated, since transport of seed by wind from Java across so wide a stretch of sea seems scarcely possible. Mr. Backer himself had the opportunity of visiting Krakatao in April 1906, with Ernst, Pulle, and D. H. Campbell, but as he had not properly equipped himself for the expedition, he failed to climb higher than some 400 metres up the mountain. Had he reached the upper slopes, the botanical information he could have given would have been of the utmost value. As, however, he did not himself fully explore the mountain or make the detailed investigation which, as he rightly points out, was so much needed, his criticisms of others, and more especially of Dr. Docters van Leeuwen, the present director of the Buitenzorg Gardens, seem singularly out of place.

It is easy in these days, so long after the eruption, to point out the shortcomings of those who paid the early visits to the Island, but it must be remembered that the climbing of the deeply and intricately fissured mountain side, covered with ash and pumice, was fraught with difficulties well-nigh defying the attempt. The ravines had almost vertical sides, and the ascent of the slope entailed a series of constant descents and ascents in and out of the deep fissures and ravines which cut the mountain side in all directions.

Treub, it will be remembered, found eleven ferns growing on the rocks at Zwarte Hock in 1886. These are all species which grow on steep cliff walls, and it is conceivable, owing to the nature of their habitat, that they may have survived the eruption either by means of rhizomes or spores lodged in clefts of these basaltic cliffs, since neither pumice nor ashes could have lain there to any depth, and would quickly have been washed away by the rain. In fact, two months after the eruption, Verbeek found the old rocks of Zwarte Hock locally bare, so that in well-sheltered localities part of the old fern vegetation may have survived as Mr. Backer suggests.

Mr. Backer has a good deal to say about the incorrect determinations of the plants collected on the various visits. As a systematist he is doubtless correct; but one cannot help objecting to the manner in which he expresses his criticisms. With regard to the re-covering of the Island, it is evident that the littoral vegetation is entirely new, and is due to seeds and fruits which have been washed up on the shores. Mr. Backer brings forward many arguments to show that very few, if any, seeds could have been wind-borne as has been assumed, though he considers seeds may have been brought over by birds and almost certainly by the many visitors and fishermen who have visited the Island. His main contention, however, is that the old vegetation was not entirely destroyed, as stated by Treub, but that on the steep cliffs of Zwarte Hock, and on the south and south-east higher slopes, living plants persisted. From these remnants of the old vegetation he believes the slopes may have been reclothed downwards, and the fern population of the cliffs restored. The new vegetation was certainly not long in making its appearance, since a year after the eruption an observer, on a ship, thought he saw some plants growing near the summit of the mountain.

The mode of origin of the new vegetation of Krakatao, except for the littoral plants, must therefore be regarded as unsolved, since we know so little of what was actually growing on the Island in the first few years after the eruption, and it was not until twenty-three years had elapsed that any attention was paid to the vegetation on the eastern and south-eastern sides.

Mr. Backer's conclusions at the end of his book are typical of the spirit in which it is written. He writes:

"I have tried to find the very few bones in these wagon-loads of rubbish and will finish by stating once more, that:

1. It is not at all proven that by the eruption of 1883 all vegetable life on Krakatao was destroyed.

2. Even if this could be proven, we know—with the exception of the littoral flora—nothing at all about the manner in which the new vegetation has appeared. Only guesses without scientific value have been made, but no reliable observations nor experiments.

3. Therefore the Krakatao problem can neither now nor in the future either be posed [? proved] or solved, and is of no importance at all for Botanical Science."

A. W. H.

Ovarian Secretions.

The Internal Secretions of the Ovary. By Dr. A. S. Parkes. (Monographs on Physiology.) Pp. xv + 242. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1929.) 21*s.* net.

DR. PARKES is one of the best-known authorities on this branch of physiology concerned with internal secretions, and his book gives a comprehensive survey of all the past and current work carried out on the subject by the leading men of science of all countries. During the last ten years or so a much keener interest has been taken in the properties of the ovarian secretions, as it has been gradually realised what an important part they play, and thus the amount of experimental data has been rapidly accumulating. This has greatly added to the difficulty of Dr. Parkes's task, as he has had to exercise great discretion in the choice of his subject matter, and it is never easy to distinguish between the important and relatively unimportant work of contemporaries, and to realise which views will stand the test of time and which will in later years prove to be erroneous. It can, however, be seen at once that no space has been wasted in dealing with vague hypothetical considerations and views which are not supported by solid evidence, but only those are included which have been proved experimentally. The book is very well and fully illustrated throughout, thereby greatly adding to the value and clarity of the text. It is easy to see that the experiments on animals to show the functions and properties of the ovarian secretions are the careful work of experts, as they are all of them conclusive and have been carried out with the greatest accuracy.

The book is divided into sections, the less detailed ones dealing with such subjects as the morphology of the female reproductive organs coming first. There is no need for more than a very general account of this, as numerous anatomical and histological text-books contain fuller descriptions. The author then passes on to a review of sexual periodicity in the female mammal, showing how certain animals have salient points in common. There is a very interesting account of types of œstrus cycle in those animals in which it has been sufficiently studied, and this is followed by a section on the ovary as an organ of internal secretion.

The œstrus-producing hormone is dealt with by Dr. Parkes in detail; no full account of this has previously appeared in the literature up to date, and the description of its preparation, properties, and administration is excellently done and will be found of great interest by all readers. In the section dealing with the ovary and the anterior pituitary body, the author shows that it is only of recent years that the importance of the relation between these two has been discovered, and he discusses the many problems connected with this relationship.

A detailed account of the chemistry of œstrin is given, stating the various methods of preparation with references so that those interested can obtain a full description. From the general point of view, the most important section is the one dealing with the physiological effects resulting from its administration to animals. The source of the material is also discussed and the significance of its occurrence in the bodily secretions of animals and men.

In conclusion, we feel that this work will become a classic, and trust that new editions will appear at frequent intervals.

Robert Hooke.

Early Science in Oxford. By Dr. R. T. Gunther. Vol. 6: *The Life and Work of Robert Hooke* (Part 1). Pp. xxiv + 396. 31*s.* 6*d.* Vol. 7: *The Life and Work of Robert Hooke* (Part 2). Pp. viii + 397-806. 31*s.* 6*d.* (Oxford: The Author, Magdalen College, 1930.)

THE two latest volumes of Dr. Gunther's series of books on early science in Oxford deal with the life and work of Robert Hooke. Dr. Gunther makes high claims for the hero of his story, and if we cannot accept quite all his claims, we can at least agree that Hooke was one of the most prominent of those remarkable Englishmen who made the second half of the seventeenth century illustrious in the history of science.

The volumes before us contain as preliminary

matter an essay by Dr. Gunther in the form of a preface, and a reprint of Richard Waller's "Life of Hooke", first printed in 1705, with added extracts from John Ward's "Lives of the Gresham Professors" (1740), and Aubrey's "Short Lives". The bulk of the work consists of notes on Hooke's experiments, discoveries, and inventions, extracted from the records of the Royal Society and other sources.

Hooke was born in 1635 at Freshwater, in the Isle of Wight. Though a weakly child, he was "very sprightly and active", amusing himself by "making little mechanical Toys". From Westminster School he went as a chorister or servitor to Christ Church, Oxford. Here his early mathematical and mechanical aptitudes brought him into touch with Oxford men of science, and he became chemical assistant first to Thomas Willis, and then to Robert Boyle, whose "Pneumatick Engine", that is, air pump, owed much to Hooke's skill. In 1656 or 1657, Hooke invented the anchor escapement for pendulum clocks, and, seeing the practical importance of accurate chronometry for the determination of longitude at sea, was led "to the use of Springs instead of Gravity for the making a Body vibrate in any Posture", and thus to the spring-controlled balance wheel of watches and chronometers. His attempt to obtain a grant of a satisfactory patent for this having failed, he put aside the application of the invention to chronometers, which first became practicable when in 1761 John Harrison corrected the balance wheel for thermal expansion.

In 1662, Hooke was appointed curator of experiments to the newly founded Royal Society, and left Oxford for London, residing at Gresham College in Bishopsgate for the rest of his life. As Miss A. M. Clerke says in her admirable account of Hooke in the "Dictionary of National Biography":

"The Registers of the Royal Society testify to the eagerness with which Hooke hurried from one inquiry to another with brilliant but inconclusive results."

Dr. Gunther acknowledges this characteristic in other terms:

"On the other hand, the fact that he had noted an idea in one of his synoptic tables probably led to his claiming it as his exclusive copyright. This may explain why it not infrequently happened that when some new discovery was mentioned to him, he was apt to think that he had himself made it long before, whereas he had merely considered the possibility of such a discovery, and had noted it in an appropriate place in an 'algebra'. With the onrush of other and newer interests, he had not been allowed time for following out the investigation suggested."

Nevertheless, Hooke's work comprises a long list of solid achievements. Perhaps he is best known by Hooke's Law of Elasticity, *Ut tensio sic vis*; but that is merely one among many other discoveries and inventions. Besides his mechanical ingenuity, shown in his improvements in watches and clocks mentioned above, and in the invention or improvement of numerous other scientific and technical instruments, he was a busy and successful architect, building Montague House, the Bethlehem Hospital, and the College of Physicians, and acting as surveyor to the City of London. Moreover, he made notable advances in biology and chemistry: he was one of the earliest microscopists, and described the cellular nature of living tissue; he proved that life could be maintained by blowing air over the surface of the lungs without muscular movement; and partly anticipated Mayow in a true explanation of combustion.

Dr. Gunther claims that "it is certainly hardly fair to Hooke's memory that the coloured diffraction bands discovered by him should be everywhere known as Newton's rings". But the mere observation of the colours of thin plates—even the blowing of glass thin enough to show them—seems less meritorious than Newton's detailed study, with careful measurements and a calculation of the intervals of "fits of easy transmission"—the first determination of the wave-length of light. Hooke's credit is that of the pioneer, who makes discoveries and suggestions and passes on. The demonstration of the colours of thin plates, the idea that light was a wave motion, and a wave motion transverse to the direction of propagation, the attempt to measure the parallax of a fixed star, the proposals for flying machines, all are examples of Hooke's insight into possibilities for the achievement of which the time was not ripe.

Probably Hooke's greatest work for science was done as 'curator' and later as secretary of the infant Royal Society. He demonstrated not only his own experiments but also those of others whom he often helped in their difficulties. If he sometimes showed a querulous temper, he had valid excuses, as Dr. Gunther points out. But, in the main, he set the fashion of that quiet and self-effacing helpfulness for which so many officers of the Society have been remarkable from Hooke's day to this. How much Hooke did to further science at a critical stage in its history is well seen in Dr. Gunther's two useful volumes.

W. C. D. D.-W.

Our Bookshelf.

Fungi and Fungous Diseases. (Adolph Gehrmann Lectures of the University of Illinois College of Medicine, 1926.) By Prof. Aldo Castellani. Pp. iv + 203 + 4 plates. (Chicago, Ill.: American Medical Association, 1928.)

Sir Aldo Castellani's latest contribution to medical mycology is based on a course of lectures delivered by him in 1926 as Adolph Gehrmann Lecturer of the University of Illinois College of Medicine. It is well recognised that the advent of the bacteriological era retarded considerably the development of mycology in its relationship to disease of man and animals, and even now, in spite of our vastly increased knowledge of pathological conditions associated with fungi, the systematic classification and nomenclature of these fungi have been the concern of but few professional mycologists. Castellani has worked largely in this field and he has been able to combine with considerable success his well-known clinical interest and experience of tropical skin diseases of fungous origin with studies of the fungi concerned.

The inexpert reader will, we are afraid, be rather repelled than otherwise by the elaborate classification tables and well-meant simplifications of them presented by the author. He will note recent tendencies to replace old familiar genera by new and unfamiliar ones. He will be grateful, however, for the author's account of the fermentative activities of fungi and the use to which these activities may be put not only as an aid to their systematic classification but even to the detection of particular carbohydrates in pathological fluids. The author has given much attention to this subject, and, in particular, his employment of differential fermentation effects by known fungi in order to detect the presence of the rarer carbohydrates in fluids has aroused wide interest.

The second half of the book deals with pathological conditions in man that are due to fungi and includes a description of interesting tropical skin diseases, to some of which Castellani was the first to direct the attention of dermatologists. It contains some excellent photographs and coloured plates of skin lesions. It is clear that a wide field is open for the co-ordinated research of clinical pathologist and professional mycologist. J. C. G. L.

Standard Methods for Testing Tar and its Products. Pp. xxix + 295 + 10 graphs. (London: Standardization of Tar Products Tests Committee, 1929.) 7*s.* 6*d.* net.

To ensure uniformity of analytical results on such composite products as many of those which fall within the generic term of 'tar products', standard processes are, in most instances, essential. The present volume is the outcome of a vast amount of work, carried out by a committee formed as the result of the advocacy in 1926 of the need for such standardisation. In addition to members of the trade, the committee included—or rather includes, for it is still in being—external bodies who represent in some measure chemists approaching such work for the first time. Further, the co-operation of the National Physical Laboratory was sought to consider the question of glassware and, as a result, an extensive schedule of apparatus is appended.

Introductory sections deal with the problem of adequate sampling, so essential if the subsequent tests are to be of any value, and with the general principles of distillation and of the determination of specific gravity. Then follow the methods laid down, under the general headings (1) crude tar, (2) refined tar, including road tar, (3) lower boiling fractions, (4) tar acids, (5) naphthalene, (6) tar bases, (7) creosote oil, (8) crude anthracene and (9) pitch; many of these sections are further subdivided. Appendices include, in addition to that on glassware, tables of constants and equivalents and a convenient collection of graphs, some of an elaborate character. For general laboratory use, the set of graphs may be obtained separately.

No claim to finality is made; indeed, provision is made for the subsequent inclusion of such additional tests as the committee may deem desirable. Only those who have been in any way associated with the project can fully appreciate the enormous amount of labour, well repaid, in the production of this book, which may be recommended with confidence to all who have to deal with 'tar products', much or little. Commendation, indeed, is insufficient; to such, the volume is a necessity.

B. A. E.

The Romance of the Portuguese in Abyssinia: an Account of the Adventurous Journeys of the Portuguese to the Empire of Prester John; their Assistance to Ethiopia in its struggle against Islam, and their Subsequent Efforts to impose their own Influence and Religion, 1490–1633. By Charles F. Rey. Pp. 319 + 16 plates. (London: H. F. and G. Witherby, 1929.) 18*s.* net.

In the volume under notice, Mr. Rey tells the story of the endeavours made by the Portuguese nation for a century and a half to secure a footing in Abyssinia. This was an outcome of the policy of exploration and expansion initiated by Henry the Navigator. When Pedro da Covilham and Alphonso da Payva were sent out in 1487 in search of Prester John, it was not entirely in a spirit of romantic adventure. They were also instructed to search out the sources of the wealth of the East and of its commercial products. They stumbled, by accident as it were, on Abyssinia; but in the dispatches which they were allowed to send home, though they themselves were never permitted to leave the country, they reported that they had found the legendary kingdom of their search.

Mr. Rey here tells the story of the subsequent growth of Portuguese influence at the court of the Negus, strengthened as it was by the help which they were able to give the Abyssinians in their resistance to Islam, and of the collapse of both military and missionary adventure which ended in the final expulsion of 1633. Mr. Rey's story is well told, with a full appreciation of the bearing of Portuguese policy and its after effects on the fortunes of Abyssinia. The book is illustrated by some well-chosen reproductions of old prints.

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.*]

Test of a Relativity Postulate.

CLERK MAXWELL'S original suggestion, revived in NATURE for April 12, p. 566, was in danger of being lost sight of, although it has been renewed independently from time to time; see, for example, *Phil. Trans.*, 1893, p. 784. The prevailing relativity postulate that motion through the ether is undetectable, or in another form that no motion of an observer can affect his determination of the velocity of light in free space, has not yet been actually and directly verified. Common sense seems to assert that motion of source can have no influence on waves after they have left it, while motion of receiver should subjectively affect their speed of arrival; but this would be contrary to the relativity postulate.

Attempts to observe a relative ether drift, by experiments made on a to-and-fro journey between terrestrial stations, appear neutralised by a FitzGerald contraction: a first order test is needed; and that can only be furnished by astronomy. The Jovian system is a clock to or from which we are sometimes approaching, sometimes receding; and the consequent essentially Doppler effect (change in satellite periods) is well known. But a Doppler effect, though not caused by a drift, can be modified thereby if the drift is inconstant. Syrens and church bells presumably wail during gusts. The orbital motion of the earth is equivalent to a variation in the drift of the solar system; so there may be an observable modification for the eclipse intervals of Jupiter's satellites. Quadruple satellite motion may be too complicated for the test; that is a question for astronomers: but there is a previous question, the one apparently first propounded by Maxwell; and I do not see that the answer is as yet assuredly in the negative.

If, however, waves are more like projectiles than used to be thought, several lines of reasoning will have to be modified (see, for example, *Proc. Roy. Inst.* for April 1, 1892, or NATURE, vol. 46, p. 497); and the relativity postulate may turn out to be justified by a curious interlocking with the quantum.

OLIVER LODGE.

Normanton House,
Lake, Salisbury,
April 14.

Mechanism in Nerve Centres.

IN NATURE of Dec. 14, 1929, there appears a letter from Prof. Alexander Forbes attacking the arguments I have made in criticism of the mechanistic interpretation of reflex functions.[1] I believe this challenge ought to be taken up, because it is both courteous and impersonal in tone and because I fear that the well-merited dignity of my critic's name may lend undue weight to his arguments among those who are unfamiliar with neurology.

Prof. Forbes's criticisms are focused on a statement of mine that mechanism cannot account in full for the function of nerve centres because a machine "cannot change itself or its functions to meet new conditions; it does not improve its performance with practice; it cannot perform some particular function depending originally on one part, after that part has been destroyed". Had he proceeded with this quotation he would have added: "An internal combustion engine cannot learn by itself to run as well at a high altitude as at a low. If a motor-car turns in at a certain gate 999,999 times, it will have no more tendency to leave the road at that point the millionth time than it had the first. If one cylinder of a motor is put out of action, the speed and power of the engine is reduced in a mathematically predictable proportion; or the loss of a small part in a complicated mechanism may mean the total cessation of function, as in a watch that loses a wheel. Yet these are kinds of things which the central nervous system may do—or do without."

These explanatory examples Prof. Forbes omits: he denies the generalisation and cites other examples from the mechanical world to support his claim. These show, I believe, that he does not understand the difference between living and mechanical processes which constitute the problem under discussion, for he uses changes in the mode of operation in a machine as instances of adaptation. Biologically, adaptation involves the development of a response or of a structure, which has not previously existed in the organism. Prof. Forbes's examples are of changes in mode of functioning of machines that have been designed so to change.

Prof. Forbes first cites the case of a mechanical beetle that turns away from the edge of a table and walks in another direction. His second is the stabiliser of an aeroplane which operates the controls so as to reinstate it on its course when deflected by a 'bump'. A biologist would not regard these as adaptations to new situations because no reaction previously foreign to these 'organisms' has appeared. Perfection of function with practice he illustrates by a motor that runs better after the first 500 miles of use. But this is mere elimination of friction in the bearings, etc., which is, theoretically, part of the process of manufacture and may indeed be accomplished without running the engine at all. 'Running in' does not produce any increase in power generated as would happen were there true perfecting with practice. A true analogy does exist between the regulation of the order of firing in the cylinders of an internal combustion engine and the co-ordination of muscular contractions in the animal body. Both depend on accurate timing, and the better the timing the more power is there produced in both cases. Would an eternity of practice make an engine improve the timing of its explosions?

As to vicarious function in the central nervous system, which means the reappearance of a function that has been originally mediated by some part which is destroyed, Prof. Forbes thinks that "an ingenious mechanic might devise a number of ways in which a machine could be made to change automatically from one mode of operation to another in consequence of the failure of some of its parts; for example, a steam-pipe might be provided with an automatic valve which, if the pipe burst, would divert the steam through another pipe. Electrical devices which perform essentially this function are actually in use in electric railways." But these are not examples of vicarious functions. The use of the word 'automatic' proves that the mechanisms cited were designed to use alternative parts. After destruction of a 'centre' in the central nervous system, the function previously operating through this part does not automatically reappear in the working of another part. The recovery is slow and laborious: moreover, the parts which take over the function could not have been designed as specific alternative mechanisms. Instances of vicarious function in the brain are notorious, but I will cite one which is more in Prof. Forbes's

field, namely, the spinal cord. Lashley[2] has recently shown by double hemisection of the spinal cord that control of the limbs is regained in three months after the permanent interruption of all the long spinal paths from the brain to the motor centres for the limbs. It takes three months for the nerve impulses to 'learn' to follow a circuitous route: they must travel through pathways the original function of which it was to connect up adjacent centres in the cord. If these short fibres were designed as an alternative route for impulses from the brain, they would come into service as soon as the immediate effects of the operation had passed away. In man the improvement of function after injury to the spinal cord may go on for years.

If one assumes, as do mechanists, that the principles of mechanical and biological functions are identical, the problem of discriminating between them does not arise, and errors, such as those cited above, are quite understandable. But Prof. Forbes's enthusiasm carries him to more uncritical lengths. He devotes his longest paragraph to knocking down a straw man. He alleges that I claimed the production of impulses in the central nervous system to be a performance of which no machine could be capable. He then argues that machines could do such things. With this argument I am in agreement, for it destroys a claim I have never made or contemplated.

The reader may, perhaps, think that these are mere debating points and that differences between mechanists and non-mechanists are philosophical squabbles without practical significance. The very contrary is true, as I think anyone will agree who has studied the way the minds of investigators work. Roughly speaking, we find only that for which we seek: the hypothesis precedes the discovery. The mechanist—in so far as he is faithful to his creed—finds only the mechanical factors underlying the functions he studies and has no further curiosity as to the nature of the functions themselves. But for the Pasteurs and Darwins of science, functions, *qua* functions, have had a fascination.

JOHN T. MACCURDY.

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[1] These appear in my book, "Common Principles in Psychology and Physiology".
[2] *Psychological Review*, vol. 37, p. 1, 1930.

New Data on Cellulose Space Lattice.

