THURSDAY, MAY 8, 1919.

JOSEPH BLACK.

The Life and Letters of Joseph Black, M.D. By Sir William Ramsay. With an Introduction dealing with the Life and Work of Sir William Ramsay, by F. G. Donnan. Pp. xix + 148. (London: Constable and Co., Ltd., 1918.) Price 6*s*. 6*d*. net.

THIS little book has a special interest in being the last published work of the late Sir William Ramsay. As Prof. Donnan states in his graceful appreciation of the author's life and work, Ramsay possessed an intimate knowledge and true perception of Black's position in the history of science, and as they were both *alumni* of the same *alma mater* (the University of Glasgow) it was exceedingly appropriate and a charming act of piety that he should have paid such a tribute to the memory of one with whose name and fame that university is so closely identified.

At the same time it cannot, in strict truth, be said that we have thereby gained any fresh light on Black's life and character, or on the nature and influence of his work. Nor was this to be expected. Practically all that can be said concerning his personal history, his habits, his occupations, his intellectual powers, his social gifts, and his influence as a teacher was said long ago by his successor and biographer, Robison, and his contemporaries, Playfair and Brougham, and it has been summarised in Thomson's well-known account. Indeed, says Ramsay with that quaint turn of humour and gentle irony so characteristic of him, "Dr. Thomas Thomson found Dr. Robison's estimate of Black's character so just that he appropriated it almost verbatim in his 'History of Chemistry' without the formality of quotation marks."

As regards, too, the influence of Black's work and teaching, there is nothing fresh to be learned. History has set its seal upon them, and posterity will accept the verdict. There will be no appeal. Epoch-making as Black's services to science were, few men of such eminence ever furnished so little material to the historian. His great achievements were made at the very outset of his career. He became famous almost at a bound, and for upwards of forty years he lived upon his reputation, augmenting it, indeed, by the wise and philosophic insight, the depth and range of his knowledge, liberality of thought, and sound judgment with which he impressed his colleagues and contemporaries, and influenced and stimulated his students. To all this Sir William Ramsay bears admirable testimony. The subject was evidently congenial to him, and the story as told by him was well worth the telling. For Robison's biography is practically forgotten except by bibliophiles, and Thomson's "History," a compilation of no great merit, and mainly of value for its record of events within the author's personal experience, is probably never looked into by the modern student. What is worth preserving in it, from the point of view of history, has long since been incorporated into later and more important works.

A physician with a very limited practice, whose energies, such as they were, were almost wholly engrossed in the work of preparation for his lectures on chemistry, mainly to medical students, of feeble health and little physical vigour, Black lived a singularly tranquil and uneventful life. His constitutional weakness predisposed him to indolence, and he was incapable of any sustained mental exertion. Literary composition was evidently irksome to him. His correspondence might have been as world-wide as his fame had he cared, or been able, to maintain it. But a valetudinarian before he had reached middle life, he attained the allotted span only by the strictest regimen and by a routine almost monotonous in its regularity.

Moreover, the conditions both at Glasgow and at Edinburgh offered little inducement to experimental inquiry; in those days there was nothing in the nature of laboratory instruction to students, nor had Black facilities for working by means of assistants. Still, had he possessed something of the zeal and enthusiasm of a Scheele or a Priestley, he would have triumphed over these obstacles, for Black was not a poor man, and was well able to afford the expense of tilling the field of inquiry, especially in the domain of heat, which he had opened out for himself. As it was he left it to others to garner the rich harvest which lay ready to his hand had he only had the will and the vigour to gather it. Not that Black was careless of, or indifferent to, his reputation. He complained, and with good cause, of the manner in which his pioneering work was ignored by his French contemporaries, and he was consequently annoyed by the fulsome flattery addressed to him by Lavoisier when it became known that he was not indisposed to accept the doctrine of the anti-phlogistians. But he never sought for honours and distinctions or marks of recognition by foreign academies, and was genuinely surprised, and with an almost childlike gratification, when he received them.

Sir William Ramsay's pen-portrait conveys a vivid and lifelike presentment of a guileless, unaffected character, a man of strict integrity, perfectly transparent, firm and constant in his friendships, of a cheerful, lovable disposition, easy of approach, affable and courteous in bearing, and honourable in all transactions and social obligations. He lived a serene and unembittered existence, wholly unmoved by faction and undisturbed by polemical strife. He died as he had lived, and his gentle spirit left him when seated in his chair, without the slightest sign of even momentary pain.

The student of chemistry who is at all interested in the personal history of the science will read this book with pleasure and profit, for no better instance of the happiness and contentment that attend a life free from worldly troubles, and devoted to the unselfish pursuit of science and to the contemplation of its truths, can be found than in that of Joseph Black, who is to us, as he was to his contemporaries, one of the greatest ornaments of his age.

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THE FUNCTIONS OF THE INTERNAL EAR.

Equilibrium and Vertigo. By Dr. Isaac H. Jones. With an analysis of pathologic cases by Dr. Lewis Fisher. Pp. xv+444. (Philadelphia and London: J. B. Lippincott Co., 1918.) Price 21*s.* net.