IN previous investigations made to determine the space lattice of cellulose, the material used was in the form of minute fibres. Due to the cylindrical form of the fibres, it was not possible to determine directly by experiment the relations that exist between the planes which are parallel to the long axis of the fibre. Several attempts were made to construct a lattice which would fit the diffraction data, but no common agreement was attained.[1] The principal difficulty was in the interpretation of the reflections which appeared on the 'equator' in spot diagrams when the X-ray beam was perpendicular to the long axis of the fibres; and which appeared in the line diffraction patterns whenever the beam was parallel to the long axis. In both cases the planes were evidently parallel to the long axis, but no experimental evidence was available to show how they were situated with respect to one another.

New data which clearly bring out that relation were obtained from a plant in which the cellulose is deposited in relatively large sheets instead of in minute cylinders. The plant is *Valonia ventricosa*. It is a green alga which grows in the form of a single-celled hollow sphere often 20 mm. in diameter. The wall of the sphere is thickened by depositions of cellulose from the inside in thin sheets making the wall many layers in thickness.

Line diffraction patterns were made from a layered block composed of many pieces of the wall of this plant. The interplanar spacings computed from the lines correspond to those from fibres, indicating an identity of molecular structure in the two forms—sheet and cylinder. When pin-hole photographs were made the location of the planes in question was made clear. In Fig. 1 from fibres and Fig. 2 from *Valonia* sheets, the reflections in which we are interested are indicated by the spots lettered A_1, A_2, and A_3. They appear in a row along the 'equator' in the pattern from the fibres, where A_1 and A_2 are

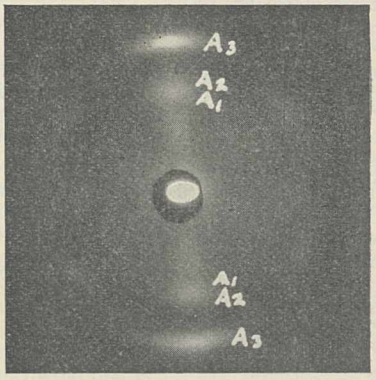

FIG. 1.—Pin-hole diffraction pattern from fibres.

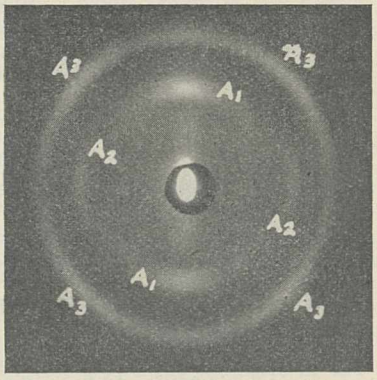

FIG. 2.—Pin-hole diffraction pattern from *Valonia*.

partially superposed making a wide spot. But in the pattern from *Valonia*, A_1 is 90° from A_2. The former was produced by planes which were parallel to the surface of the sheets, while A_2 was produced by planes at right angles to the surface; that is, the planes reflecting to A_1 and A_2 respectively were at right angles to each other. A_3 appeared as four maxima lying between A_1 and A_2. Here for the first time the relation between these three sets of planes seems to be clearly demonstrated. In both spacing and angular position the diffraction maxima are in agreement with an elementary cell in which the planes (010) are parallel to the surface of the cell wall and are represented by planes spaced 6·10 A.; the planes (100) are perpendicular to the surface of the cell wall and are represented by 5·33 A. spacings; and the diagonals (110) are represented by the maxima, A_3, spaced 3·93 A. These three interplanar values are probably better values for cellulose than those so far published, because the lines produced by *Valonia* are sharper and more clean cut than those obtained from fibres.

The significance of the new data lies in this, that while the *c* axis only can be determined directly from fibres, the data from *Valonia* make it seem fairly certain that now the *a* and *b* axes also may be experimentally determined and that they are represented by A_2 and A_1 respectively of Fig. 2. Based on this new evidence the elementary cell for cellulose is practically as reported by Sponsler and Dore for fibres. With the slight refinement of measurements, made possible by *Valonia* diffraction lines, the axial dimensions for cellulose are

$$a = 10{\cdot}7 \text{ A.}; \quad b = 12{\cdot}2 \text{ A.}; \quad c = 10{\cdot}3 \text{ A.}$$

The angles between them are within 2° or 3° of right angles.

Complete details of the work with *Valonia* will be submitted elsewhere. O. L. SPONSLER.

University of California at Los Angeles.

PROF. SPONSLER is to be congratulated on his discovery of a plant in which the cellulose crystals are arranged so favourably for X-ray analysis. The results help to place the determination of cellulose structure on firm ground. Prof. Sponsler does not refer in his list of papers to certain attempts that have been made to produce artificially the same sort of special arrangements as he has now found in *Valonia*. For example, Mark and Susich, having prepared a sheet from tunicin and having stretched it in one direction, were able to obtain an X-ray diagram of the same character as that of Prof. Sponsler's Fig. 2 (*Zeit. f. phys. Chem.*, 4, p. 433, Fig. 3D; 1929). They, as Prof. Sponsler does, deduced that the planes with spacings 6·08 and 5·45 (Sponsler 6·10 and 5·33) were nearly at right angles to one another, while the plane with spacing 3·95 (Sponsler 3·93) was inclined at about 45° to each of the others.

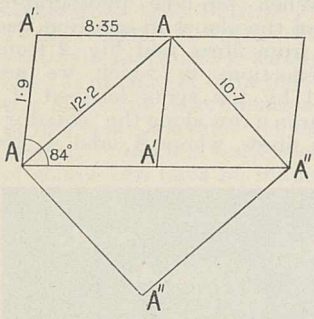

FIG. 1.

Prof. Sponsler describes the cell as nearly orthorhombic with axes 10·7, 10·3, 12·2. The description of Mark and his collaborators is:

$$a = 8{\cdot}35,\ b = 10{\cdot}3,\ c = 7{\cdot}9,\ \beta = 84°$$

The two descriptions, though they differ apparently, are almost equivalent. The identity period along the fibre is the same in both, namely, 10·3.

Prof. Sponsler's cross section is $A\ A\ A''\ A''$ in Fig. 1; that of Mark and others is $A\ A'\ A\ A'$. In the former case, A and A'' represent molecules or molecular chains in similar positions, with A' differing somewhat. In the latter case, all the A's are identical. The larger cell contains twice as many molecules as the smaller.

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[1] Polanyi: *Naturwiss.*, **9**, 228; 1921. Sponsler: *Jour. Gen. Physiol.*, **9**, 221-233; 1925; and 677-695; 1926. Sponsler and Dore: Colloid Symposium Monograph, **4**, 174-202; 1926. Herzog: *Jour. phys. Chem.*, **30**, 455-467; 1926. Andress: *Zeit. f. phys. Chem.*, **136**, 279-288; 1928. Mark and Meyer; *Ber. d. D. Chem. Gesells.*, **61**, 593-614; 1928; and *Zeit. f. phys. Chem.*, B **2**, 115-145; 1929.

Pressure Effects in the Band Spectrum of Calcium Hydride.

SOME years ago Mulliken (*Phys. Rev.*, **25**, 509; 1925) reported a band in calcium hydride (CaH) at λ3533, having a very unusual structure. The band was photographed at low pressure (~40 mm. hydrogen) and is composed of single P- and R-branches, which are abruptly cut off at P ($11\frac{1}{2}$) and R ($9\frac{1}{2}$). As no more bands appeared corresponding to any higher vibrational states in the molecule, the effect was interpreted as a manifestation of some very unstable conditions in the initial C-state. Indeed, it was later supposed that the molecule dissociates by pure rotation, and Franck and Sponer (*Gött. Nachrichten*, 241; 1928) calculated the dissociation energy of the C-level to be about 0·09 volts.

In connexion with some work on the pressure effects in band spectra at present going on in this laboratory, we undertook an investigation on this rather interesting band, varying the hydrogen pressure in the arc from 10 mm. of mercury up to seven atmospheres. We found that the entire spectrum of calcium hydride was brilliantly increased with the pressure. In the C-band a very remarkable effect appeared. At high pressure, the P- and R-branches were strongly developed to about $J = 40$, the first few lines above the critical value $J = 10\frac{1}{2}$ being somewhat diffuse. In addition, a number of new bands appeared, apparently forming a band system, the vibrational quantum numbers ($\nu'\ \nu''$) of which are here given:

HEADS OF BANDS IN λ (AIR).

ν'' \ ν'	$\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$
$\frac{1}{2}$	3533·6	3367·6				
$1\frac{1}{2}$	3696·6	3515·4	3356·3			
$2\frac{1}{2}$			3498·1	3346·5		
$3\frac{1}{2}$				3482·0	3337·6	
$4\frac{1}{2}$						3330·8

The correctness of this scheme has been checked by a comparison with other band systems in calcium hydride having a common final state $^2\Sigma$. There are numerous interesting details in the pressure effects on the C-bands; for example, the appearance of some diffuse doublet components of the P- and R-series, apparently forming the missing components to be

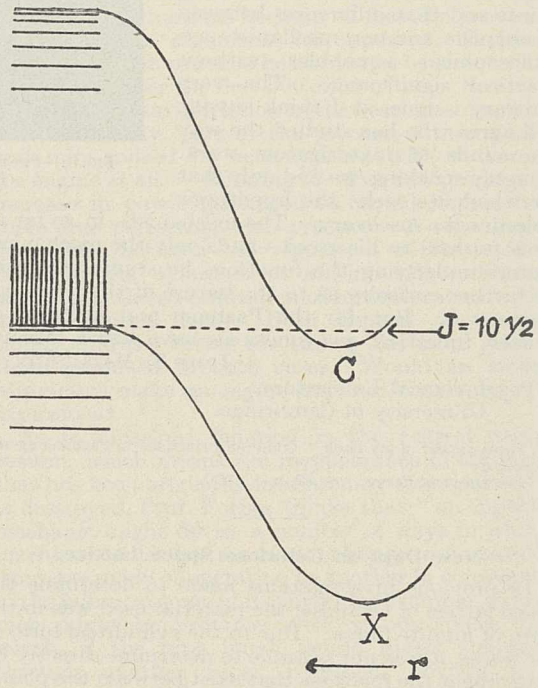

FIG. 1.

expected in a $^2\Sigma - {}^2\Sigma$ transition. A complete description, including the analyses of new band systems in the visible and the near infra-red, will, however, be published later.

From the observations mentioned above, the following conclusions may now be drawn. The abrupt cut off in the C-band at low pressure is not due to an extremely small D-value of the C-level, but must be caused by perturbing influences from some unknown electronic level X, as shown in Fig. 1. The effect is considered as a predissociation of the C-state into the

continuous region above this X-level. One is tempted to say that the unusual band of Mulliken appears in the spectrum only due to the dipping of the C-level into the region of discrete *Eigenwerte* in X. According to the theory of Kronig (*Zeit. f. Phys.*, **50**, 347; 1928) the Λ of the perturbing X differs from that of the C-level by zero or $\pm$ 1. The C-level is interpreted as a $^2\Sigma$-state ($\Lambda = 0$), so the X-level must be either a $^2\Sigma$- or a $^2\Pi$-state ($\Lambda = 1$). The nature of the effect —the appearance of a great number of additional lines at high pressure—leads us to adopt the first of these alternatives as the correct theory.

Pressure effects of similar character, although due to interactions between Π- and Σ-states, have recently been reported by E. Bengtsson and R. Rydberg (*Zeit. f. Phys.*, **59**, 540; 1930) in the spectrum of aluminium hydride. Mr. G. Stenvinkel has interpreted this effect in terms of Kronig's theory. His hypothesis is readily applied to the effects in calcium hydride, so that we may refer to his paper (*Zeit. f. Phys.*, in press) for further details in the mechanism of the pressure effects.

B. GRUNDSTRÖM.
E. HULTHÉN.

University of Stockholm,
Mar. 17.

The Absorption Spectrum of Vitamin D.

IN 1929 we published evidence (*Proc. Roy. Soc.*, B, **104**, 561; 1929) showing that in preparations made from ergosterol by exposure to ultra-violet radiation, and subsequent removal of unchanged ergosterol, there was a close correlation between antirachitic activity and intensity of absorption for radiation of wave-length 280 mμ. On this and on other evidence we argued that it was probable that vitamin D was the substance present in these products which was responsible for the intense absorption band with heads at 280 mμ and 271 mμ (substance A). We have now obtained definite evidence that this inference is not correct, and that the reactions which occur on irradiation of ergosterol are more complex than then appeared probable.

We have succeeded by the use of light filters and other methods in obtaining preparations showing very high antirachitic power but relatively low absorption at 280 mμ. Further, by irradiating ergosterol with radiation only of wave-lengths longer than 280 mμ (through a filter of xylene), removing the unchanged ergosterol and re-radiating with short wave-lengths only (through filters of chlorine and bromine), we have often obtained during our second radiations a considerable rise in absorption at 280 mμ simultaneously with a destruction of antirachitic activity. In this way we have obtained mixtures showing high absorption closely resembling that which we defined as due to substance A (and almost certainly due to this substance) but showing only low antirachitic activity.

Thus, while it is not yet possible to say what is the true absorption of vitamin D, it is evident that the substance showing the very intense maximum at 280 mμ produced in the early stages of the irradiation of ergosterol by a mercury vapour lamp (without light filters) is not vitamin D.

This non-identity of the two substances is in agreement with the findings of Reerink and Van Wijk (*Biochem. Jour.*, **23**, 1294; 1929) and Windaus (*Nachr. ges. Wiss. Göttingen*, 36-57; 1930).

R. B. BOURDILLON.
R. G. C. JENKINS.
T. A. WEBSTER.

National Institute for Medical Research,
London, N.W.3,
April 10.

Presence of a Yeast in the Death Watch Beetle (*Xestobium rufo-villosum* De G.).

MY attention has been directed to the paper by Campbell in the *Biochemical Journal*, vol. 23, No. 6, 1929, in which reference is made to the work of Uvarov (1928), who suggests that wood-eating insects may partially digest wood particles with the aid of the secretions or excretions of micro-organisms, or even digest the micro-organisms themselves. Campbell, as the result of his work, suggests that it is probable that intestinal micro-organisms play a prominent part in the biology of the larva. In view of these suggestions, it is thought to be of interest to direct attention to the fact that, whilst conducting an investigation under the direction of the late Prof. H. Maxwell Lefroy during 1924, I found that a yeast was invariably present in larvæ and adults of the death watch beetle. While no evidence was obtained that the yeast was actually concerned in the digestion of wood particles, a number of facts concerning the distribution of the yeast in the various stages of the insect was determined. Dr. S. G. Paine, of the Imperial College of Science, was also closely concerned with the investigation and made a number of attempts to cultivate the yeast.

Briefly, the facts ascertained with regard to the yeast were as follows:

1. Yeasts were found in large numbers in the hepatic diverticula and closely connected portions of the alimentary canal of the adult male and female insects, and also in the larvæ. They are enclosed within the cells of the hepatic diverticula of young larvæ, but free in the diverticula of older larvæ and of the adult insects.

2. Yeasts are extremely rare in portions of the alimentary canal other than those mentioned above.

3. Yeasts are to be found in large numbers in the spermathecæ and vagina of the adult female, from whence they are doubtless conveyed to the eggs.

Unfortunately, when I left the Imperial College to take up my present appointment, the work had to be discontinued. An important fact, which still requires elucidation, is the means whereby the yeasts migrate from the hepatic diverticula, in the larva, to the spermathecæ of the adult female. It would seem that this can only take place in the pupal stage, during histolysis. The yeasts also require tracing from the egg to the newly hatched larva.

It is hoped that the observations here recorded may be of assistance to those endeavouring to elucidate the metabolism of the death watch beetle.

L. N. STANILAND
(Advisory Entomologist).

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Long Ashton, Bristol.

Integration of Sunlight.

IN their letter on this subject in NATURE of Mar. 22, p. 447, Messrs. Teegan and Rendall refer to a photo-electrolytic method. The electrolytic method of integration does not appear to be very sensitive.

For investigation of the flow of heat at a window, into or out of a room, apparatus has been devised which produces an electromotive force of 70 micro-volts for a heat flow of one British thermal unit per square foot per hour and affords a continuous record of the flow. This has been described in the *Philosophical Magazine* (**8**, 841, December 1929).

With intermittent sunshine the continuous record is naturally difficult to integrate and an integrator has therefore been devised to 'meter' the heat flow.

This instrument works from A.C. mains and operates a six-figure counting train, one unit corresponding to one microvolt-hour. The integrator is arranged to handle electromotive forces ranging from −150 to +300 microvolts. A description of the apparatus is being prepared for publication.

A. F. DUFTON.

Building Research Station,
Garston, Herts, Mar. 24.

Method of Registering Multiple Simultaneous Impulses of Several Geiger's Counters.

PROF. W. BOTHE in the *Zeitschrift für Physik* (vol. 59, p. 1) describes a method for registering simultaneous impulses of two Geiger's counters, which depends principally on the working of a two-grid thermionic valve. Lately, I have had the opportunity of experimenting with a circuit which perhaps is simpler and at the same time has the advantage that it can be extended also to the registering of triple

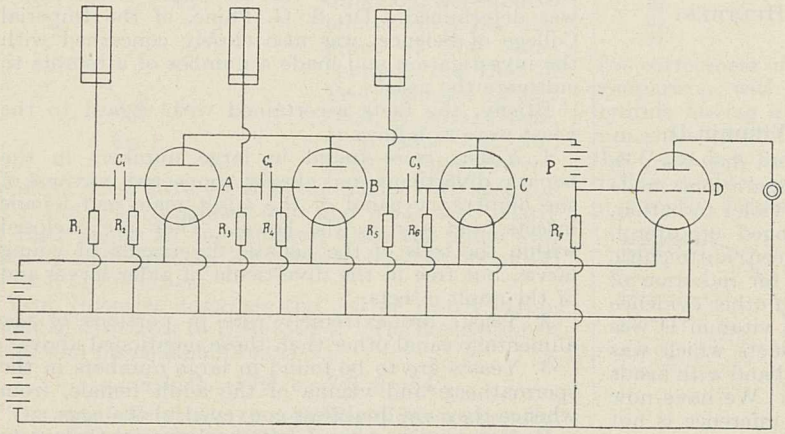

FIG. 1.

simultaneous impulses or even more. The circuit adopted (for triple coinciding impulses) is shown in the accompanying diagram (Fig. 1).

R_1, R_3, $R_5 = 5 \times 10^9$ ohms.
R_2, R_4, R_6, $R_7 = 8 \times 10^6$ ohms.
C_1, C_2, $C_3 = 10^{-4}$ μF.

The positive electrodes of the three counters (in my experiments I have used Geiger's wire counters) are electrostatically coupled to the grids of the three valves *A*, *B*, *C*. In normal conditions these grids have a zero potential; whenever a discharge occurs they become negative, thus interrupting the current flow.

As the resistance R_7 is very great compared with the internal resistances of the valves *A*, *B*, *C*, their anodes are at a potential near to zero. The grid of the valve *D* (for the introduction of the auxiliary battery *P*) is at a slight negative potential. This potential varies very little when only one or two counter tubes are working, while it undergoes a sudden rise when, for the simultaneous working of the three counter tubes, the current is interrupted in all the three valves.

The consequent variation of the anode current (eventually amplified by a fifth valve) is acoustically detected by a telephone.

The circuit arrangement, in regard to the counter tubes, is perfectly symmetrical, a condition which is not fulfilled in the circuit of Prof. Bothe, because the grids of the two-grid valve have rather different characteristics.

It appears that the triple coincidences method is the only one available for studying the form of the paths of cosmic rays, and I mean to employ it in experiments on the magnetic deviation of these radiations.

BRUNO ROSSI.

Physical Institute of
the University of Florence,
Arcetri, Italy, Feb. 7.

The Conversion of α Benzilmonoxime into the β Oxime by Animal Charcoal.

DURING the course of an investigation into the properties of the isomeric monoximes of benzil, we have made the following somewhat startling observation.

We have been able to devise a method for estimating mixtures of the α and β oximes and have shown that the α oxime shows no appreciable change into its isomer (which is the more stable of the two) in solution in alcohol or benzene at 50° in a period of thirty-six hours, and that the change is not accelerated by acids or alkalis when present in small concentration. On the other hand, if a benzene solution of the α oxime is boiled with animal charcoal for a few seconds, the change is complete and no α oxime can be detected in the solution.

Finely powdered soft-wood charcoal and powdered silica gel showed no such effect, the α oxime being recovered unchanged. Finely divided calcium phosphate is also without action. That the conversion does not arise from the action of catalysts dissolved from the charcoal by the benzene is shown by boiling some benzene with animal charcoal, filtering off the charcoal, and using the filtrate as a solvent for the α oxime; there is no conversion into the isomer.

This observation suggests that care should be exercised in the use of animal charcoal as a decolorising agent in the purification of isomers of the type of this α oxime. A full account of our work on this subject will be published later elsewhere.

T. W. J. TAYLOR.
SALLY MARKS.

The Dyson Perrins Laboratory,
Oxford, Mar. 17.

Fluorescent and Phosphorescent Substances.

SUBSTANCES which fluoresce strongly under the influence of X-rays are barium and magnesium platinocyanides and cadmium tungstate. The formulæ of these compounds, as given by Werner, are as follows:

$[Pt(CN)_4][Ba(H_2O)_4]$,
$[Pt(CN)_4][Mg(H_2O)_7]$,
$[WO_4]Cd$.

An atom of high stopping power with four light atoms or radicals arranged about it, perhaps tetrahedrally, and a bivalent positive ion, are present in all.

With the first part of the formulæ may be compared the structure of zinc sulphide and diamond, which phosphoresce in X-rays; phosphorus and yellow arsenic exhibit phosphorescence on oxidation, and arsenious oxide is luminous on crystallisation from acid solution.

J. R. PARTINGTON.

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The Medical Research Council.*

IN the fifteenth annual report of the Medical Research Council, the opportunity is taken to review the progress of the past five years as well as the work of the year 1928–29. Certain changes in the composition of the Council occurred during the year: the late Lord Balfour resigned the chairmanship and was succeeded by Lord D'Abernon: Sir Charles Trevelyan, Prof. E. P. Cathcart, and Sir Charles Sherrington retired, and were succeeded by Major A. G. Church, Prof. J. J. R. Macleod, and Mr. W. Trotter.

The financial resources of the Council have again been augmented by donations from private benefactors and various public bodies: at the same time, grants have been made to numerous workers at university and other centres of research and the laboratory facilities provided by these authorities have indirectly extended the resources of the Council. In addition to appointing annually suitable workers to the Rockefeller Travelling Medical Fellowships, the Council during the past year has received a donation from Mrs. Odo Cross for the endowment of research fellowships for the study of tuberculosis.

The title of the Industrial Fatigue Research Board has been changed to the Industrial Health Research Board, since its investigations are now chiefly directed towards problems other than fatigue as such. Among other changes in the constitution of the Board, Lord D'Abernon has retired from the chairmanship and has been succeeded by Sir Arnold Wilson.

The report points out that at no time has a capital grant been made to the Council for the provision of laboratories and equipment: the National Institute and the field Laboratories have been acquired and equipped out of income. The former was bought in 1914 out of monies derived from non-expended income in the first year of work before any awarded grants became effective: during the War, the building reverted to its original use as a hospital; after the War, scientific equipment for the Institute and a freehold site of nearly 40 acres at Mill Hill were acquired out of savings accumulated during the War. Further equipment has been gradually provided out of income, a laboratory building at the farm from a bequest by the late Miss O. H. Stubber, and during the past year a much-needed extension to the Institute from a bequest by the late Lord Justice Ronan. The latter was designed to give the highest standard of hygienic conditions for the keeping of experimental animals: its completion brings the National Institute as a whole, including the Farm Laboratories, to a stage of development which may be expected to provide all the main requirements for the research work centralised here for many years. With the increase in accommodation provided by this extension, it has now been possible to remove the unsightly huts from the grounds of the Institute.

One of the most important functions of the Council is the establishment, maintenance, and distribution of standards for certain remedies, the activity of which can only be measured by biological methods. This work involves the preparation of stable standards and the determination of suitable methods of biological assay, as well as the checking of the activity of new preparations of the standard, especially in terms of an international standard, where such exists. The following national standards are required to be kept at the Institute under the Therapeutic Substances Act 1927: diphtheria antitoxin, tetanus antitoxin, anti-dysentery serum (Shiga), tuberculin, insulin, pituitary posterior lobe, arsenobenzene, novarsenobenzene, and sulpharsenobenzene. All these are based on the international standards, of which those for tuberculin and insulin were actually prepared at the Institute. The international standards now held there for maintenance and general distribution are those of insulin, sulpharsenobenzene, digitalis, and ouäbain. National standards for the two latter are available for distribution when any authority shall require them. The only commercial products which are now regularly tested at the Institute before issue are the drugs of the arsenobenzene group, but samples of the other scheduled substances prepared by the manufacturers and assayed in terms of the standard are periodically tested to see that they fulfil the specified requirements of potency, sterility, etc.

The fact that most of the research work supported by the Council is conducted in the laboratory raises the question, Is there a science of experimental medicine, of which the material for study is the human patient? Clinical research can only rarely be carried out by a practising physician: his work is to diagnose the condition from which the patient is suffering and to treat it, for which he must have a wide knowledge and experience of disease. The advancement of scientific knowledge cannot be his primary object. The clinical research worker, on the other hand, can devote his attention to one particular disease or group of diseases, and need not maintain his knowledge and skill at concert pitch over the whole clinical field. He must tend to ignore the individual patient and study the disease process as such by experimental methods, whether at the bedside or in the laboratory. Again, it is clear that the teaching of general medicine is incompatible with a whole-time devotion to the study of one small corner of this field. It is for this reason that the clinical 'units' set up in certain teaching hospitals have been unable to carry out much research work although they have served as excellent centres for the teaching of clinical medicine.

Fifteen years ago the Council set up a clinical 'research unit' at University College Hospital, London, appointing Dr. (now Sir) Thomas Lewis as whole-time director and providing adequate personnel and facilities for his work. The success of this experiment answers the question asked

* Committee of the Privy Council for Medical Research. Report of the Medical Research Council for the year 1928–29. (London: H.M. Stationery Office, 1930.) Price 3s. net.

above : there is a science of experimental medicine. The work of Sir Thomas Lewis and his collaborators on the heart and vascular system, its disorders and their treatment, has constituted the central stream of progress made in these subjects during the past decade. For similar advances in other directions it is essential to recruit clinical research workers, but men will not be attracted without the possibility of some definite post in clinical research being available to them in the future, which is not the case at present. The Council therefore proposes to increase the number of clinical workers upon its permanent staff as soon as suitably-trained candidates who have shown their aptitude for this type of research are available. Meanwhile, the Council is prepared to encourage young workers to test themselves in this branch of medical research with the view of its becoming their life-work.

The vascular response of the skin to injury has been further investigated during the year. The vessels in the frog's tongue react to injury in the same way as those of the human skin, but do not respond to histamine. A substance, probably a base of the histidine-arginine series can, however, be extracted from frog's skin which will reproduce the vascular reactions of injury not only in the frog's tongue, but also in the human skin (Grant and Jones). This result confirms the previous conclusion that the reaction to injury consists essentially in the liberation from the cells of the skin of histamine or some similar substance. Similarly, the demonstration that acetylcholine can be isolated from the spleen is evidence in favour of its actual liberation in the tissues following certain kinds of nervous action, when the results of such nervous stimulus can be duplicated by the injection of acetylcholine (Dale and Dudley).

In this review it is impossible to refer to more than one or two of the other researches which have been carried out by members of the scientific staff of the Council or by independent workers helped by grants-in-aid : abstracts of these researches, together with references to published papers, are given in the report. Work on virus diseases has been continued : the difficulty of making rapid progress is due to the fact that they cannot yet be grown on artificial media, although some will grow *in vitro* in the presence of a piece of surviving tissue. The present position with regard to viruses is rather like that facing bacteriologists fifty years ago before adequate methods of microscopic study and cultivation had been worked out. More progress has been made in the devising of methods of immunising animals to these diseases, and it is now possible to immunise dogs to distemper, fowls to fowl plague, and monkeys to yellow fever.

Research on chemotherapeutic agents is being actively pursued : certain aromatic amides containing arsenic have a pronounced curative action in some types of trypanosomiasis, as well as some new styryl compounds : the latter are being tested against trypanosomiasis of cattle in Tanganyika Territory.

Finally, among other subjects referred to in the report may be mentioned work on cancer and radium, anæsthetics, the vitamins, and the physiological actions of different types of light.

The Deutsches Museum, Munich.

THE Royal Commission on National Museums and Galleries in its Final Report, of which, as a whole, we had something to say in our issue of Feb. 1 (p. 153), deals with individual institutions. We are particularly interested in those which are wholly or partly of a scientific character, and we notice that the Commissioners in dealing with the Science Museum direct pointed attention to the Deutsches Museum von Meisterwerken der Naturwissenschaft und Technik, to give it its full title, "not only because it is in itself a remarkable example of how a modern Museum can be made a great instrument of technical as well as of popular instruction, but because it is a symbol of national efficiency. It reveals the intense concentration in the Germany of to-day on the scientific means of industrial progress, a concentration which we believe has its sharp significance for this country." We are pleased, by the way, to see that the Commissioners commend to the nation the scientific attitude of mind, for it is one that we try year in and year out in these columns to inculcate.

Perhaps, then, we can scarcely do greater service to our readers than to place before them a brief account of the Deutsches Museum. Its aim is stated succinctly and correctly in the words of the Report : to illustrate "the development of research and discovery of every age and of all countries, an Institution in which the results of scientific research and experiment should be fully shown. . . . But beyond this another purpose has been kept in view. The Museum is to be a great instrument for the education of the visitor. He must not only be informed by studying the exhibits as to the growth and progress of a subject, but as far as possible he must be put into a position to realize and verify, through experiments performed by himself, the steps by which the progress has been achieved." Such is the example held up to us for emulation.

A short account of the Museum was published in NATURE in 1925 (Vol. 115, 611), when the Museum was about to be formally opened, and it is unnecessary, therefore, to repeat the history beyond saying that the institution, contrary to what one might expect in Germany, is neither State owned nor State governed. It owes its inception and management up to the present to Dr. Ing. Oskar von Miller, a distinguished electrical power engineer, and it is an open secret that the idea of forming a museum of this kind was implanted in his mind when, as a young man, he visited the Loan Collection of Scientific Apparatus at South Kensington in 1876. He pondered the idea for more than a quarter of a century until he felt able to put his

plans before the technical and scientific public of Germany. The scheme was approved unanimously and work was at once commenced in temporary premises. The permanent building, of a model of which, prepared last year, we give an illustration (Fig. 1) kindly supplied by Dr. von Miller, together with a ground plan (Fig. 2), from the same source, is magnificently situated on an island in the River Isar, on which the city of Munich stands. The Museum was opened with almost princely splendour on May 7, 1925, the seventieth birthday of the founder and director.

The building is rectangular in plan, 345 feet by 325 feet, and the whole of the area on the ground floor is given up to exhibition space, side and top lighted. The basement, of the same extent, is

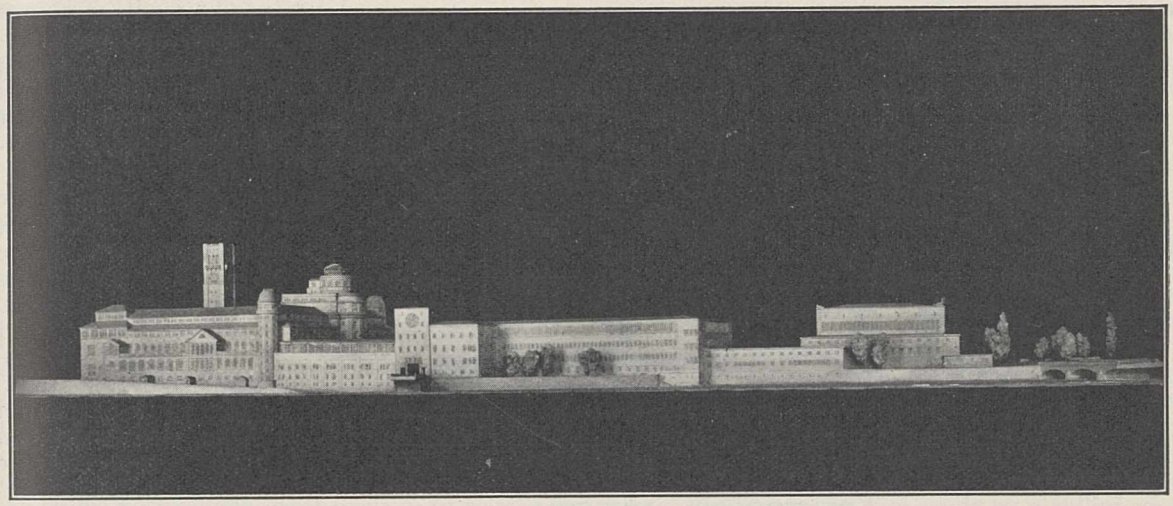

Fig. 1.—The Deutsches Museum, Munich.

taken up partly by exhibits, partly with workshops and the necessary museum services. A sub-basement is used to set out coal, mineral, and salt mines. On the first floor the building is brought to the form of a hollow rectangle with a median gallery, which in common with the two galleries parallel to it are 68 ft. wide; the galleries at the ends are 57 ft. wide. The second, third, and fourth floors are repetitions of the first without the median gallery. At the south-west angle is a noble tower used for a barometer and lift. At the north-east angle a fifth and a sixth floor have been built for astronomy. In all there is a grand total of 387,000 sq. ft. of public floor space. Both electric heating and lighting are supplied free by the city of Munich from a transformer station fed from the great Walchensee grid supply, in the origination of which von Miller himself was largely concerned.

The way in which the building was carried out, mainly in the post-War period of financial instability, reads like a romance. The aggregate for the reinforced concrete came from the bed of the river; the cement, stone, wood, and steel were given, the professional men received no fees, and the workmen even worked on Sundays for nothing. The result is a building estimated to have cost $1\frac{1}{2}$ million pounds.

The Museum galleries are subdivided by partitions into spaces each sufficient for the section concerned, which is thus marked off from the rest, at the same time affording space for wall cases or diagrams. In museum fittings there is no rigidity; everything seems designed to suit the particular circumstances.

On the first floor over the entrance is a Hall of Fame, where memorials to the great men of science are set up. This human touch is everywhere, for lesser men are commemorated in the sections where their labours are recorded. On the second floor is a reading room with a supply of technical literature and there are four bookstalls. There are also two refreshment rooms.

'Interiors' affording a further human touch are a great feature. These take a variety of forms; for example, a scythe forge of 1803 from the Black Forest; a copy of a Swiss watchmaker's shop with its hand tools, side by side with a portion of a modern factory with machine tools, for comparison; an actual paper mill of the eighteenth century; reproductions of an alchemist's and of an eighteenth century chemist's laboratory; a scriptorium with a monk copying a missal; a fine salon containing the old musical instruments, with a musician in attendance to play upon them.

Interiors of a different order are the two planetaria in the Astronomy Section. We need mention only the Ptolemaic one; by an optical projection apparatus images of the fixed stars of the northern hemisphere are thrown on the domed ceiling of a darkened room and the motion of the heavens during twenty-four hours can be reproduced in the space of four minutes. Further, by another projection apparatus, in conjunction with gearing like an

orrery, the images of the sun, moon, and planets can be thrown on the same dome, and their motion during a whole year reproduced in five minutes. The effect is thrilling and created a furore in Germany, with the result that planetaria have been installed by many of the larger cities.

Since the main function of a museum as usually understood is to conserve objects, we find a great feature made of collections of original apparatus and MSS. of famous workers in science. The wealth of material under this head is remarkable when it is considered how loth to part with it must have been the institutions in which it had hitherto been preserved. It is a tribute to von Miller that he has been able to deflect the policy, only too frequently pursued, of the 'dog in the manger'.

Were there nothing further in the Museum than what we have cited above, we should describe it as an advanced institution of its kind, but little more. We find, however, another feature, and the outstanding one, and that is its direct educational purpose. Everywhere, and more particularly in the Physics Section which has been longest in being and is presumably most mature, the visitor finds experiments described in modern text-books so arranged that he can perform them by himself or with the aid in some cases of an obliging attendant. He can demonstrate natural laws and reproduce some of the more striking results of modern physics. The dictum of Goethe has been acted on: "Es ist nicht genug zu wissen, man muss auch thun." For example, in acoustics the gradual development of our knowledge of sound vibrations is brought out by experiment. The formation of the voice, the action of the ear, the phonograph and gramophone are made clear with working models. In a specially designed room are experiments to hand on the composition and resolution of musical notes. In optics, again, for example, defects of vision are shown by four models of an eye viewing illuminated objects at a distance. In each case the retina is transparent, and the visitor sees from behind the images of the objects projected on it. The first eye is normal; by a slight adjustment of the lens in the eye the near or far distant object can be focused. The second eye is short-sighted; the near object is distinct, the far object is brought into focus by interposing a concave lens. The third eye is long-sighted for the near object; a convex lens has to be interposed. The fourth eye is astigmatic and a cylindrical lens is required for correction. Would any person after seeing this exhibit wear spectacles picked up at random?

In aeronautics is a small working wind channel where, with the aid of an attendant, the lift and resistance of solids can be measured on sensitive direct-reading balances. Selected objects that have the same resistance but are very different in shape, for example, a circular disc and a model of an airship, are tried successively. In section after section one comes across similar experimental apparatus.

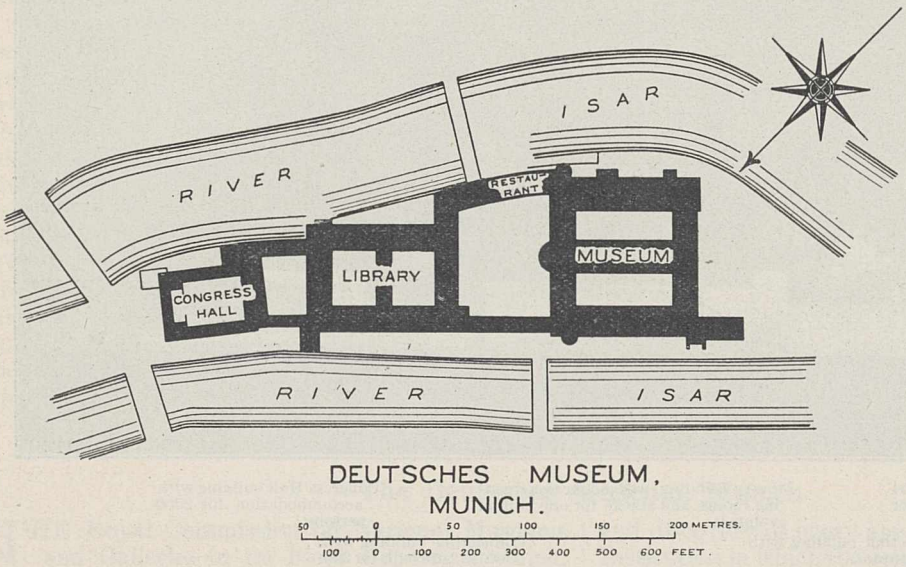

FIG. 2.

There are other activities that we noticed, such as the guide lectures twice daily in the galleries. These are so arranged that practically the whole of the collections are covered in the week. Lantern and film lectures are given in the afternoons.

This, however, is far from completing the story, for von Miller had the further conception of a vast library to contain MSS. and books on science, periodicals, drawings, diagrams, portraits, photographic films, lantern slides and catalogues, in fact to constitute a record office of the march of science, a storehouse of garnered knowledge and of material upon which further research can be made. The Museum really only presents in an assimilable form an epitome of what will be found eventually in the Library. This conception is taking shape rapidly, and the building, adjoining the Museum, yet integral with it architecturally, is being pushed on rapidly so that it may be opened next month. From what has just been said it will be seen that the Library is much greater in extent than the Museum.

Beyond the Library building must be mentioned the Congress Hall with accommodation for 2000 persons. This is provided with arrangements for lantern, silent and sound film projection, as well as for scientific demonstrations.

The building that joins the Museum to the Library has restaurant accommodation, and in the corresponding building between the Library and the Congress Hall are two lecture rooms with

accommodation for 200-300 persons, principally intended for schools and institutions.

As one traverses the galleries and muses on the complexities of civilised life and how little the great bulk of our populations realise, much less understand, the nature of the network of social activities upon which their very existence depends, to say nothing of the conveniences and amusements with which they are surrounded, one cannot help thinking that wise statesmen would see to it that museums such as this should be established in every large territory and that visits to it should be part of the duties of citizenship. Judging from our own reaction to the Museum, it fires the imagination, arouses the creative or inventive instinct, deepens the sense of responsibility to one's fellows and leads to a determination to add if possible to the common weal.

What lessons has the Museum to teach us, particularly in regard to developing the Science Museum at South Kensington? Let us remember that it was in Great Britain three-quarters of a century ago that the idea originated that a museum must not be a storehouse merely, but also a direct means of education. Without slavish copying, and bearing in mind the serious limitations imposed by the nature of the present site at South Kensington, we suggest that considerable extension of the experimental apparatus should be made. Further, that the human note should be sounded by paying greater attention to the lives of the great men who have left their mark on this age of ours. The addition of interiors, again giving the human touch by showing man in his environment at different periods, is eminently desirable. A planetarium should be installed even if the necessary large outlay —£20,000—upon it should have to be recouped by a special charge for admission.

It is no use complaining of the attitude of the public towards science; that attitude can be changed for the better if we bring science to the public. The success of the Science Museum, judging by the attendances since the present building was opened, shows that response is immediate.

Obituary.

PROF. J. O. ARNOLD, F.R.S.

PROF. ARNOLD, whose death occurred on Mar. 27, must be regarded as one of the founders of the modern metallurgy of steel. It was largely through his efforts that the scientific control of manufacture by chemical analysis and microscopical examination has been generally adopted in the steel industry, whilst his researches have played a most important part in building up our knowledge of the constitution of the alloys of iron. In both these directions he rendered great services to science in general, and to the industry of his adopted city of Sheffield in particular.

John Oliver Arnold was born at Peterborough on Dec. 29, 1858, his father being an engineer by profession. He was educated at King Edward VI. School, Birmingham, and entered the navy as a cadet, but quitted it after a voyage to India, becoming a works chemist at a time when few steel works had such men on their staff. His naval experience left him with a strong love of the sea, and he remained an enthusiastic yachtsman to the end of his life, although the restrictions of the War period compelled him to leave the stormy seas of the west coast and to confine his sailing to the waters of Windermere.

In 1889, after eleven years as a works chemist and consultant, Arnold was appointed professor of metallurgy in the Sheffield Technical School, and here he continued to work until his retirement through ill-health in 1920, the Technical School having meanwhile become a part of the University of Sheffield, with a separate Faculty of Metallurgy, of which Arnold was appointed Dean. On his retirement he was nominated emeritus professor. His work during thirty-one years was intimately bound up with the progress of the Department of which he was the head, and its interests always stood first in his activities. He had to create the demand for trained men in the steel industry, and his enthusiasm enabled him to achieve great success in this direction, so that he had the pleasure of seeing his old students occupying leading positions in industry, and themselves carrying out researches in his favourite science.

On the scientific side, Arnold's work followed on that of Sorby, whose friend and disciple he was. He became convinced of the value of Sorby's use of the microscope in the study of steel, and himself did much to perfect the technique of metallography, whilst his discoveries were made by a skilful combination of chemical and microscopical methods. It is remarkable that for many years he made little use of photography in recording the structure of metals, but preferred drawings, many of which were executed with wonderful skill and patience by members of his staff. He was always inclined to prefer a chemical explanation to one which depended on more obscure physical changes, as in his long controversy concerning the causes of the hardness of steel, which he maintained to be due to combination with carbon rather than to the existence of allotropic modifications of iron. The two schools have become reconciled since, but it is impossible to read the earlier papers without realising that Arnold was always close to experience, and that his arguments were invariably based on practical knowledge of the behaviour of steel in the laboratory and in the works. His descriptions of troostite and of what is now called martensite show a remarkable insight, although the terms in which he described the structures often seemed to differ from those in general use. He also added much to our knowledge of the influence of impurities on steel.

Arnold was closely connected with the development of high-speed tool steels, and in this matter he had the closest confidence of the manufacturers. It was due to him that vanadium was adopted as a constituent of the highest class of such steels,

whilst his long series of papers on the carbides threw much light on the influence of alloying elements in special steels. He was frequently involved in controversy, and appeared to enjoy it, his vigorous personality and his command of picturesque English lending interest to his frequent interventions in the discussions of the Iron and Steel Institute. He was elected a fellow of the Royal Society in 1912, and was awarded the Bessemer medal of the Iron and Steel Institute in 1905. Of fine presence and genial manner, a good talker with a fund of humour, he was devoted to the interests of his students and was loved by them. He has left a vivid impression on all who knew him, and his place in the history of metallurgy will be a high one. C. H. D.

SIR EDWARD BRABROOK, C.B.

WE regret to record the death of Sir Edward W. Brabrook, which took place in his ninety-first year at Wallington, Surrey, on Mar. 20. Within the space of one week, two prominent survivors of the Victorian Age in the learned world, Edward Clodd and Edward Brabrook, passed away at an advanced age. They had much in common: both were men of affairs, both were interested in anthropological studies, especially folk-lore, and both were members of the circle in which were Huxley, Avebury, Sir John Evans, Pitt-Rivers, E. B. Tylor, and others upon whom in the latter half of the last century fell the burden of winning for anthropological studies an independent and recognised place in the academic and scientific world. It was only in 1884 that anthropology was granted a separate section at the annual meeting of the British Association. In this struggle—for it was little less—Brabrook took his full share.

Edward William Brabrook was born in Cornhill, London, on April 10, 1839. He was educated at the school of Mr. William Pinches, Bell Alley, Lombard Street, and then entered an insurance office; but in 1869 he was appointed Assistant Registrar of Friendly Societies. Later he was called to the Bar. A Civil Servant of the best type, his official career calls for little comment. He was appointed Chief Registrar in 1891, and retired under the age limit in 1904, having been created C.B. shortly before and receiving the honour of knighthood on retirement. A recognised authority on the subject of thrift, his writings on friendly societies and State insurance, and particularly his review of the progress of friendly societies down to 1914, which appeared in the *Journal of the Statistical Society*, are classics in their field, even though the author adhered to the idea of 'self-help' at a time when in practical politics the view of the responsibility of the State had ceased to be restricted by that principle.

Brabrook's activities were by no means confined to his official duties. Indeed, it was outside the range of those duties that he was best known and perhaps will best be remembered. He was a man of many friendships, and these lay where his intellectual interests called him—in the learned world, and especially in the world of anthropology and archæology. In 1860 he became a fellow of the Society of Antiquaries, and soon after the foundation of the Anthropological Society by Sir Richard Burton and George Hunt in 1863, as the result of a split in the Ethnological Society, he became the director or honorary secretary of the newly formed body. He thus came to take a share in the controversies and discussions between the two divergent views on the scope and methods of anthropological science which were finally composed by the foundation of the Anthropological Institute of Great Britain and Ireland in 1871. In this, as in the many other societies he helped to found, and in the work of which he took an active part, Brabrook's position was unique. By his knowledge of procedure and of the technicalities relating to associations "not trading for profit", he was able to guide them through the difficulties of their early days, while his interests over a wide field of research, combined with his abilities and experience as an administrator, made him an invaluable aid in the promotion of combined action in scientific studies which led to the publication by the British Association of "Notes and Queries on Anthropology" and to proposals for anthropological and ethnographical research in Great Britain and in the dependencies, some of which have since borne fruit, while others, unfortunately, are still the objects of desire of the anthropologists of to-day.

It was these qualities, as much as his scientific knowledge, which made Brabrook a valued member of the governing bodies of the Anthropological Institute, of which he was director in 1873 and president in 1895–97, of the Folk-Lore Society, founded in 1878, of which also he was president in 1901–2, of the Child Study Society, of the Eugenics Education Society, and of the Rationalist Press Association. In 1898 he was president of Section H (Anthropology) of the British Association at Bristol, an occasion made notable by the appearance of de Rougemont, and in 1904 he was also president of Section F (Economic Science and Statistics). So late as 1920–21 he was president of the South-Eastern Union of Scientific Societies.

Apart from subjects related to his official duties, upon which he wrote three books, Brabrook's voluminous writings are, for the most part, scattered in the publications of the many societies to which he belonged; but he wrote a history of the Society of Literature, several legal treatises, and a history of the dining club of the Society of Antiquaries, of which he had long been a member.

PROF. EUGENIO RIGNANO.

EUGENIO RIGNANO was born on May 31, 1870, at Livorno in Italy. His education was almost wholly physical and mathematical, and after graduating from the University of Pisa he obtained full engineering qualifications in 1893. Instead of practising this profession, however, he devoted himself to philosophical studies, being particularly interested in the borderline between philosophy and science, especially biology. In later life he

was appointed professor of philosophy at the University of Pavia, although he had never officially taught that subject. In 1906, Rignano was able to bring into being a scheme he had long cherished, namely, the foundation of an international journal dealing with the theoretical aspects of science and its relations with other realms of human experience. Under the name of *Scientia* this journal continues to flourish, and Rignano edited it himself until his death on Feb. 9 last. Towards the end of his life he was the recipient of numerous honours; in 1920 he was the Michonis Lecturer at the Collège de France, in 1923 he was named corresponding member of the Institute of France, and in 1926 of the Academy of Madrid.

Rignano's early association with engineering conferred a quality upon all his thought and writings which they never lost. Instead of constructing bridges across material ravines, he was constantly eager to bridge the gulfs which separate opposing positions in philosophy, and in this process merely destructive criticism was useless to him. Invested with a pre-eminently cross-bench mind, he approached each new opposition with only one prejudice, namely, that in all probability both sides would be partially right. Although in many cases his diagnosis of where they were wrong did not commend itself to other students, the example which he gave of creative synthesis of antinomies always merited the utmost praise.

In biology Rignano's efforts were all directed to mediating between the ancient enemies of vitalism and mechanism. He recognised on one hand that mysterious postulates such as the entelechy were admissions of the bankruptcy of our notions of causation, but, on the other hand, he felt that teleological considerations were too closely bound up with the phenomena of life to come unstuck, as it were, from them, even through the powerfully solvent action of the study of scientific method. Final causes were not, however, interpreted by Rignano in an Aristotelian manner, that is, as existing posterior in time to the events caused; his teleology was based on a postulated mnemonic quality on living organisms, which he called 'specific accumulation'. With the aid of this hypothesis, and of one or two others, such as the attribution of a separate form of energy, equivalent to heat or mechanical energy, to living systems—a form which would be transmutable into any of the others, following the principles of conservation, and yet would not be measurable since no apparatus had been devised for measuring it—Rignano constructed a complete theoretical biology. 'Energetical vitalism', as he called it, bridged the gulf between the disputants by retaining what was best from each, but it cannot be said to have won general approval, and is perhaps more valuable in its example than in its essence. It is fully described in Rignano's "On the Transmissibility of Acquired Characters: Hypothesis of a Centro-Epigenesis", "Biological Memory", "The Finalistic Aspect of Life", "What is Life?" and "Man Not a Machine".

In other fields Rignano's passion for synthesis and the abolition of contradictions appeared equally clearly. In his "Problems of the Psyche", he attempted to conciliate English 'Associationism' on one hand and German 'Gestaltism' on the other, demonstrating that at least potential activity impregnates all the manifestations of thought. In his "A Socialism in accordance with Liberal Economic Doctrine" he intervened between the elementary social justice to which the socialist critic appeals and the Utopian and impractical character of collectivism and other socialist systems, in order to advocate a gradual nationalisation of private capital by means of new laws relative to the right of testation. Finally, in the domain of ethics, he faced seriously the conflict between the morals of paganism and of ascetic Christianity, and in his "The Purpose of Man" proposed an ethical system founded on the harmony of life. His death is a severe blow to the constructive forces in philosophy at the present day.

Joseph Needham.

Mr. Charles Edgar Salmon, the well-known systematic botanist, whose sudden death occurred on Jan. 1, 1930, was born on Nov. 22, 1872. He was an architect by profession and had an extensive practice in the Reigate district. Salmon was essentially a field botanist with a wide knowledge of the British spermatophytic flora, to the study of which he had devoted most of his leisure time for many years. A considerable number of papers in the *Journal of Botany* and elsewhere testify to his industry and the part he played in advancing the study of British flowering plants. In addition, Salmon was an authority on the sea-lavenders (*Limonium*), and at the time of his death was correcting the proofs of a flora of his own county of Surrey. He was an active member of the Linnean Society and served on its Council from 1920 to 1923. His extensive herbarium, including part of the collections of the late Mr. Arthur Bennett, has been bequeathed to the British Museum (Natural History). His many colleagues will miss, first the help he was always willing to give in identifying species of the many genera with which he had worked and, above all, a genial unselfish friend remarkable for his amiability and sense of humour. W. B. T.

We regret to announce the following deaths:

Dr. Henry J. Cox, senior meteorologist in charge of the north-central forecasting district and corn and wheat region service of the U.S. Weather Bureau, on Jan. 7, aged sixty-six years.

Sir Gordon Guggisberg, K.C.M.G., until recently governor and commander-in-chief of British Guiana, formerly surveyor-general of Nigeria, and author, with the Rev. A. G. Fraser, of "The Future of the Negro", on April 21, aged sixty years.

Dr. R. M. Pearce, director of the Division of Medical Sciences of the Rockefeller Foundation, on Feb. 16, aged fifty-five years.

Mr. P. A. Ralli, chief aerodynamic expert and technical engineer for many years of the Fairey Aviation Company, who was known for his studies of air screws, on April 17, aged forty-one years.

News and Views.

PROF. SMITHELLS, the retiring president of the Institute of Chemistry, discussed in his presidential address, which has recently been published, a matter which has become one of some concern to students, to teachers, and to employers, namely, the ever-increasing load put upon professional chemical students. The knowledge of inorganic, organic, and physical chemistry with which the student to-day is expected to equip himself, usually within a period of three academic years, forms in its content of fact and charge on the memory a burden which Prof. Smithells estimates to have nearly doubled during his own experience. Whilst willing to admit that the capacity of succeeding generations expands, he does not believe that in such a brief period of human evolution the powers of apprehension or of memory have become doubled; he therefore anticipates that, as a result, there will be undigested knowledge of what are thought to be the higher things of chemical science, and, worse still, a superficial knowledge or entire ignorance of simpler things.

PROF. SMITHELLS' own experience of the results derived from modern chemical curricula will find support in the experience of many of his professional colleagues both within and outside university chemical departments, and students themselves would be the first to admit that the width and depth of the studies now required of them in preparation for a first degree leave little opportunity for independent thought or for the free culture of the chemical arts. Pressure similarly falls upon their instructors, who are too frequently condemned to spend their time term by term doling out partially predigested and ever-growing masses of fact and theory in the hope that an adequate proportion will be retained long enough for examination purposes. Specialist instruction properly finds its place in modern teaching institutions. It is, of course, their function to disseminate what is erudite as well as what is simple and fundamental, to test all kinds of facts and theories, and to advance knowledge in every branch of learning. Prof. Smithells insists, however, that there is a limit to what may be rightly imported from new provinces into the common stock of what purports to be general chemical training. In his experience a teacher reluctantly jettisons old cargo to make room for new, and since at the same time the last charge he would wish to lie against him is that of not keeping up with the times, the courses tend to become overloaded, the pace too great, and the foundation ill-laid.

PROF. SMITHELLS thinks that we have unwittingly allowed a good deal to come into our general courses of instruction that should be left for a subsequent period of specialisation. In pleading for a slackening of the pace, he feels that we are sacrificing not so much any particular kind of knowledge as the conditions under which sound knowledge can be acquired. He is, however, speaking of the training of professional chemists whose national responsibilities will in due time be so much greater than formerly, whose capacity will determine in no small measure the industrial future of their country. Hence we would wish that Prof. Smithells had laid greater emphasis on his statement that the young chemist is now often not kept long enough or exercised sufficiently in the wider territory of the science. At least as long a road must be travelled whether the pace is moderated or not. Students differ widely in their ability to assimilate what is presented to their minds and to their memories, but on the whole we feel that a case for such moderation has been made out. If the sound fundamental training in the science, involving as it must do the basic principles of the most recent achievements as well as the older philosophy, cannot be acquired in three years, extension of the course for a first degree would be preferable to contraction of the field of vision.

NOMENCLATURE in chemistry is so devised as to reflect constitution and behaviour as concisely and as accurately as possible. Among the more or less unsatisfactory names which chemists have inherited from an earlier age is the word 'chemist' itself; not that it does not describe concisely and accurately one who, in the definition employed by the "Encyclopædia Britannica", "for pleasure or profit concerns himself with the acquisition of information relating to the composition of bodies and the changes of composition which they undergo". The dissatisfaction arises from the fact that the law of England says that it means something quite different. The use of the title by anyone who is not a registered pharmacist is, indeed, an offence, being prohibited generally by the Pharmacy Act, 1868. The prohibition is not, of course, enforced, but is for that matter none the more seemly. None will deny that it is essential that the public should be protected, and proper that the profession of pharmacy should be closed to all but properly qualified persons—if need be by the grant of an exclusive title. It is mentioned in a recent issue of the *Journal and Proceedings of the Institute of Chemistry* that representations were made on the subject to the Departmental Committee on the Poisons and Pharmacy Acts. The Report of that Committee shows that the continuance of the anomaly is considered to be undesirable. Pharmacists raise no objection to the use of the title 'chemist' by certain qualified, though unregistered, persons, except in connexion with a retail business. The relinquishment of the title (in favour, for example, of 'pharmacist') by registered pharmacists was, however, considered to be impracticable from the point of view both of the expense involved in the alteration of signs and fascias, and of the popular connotation of the word itself.

AT his death in 1880, Frank Buckland left to the nation his Museum of Fish Culture, which is now at South Kensington, and a reversionary sum of £5000 with which to endow a professorship of economic fish culture. The first-fruits of this Buckland Foundation

were recently reaped when Prof. W. Garstang, of the University of Leeds, as Buckland professor for 1930, delivered the first course of fisheries lectures at Grimsby and Hull, an abstract of which appears elsewhere in this issue. Remembering Prof. Garstang's pioneer work in the transplantation of plaice from the nurseries off the coast of Europe to the rich feeding grounds of the Dogger Bank, it is singularly appropriate that he should have been chosen as the first to remind us of the life and work of Buckland, who early envisaged the 'farming' of the seas, just as the agriculturist farms the land. One wonders what action Buckland would have advocated had he possessed the knowledge which has been acquired since his death and forms the subject matter of Prof. Garstang's later lectures. Would he have agreed with Prof. Garstang that the solution of the plaice problem in the North Sea lies in transplanting every year some millions of the small, overcrowded, and slow-growing fish from the coastal banks to the Dogger? Furthermore, having agreed, would his great personal assets of earnestness and imperturbable humour, so helpful in negotiations, have enabled him to induce the traditional enterprise of the great Humber fishing ports to take up the matter of transplantation as a commercial proposition? Whatever the answers to these questions may be, the annual Buckland lectures will keep fresh the memory of a life devoted to the turning of natural history into practical channels, and will perform an additional service in indicating current progress towards the ideal of a rational exploitation of the resources of the sea.

THOSE who, knowing the range of Prof. P. Debye's interests, and his remarkable linguistic powers, attended the Guthrie lecture of the Physical Society delivered by him on April 11 in the expectation of hearing original views delivered freshly and vigorously, were not disappointed. Prof. Debye has left his mark on modern science at many points, and it may be said of him with more truth than is to be found in most eulogiums, *nullum tetigit quod non ornavit*. The debt of the chemist to him is a specially heavy one. The theory of strong electrolytes was ever a difficulty until he took the matter in hand, and now his researches on X-ray scattering promise equally to smooth the path of the organic chemist. The scattering of X-rays by the vapour of carbon tetrachloride and allied compounds formed the main part of Prof. Debye's discourse. An elementary investigation in which the effect of the carbon atom is neglected in comparison with that of the more massive chlorine atoms (considered as points) leads to an expectation of maxima of intensity in certain angular directions, which is confirmed by experiment. A closer approximation may be made by taking into account the dimensions of the atoms, and the distance between the atoms calculated from observation of these maxima is in good accord with values obtained by independent methods. More remarkable even, as illustrating the agreement between two quite independent arguments, are the results deduced from experiments made on *cis-* and *trans-* compounds. Here the different distances between the chlorine atoms in the two forms as given by the structural formulæ of the organic chemist are faithfully reflected in the distances calculated from the results of Prof. Debye's experiments. If any one lesson may be drawn from his discourse, it is that the sciences cannot live in water-tight compartments, and that organic chemistry in particular needs all the assistance that modern mathematics and physics can give. The address, delivered in fluent and idiomatic English, was most happily balanced in its account of theory and experiment, and will live long in the memories of those who were privileged to attend it.

AT the annual meeting of the East African Section of the London Chamber of Commerce on Mar. 19, several matters of importance were dealt with. A start has now been made with aerial surveys in East Africa, a subject to which the Section has devoted much attention during the last year or two, and it is probably largely through its efforts that the survey of Rhodesia has been decided on, for which purpose Mr. Butler, chairman of the Aircraft Operating Co., left Heston on Mar. 20 in a large Gloster biplane of new type for the aerial survey of 63,000 sq. miles in Rhodesia. It is hoped that other similar surveys will shortly be made in East Africa, for, as already pointed out in a memorandum which the Section submitted to the Council of the London Chamber of Commerce, such surveys are of the utmost value to a new and progressive country. They are much more comprehensive and rapid than those on land, and are especially useful in connexion with the mapping out of routes for new roads and railways, of areas suitable for intensive development, forests, river courses, and much else. The cost of these surveys could be looked upon as capital charge, and could doubtless be met from loans either under the East African Guaranteed Loan Act of 1926, or under the Colonial Development Act.

ROAD and rail construction in British East Africa is likely to demand close attention in the near future. The Council of the London Chamber has already adopted a recommendation from the Section that the Government should set up an Imperial Committee to study road transport in Central Africa (Rhodesia to the Sudan) and to make definite proposals for the construction and financing of a satisfactory road and bridge system. The Prime Minister promised to give the matter earnest consideration, and it was further considered at a special meeting last October when various technical experts were present. It is suggested that the vast areas in East Africa can only be opened up adequately by a carefully designed road system as an adjunct to the railway system; and so far little attention has been given to roads especially in Kenya and Tanganyika. There have been several complaints as to the roads in Kenya of late, and the recent floods in Tanganyika have of course played havoc with the road system in that country. According to the *East African Standard*, Mr. G. H. Moore, Director of Roads, etc., in Kenya, and also other authorities, are giving the matter very close attention, and the possibility of a loan for a large programme of road construction is under discussion.

AT the general meeting of the Rubber Growers' Association (Inc.) on April 11, the chairman, Mr. G. H. Masefield, gave the following figures regarding the use of rubber in recent years. The absorption of crude rubber during 1920 was 310,000 tons, of which the United States used 215,000 tons and the rest of the world 95,000 tons. By 1925, these three totals were 435,000, 315,000, and 120,000 tons respectively, while by 1929 the corresponding figures were 785,000, 470,000, and 315,000 tons. During the last nine years, he said, the world consumption has increased by 153 per cent; the consumption of the United States by 119 per cent, and that of other countries by 232 per cent. The Association, the constituent companies of which control 1,812,000 acres planted or interplanted with rubber, takes an active part in the work of scientific research in Malaya, Ceylon, South India, and in the Netherland East Indies, and, said Mr. Masefield, "There can be no question that research work will become an increasingly important factor in the future, and it will be to the scientists that we must look if we are to avoid and combat the dangers that are likely to threaten the industry when we face on the one hand huge areas of plantations run on scientific lines, and on the other an almost equal area of rubber planted haphazard in small holdings on which disease in many cases is likely to become completely out of hand".

IT is announced that the Second International Congress of the History of Science and Technology is to be held in London in July 1931. These congresses take place biennially and are organised by Le Comité International d'Histoire des Sciences, which was founded at Oslo on Aug. 17, 1928, and the permanent secretary of which is Prof. Aldo Mieli. The aim of the Congress is to provide opportunity for intercourse and exchange of thought between all those who are interested in any aspect of the history of science and technology. The co-operation of the three international societies which cover this field of learning, namely, the History of Science Society, the Newcomen Society for the Study of the History of Engineering and Technology, and Le Comité International des Sciences Historiques, has already been assured. A number of influential men of science are giving their support, and a council is now being formed to further the aims of the Congress. A programme is being arranged to cover a period of five days, during which scientific communications will be received, visits to places of historic interest will be made, and social gatherings will be held. The headquarters of the Congress is at the Science Museum, South Kensington, S.W.7; the honorary secretary is Mr. H. W. Dickinson, from whom further particulars can be obtained.

THE establishment, on the recommendation of the U.S. National Academy of Sciences, of the new Woods Hole Oceanographical Institution is of much interest and importance. Its purpose is to carry on and encourage the study of the sea in the broadest sense, and funds from the Rockefeller Foundation are available for the building and for a sufficient operating income. It is, like the Marine Biological Laboratory at Plymouth in Great Britain, an independent organisation, but similarly assured of informal association with other educational and research institutions through its trustees. The initial board includes many well-known names, with Dr. Henry R. Bigelow as director and Dr. Frank Lillie as president. After careful consideration, Woods Hole was chosen as the site of the new Institution, the principal reasons being its proximity to the famous marine biological laboratories and its extremely favourable position with regard to the neighbouring waters. Some of the most productive fisheries can be reached in a few hours, and the variety of conditions is unparalleled. It is planned to have a sea-going ship equipped for scientific investigations in all fields of oceanography, capable of extended voyages, to be in commission throughout the year, and to have a resident staff for the laboratory. Plans are already in preparation, and it is hoped that the Institution will be ready to open by the summer of 1931. Meanwhile, the trustees will announce the plans for research based on the general principle of offering opportunities to visitors from America or from other countries, especially for work at sea, and for them to co-operate with the staff in a general programme of oceanographical research, besides giving every facility to individual workers on shore. It is hoped also to offer instruction to university students in oceanographical methods both at sea and in the laboratory. This institution will be a welcome addition to the resources of oceanographical studies.

THE gorilla expedition, organised under the joint auspices of the Carnegie Institution of Washington and Yale University, which set out last June for Central Africa, has completed its work, and a summary of results has been issued by the Carnegie Institution. Dr. Harold C. Bingham and his wife reached the Belgian gorilla reservation in the Kivu region early in August and commenced work at the spot where Carl Akeley died in 1926. They were frequently in contact with various gorilla groups, following them as they fed their way along, carefully recording, for future study, observations on the nests, the feeding habits, the social responses, the nomadic behaviour, and the individual traits of the animals. They took moving and still pictures whenever conditions favoured. The mountain gorilla of this region inhabits the slopes of volcanic peaks at an altitude of 8000 to 12,000 ft., and it is especially in the bamboo belt of the dense forest and for a considerable distance above it, that the gorilla ranges in search of food. This consists mainly of the succulent 'suckers' sent up by the bamboo roots, and of a luxuriant 'wild celery' which attains a height of six to eight feet over extensive areas.

DOUBT has been expressed regarding the nesting habits of the mountain gorilla, some reports stating that nests are constructed in trees, while others allege that they are never built off the ground. Dr. and Mrs. Bingham undoubtedly found, in and below the bamboo belt, that tree nests were built, sometimes as high as fifty feet above ground, and they also found old nests of chimpanzees. The gorilla nests were very simple

affairs, usually made by pulling and breaking down the plants and vines which chanced to be at hand. They gave evidence of being occupied only for a single night during the perpetual wanderings of the gorilla bands. But the explorers are cautious about dogmatising concerning the position of the nests, and suggest that the varying physical conditions in the areas over which the gorillas range may lead to important differences in feeding and nesting habits. They think it probable that changes in climate, in seasons, in rainfall, in temperature, possibly also changes in air currents and the like, may affect the behaviour of the gorillas so that they exhibit significant environmental adaptations.

RUGBY School Natural History Society, as the *Report* for 1929 shows, has greatly increased its adherents by the introduction of popular lectures and exhibits of kinematograph films. On the other hand, the attendances at the specialised sections has fallen off and many of the reports of the secretaries show a very great lack of interest on the part of members in lectures and even open-air excursions. The contrast suggests that it may be mistaken policy to form highly specialised sections (there are twelve in the school) the efforts of which must appeal strongly to very few boys. Boys will have hobbies, and hobbies are to be encouraged, but the place of a school natural history society is not to intensify the notion of specialism and sectionalism, but to keep in the forefront the idea of scientific unity, and to encourage at the school stage the widest possible acquaintance with the various aspects of scientific truth.

COMPARISONS may be instructive, and the Report of the Marlborough College Natural History Society for 1929 has just been received. The Natural History Society here has also its sections, but there are five only, and the enthusiasm of the members is evident. Not only have the sections been well supplied with lectures, but the original records and observations in the ornithological, entomological, and botanical groups cover many pages. More than half the Report (of 120 pages) contains excellent articles dealing mainly with local matters of scientific interest and including a list of the microlepidoptera of the district compiled from the Society's records, a good list of 677 species. From the miscellaneous notes we learn that the grey squirrel has made its appearance in the neighbourhood.

IN the course of a Lucknow University Extension lecture on Nov. 15, 1929, on the interpretation of the Raman effect, a copy of which has reached us, Mr. Satyendra Ray put forward a novel point of view. He looks on the Raman lines as related to an effect which he calls the Bhar effect — namely, that the position of a line in a spectrogram depends upon the intensity of the source, which is taken to prove that the velocity of light is not constant, but depends upon the amplitude, analogously with sound. In experiments on this effect made in 1925 by Mr. Ray using rhodamine solution to weaken the *D*-lines by absorption and so vary the effective amplitude of the source, the *D*-lines shifted different amounts for different concentrations of the rhodamine solution, and for certain critical densities gave rise to a continuous band. This is taken to be connected with the Raman effect, and particular attention is directed to the continuous spectrum often found in Raman spectra. Mr. Ray believes that a classical dynamical interpretation of the Raman effect can be made if it is recognised that the velocity of light is variable, that transformations of frequency are possible, and that combination tones are possible, whether differential or summational.

THE Ordnance Survey has tried the experiment of issuing certain sheets of the maps of Great Britain on a tough waterproof paper. This paper is not merely coated with a waterproof solution but is also impregnated after printing by a process which, it is claimed, renders it absolutely waterproof and washable, and gives it a parchment-like appearance. These claims appear to be justified. The paper is unaffected by water and after crumpling can be ironed flat. Efforts to injure our review copy by any usage to which a map might probably be subjected in the field, failed to make any notable impression. The colour and legibility of the map are fully as good as the usual sheets. The map is not thicker than the paper edition mounted on linen. Undoubtedly this innovation should prove a blessing to those who need to use maps in the open in all weathers. The sheets at present available are the "Tourist" 1 inch sheet of the Middle Thames, several of the "Popular" 1 in. sheets, including some in the Midlands, Surrey, Kent, and Perthshire, and sheet No. 8 of the quarter-inch map of England and Wales. The prices are those of the ordinary edition linen mounted and cut into sections.

AN announcement of the highest importance to museums in Great Britain is made in the April number of the *Museums Journal*. The Trustees of the Carnegie United Kingdom Trust have already shown in the Report issued under their auspices their interest in the progress of the museum movement. As a sequel to that Report they have now announced a practical move to test its conclusions. This limited preliminary experiment is to be carried out in collaboration with the Museums Association, is to cover the five years 1931–35, and is to involve an expenditure of £10,000. The money is to be allocated under a threefold scheme. In the first place, £7000 is to be devoted, in grants of not more than £250 each, to public museum authorities who are prepared to adopt some definite policy and to reorganise their institutions on the lines recommended by Sir Henry Miers in his 1928 Report to the Trustees. The grants are to be confined to towns with between 10,000 and 70,000 inhabitants, may be used for capital expenditure only, will not be available for building purposes, and will probably be offered on a £ for £ basis.

A FURTHER move on the part of the Trustees of the Carnegie United Kingdom Trust is the offer of £3000 for the training of curators; but since the Museums Association is already negotiating with the national museums in London for an experimental school there, the Trustees will take no action until the result of this experiment has been considered. In the third place, the Trustees, after their experience in connexion with the co-operative library service in rural areas, believe that some similar scheme might be the subject of a

useful experiment in the sphere of museums. They therefore propose, with the collaboration of the Museums Association, to explore this possibility. This broadly conceived experiment opens up wide prospects of benefit to the public through the agency of museums, and we wish it every success.

PROF. NIELS BOHR, of Copenhagen, will deliver the Faraday Lecture of the Chemical Society on May 8, taking as his subject "Chemistry and the Quantum Theory". The lecture will be delivered at the Salters' Hall, St. Swithin's Lane, E.C.4.

THE Faraday Medal of the Institution of Electrical Engineers will be presented to Sir Ernest Rutherford at the ordinary meeting of the Institution to be held on Thursday, May 1. The presentation will precede the twenty-first Kelvin Lecture, which will be delivered by Mr. R. H. Fowler on "Some Recent Advances in the Electron Theory of Metals".

THE following appointments have been made at the Museum of Science and Industry, Chicago: Dr. Louis Ehrenfeld, of North-western University, to be curator of organic and industrial chemistry; Mr. Herman R. Eberle, of the Michigan College of Mining and Technology, to be assistant curator of mining; Mr. M. K. Hubbard, of the University of Chicago, to be research associate in geology and geophysics.

SIR WILLIAM BRAGG, Fullerian professor of chemistry in the Royal Institution and director of the Davy Faraday Research Laboratory, who has been awarded the Franklin Medal for his work on X-rays and crystal structure (NATURE, Feb. 22, p. 286), will visit the United States shortly, when he will receive the Medal in the hall of the Franklin Institute, Philadelphia, on May 21 and deliver an address. Sir William will also give lectures at Johns Hopkins University, Baltimore, at Columbia University, New York, and at Princeton University.

PROF. M. SIEGBAHN, of the Physical Institution, Uppsala, referring to the article on the Nobel Foundation in NATURE of Mar. 29, writes to say that when Dr. Nobel was asked to send to the University of Uppsala some biographical details in connexion with the conferment upon him of the honorary degree of doctor of philosophy, he stated that he was a member of the Royal *Institution of London*, and no mention was made of the Royal *Society*. The quotation given in NATURE was from Nobel's "Life", which was translated from the German work. We suggest that though Nobel wrote *Institution* in his note, this was inadvertently understood as *Society* when rendered into German or in the English translation where the word wrongly appears.

THE following medal awards for 1929 and 1930 have been made by the American Geographical Society: *Cullum Geographical Medal* for 1929: Dr. Hugh Robert Mill, formerly director of the British Rainfall Organization; Prof. Jean Brunhes, professor of human geography at the Collège de France, and author of "La géographie humaine", and related works; Prof. Alfred Hettner, professor of geography in the University of Heidelberg, and founder and editor of the *Geographische Zeitschrift*; and Prof. Jules de Schokalsky, professor of oceanography in the Leningrad State University, and president of the Russian Geographical Society. Awards of the Cullum Geographical Medal, given from time to time to those "who distinguish themselves by geographical discoveries, or in the advancement of geographical science", had not been made since 1925. *Charles P. Daly Gold Medal* for 1929: Cav. Filippo De Filippi, secretary-general of the International Geographical Union, who has done distinguished work in exploration; and Prof. Émile Félix Gautier, of the University of Algiers. The Charles P. Daly Gold Medal is awarded from time to time "for valuable or distinguished geographical services or labours". The last award was made in 1927.

FOWL typhoid, an acute infectious disease of fowls, is the subject of a leaflet (No. 39) issued by the Ministry of Agriculture and Fisheries. The symptoms, diagnosis, and spread of infection are described, and directions are given for eradication and prevention.

THE *Journal of the Cancer Research Committee of the University of Sydney* for February (vol. 1, No. 4) contains an article by W. B. S. Bishop on the occurrence and possible importance of the metallic elements in animal and plant tissues. A very useful summary of the subject is given, with a list of 143 references to the literature.

A SECOND edition of "A Summary of Facts regarding Malaria", by Sir Ronald Ross and Sir Malcolm Watson, has been issued (John Murray, Albemarle Street, W., 6*d*.). This pamphlet gives an excellent popular account of malaria, and the parasites and the fever, the mode of infection, and some facts concerning mosquitoes are briefly described. The final pages deal with prevention, personal and public, of the disease.

THE March issue of the *Bulletin of Hygiene* contains a review by Dr. J. D. Rolleston of recent literature on the tobacco problem, including the historical aspects and prevalence of the tobacco habit, experimental work in connexion with nicotine and other constituents of tobacco smoke, the nicotine content of cigars and cigarettes, with special reference to so-called 'denicotinised' tobacco products, the relation of tobacco to public health, and the pathological effects of tobacco, especially on the alimentary, cardio-vascular, and nervous systems.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A geologist in the Geological Survey Office, Department of Industry and Commerce, Irish Free State—The Secretary, Civil Service Commission, 45 Upper O'Connell Street, Dublin, C.8 (April 30). A full-time assistant teacher in the Engineering Department and Junior Technical School of the Harris Institute, Preston—Principal and Secretary, Harris Institute, Preston (May 2). An assistant clinical pathologist at the General Hospital, Birmingham—The House Governor, General Hospital, Birmingham (May 6).

A head of the Department of Mechanical Engineering, an assistant master in botany and chemistry, an assistant master in electrical engineering, and a teacher of workshop practice (electrical and motor engineering) at the Liverpool Central Municipal Technical School—The Director of Education, Education Offices, 14 Sir Thomas Street, Liverpool (May 7). An assistant in electrical engineering at the Rutherford Technical College, Newcastle-upon-Tyne—The Director of Education, Northumberland Road, Newcastle-upon-Tyne (May 17). A full-time graduate assistant in the Department of Engineering of the Leicester College of Technology—The Registrar, College of Technology, Leicester (May 18). An assistant professor of chemistry in the University of Manitoba—The Secretary to the Board of Governors, University of Manitoba, Winnipeg, Canada (June 1). A professor of physiology at Middlesex Hospital Medical School—The Academic Registrar, University of London, South Kensington, S.W.7 (June 12). A development officer and a research manager under the British Non-Ferrous Metals Research Association — The Director, British Non-Ferrous Metals Research Association, 71 Temple Row, Birmingham. A junior assistant under the Directorate of Explosives Research of the Research Department, Woolwich—The Chief Superintendent, Research Department, Woolwich, S.E.18.

Our Astronomical Column.

The Lowell Object.—A very remarkable orbit of this object has been computed by the Flagstaff astronomers, and distributed by telegram from Prof. Shapley (*I.A.U. Circular*, No. 271). They find an ellipse with eccentricity, 0·909; semi-major axis, 217 units; perihelion distance, 19·64 units; perihelion passage, 1900·5; longitude of perihelion, 12° 52′; ascending node, 109° 21′; inclination, 17° 21′; mean daily motion, 1·112″; period, 3191 years; present distance from sun, 41·3 units. There is no doubt that the present distance and the node and inclination are near the truth, but the eccentricity is stated to be uncertain. If the above value is right, the object would have been of the twelfth magnitude when in perihelion, so that there ought to be little difficulty in finding images of it on old plates. It is advisable to make search in the first place on fairly recent plates, as the limits of error are much smaller; the following short ephemerides have been prepared from these elements; they are for 0 h.

1928.	R. A.	N. Decl.	1929.	R.A.	N. Decl.
Jan. 1.	7h 9m 11s	21° 23′	Jan. 1.	7h 15m 8s	21° 39′
,, 17.	7 7 40	21 27	,, 17.	7 13 40	21 42
Feb. 2.	7 6 15	21 30	Feb. 2.	7 12 16	21 46

The uncertainty of these positions is much smaller than that of the elements, and should not exceed a few minutes of arc. All the observatories that search for minor planets are likely to have plates of the region. Rough ephemerides for earlier years can be formed from the annual differences shown above.

Periodic Changes in the Solar Corona.—The connexion between the form of the corona and the phase of the sun's general activity in the 11-year period has long been known, with the natural result of a similar (though less marked) relation with the sun's spotted area. Dr. W. J. S. Lockyer pointed out in 1903 that prominences were related much more closely than spots to the coronal form, and fully confirmed this result by a further research in 1922 in which the material was brought up to date. In a recent paper (*Upsala Meddelanden*, No. 46) Prof. Bergstrand reaches the same conclusion by an analysis of previously published results of Ludendorff, in which the latter gives 'isophotes' (lines of equal luminosity in the corona) for different eclipses. Bergstrand gives a correction to these isophotes in the polar regions to allow for the superposition of streamers from equatorial or intermediate latitudes, and deduces a quantity, p, giving the ratio of coronal luminosity in equatorial and polar regions at the same height above the solar surface. There is a slight correlation between p and sunspot numbers, but the variations in the former follow much more closely those of prominences in the high latitude zone. Prof. Bergstrand is led to the "irresistible impression that the strong development of the polar corona towards the epoch of sunspot maximum is related to the simultaneous appearance of prominences in the neighbourhood of the solar poles", thus strongly supporting the work of Lockyer mentioned above.

Radial Velocities of 741 Stars.—A valuable addition to our knowledge of stellar radial velocities appears in the *Astrophysical Journal*, vol. 70, p. 207, in which results are given for 741 stars measured at the Mount Wilson Observatory by Messrs. Adams, Joy, Sanford, and Strömberg. The 60-inch and 100-inch reflectors were used, with one-prism spectrographs giving dispersions ranging from 37 A. to 76 A. per mm. in the neighbourhood of $H\gamma$. The majority of the stars are of spectral types F to M, but some (91) of types O, B, and A are also included. Their visual magnitudes range from 3·0 to 10·8, most of the fainter stars being dwarfs with large proper motions which show (as might be expected) a considerable proportion of large radial velocities. An interesting feature of the results is the almost complete absence of large positive velocities from R.A. 15h to 2h in the northern hemisphere, thus illustrating the asymmetry of stellar motions previously noted by Strömberg. This list brings the number of radial velocities determined by the two large Mount Wilson reflectors up to a total of 1754.

Handbook of Cracow Observatory for 1930.—This is the eighth issue of this useful annual handbook, which is edited by Prof. Banachiewicz. The greater part of it is occupied with ephemerides of variable stars, both long-period and eclipsing. Then follow tables of obliquity of ecliptic, precession, selenographical co-ordinates, and predictions for 1930 of occultations of stars by the moon, for five observatories in Poland. It is suggested that the selenographical co-ordinates may be used to find the regions of the moon at which occultations occur, and then apply corrections for the altitudes of these regions. This is a refinement that will doubtless become general in the future; there is not the same need for it in meridian observations of the moon, as a long arc of the limb is visible, and the eye can make an estimate of the mean position of the limb, which is certainly more accurate than observing an outlying mountain. But in all the most accurate observations of occultations the limb is dark, and these irregularities are invisible. The headings and explanations of the tables (except those relating to the details of occultations in Poland) are given both in Polish and in flexible Latin, the latter being easy to read.

Research Items.

Australian Petroglyphs.—The discovery of a number of petroglyphs, believed to be new, by Mr. B. E. Hornshaw is recorded in the *Victorian Naturalist* for February. Mr. Hornshaw has spent some twenty years searching for art relics of the aborigines and has found many examples previously unknown. Those which he now describes are situated in Kuring-gai Chase, between Cowan Creek and Pittwater, about 35 miles from Sydney. Among them—all being engraved with the exception of a number of hands stencilled in red in a rock-shelter—was a large carving deeply cut and about 9 ft. in height, such as the author had not seen before in all his twenty years' experience. The upper part of the figure is shaped like the head and bill of a platypus. The arms are outstretched, showing a large boomerang in one hand, while the other points to a female. The conjecture is made that it represents the totem deity of the Kuring tribe. The female figure has her arms upstretched, with a circle attached to the left leg. It is suggested that the site may have been used as a bora ground for the initiation of young men into the tribe.

Egyptian Chronology.—In *Ancient Egypt*, 1929, pt. 2, Sir Flinders Petrie reopens the discussion of Egyptian chronology in the light of fresh evidence obtained from last season's excavations in Palestine at Beth-pelet. A long series of scarabs has been found which belongs to a large part—nearly the whole—of the Hyksos period. From these it is now possible to deal with this age on a monumental basis. Provisionally, the groups of scarabs have been classified in a succession of styles lettered from *A* to *W*. In *A* and *B* the resemblance to good Egyptian work is very close; soon follow, in *C* and *D* figures, decomposed signs and the late Hyksos type of a name between vertical lines; and so forth to a final stage showing twists and side lines derived from decomposed *neter* signs. Amid these changes down to the middle of the series are often various types which can be dated to known kings. So close is the comparison that it is hard to believe that these types, decaying in the thirteenth Dynasty, were revived at a later date. Indeed, the twelfth and thirteenth fashions had been so closely followed in the different types, that it is impossible to regard the Hyksos forms as belonging to a much later series. This constitutes a strong case for the Hyksos age being contemporary with these two dynasties. Turning to the literary record, if the lists of Manetho be used, it must be by placing the fifteenth and sixteenth Dynasties side by side with the thirteenth and fourteenth; Salatis, the first of the six great kings, probably entered the Delta at about the close of the reign of Amenemhat IV. The Hyksos may have gradually occupied the Delta from the thirteenth to the fifteenth Dynasties and the whole of it up to Memphis by about the time of the twenty-first king. The recorded periods would then adjust themselves to show the thirteenth Dynasty ending in 1922 and the fourteenth at 1738, the seventeenth extending from 1738 to 1587.

British Bird Ringing.—The *British Birds* marking scheme has been by far the most thorough of British ringing agencies, and with the conclusion of 1929, when the record was reached with 25,243 individuals marked, a grand total of 258,791 has been accounted for during the twenty-one years of the scheme. In his summary of the year's work, H. F. Witherby mentions some interesting records—a ring-ouzel ringed in Dumfriesshire recovered in Algeria, a Cumberland teal in the Gulf of Archangel, a Kinross wigeon two years later near Novgorod, Russia, and so on (*British Birds*, March, p. 258; 1930). On the whole, the striking feature of the list with which he concludes his paper is the very small number of recoveries of ringed birds. Most exceptionally, as in the case of the merlin, as many as 20 per cent have been seen again, but the general run of recoveries is 2-4 per cent and often the recoveries are negligible. The low recoveries often affect unlooked-for species. Of 413 grey wagtails ringed between 1909 and 1928 only one has been recovered, and only one wood-warbler out of 813 ringed, one sedge-warbler out of 647, and not a single garden warbler out of 660. Of the common wren 2856 have been ringed in the same period and only 8 have turned up again. The figures suggest that now certain birds might well be struck off the list, since they are unlikely to yield scientific data of value and they themselves cannot come scatheless out of the process.

Chinese Amphibia.—A useful check list of Chinese amphibia with notes on geographical distribution has been compiled by N. Gist Gee and Alice M. Boring (*Bull. Pekin Soc. Nat. Hist.*, vol. 4, pt. 2, p. 15; December 1929). The list records 131 species, including one Apoda, 15 Caudata, and 115 Salientia. An analysis of the ranges of the species shows that the amphibian fauna may be divided into a north China group with palæarctic affinities, and a south China group with Indo-Malaysian affinities. Although there are only four genera peculiar to China, there are 84 endemic species, 53 being localised in mountain ranges, 13 on islands, and 12 in the northern mainland section. There seem to be three mountain centres of species formation, Szechuan, Yunnan, and Fukien, and the situation of these areas means that most of the endemic species are in the south central region. Both because of this and because the Indo-Malaysian amphibian fauna is richer than the palæarctic, the amphibian fauna of south China is much more abundant than that of north China, but the wide range of the species in the latter area suggests that many problems of specific and subspecific forms may still have to be dealt with there.

Value of Field Studies in Zoology.—Dr. S. L. Hora chose as the topic for his presidential address to the Section of Zoology of the Seventeenth Indian Science Congress at Allahabad in 1930, "The Value of Field Observations in the Study of Organic Evolution" (Calcutta, Asiatic Society of Bengal, 1930). This is a subject at which the author has worked for a number of years and to which he has obviously given much thought. The aspect of field work chosen to illustrate the address is the structural modifications undergone by the fauna of torrential streams to meet the strenuous demands of the environment, and in particular those exhibited by the fishes. The genus *Nemachilus* provides interesting parallel series of modifications of the 'air-bladder' in correlation with diverse habitat preferences in swift streams and still lakes in different river systems. The author puts forward a well-timed plea against the enthusiasm of those who advocate experimental zoology as the solution of all problems, and claims with Kerr that "evolution is a philosophy of wild Nature".

New Species of *Amœba* with a Stigma.—A. Pascher (*Biol. Zentralbl.*, Bd. 50, Heft. 1, 1930) describes *Amœba stigmatica*, a relatively small species 0·03 to 0·05 mm. in diameter, with two contractile vacuoles, zoochlorellæ and a large, grooved, bright-red stigma. The nucleus has a granular karyosome of moderate size. No flagellate stage was seen, nor was division of the active amœba or holozoic feeding observed. The reserves in the cytoplasm are fat and oil droplets.

Encysted examples had a firm, light yellow envelope surrounding the contracted protoplast, the zoochlorellæ and the stigma. From one cyst issued a single amœba, but in another, division occurred and two amœbæ issued. This amœba is markedly phototactic probably due to the presence of the stigma, but the symbiotic algæ may also be a factor. This amœba is to be regarded as a descendant of a chromatophore-bearing flagellate. The grooved type of stigma is found in only two groups of flagellates, the Euglenidæ and the Dinoflagellates, and the author considers the former the more probable line of origin. This new amœba affords further evidence in support of the origin of the Rhizopoda from the Flagellata.

Marine Mollusca off the West Coast of Ireland.—The Fisheries Branch of the Irish Department of Agriculture has done much dredging off the west coast of Ireland since 1900, and an account by Anne L. Massy of the mollusca procured—exclusive of the Cephalopoda, Amphineura, Nudibranchia, Pteropoda and Heteropoda—has now been published (*Proc. R. Irish Acad.*, vol. 3, Sect. B, No. 13). The area dealt with lies between 49° N. lat. and 56° N. lat., and between the 50 fathom and 1500 fathom lines, exclusive of the area to the east of the Fastnet Light. Since the *Porcupine* expedition of 1869, dredging has taken place from time to time in different parts of the area, and to make the present paper more complete all records from these earlier researches have been included. In all, 313 species are enumerated, mainly under the nomenclature of the Conchological Society's 'List' of 1929. Under each species are given the occurrences at fisheries branch stations, previous records, distribution in space, vertical range, and fossil records; whilst a bibliographical list of references, particulars of stations, and index of genera conclude the paper, which thus forms a most valuable contribution to a knowledge of the molluscan fauna of the seas off the British Isles.

Transplanting Cereals.—For several years past extravagant claims have been made of large increases in yield resulting from the transplantation of cereals. *Landtechnik* (quoted in *Jour. Min. Agric.*, March 1930) gives the results of records of German experiments obtained by the Reichskuratorium für Technik in der Landwirtschaft. In 146 experiments observed in 1929, the spacing varied from 20 cm. × 20 cm. to 35 cm. × 35 cm., tillering in all cases being extraordinarily good. The transplanted plots were 8-14 days later in ripening than those drilled in the usual way, and as the former also suffered from the dry period of the year, the yields may have been unfavourably affected thereby. Only 32·4 per cent of the transplanted plots gave higher yields than the drilled plots, whereas 67·6 per cent showed lower yields. The yield increases were between 0 and 69·2 per cent, less than half of the increases being greater than 30 per cent. In no single instance was 100 per cent increase recorded. It is considered that the value of the transplanting of cereals must be regarded as negative from the point of view of practical agriculture. Nevertheless, in view of the fact that increases of about 50 per cent were obtained in certain properly controlled experiments, it is desirable that the investigations should be continued in order to determine the conditions of growth under which these yield increases occur, and this work is being carried on by the Landwirtschaftliche Hochschule, Berlin.

Rainfalls Accompanying Volcanic Explosions.—In the literature on volcanic explosions, there are numerous references to mud flows, and landslides that have their cause in heavy rainfalls, the alleged source of which is in condensed steam. In the *Am. Jour. Sci.* for February 1930, R. H. Finch examines critically the evidence bearing on the source of such rainfalls, the records of the 1924 explosion of Kilauea supplying most of the data for the discussion. Rainfalls do not accompany all volcanic explosions and the heaviest rains reported at Mt. Pelée and Vesuvius did not immediately follow the maximum of activity. On the other hand, the available records show good correlation between observed relative humidity and rainfall. It is concluded that, while light rains may well have had part of their source in condensed steam, the main source must be the moisture of the surrounding air.

Recent Spectroscopic Researches.—The issue of the *Zeitschrift für Physik* for Feb. 10 (vol. 60, Nos. 1 and 2), which is devoted to publications from the University of Bonn, contains a number of important papers dealing with several branches of spectroscopy. Extreme infra-red work is represented by contributions from E. Rütten and T. Dreisch on absorption by thin sheets of metal and other substances. P. Lueg gives an account of improved methods for photography in the near infra-red, and he and Miss J. Querbach describe some spectra obtained in part with the aid of the new technique. Contributions to the measurement of standards of wave-lengths are made by P. H. Brodersen and H. Pressentin. Other papers are by Prof. Mecke and R. M. Badger, on the atmospheric absorption band of oxygen at 7600 A.; by W. Scheib, on the band spectrum of boron monoxide, which has been measured and analysed; and by W. Kerris, on the spark spectrum of iodine. The whole forms a notable addition to the literature of spectroscopy, and has evidently been largely inspired by Prof. Konen and Prof. Mecke.

Tests of Tool Steels.—In order to provide information as to the behaviour of tool steels when used as in average workshop practice, an extensive series of tests has been carried out at the U.S. Bureau of Standards at Washington by Messrs. H. J. French and T. G. Digges, who give an account of their results in the first 70 pages of the December issue of the Bureau's *Journal of Research*. Their method consists in setting two tools at equal depths in the same tool holder and noting when the following tool begins to cut on account of the wear of the leader, and they investigate the effects of tool form, depth of cut, feed, cutting speed, lubrication, composition of the steel and its heat treatment on the life of the tool. They find that the life is inversely proportional to the tenth or twelfth power of the cutting speed, is not much influenced by the lubricant, while of twelve elements added to chromium-tungsten-vanadium steel, only one, nickel, produced decidedly beneficial results on the life; copper had a slight, tin a greater, and arsenic and antimony decided, adverse effect.

Automatic Thermostat.—An automatic temperature control apparatus for experimental chambers heated by alternating electric currents, which claims to regulate to 1/100° C., has been introduced by Messrs. Baily, Grundy, and Barrett of Cambridge. A thermometer in the chamber has an adjustable platinum wire above the mercury with which the mercury on rising makes contact and so applies to the grid of a valve a suitable potential. The anode current produced operates the main contact in the heating circuit, which may take a current of 10 amperes. The filament, grid, and anode potentials are supplied by a small transformer on the alternating mains, and the power used is about 0·6 unit per day.

Electrical Applications in Motor-Cars.—In the *Journal of the Institution of Electrical Engineers* for

January, an interesting account is given by Prof. Parker Smith of the progressive development of electrical applications to motor-cars. In the early days, any electrical accessories were added after purchase. At the present time, they form an integral part of the equipment and are built into the chassis by the manufacturer. Electric ignition, which is now universally adopted, was the earliest application. Electric lighting also has gradually displaced the one-time popular and originally more powerful acetylene lamp. Batteries being introduced, a charging dynamo became a necessity. This was followed by the starting motor now almost universally used on private cars and widely adopted on commercial vehicles. The later introduction of other electrical devices such as electric horns, windscreen wipers, fuel pumps, and signalling devices was both simple and natural. The author points out that, almost without exception, every piece of electric equipment for automobiles had to be developed against strong competition from non-electrical alternatives. The stage of development seems now to be passing, and signs of standardisation, with the consequent cheapening of the products, are making their appearance. British manufacturers, backed by the British Engineering Standards Association, are making determined attempts to ensure interchangeability of parts wherever possible. Since the beginning of the War, the modern magneto has been immensely improved and dual ignition is generally regarded as unnecessary. Perhaps the question of 'glare' is the problem that has not yet been satisfactorily solved.

Rauschelbach Current Meter.—Particulars have reached us of a new electric current meter (Dr. Rauschelbach's design) manufactured by the Askania-Werke A.G. of Berlin-Friedenau, which is intended for use in determining the direction and velocity of tidal, coastal, and marine currents by means of observations from a vessel riding at anchor. It is claimed that accuracy of direction can be obtained within limits of 3° and velocities within a range of 0·05 to 3 mm. The appliance consists of a frame with suspension cables, supporting the meter with its switchgear, spindle, current vane, propeller, contact box, loading weights, etc. The meter is secured within the frame and rotates freely on the vertical spindle, to which are attached a multi-bladed propeller and a controlling vane of the usual type. The revolutions of the propeller are transmitted by worm gear to a contact disc in the contact box, and thence to the recording instrument which is kept on board. The recorder is provided with fourteen pens, having fourteen corresponding electro-magnets to actuate them each time the respective circuits are closed. The first of these pens traces a time record on the chart, the second records the number of revolutions of the propeller, and the remaining twelve serve to show the direction of the current. Testimony is adduced from the Königsberg Water Board to the effect that the meter has been satisfactorily employed for a year in the harbour of Pillau and adjacent waters. Several instruments are also stated to have been in service during the summer of 1928 on the lower Elbe and outer Ems.

Odoration of Town Gas.—The possibility of making illuminating gas more powerfully odorous with the object of preventing poisoning through leakage is attracting attention, and a pamphlet on the subject has been published as No. 6 of the *Abhandlungen aus dem Gesamtgebiete der Hygiene*, edited by Dr. R. Grassberger of the University of Vienna. A large number of experiments made with various substances of sufficient volatility and powerfully odorous showed that the liquid hydrocarbons separating from compressed oil gas and the light oil pre-distillates of gas works were most suitable. So long as it is impossible to transform the carbon monoxide of the gas into methane, it is suggested that the gas should be impregnated with the vapours of these materials.

The Glass Electrode.—The use of the glass electrode in potentiometric measurements is extending, and in this connexion the existence of a permanent potential difference across the glass film is of importance. This disturbing effect has been investigated by MacInnes and Dole, who have studied its relation to the composition of the glass. The January number of the *Journal of the American Chemical Society* contains a paper by these authors in which previous work is briefly mentioned and in which further experiments are described. The most suitable type of commercial glass was found to have the composition SiO_2 72, Na_2O 22, and CaO 6. The potential at the surface of this glass changed quantitatively with the hydrogen ion activity up to *p*H values of 9·5, though this limit was lowered in strong salt solutions, Since the glass electrode is used in biological work, it is essential that these anomalies should be known.

Molecular Weight of Casein.—In view of the discordant results given for the molecular weight of casein, a new determination by Svedberg, L. M. Carpenter, and D. C. Carpenter by the ultra-centrifuge method, and described in the January number of the *Journal of the American Chemical Society*, is of considerable importance. Casein prepared by the Hammarsten method was found, in *p*H 6·8 buffer solution, to consist of a mixture of protein molecules of different weight. An alcohol soluble casein was prepared from Hammarsten casein and was found to be homogeneous and probably a pure chemical individual. The molecular weight was 375,000 ± 11,000. The molecule was not spherical and deviated from the spherical shape by about the same amount as found for several other proteins. The same journal also contains a paper by Svedberg and Sjögren on the molecular weights of two vegetable proteins, amandin and excelsin, determined by the centrifuge method. These were found to be 208,000 ± 5000 and 212,000 ± 5000 at various *p*H values. Both molecules are spherical with radii of 3·94 mμ and 3·96 mμ, respectively.

Test of Low Temperature Carbonisation Plant.—The Director of Fuel Research has tested, in accordance with the scheme in vogue, the Turner plant for the low temperature carbonisation of coal, erected at the Comac Oil Co., Ltd., Coalburn, Lanarkshire. In this retort the coal is heated internally by steam superheated to nearly 600°. Penetration of the charge by steam and heat is ensured by frequent and sudden alternations of pressure on the retort. To achieve this, the retort is made practically gas tight with an ingenious system of valves, automatically controlled, which is claimed to be an essential feature of the installation. A Scotch coal of feeble caking properties was carbonised in the test, lasting nearly 5 days, without serious difficulty. The yields per ton were: Coke 12·2 cwt., tar 19·2 gal., spirit from gas 1·7 gal., gas 2400 cub. ft. of calorific value 790 B.T.U./cub. ft. The coke was readily ignited and suitable for use in normal domestic grates although not entirely smokeless. It is not clear how much would be saleable for this purpose. Fuel would be consumed in producing and superheating the large quantity of steam required. This, after condensation, yields much liquor (464 gal./ton) probably of a character not welcomed by sewage and river authorities.

Frank Buckland and Fish Culture.

THE first course of public lectures on fishery subjects under the Buckland Foundation was given on Feb. 24, 25, and 27 at Grimsby, and on Mar. 24, 25, and 26 at Hull, by Prof. W. Garstang, of the University of Leeds, who holds the appointment of Buckland professor for 1930. Prominent members of the fishing industry presided over the six meetings, including Sir George Moody, Councillor A. Bannister, and Mr. G. L. Alward in Grimsby, and Mr. A. Cargill, Mr. Percy Ross, and Lieut.-Colonel Hudson in Hull.

Prof. Garstang devoted his first lecture to a sketch of Frank Buckland's interesting personality, parentage, and career, and his remaining lectures to the bearings of modern scientific work on the problem of 'farming the sea', a dream which Buckland cherished and on which his pen was busy up to a few days before his death. The lectures will shortly be published by the Trustees of the Buckland Foundation, 43 Parliament Street, London, S.W.1. In the meantime, the following abstract will indicate the ground covered.

Rather more than a hundred years have fled since Frank Buckland's birth (1826) and nearly fifty since his death (1880). His father was the celebrated Dr. William Buckland, Dean of Westminster, formerly Canon of Christ Church, and the first professor of geology in Oxford; his mother had artistic gifts as well as a great interest in natural history. In the sixties and seventies of the last century, Frank Buckland was in the height of his powers, and was tireless in pressing upon his countrymen the importance of fisheries to the national welfare and the need of fuller knowledge bearing upon them. His death at the untimely age of fifty-four years was entirely due to the desperate exertions he made in January 1878 to fulfil a late but urgent request of the New Zealand Government for an additional consignment of salmon ova. He succeeded, but never recovered from the effects of the prolonged exposure to icy water and driving snowstorms which he endured on this occasion.

At his death, Buckland left to the nation his Museum of Fish Culture (now at South Kensington) and a reversionary sum of £5000 with which to endow a professorship of economic fish culture. By this term, as shown by numerous passages in his later writings, Frank Buckland meant something much wider than fish-hatching, for which he had an early enthusiasm, and meant all knowledge bearing on the practice, maintenance, and advancement of the fisheries. By endowing these lectures he provided a means, never more needed than at the present time, by which additions to knowledge, however acquired, might be sifted, put together, and brought forward for the consideration of the fishing industry and the general public.

An atmosphere of natural history surrounded Frank Buckland from his cradle, and was continued during his school life at Winchester. After graduating at Oxford, and undergoing a surgeon's training at St. George's Hospital, he took up a surgical commission, like his greater contemporary, Thomas Henry Huxley, but in the 2nd Life Guards, instead of in the Navy. His chief interests, however, continued to lie in the behaviour of animals, whether kept as pets in the Deanery of Westminster or as inmates of zoological gardens, menageries, shows, and aquaria, or at large in duck pond and trout stream. He set out with a great admiration for John Hunter, and aspired to emulate him in the creation of a science of comparative physiology; but he lacked true scientific method, and, his pen running away with him, his writings soon lost all trace of such an aim, and assumed a very diversified character, in which the racy and humorous elements tended more and more to preponderate.

The loss of both his distinguished parents, for whom he had a deep veneration as well as affection, and the writing of his father's "Life" in 1858, brought to an end this phase in Buckland's career, as represented by his "Curiosities of Natural History", and he sought opportunities of turning natural history into more practical channels. He took up acclimatisation, then fish-hatching (1861), resigned his surgeoncy (1863), started *Land and Water* (1866), and in 1867 was appointed an inspector of fisheries, after which date he devoted practically all his time and energy to fishery duties and problems.

The tasks which fell to the salmon inspectors of those days were thoroughly congenial to him, and his efforts to clear the rivers of numerous obstacles to salmon migration were remarkably successful, his earnestness and imperturbable good humour being great assets in negotiations with millers and landowners. His 'practical natural history' was rewarded by a gratifying increase in the yield of salmon fisheries in almost every river in which his recommendations were adopted.

Buckland's career was cut short too soon for him to mature his views on the more complex problems of the sea fisheries, but the idea of 'farming' the waters, as agriculturists farm the land, took early hold of his practical imagination. In the last words he wrote on fishery matters, only two days before his death, he referred to the North Sea as a potential "Great Fish Farm", which only awaited more knowledge before it, too, like the rivers, could be brought under conditions of 'cultivation', as opposed to those of mere exploitation. So far, it must be admitted it is a farm in which Nature has done all the sowing and man only the reaping.

In the immense progress of marine science since Buckland's time, however, the conditions for a possible farming of the sea have become much clearer, as well as the limits set by natural factors. Chief of these is the demonstration of the limiting factors to the annual crop of plant life in the sea, on which the stocks of fish ultimately depend. In the elucidation of these difficult and highly technical questions, the staffs of the marine laboratories at Plymouth and Millport have played a very distinguished part.

The invisible floating pastures of green diatoms depend, like other plants, on sunlight and 'manurial salts' (nitrates and phosphates), and both factors are subject to great annual and seasonal variations. The outburst of diatoms in the spring may be exceptionally early or exceptionally late, thus hastening or retarding the development of the floating animal life (plankton), on which all larval, and some adult, fishes depend for their existence. As the different species of fish have their special breeding seasons, these accelerations and retardations of the plankton may correspond with, or fail to overlap, the seasons when the fry of particular fish are being hatched and are seeking food. Moreover, there is a natural 'disharmony' between the tendency of diatoms to float and multiply in the illuminated upper waters, and the downward gravitation of the main sources of manurial salts. Gales and temperature changes mix up the various water layers in winter, so that the year starts with an even distribution of the nitrates in the sea from top to bottom; but the spring outburst of diatoms quickly uses up the nutritive salts in the upper layers, and unless there are timely summer gales to bring up fresh supplies from the bottom, the diatom pastures rapidly dwindle, in spite of the increasing power of the solar rays.

Thus arise good and bad years for the replenishment

of the stocks of fish, and, unless and until man devises the means of regularising the supply of nutrient salts in the surface waters, these natural fluctuations are inevitable and uncontrollable. Who can disperse the clouds below the sun, or modify the incidence of summer storms ?

Science is not quite helpless even under these conditions, for, as the age of individual fishes can now be determined, the effects of good and bad years, when the data are adequate, can be traced to their causes, and can be followed in the actual stocks of fish through considerable cycles of years. It is thus becoming possible to predict from the age-composition of a stock of herring, haddock, etc., in a given year and its predecessors, what it is likely to be in the ensuing season. In this way Mr. Hodgson, of the Lowestoft Laboratory of the Ministry of Fisheries, last September made a remarkably close forecast of the autumn herring fishery, and leaders of the industry have already expressed their appreciation of the commercial value of such forecasts. To be forewarned is to be forearmed, and may mean the annual saving of many thousands of pounds in an industry which requires large anticipatory provision of apparatus, stores, and personnel.

From the point of view of farming the sea, the magnitude of modern fishery operations is a fact of cardinal importance, since the collective power of the fishing fleets is no longer negligible in comparison with the blind forces of Nature. It was formerly thought that this power was merely destructive ; but the problem is one of dynamics, not statics, and the destruction entailed by fishing is now known to be balanced by an increased rate of production. It is the quality rather than the quantity of fish that is changed by it. Like the destructiveness of Nature, that of the fishing fleets operates as a selective agency, and is creative of new conditions, some of which are manifestly beneficial. It is possible that the hosts of herring have been actually increased in consequence of the elimination by trawlers of the large haddocks which feed upon their spawn. It is certain that the removal of old plaice favours the survival and growth of the young, the precise nature of the result depending also on a further factor, the greater or less amount of local reproduction. In the Cattegat and Baltic, where reproduction is limited, the effect of intense fishing is seen in a great increase in the growth-rate, coupled with a reduction in numbers, thus raising the average size. A race of small, slow-growing and worthless fish has been converted into one of large, quick-growing and valuable fish, but it is feared that the rate of reproduction is insufficient to meet the steady reduction in numbers.

On the other hand, in the North Sea, with a high rate of reproduction, the effect of intense trawling is to increase the survival of the young and their emigration offshore, so that the increase of their growth-rate is checked at a certain level by additional numbers. The increase of small fish in the catches, formerly regarded as evidence of 'over-fishing', is really the greatest safeguard against it, for it means that, however intense the fishing, the gaps are immediately filled from inexhaustible reserves.

If these arguments are soundly based — and the recent experience of post-War changes overwhelmingly supports them—the North Sea problem is reduced to the question of how to increase the average size of the fish without reducing the intensity of fishing. So far as the plaice is concerned, the answer is already available.

One of the first results of scientific investigation of the North Sea was to show that the Dogger Bank, with an area as large as Wales, lies outside the track of normal plaice migration, and yet possesses enormous reserves of the favourite food of this fish. The one unimpeachable method of raising the size of plaice in the North Sea is to utilise this great reserve for the purpose, and to transplant every year some millions of the small overcrowded and slow-growing fish from the coastal banks to this great feeding ground, on which it has been shown repeatedly that the plaice transplanted grow three, four, and even six times as rapidly as on their natives shores.

Science is useless without enterprise. Great Britain looks to the traditional enterprise of the great Humber fishing ports to take up this matter as a commercial proposition. Let Grimsby and Hull take the first step towards cultivating the 'Great Fish Farm' which lies at their very door.

Opening of the Forest Research Institute at Dehra Dun, India.

THE February issue of the *Indian Forester* is a commemoration number devoted to a detailed account of the opening of the new buildings of the Forest Research Institute at Dehra Dun, India. A brief announcement of this event has already appeared in NATURE (Nov. 16 and 30, 1929).

The new main building was opened by the Viceroy on Nov. 7, 1929. Perhaps the most important part of Lord Irwin's speech was his allusion to the work of the expert committee appointed under the presidency of Sir Chunilal Mehta "to advise them about the functions and policy of the Institute and the future of its activities". The report of this Committee was presented and made public last summer and the Viceroy explained some of its recommendations as follows : "In the report they made a number of most helpful suggestions and laid down, with admirable judgment and lucidity, the line of policy which should be pursued in the future. . . . I am happy to be able to say that the bulk of their recommendations have already been taken up in consultation with Mr. Rodger and that we hope to give effect, in due course, to very many of them. We intend within the limits of our financial liability to give this Institute, now so finely housed and located, the scientific staff which it requires, and to omit or neglect no measure which we think will make for its continued success and greater usefulness.

"The Institute, and the various allied activities of which it is the centre, must, as I see it, aim at the discharge of a double purpose. On the most effective utilisation of Indian woods, I have already spoken, but it is not less our desire to train Indian personnel in all the technical branches of forestry research work. The governing consideration must remain that of efficiency."

Mr. (now Sir Alexander) Rodger, Inspector-General of Forests and president of the Forest Research Institute, in his address of welcome to the Viceroy and Lady Irwin, pointed out that Dehra Dun has been the centre for forest work since 1878, when a forest college was founded for training rangers and foresters. Forest research work has been in close touch with education since 1906, when the Research Institute was inaugurated, though, as a matter of fact, in two branches, chemistry and forest zoology, the ranger class had the benefit of lecture courses from research officers several years antecedent to 1906. Sir Alexander alluded to the enormous expansion in personnel since 1906. In the latter year there were five gazetted officers and one non-gazetted officer appointed to the charge of the six branches into which

forest research was subdivided. Each officer had a small clerical staff allotted. In 1929 the staff had expanded until the Institute now employs thirty-five gazetted officers, two hundred and twenty assistants and subordinates, and three hundred and fifty men on daily labour. It is this great development which necessitated the construction of the great buildings opened by the Viceroy on Nov. 7.

In 1906 no special accommodation was available. The first large building was erected at Chand Bagh and opened in 1914. It was confidently expected that this building would suffice for all possible requirements of the Institute for a number of years to come. The development of the forest resources of India made such strides during the War that the Industrial Commission pointed out in 1918 the necessity of expanding the Institute to meet the rapidly increasing demands of the country. The Commissioners advocated the increase of the number of research officers and stated that the equipment provided was entirely inadequate. These recommendations were accepted by both the Government of India and the Secretary of State, and, in spite of later suggestions for cutting down the scale of the new proposals, they survived the ordeal. The workshops of the economic branch were completed and in working order in 1924 and the main building was occupied during the years 1926 and 1928. The total cost of the new establishments is close upon one million pounds.

The three most handsome rooms in the Forest Research Institute are the new library, in Andamans padauk, the large hall, all Burma teak, and the entrance hall, shisham and rosewood. Another room which is very effective is the office of the forest economist, which is panelled in poon (*Calophyllum*) from Madras. The other rooms are not so decorative, but, as Burma teak of good quality has been used throughout; they are mostly handsome as well as useful. A special feature has been made of the windows, with good lighting for laboratory work. There are six museums, with floor space of 26,000 square feet, and the ordinary rooms designed for laboratories and offices cover about 63,000 square feet.

In the grounds, besides the workshops of the economic branch are offices for the different branches and numerous residences of all kinds for the staff.

As at first arranged, the buildings at Chand Bagh were to be utilised as the training centre for the Indian probationers for the Indian Forest Service, whose two years' course of training in forestry is now being given at Dehra Dun. It was perhaps too much to hope to keep Chand Bagh in the Department, even though so much forest history has grown up around it. The beautiful building is to be given up and it is to be utilised in the future for medical research work; while part of the new Institute building will be devoted to the educational requirements of the Indian Forest Service probationers.

The chief value of this commemoration number of the *Indian Forester*, for the future, will not be confined to the account of the opening proceedings of the new buildings. For the latter is followed by a valuable detailed account of the past history and development of the various branches of the Institute from the date of its inauguration in 1906.

Archæology from the Air in Central America.

THE definitive account of the recent archæological reconnaissance by air in Central America, to which reference has already been made in our columns (see NATURE, Dec. 28, 1929, p. 995), appears in the April number of the *Geographical Review* (New York). The authors are Mr. Oliver J. Ricketson and Dr. A. V. Kidder, who acted as observers. The text is illustrated by a number of photographs taken by Mr. Ricketson and Mrs. Lindbergh. As previously noted, the leader of the expedition was Col. Lindbergh, who originally suggested the idea of the reconnaissance to the Smithsonian and Carnegie Institutions.

To enable their readers to appreciate the significance of the observations on the four flights which were made, the authors recapitulate the main divisions and distribution of the remains of ancient Maya civilisation. The oldest remains are found at Peten in Guatemala, whence the city-building activities of the Maya were carried to what is now British Honduras and Yucatan. The classic period of the Old Empire, lasting from about the beginning of the Christian era to 610, was followed by a migration to lands of which northern Yucatan became the most important. There a renaissance took place in the eleventh and twelfth centuries which is marked by the magnificent buildings of Uxmal and Chichen Itzá. Later, the Mexicanisation of Maya art and religion, after the calling in of the Nahua tribes, led to a time of vigorous growth and building activity followed by a hundred years of decadence which ended with the Spanish conquest.

A great deal of the country which was thus occupied is still unexplored. Short of cutting a way through the almost impenetrable bush, the only means of access are the paths of the *chichle* gatherers (*chichle* is the sap which forms the basis of chewing gum). Although these paths are gradually opening up the country, they still do not join, and the country lying between is unknown. As travel by bush path gives no opportunity for topographical observation, the general aspect, geographical features, and contour of the Maya country are not known. As became apparent from the observations made on these flights, the existing maps are untrustworthy as regards the situation of natural features, existing settlements, towns, and ruins. Several unmapped natural features were recorded for the first time.

The flights began on Oct. 6, 1929, and a flight was made on each subsequent day up to and including Oct. 10. On the last day, however, comparatively little time was spent in archæological observation, as the party flew to Havana and Miami. The flights were usually at an altitude of 500 feet, as this was found the best for observation, and the average speed was 85 miles per hour. The difficulties of observation owing to the density of the vegetation will be appreciated from the fact that on several occasions the aeroplane circled and recrossed known sites without the observers being able to 'spot' the ruins. It was desired to follow the great causeway which runs for at least fifteen miles from Coba, but although the exact spot at which it leaves the city was known, it could not be found.

The flight on Oct. 6 was from Belize to Merida, a distance as flown of 454·8 miles, the time taken being 5 hr. 21 min. Owing to the inexperience of the observers, observation on this flight was found difficult; but as time went on rapidity and accuracy were found to come with experience. After spending the night at Merida, the party returned to Belize on Oct. 7 by a slightly shorter route, ending with a flight along the coast, the distance covered being 373 miles in 4 hr. 23 min. On this flight, Chichen Itzá and Yaxuna were visited and a landing made at Lake Payegua. On Oct. 8 a flight was made to Flores, the return being by the southward of the Cockscomb range. On this journey Yaxha, where a landing was

made, Nakun, Tikal Lake, Peten, and Peten Forest were visited—443 miles in 5 hr. 14 min. flying. The flight of Oct. 9 to Cozumel, which occupied 5 hr. flying time, was archæologically the most productive. Not only did the party fly over sites already known, such as Tzibanché, an Old Empire site discovered by Dr. Gann in 1927, but on several occasions ruins, pyramids, and buildings were sighted which were entirely unknown before. Of these one was of considerable size. After a night at Cozumel, flight was resumed to Coba, and thence, as previously stated, to Havana and Miami.

In summing up the results of the experiment, the authors express their opinion of the great advantages of the exploration of this country by air. There is obviously an immense advantage to be gained in time. In twenty-one hours of archæological flying, they covered about 1780 miles. The time it would have taken to cover the same country on the ground is incalculable. Some areas could not have been reached at all, while others could have been reached only by a large and expensively equipped expedition. Not only, therefore, does this method of exploration make possible geographical and topographical observation otherwise impossible, but the advantage in time to the excavator if a practical method of organising transport could be devised would be an enormous gain. Both the authors and Col. Lindbergh are convinced that an air survey of the region is both feasible and desirable. It is estimated that a complete survey would occupy about five months. Col. Lindbergh is prepared to give every assistance in his power towards carrying out this project. In the interests of American archæology, it is to be hoped that a generous benefactor may be found to finance the undertaking.

University and Educational Intelligence.

OXFORD.—The proposal to use the money set free by the sale of the present site of the Radcliffe Observatory for establishing an observatory in South Africa is advocated by the Savilian professor of astronomy, Prof. H. H. Turner. The grounds on which the plan commends itself to astronomers are stated by him to be chiefly two: first, the extreme uncertainty of the Oxford climate, together with the facilities which now exist for rapid communication; and secondly, the importance of supplying fresh centres of observation in the southern hemisphere, where much work will have to be done to catch up with that already carried out for the northern skies. The disappearance of the old Radcliffe Observatory will be regretted on sentimental grounds, but there would appear to be no question of the scientific advantages to be gained by the present proposal of the trustees.

APPLICATIONS for grants from the Dixon Fund for scientific research must reach the Academic Registrar of the University of London, South Kensington, S.W.7, by May 15.

GRANTS from the Thomas Smythe Hughes and Beaverbrook medical research funds of the University of London will shortly be made. Applications should reach the Academic Registrar of the University, South Kensington, S.W.7, by June 15.

SENIOR industrial bursaries for assistance in practical training in engineering are being offered by the Company of Armourers and Brasiers and applications for them should be sent before May 31 to the Clerk of the Company, Armourers' Hall, 81 Coleman Street, E.C.2.

Historic Natural Events.

April 27, 1682. Thames Flood.—Under this date, Viscountess Campden wrote to her daughter, the Countess of Rutland: "Never was such flodds known as has bine here, howses drowned and pore children drowne in theare cradels swimen up Fleet Bridge, and there taken up, and tables and hogeds full of beare and all washed away, and peoppele geting up to theare lofts and hole heards of hogs drowned; and so Roger Pratt comeing from Norfolke narely escaped drownding and logers in Fleet Dich drowned, that never such a flood was known, that it is impossable for me to returne till the watters falls".

April 27, 1894. Earthquake in North-east Greece.—A week earlier, on April 20, a strong earthquake occurred in north-east Greece, by which 224 persons were killed and houses were damaged over an area of 1760 sq. miles. The earthquake of April 27 was much stronger, houses being overthrown within an area of 3000 sq. miles. With this earthquake, crust-movements occurred along a fault, about 35 miles long, running in a constant west-north-west direction parallel to the Gulf of Eubœa. The Plain of Atalante, on the north-east side of the fault, was shifted slightly to the north-west, and depressed by an amount, usually small, but in places by as much as 5 feet.

April 29, 1697. Thunderstorm.—A violent thunderstorm occurred over Snowdon and in north-west England, accompanied by hail, over a tract two miles wide and sixty miles long. Hailstones weighed five ounces, and broke nearly all the windows, killed many fowl, poultry, and sheep, and destroyed the green corn.

April 29, 1882. Gale.—During the progress of a deep cyclonic system north-eastwards across England, a gale occurred which was unusually severe for so late in the spring. The gale blew from south-west and west, and was general over the south and east of England and the north of France. Much damage was done to the young spring foliage, the leaves being in many cases completely blackened, as though singed by fire. This effect was probably due to mechanical injury caused by the high wind, but was attributed by some observers to the action of sea-salt, crystals of which were clearly traceable upon many of the leaves.

April 29, 1892. "Malartic" Cyclone.—A very violent tropical cyclone struck Mauritius, the centre passing directly over Port Louis, where an enormous amount of damage was done. An interesting feature was the overthrow of "Malartic" monument, a column 49 feet high built of stone blocks. The upper part of this column, 26½ feet high, and 5 feet 3 inches across at the base, was overthrown by the wind, and it was afterwards calculated that the wind pressure to achieve this must have reached 142 lb. per square foot, equivalent to a velocity of more than 200 miles per hour. The highest wind velocity recorded at the Pamplemousses Observatory was 123 miles per hour.

April 30, 1575. Frost and Flood.—Holinshed records that "all the lochs, rivers, and all manner of other waters were frozen in Scotland, from the beginning of November till the latter end of April, and when the frost brake and the snows melted, there was such a flood flowing over all the plains even to the roots of the mountains as the like had not been seen. Furthermore, when the same shrunk and went away, in the mud and slime there was such a sort of frogs left that when they were dead and began to putrefy the air was so infected that many deadly diseases

issued, whereof great numbers of the inhabitants did perish." In France the winter was equally severe; no man living had seen the like, and the snow fell in such quantity that the forests were inaccessible and people could not obtain wood. Horses and men perished in great numbers, and the cold was succeeded by famine and pestilence which, it is said, destroyed almost a third of the population. Similar effects were felt in Italy and Germany, and the Rhine was frozen for a long period.

May 1, 1594. Wet Summer began.—The weather was unusually wet and unseasonable from the beginning of May until July 25; this was followed by dearth. This is believed to be the summer described in "A Midsummer Night's Dream", Act 2, Scene 1:

> The ploughman lost his sweat; and the green corn
> Hath rotted ere his youth attained a beard:
> The folds stand empty in the drowned field
> And crows are fatted with the murrain flock;
> The nine men's morris is filled up with mud. . . .

May 1, 1908. Intense Rainfall in Panama.—A downpour of unrivalled intensity occurred at Porto Bello (Panama). Owing to the indistinctness of the autographic record caused by the excessive accumulation of water, there is some doubt as to the exact amount; a conservative estimate gives 2·48 inches of water in five minutes, but another figure often quoted is 2·47 inches in three minutes. Either figure constitutes the heaviest fall of rain ever recorded in that time.

May 3, 1605. Glacier Advance.—The inhabitants of Chamonix presented a demand for reduction of taxes, on account of the damage done by "glaciers, the river Arve and other torrents". The damage was due especially to abnormal advances of the glaciers.

May 3, 1849. Cloudburst.—At 5.30 P.M. during a storm of thunder, lightning, and hail, an enormous body of water rushed down a gully in Bredon Hill, North Gloucestershire, towards the village of Kemerton. The stream was broad and impetuous, carrying everything before it. On reaching the residence of the Rev. W. H. Bellairs, of Kemerton, it broke down a stone wall which surrounded the garden, burst through the foundation of another, made a way for itself through the dwelling-house, and then carried off a third wall of brick six feet high. The garden soil was washed away, and enormous blocks of stone and debris from the hill left in its place. It flowed through the house to the depth of three feet for an hour and forty minutes. The neighbouring railway was so deeply flooded as to delay the express train by extinguishing the fire of the engine. The course of the torrent could easily be traced up the hill for more than a mile, to a barley field of five acres, the greater part of which was beaten down flat and hard, as if an enormous body of water had been suddenly poured out upon it. Beyond this there were no signs of the fall of water to any great amount.

May 4, 1697. Hailstorm.—A violent thunderstorm, accompanied by a south-westerly gale, began at Hitchin, Herts, at 9 A.M. and continued until 2 P.M. Some of the hailstones which fell during the storm were reported to be thirteen or fourteen inches in circumference; the hail split great trees and destroyed several hundred acres of wheat, and at Sir J. Spencer's, 7000 panes of glass were broken. On the same day a noteworthy hailstorm occurred also in Staffordshire, in which the hailstones were reported to be nearly twelve inches in circumference. The ground was torn up, and there were at least 100,000 cartloads of hailstones.

Societies and Academies.

LONDON.

Geological Society, Mar. 12.—R. W. Pocock: The age of the Midland basalts. Data bearing on the age of the various igneous masses in the Upper Carboniferous are brought together. The conclusion is reached that the Shropshire and South Staffordshire basalts are of the same general age: namely, Yorko-Staffordian, whether extrusive or intrusive. A volcanic belt is known to traverse the Midlands from Hanter and Stanner in Radnorshire to the Ashby Coalfield area. The main movement along this zone took place in Yorko-Staffordian time, and the basaltic masses in question are, without exception, situated along it.—**Thomas Robertson:** The origin of the Etruria Marl. The Etruria Marl Group of the Upper Coal Measures in the Midlands is mainly composed of chocolate-coloured to purple clay, mottled with green, yellow, etc., alternating with greenish sandstones (Espley Rock). In appearance and composition the Etruria marl strongly resembles the denudation-products of basalt and basic tuff, and further examination shows that it contains fragments of basalt; that its position in the geological sequence is the same as that of the Coal-Measure vulcanicity in the Midland Province; and that it is best developed in those portions of the basins of deposition towards which the denudation-products of the Midland basalts would flow.

PARIS.

Academy of Sciences, Mar. 17.—S. Winogradsky: The synthesis of ammonia by the soil *Azotobacter*. The cultivation of this organism in a mannite medium has, with one exception (Kostytschew), never given rise to ammonia. The author now shows that if means be taken to increase the *p*H of the medium to between 8 and 9, ammonia can be detected in the atmosphere above the culture.—**Giuseppe Cesàro** was elected a *Correspondant* for the Section of Mineralogy.—**Vladimir Bernstein:** Correction concerning the series of Dirichlet.—**Baule:** A method of navigation based on automatic route tracing.—**V. Schaffers:** The earth connexion of lightning rods.—**Maurice Lambrey:** The two normal states of the NO molecule. For a layer of nitric oxide of constant thickness, the optical density of the γ-bands is proportional to $p^{1\cdot81}$, whilst the optical density of the β-bands is sensibly proportional to the pressure.—**Mlle. Jacqueline Zadoc-Kahn:** The magnetic double refraction of para-azoxyanisol at temperatures above the point of disappearance of the mesomorph state. The measurements were made with the Bellevue electromagnet in a field of 40,700 gauss. The high value of the magnetic double refraction found and its rapid variation with temperature agree with the views of G. Föex.—**A. Blanc:** The photo-electric phenomena of solutions of potassium ferrocyanide.—**Adolphe Lepape** and **Marcel Geslin:** The radioactivity acquired by materials exposed to the action of atmospheric agents. The materials examined, lead, zinc, slate, and deposited dust, were obtained from the roof of the Collège de France, and all emitted a very absorbable radiation (α-rays). The activity of the lead is higher than that of the zinc, but practically equal to that of the slate. It is concluded that the radioactivity is due to substances derived from the air.—**Jean Savard:** The ultra-violet absorption spectrum of aniline vapour.—**Al. Yakimach:** Complexes of quadrivalent manganese cyanide. Description of the preparation and properties of a potassium manganicyanide, $K_4Mn(CN)_8$.—**Lespieau** and **Deluchat:** Paradivinylbenzene and paradiacetylenylbenzene.—**Georges Brus** and **G. Peyresblanques:** The fixation of ozone by benzene linkages

and by acetylene linkages. The ozonisation curves distinguish readily non-benzene double bonds, benzene linkages and triple bonds.—**Raymond Chevallier**: The permanent magnetisation of the lavas of Iceland and of Jan Mayen.—**Schribaux**: The factors of the baking value of wheat.—**Mlle. Simone Mouchet**: The mode of formation of the spermatophores in *Pagurus*.—**R. Fosse, A. Brunel, and P. de Graeve**: The estimation of uric acid, based on the urea produced by fermentation and hydrolysis.—**Fernand Caujolle and Jean Molinier**: The influence of the fatty amines and their chlorhydrates on the amylolytic activity of the saliva and of pancreatine.

BRUSSELS.

Royal Academy of Belgium, Oct. 12.—**Cl. Servais**: The geometry of the tetrahedron (4).—**Victor van Straelen**: The Jurassic decapod crustaceans of eastern Greenland.—**M. Dehalu and P. Swings**: Note on a method of star photography based on the measurement of the opacities of photographic tracks. By a slight adjustment of the mechanism driving the equatorial telescope, the image of each star is made to appear as a short line of about 1 millimetre in length, and the opacity of this line is measured with a recording photometer. The method should prove especially useful for the fainter stars.—**P. Gilard and P. Swings**: A simple method of determination of the absorption of glasses in the ultra-violet region of the spectrum. The method described has been applied to five glasses. It is shown that the addition of nickel oxide makes the glass more permeable to the ultra-violet, and that increased transparency results from the replacement of calcium oxide by barium oxide.—**E. Asselberghs**: Note on the marine fauna of the Gedinnian of the Ardennes.—**F. Govaert**: Contribution to the study of the nitration of *o*-fluorbenzoic acid. The main product of the nitration of *o*-fluorbenzoic acid is the 1 . 2 . 5-fluornitrobenzoic acid, about 5 per cent of the 1 . 2 . 3 isomer being also formed.—**R. H. J. Germay**: The equation of Gauss.—**Maurice Nuyens**: A new method of integration of the gravific equations with spherical symmetry.—**D. V. Jonesco**: Some problems relating to a formula of recurrence or to a finite difference equation.—**Th. Lepage**: Certain differential forms associated with equations of the Monge-Ampère type arising from the calculus of variations.—**Raymond Defay**: The thermodynamical study of surface tension: affinity and adsorption velocity.—**Louis van den Berghe**: Note on deglutition in the Cyprinidæ.

ROME.

Royal National Academy of the Lincei, Dec. 1.—**Guido Ascoli**: Approximate representation of a function by means of linear combinations of given functions.—**E. Bortolotti**: Geodetic co-ordinates along a line (2).—**B. de Finetti**: Integration of functions with aleatory increment.—**G. Sansone**: Surfaces applicable to surfaces of constant mean curvature: New demonstration of Ricci's theorem.—**B. Segre**: Existence of distinct continuous systems of plane algebraic curves with given Plueckerian numbers. In continuation of the author's recent communication on questions relating to the existence and dimensions of continuous (irreducible) systems of plane algebraic curves with given characters, it is now shown that there may exist several distinct complete continuous systems (even of different dimensions) of irreducible algebraic curves with given Plueckerian characters. Certain applications of the theory of continuous systems are also considered.—**M. Picone**: The interval of indetermination of Poisson's summation procedure for Fourier's and Laplace's systems.—**Pia Nalli**: Rigid displacements and generalised derivatives.—**A. Gelfond**: A theorem of G. Polya.—**G. Boaga**: Simple rapid topographical procedures.—**N. Passerini**: Minimum temperatures at different small heights above the ground. Observations made at the Meteorological Observatory of Pisa between June 1, 1924, and June 30, 1927, show that, with rare exceptions, the minimum temperature during the twenty-four hours increases from 0·05 m. to 2 m. above the ground. The extreme differences may exceed 3°, and in one instance (Jan. 3, 1925) reached 4·5°. In most cases the minimum readings at 0·05 m. and 1 m. show a greater difference than those at 1 m. and 2 m.—**Rita Brunetti**: Variations of crystalline polychroism under the influence of the electric field.—**E. Segrè**: Anomalous dispersion in band spectra.—**A. Ferrari and C. Colla**: Crystalline structure of neutral carbonates of cobalt and nickel. Normal cobalt carbonate exhibits rhombohedric structure of the 'calcite' type, the dimensions of the unit cell, which contains four molecules being: $a = 5{\cdot}91 \pm 0{\cdot}005$ A., $\alpha = 103° 22'$; the density is 4·24. Unlike the cobalt salt, natural normal nickel carbonate has never been found, although nickel compounds are more widely diffused than those of cobalt. Preparation of nickel carbonate by various synthetic methods employed has not been found possible.—**V. Zagami**: Muscular phosphogen in fish. Experimental results are given which indicate the existence of a direct relationship between the phosphogen content of the muscles of fishes and the degree of activity and muscular strength as regards swimming. In other words, migratory and strong swimming fish contain more phosphogen in their muscles than stationary fish or those that swim less. Moreover, the caudal region always contains more phosphogen than the cranial region. The more highly the dental apparatus of the fish is developed, the greater is the proportion of phosphogen in the masseter muscle in comparison with that in other muscles of the same organism.—**R. Savelli and N. Soster**: Provocation of monophylly in *Cannabis sativa* L. by means of wounds.

SYDNEY.

Royal Society of New South Wales, Dec. 4.—**M. B. Welch**: (1) Some mechanical properties of Australian grown *Pinus insignis* (2). Whilst considerable variation occurs, the wood is by no means brittle and devoid of strength as is commonly believed. Whereas the denser Gosford wood closely resembles in every respect pitch pine, the lighter and milder South Australian wood possesses the characteristics of the clear and sugar pines. It seems, therefore, that by proper grading, *Pinus insignis* can be obtained for most of the purposes for which imported softwoods are used, provided, of course, that it can be obtained in length free from defects.—(2) Some properties of red satinay, *Syncarpia Hillii*. This is a close textured reddish coloured timber occurring in large quantities on Fraser Island, off the Queensland coast, but is little known on the Sydney market. The wood is very durable, borer and white ant resistant, and is also remarkably difficult to burn. The weight, about 52 lb. per cubic foot, precludes its use for many purposes, but where this factor is not important the wood should be useful. It works crisply and does not splinter easily, and with the added advantage of fire resistance should make an excellent flooring timber, whilst figured logs are very suitable for veneer. The wood requires little filler and readily takes a high polish. It is, however, inclined to be brittle and is not suitable for positions requiring toughness.—**L. L. Waterhouse and W. R. Browne**: Note on an occurrence of quartzite containing common opal and chalcedony at Tallong, N.S.W. The rock overlies a Permo-Carboniferous sandstone

and is itself overlain by Tertiary basalt. It is considered probable that the quartzite was originally a Tertiary sand derived from the underlying sandstone, and that silica was added mainly from volcanic sources. The cementing material is in the forms of quartz, common opal, and chalcedony, and there are veinlets through the rock lined with opal and filled with chalcedony. The order of deposition, quartz, opal, chalcedony, was probably one of decreasing temperature; no sign of a transition from opal to chalcedony was observed.—**G. D. Osborne** and **H. G. Raggatt**: Some interesting geological faults in the vicinity of Branxton, N.S.W. The stratigraphy of the Upper Marine rocks exposed in a railway cutting near Branxton is described and a detailed account of the faults intersecting these beds is given. There are nine faults, seven being of overthrust type. The displacement in each case is small. A consideration of the strike, dip, and general features of the thrusts leads to the conclusion that they were produced in Post-Palæozoic time when the area was subjected to the crustal compression which culminated in the development of the Hunter Overthrust.—**Miss J. Chalmers** and **J. C. Earl**: Studies on the hydrolysis of cellulose (1). By using a boiling 5 per cent solution of hydrogen chloride in methyl alcohol, it has been possible to accomplish a graded breakdown of cellulose triacetate. Properties of some intermediate products are placed on record.—**Francis Lions**: (1) Some trimethoxyquinoline derivatives. 1-Acetyl-2:4-dimethyl-5:6:7-trimethoxytetrahydro-quinoline and 1-acetyl-2:4-dimethyl-6:7:8-trimethoxytetrahydro-quinoline have been synthesised from 3:4:5-trimethoxy-aniline and 2:3:4-trimethoxy-aniline respectively by condensation with acetylacetone followed by ring closure, reduction, and acetylation.—(2) Researches on indoles. (1) 6-Acetylamino eugenol methyl ether obtainable from eugenol methyl ether by nitration and reduction, followed by acetylation, readily yields a dibromide ($C_{13}H_{17}O_3NBr_2$), which on treatment with concentrated alcoholic potash is converted into 2-methyl-5:6-dimethyoxindole.—**H. Finnemore** and **C. B. Cox**: Cyanogenetic glucosides in Australian plants (2). An examination of the 'native fuchsia' has shown that the cyanogenetic glucoside, which was present in the remarkably high amount of 10 per cent in a sample of air-dried leaves from Queensland, is identical with prunasin, which has been previously prepared by the controlled hydrolysis of amygdalin, and is found in Nature in the drug *Prunus seretina*.

Official Publications Received.

British.

Air Ministry: Aeronautical Research Committee. Reports and Memoranda. No. 1282: Full Scale Experiments on High Tip Speed Airscrews. Comparative Performance Trials of Three Airscrews of Different Sections. By W. G. Jennings. (T. 2864.) Pp. 6+5 plates. 6*d*. net. No. 1217 (Ae. 376): Conditions for the Prevention of Flexural-torsional Flutter of an Elastic Wing. By R. A. Frazer and W. J. Duncan. (T. 2704 and a.) Pp. 16. 9*d*. net. No. 1276 (Ae. 422): The Effect of Span on Aircraft Performance. By W. G. Jennings, in collaboration with Messrs. Boulton and Paul. (T. 2802 and a.) Pp. 17+11 plates. 1*s*. net. (London: H.M. Stationery Office.)

The Gardens' Bulletin, Straits Settlements. Vol. 6, Part 2: Malay Village Medicine. Prescriptions collected by I. H. Burkill and Mohamed Haniff. Pp. 167-321. (Singapore: Botanic Gardens.) 2.50 dollars.

Transactions of the Optical Society. Vol. 30, No. 5, 1928-29. Pp. 185-272+xiv. (London.) 10*s*.

The Institution of Professional Civil Servants. Annual Report of Council for the Year 1929. Pp. xiii+55. (London.)

Biological Reviews and Biological Proceedings of the Cambridge Philosophical Society. Edited by H. Munro Fox. Vol. 5, No. 2, April. Pp. 91-176. (Cambridge: At the University Press). 12*s*. 6*d*. net.

Board of Education. Vacation Courses in England and Wales and Scotland, 1930. Pp. 26. (London: H.M. Stationery Office). 6*d*. net.

Reports of the Council and Auditors of the Zoological Society of London for the Year 1929, with an Appendix on the Centenary Celebrations, prepared for the Annual General Meeting to be held on Tuesday, April 29th, 1930, at 4 p.m. Pp. 119. (London.)

Foreign.

Publications of the Astronomical Observatory of the Warsaw University. Vol. 5. Pp. iii+76. (Warsaw.)

Deutsche Forschung: aus der Arbeit der Notgemeinschaft der Deutschen Wissenschaft. Heft 1. Pp. 116. (Berlin.)

The University of Colorado Studies. Vol. 17, No. 4. Pp. 269-431. (Boulder, Colo.)

Review of Legal Education in the United States and Canada for the Year 1929. By Alfred Z. Reed. Pp. iii + 72. (New York: The Carnegie Foundation for the Advancement of Teaching.) Free.

U.S. Department of Commerce: Coast and Geodetic Survey. Serial No. 453: United States Magnetic Tables and Magnetic Charts for 1925. By Daniel L. Hazard. Pp. ii+136. (Washington, D.C.: Government Printing Office.) 60 cents.

Smithsonian Institution: Bureau of American Ethnology. Bulletin 91: Additional Studies of the Arts, Crafts and Customs of the Guiana Indians, with Special Reference to those of Southern British Guiana. By Walter E. Roth. Pp. xvii+110 + 34 plates. 1 dollar. Bulletin 93: Pawnee Music. By Frances Densmore. Pp. xviii+129+8 plates. 90 cents. (Washington, D.C.: Government Printing Office.)

State of Connecticut. Public Document No. 24: Fifty-second Report of the Connecticut Agricultural Experiment Station, New Haven, for the Year 1928. Pp. xi+862+xxx. (New Haven, Conn.)

National Research Council. Organization and Members, 1929-1930. Pp. 65. (Washington, D.C.: National Academy of Sciences.)

Proceedings of the American Philosophical Society. Vol. 68, No. 4, 1929. Pp. xix+275-326. Vol. 69, No. 1, 1930. Pp. 17. (Philadelphia.)

U.S. Department of Commerce: Bureau of Standards. Bureau of Standards Journal of Research. Vol. 4, No. 2, February. Pp. 177-327. (Washington, D.C.: Government Printing Office.) 40 cents.

Catalogues.

Judex Analytical Reagents and Laboratory Chemicals. Pp. 72. (London: The General Chemical and Pharmaceutical Co., Ltd.)

Cambridge Instruments for Hydrogen-ion Measurements. (List No. 108.) Pp. 24. (London and Cambridge: Cambridge Instrument Co., Ltd.)

The Creation of a Microscope Objective in the Rathenow Works of Emil Busch Optical Company. Pp. 20. (London: Emil Busch Optical Co., Ltd.)

Diary of Societies.

FRIDAY, April 25.

Faraday Society (at Chemical Society), at 2.15.—Annual General Meeting.

Royal Society of Medicine (Medicine Section), at 5.—Cinematographic Demonstration by Dr. L. G. Rowntree: Ganglionectomy in Chronic Arthritis.—Prof. Dixon and Dr. G. N. Myers: The Curative Action of Digitalis in Toxæmia.

Institution of Mechanical Engineers, at 6.—W. Nithsdale: The Design and Results of a 600 lb. per sq. in. Boiler Installation.

Royal Society of Medicine (Epidemiology Section), at 8.—Prof. S. L. Cummins: Some of the Clinical and Pathological Factors underlying Mortality Rates in Tuberculosis.

Institution of Electrical Engineers (West Wales (Swansea) Sub-Centre).—S. W. Melsom, A. N. Arman, and W. Bibby: Surge Investigations on Overhead Line and Cable Systems.

SATURDAY, April 26.

North of England Institute of Mining and Mechanical Engineers (at Newcastle-upon-Tyne), at 2.30.—G. E. Tansley: The Value of the Economiser in Present Day Boiler Installations.—Paper open for further discussion:—Notes on a Winding Accident at Mainsforth Colliery, C. Howson.

British Psychological Society (at University College), at 3.—Dr. O. A. Oeser: A Critical Examination of Kohler's Gestalt Psychology.—G. C. Grindley: Psychological Factors in Peripheral Vision.—Miss M. D. Vernon: A Photographic Study of Eye Movements in Reading.

MONDAY, April 28.

Victoria Institute (at Central Buildings, Westminster), at 4.30.—Rev. Dr. H. C. Morton: The Concept of Evolution in the New Psychology.

Institute of Actuaries, at 5.—P. N. Harvey: Notes on the Relative Mortality of Married Men and on an Experiment in Forecasting Mortality over a Limited Period.

Royal Institute of British Architects, at 8.—Prof. A. E. Richardson: Architects' Drawings of 1800–1850.

Royal Society of Medicine (Odontology Section), at 8.—F. Coleman: Buried Mandibular Teeth with Crowns in Occlusion.—Mrs. May Mellanby: Some Further Investigations on Man and Animals, into the Causes of Dental Disease, with Special Reference to Factors Controlling the Resistance of the Dental Tissues to Harmful Agencies.

TUESDAY, April 29.

Royal Society of Arts (Dominions and Colonies Section), at 4.30.

Royal College of Physicians of London, at 5.—Prof. J. J. R. Macleod: Diabetes as a Physiological Problem (Oliver Sharpey Lectures) (1).

Institution of Civil Engineers, at 6.—E. T. Ward: The Navigability of the Lower Danube.

Royal Photographic Society of Great Britain (Scientific and Technical Group), at 7.—J. Durward: Air Photography Surveys.—Dr. F. M. Hamer and O. Bloch: The Optical and Photographic Properties of Certain Dyes of the Thionine and Related Types.—A. S. Newman: Demonstration of H. and D. Exposure Machine.—O. J. Wilkinson: Concerning Photography in the Gangetic Delta.

ROYAL ANTHROPOLOGICAL INSTITUTE (jointly with Folklore Society), at 8.30.—Dr. M. Gaster: Roumanian Art and Handicraft in Relation to the Balkan Peoples.—Mrs. Murgoci: Description of the Collection of Roumanian Folklore Objects on Exhibition.

WEDNESDAY, APRIL 30.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—Emily Dix and Dr. A. E. Trueman: Some Non-Marine Lamellibranchs from the Upper Part of the Coal Measures.—Emily Dix: The Flora of the Upper Portion of the Coal Measures of North Staffordshire.

NEWCOMEN SOCIETY FOR THE STUDY OF THE HISTORY OF ENGINEERING AND TECHNOLOGY (at 17 Fleet Street), at 5.30.—Major E. A. Marples: Ancient Civilisations.

ROYAL SOCIETY OF ARTS, at 8.

EUGENICS SOCIETY (at Royal Society), at 8.30.—Dr. C. P. Blacker: Birth Control Research and Practice in Europe.

ROYAL SOCIETY OF MEDICINE (Urology Section), at 8.30.—Prof. H. Young: The Advantages of the Perineal Route in the Treatment of Various Diseases of the Prostate.

ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY.—Dr. W. E. Patterson: Resistance of Electrodeposits to Corrosion, with Special Reference to Cadmium and Zinc.

THURSDAY, MAY 1.

LINNEAN SOCIETY, at 5.—E. B. Worthington: On the Movements of Plankton in the African Great Lakes.—Dr. G. P. Bidder: On the Attitude of a Hexactinellid at the Bottom of the Sea, as compared with that assumed in Museum Jars and Monographs.—M. Burton: Glass-Sponges.

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 5.—Prof. J. J. R. Macleod: Diabetes as a Physiological Problem (Oliver Sharpey Lectures) (2).

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.—Annual Meeting.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—R. H. Fowler: Some Recent Advances in the Electron Theory of Metals (Kelvin Lecture).

CHEMICAL SOCIETY, at 8.—R. J. W. Le Fevre and E. E. Turner: Orientation Effects in the Diphenyl Series. Part VIII. The Nitration of 4:4′-difluorodiphenyl.—Miss D. L. Fox and E. E. Turner: The Scission of Diaryl Ethers and Related Compounds by Means of Piperidine. Part IV. Elimination of Halogen Atoms and Scission Reactions during Substitution Processes.

ROYAL SOCIETY OF MEDICINE (Tropical Diseases Section) (Annual General Meeting) at 8.

INSTITUTION OF CIVIL ENGINEERS (Birmingham and District Association) (at 6 Corporation Street, Birmingham).—Annual General Meeting.

FRIDAY, MAY 2.

ROYAL SOCIETY OF MEDICINE (Otology Section) (Annual General Meeting), at 10.30 A.M.—Papers by Prof. M. Sourdille and G. J. Jenkins.

ROYAL SOCIETY OF MEDICINE (Laryngology Section), at 5.—Annual General Meeting.

ROYAL SANITARY INSTITUTE (at Town Hall, Tunbridge Wells), at 5.30.—Dr. F. C. Linton and others: Discussion on The Maternity Home as a Health Asset.—H. T. Taylor and others: Discussion on Can the Slum be Abolished?

INSTITUTION OF ELECTRICAL ENGINEERS (Meter and Instrument Section), at 7.—C. W. Marshall: The Metering Arrangements for the 'Grid' Transmission System in Great Britain (Lecture).

INSTITUTION OF MECHANICAL ENGINEERS (Informal Meeting), at 7.—Major A. W. Farrer: Empire Free Trade and the Engineer.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Pictorial Group), at 7.—Informal Meeting.

GEOLOGISTS' ASSOCIATION (at University College), at 7.30.—A. A. Miller and J. S. Turner: The Lower Carboniferous Succession along the Dent Fault and the Yoredale Beds of the Shap District.—R. G. S. Hudson: The Carboniferous of the Craven Reef Belt: The Namurian Unconformity at Scaleber, Nr. Settle.

FARADAY SOCIETY (at Chemical Society), at 8.—Prof. G. Wiegner: On Coagulation (Lecture).

PHILOLOGICAL SOCIETY (at University College), at 8.—Anniversary Meeting.

ROYAL SOCIETY OF MEDICINE (Anæsthetics Section) (Annual General Meeting), at 8.30.—Dr. R. J. Clausen: Ethylene Anæsthesia.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—H. E. Wimperis: A Study of the Phenomenon of Spin in Airplanes.

PUBLIC LECTURES.

MONDAY, APRIL 28.

FISHMONGERS' HALL, E.C.4, at 3.—W. L. Calderwood: Modern Views on Salmon Hatching (Buckland Lectures) (1).

TUESDAY, APRIL 29.

FISHMONGERS' HALL, E.C.4, at 3.—W. L. Calderwood: Modern Views on Salmon Hatching (Recent Results from Canada) (Buckland Lectures) (2).

UNIVERSITY COLLEGE, at 5.30.—Dr. J. C. Flugel: The Methodology of Happiness.

GRESHAM COLLEGE, at 6.—W. H. Wagstaff: Geometry. (Succeeding Lectures on April 30, May 1 and 2.)

WEDNESDAY, APRIL 30.

FISHMONGERS' HALL, E.C.4, at 3.—W. L. Calderwood: The Sea and River Life of the Salmon (Buckland Lectures) (3).

THURSDAY, MAY 1.

ST. THOMAS'S HOSPITAL MEDICAL SCHOOL, at 5.30.—Dr. H. Leslie-Roberts: Some Biological Aspects of the Human Skin. (Succeeding Lecture on May 2.)

FRIDAY, MAY 2.

UNIVERSITY COLLEGE, at 5.—Prof. B. Ashmole: History of Ancient Sculpture.

EXHIBITION.

APRIL 28 TO MAY 3.

EXHIBITION OF ROUMANIAN PEASANT ART (under the Auspices of the Royal Anthropological Institute and the Folk-Lore Society) (at 52 Upper Bedford Place, W.C.1), from 10.30 A.M. to 5.30.

April 29, at 8.30.—Dr. M. Gaster: Roumanian Art and Handicraft in its Relation to the Balkan Peoples.

DISCUSSION.

APRIL 25 AND 26.

FARADAY SOCIETY (at Chemical Society).—Optical Rotatory Power.

Friday, April 25, 2.30 to 7 P.M.—Prof. T. M. Lowry: Introductory Paper.

(*a*) The Physical Basis of Optical Rotatory Power:

Prof. P. P. Ewald: Introduction to Physical Theories of Natural Optical Activity.

G. Temple: Wave Mechanics of Optical Rotation and of Optically Active Molecules.

Prof. R. de Mallemann: On Molecular Theory and the Calculation of Natural Rotatory Power.

Dr. W. Kuhn: The Physical Significance of Optical Rotatory Power.

Dr. K. Wolf: The Principle of the Free Rotation of Optically Active Molecules.

Dr. H. G. Rule: The Influence of Polar Substituents on the Optical Rotatory Power of Organic Compounds.

(*b*) Apparatus and Methods:

Dr. R. Descamps: Methods for the Measurement of Natural Rotatory Power in the Ultra-Violet Region of the Spectrum.

Prof. T. M. Lowry and Dr. G. Owen: Note on the Calculation of Dispersion Equations.

Saturday, April 26, from 10 A.M. to 1.15 P.M., and 2.30 to 4 P.M.

(*c*) Rotatory Power of Solutions:

Prof. A. Cotton: The Existence of Racemic Compounds in Solution and the Application of Circular Dichroism to the Synthesis of Active Compounds.

Prof. E. Darmois: Salt Effect and Rotatory Power.

Prof. G. Bruhat: The Absorption and Rotatory Dispersion of Solutions of Tartaric Acid.

Dr. P. C. Austin: The Rotatory Dispersion of Tartaric Acid and its Derivatives.

Dr. R. Lucas: The Origin of the Variations in the Rotatory Power of a Compound.

Prof. T. S. Patterson: The General Behaviour of Optically Active Compounds from a Single Point of View.

G. Owen: The Effect of Concentration on the Values of the Dispersion and Rotation Constants for Solutions of Camphor in Methyl Alcohol.

(*d*) The Chemical Aspects of Optical Rotatory Power:

Dr. W. H. Mills: Molecular Dissymmetry.

Prof. R. Betti: Relationship between Rotatory Power and Chemical Constitution.

Dr. J. Kenyon: Relation between the Rotatory Powers of the Members of Homologous Series.

Prof. J. Read: Optical Superposition.

Dr. J. Kenyon and Dr. H. Phillips: Some Recent Developments in the Study of the Walden Inversion.

ANNUAL MEETING.

MAY 1 AND 2.

IRON AND STEEL INSTITUTE (at Institution of Civil Engineers).

Thursday, May 1, at 10 A.M.—Presentation of Bessemer Gold Medals to Dr. E. Schneider and Dr. W. Rosenhain.

Prof. W. A. Bone, L. Reeve, and H. L. Saunders: An Experimental Inquiry into the Interactions of Gases and Ore in the Blast-Furnace. Part II. Carbon Deposition at 450° C. and its Influence upon the Ore Reduction; Equilibria between Gases and Ore at 650° to 1000° C.

F. Bainbridge: Developments in Fuel Economy at Skinningrove.

At 2.30.—R. Whitfield: Single-Sheet or Thin-Pack Normalising, or Heat Treatment *versus* Box-Annealing of Sheets.

E. Mort: Tin and Sheet Mill Rolls. Their Treatment, Performance, and Premature Failure in Service.

Sir H. C. H. Carpenter and J. M. Robertson: The Metallography of some Ancient Egyptian Implements.

J. A. Jones: Chromium-Copper Structural Steels.

Friday, May 2, at 10 A.M.—Announcement of Award of the Andrew Carnegie Research Scholarships for 1930–31. Announcement of Award of the Williams Prize to W. E. Simons.

Dr. W. Rosenhain and C. H. M. Jenkins: Some Alloys for Use at High Temperatures. Nickel-Chromium and Complex Iron-Nickel-Chromium Alloys. Part I.—C. H. M. Jenkins, H. J. Tapsell, C. R. Austin, and W. P. Rees: Part II.

J. L. Haughton and M. L. Becker: Alloys of Iron Research. Part IX. The Constitution of the Alloys of Iron with Silicon.

M. L. Becker: Carburising and Graphitising Reactions between Iron-Carbon Alloys, Carbon Monoxide, and Carbon Dioxide.

A. L. Norbury and E. Morgan: The Effect of Melting Conditions on the Microstructure and Mechanical Strength of Grey Cast Irons containing Various Amounts of Carbon and Silicon.

A. R. Page and J. H. Partridge: The Properties of some Steels containing Chromium.

D. Brownlie: The History of the Cementation Process of Steel Manufacture. Part I.—Baron de Laveleye: Part II.

S. Maita: The Corner Ghost in Steel Ingots.