ALTHOUGH the internal ear or labyrinth of man's body is so small that it may be placed within a hazel-nut of moderate size, it contains two organs of the first importance—one for the recognition of sound, the other for the recognition of movement. A hundred years ago anatomists and physiologists had no suspicion that the internal ear was a double organ. When John Hunter discovered that fishes had an elaborate internal ear or labyrinth, with three well-developed semicircular canals, he believed he had established as a fact that fishes are furnished with the power of hearing. The discovery made by Flourens in 1825 that a partial or total destruction of the semicircular canals of a pigeon deprived the bird of all power of controlling its movements was altogether unexpected and puzzling. No one had suspected that the vertebrate animal was furnished with an organ which silently answered the purposes of a mariner's compass, nor could it have been anticipated that such an instrument should form part of the apparatus known as the internal ear or labyrinth.

After the initial discovery by Flourens our knowledge of the equilibrating function of the labyrinth developed slowly and intermittently, being regarded as a matter of mere academical interest until 1905. In that year Robert Bárány, lecturer on aural surgery in the University of Vienna, made a chance observation which led to a knowledge of this obscure and silent function of the ear becoming a matter of immediate practical importance to every medical man. Bárány noted that when he douched the ear-passage of a patient with cold water, the eyes immediately swung in one direction; when he employed hot water in place of cold, the eyes moved in a reverse direction. He immediately suspected, and proceeded to prove, that the douches set up convection currents of opposite directions in the adjoining semicircular canals, the cold douche giving a downward flow, the hot one in a reverse direction. If there was a diseased or disordered condition of the canals, then no response was given by the eyes, because the automatic mechanism which fixes the gaze on an object when one's head is turned no longer acts.

In 1909 Bárány made the further and even more important observation that the action of every muscle of the body was influenced by messages or stimuli which arise in the semicircular canals and adjoining parts. When he set up currents within the canals either by douching or by seating the patient on a rotating chair, he found that the power of carrying out precise movements was lost in every part of the body. Thus the canalicular mechanism of the ear establishes a connection with every part of the executive elements of the central nervous system. By testing the reactions yielded by the semicircular canals, the physician can explore the central nervous system and ascertain whether or not a multitude of its connections are in a normal condition of health.

In no country has the practical application of Bárány's discoveries been more vigorously followed up than in the medical schools of the United States. That has been particularly the case in the University of Pennsylvania, where Dr. Isaac H. Jones holds the post of instructor in "neuro-otology," and at the same time acts as laryngologist to the Philadelphia General Hospital. In the work under notice Dr. Jones not only introduces his readers to the latest teaching regarding the functions and connections of the labyrinth, but also adds certain discoveries of his own. He claims that the nerve-fibres from the external or horizontal canals pursue a separate course and form different connections in the central nervous system from the fibres which issue from the vertical canals—the superior and posterior. The section of this book in which Dr. Lewis Fisher gives an analysis of a great number of cases where a defect had occurred in the balancing mechanism of the body will prove of particular interest to clinicians. Of more immediate importance are the chapters devoted to a description of the tests applied to candidates for the aviation corps, for it is manifest that a sound and sensitive equilibrating mechanism is as necessary for a flying man as for a bird. The essential tests are based on Bárány's discoveries.

Dr. Jones does not touch on the very interesting problem of how two functions so different in nature as are those of balancing and of hearing became associated in the same organ, nor is our knowledge sufficiently complete to permit us to tell the story in full. Yet from a double source—from the evidence of embryology and of comparative anatomy—we know for certain that the internal ear was evolved as a balancing mechanism—as a sense-organ to provide the body with a knowledge of its position and of its movements—and that the part which serves the function of hearing is a comparatively late addition or extension. In making that addition Nature introduced no new principle, but by a slight modification of the apparatus used for registering changes in the position of the body she evolved an instrument for the registering of sound-waves and for their conversion into nerve stimuli. The basal design of the labyrinth is a minute closed sac filled with fluid. On its floor is a carpet of cells bearing cilia; on the cilia is poised a load. The slightest change in the position of the body of the animal is accompanied by a change in the position of the load and a bending of the cilia. In a manner which we can only guess, the mechanical bending of the cilia is converted by their basal cells into nerve stimuli. For the detection of bodily movements, part of the closed sac became converted into semicircular canals, and across each canal was drawn a barricade of cilia, also loaded. The canals are so set that a displacement of the fluid within them accompanies every movement, the rate of the displacement being registered by the barricade of hair-cells set across their lumina. By the introduction of a few modifications an area of hair-cells was exposed to displacements of fluid set up by the impact of sound-waves.

Physiologists are only beginning to realise that Bárány's researches on the action of the balancing part of the labyrinth are at the same time throwing a novel light on the nature and action of its cochlear or auditory part. The machinery and the manner in which the machine works are the same in both cases—that of registering a mass displacement of the contained fluid. The evolutionary story of the ear, so far as we know it, is dead against any part of the cochlea acting as a resonator. A. KEITH.

MILITARY GEOLOGY AND TOPOGRAPHY.

Military Geology and Topography: A Presentation of Certain Phases of Geology, Geography, and Topography for Military Purposes. Edited by Herbert E. Gregory. Prepared and issued under the auspices of the Division of Geology and Geography, National Research Council. Pp. xv+281. (New Haven: Yale University Press; London: Oxford University Press, 1918.) Price 5*s.* 6*d.* net.

THIS work is essentially a text-book, prepared with the primary intention of helping in the teaching of the elements of geology and geography to those about to take commissions in the Army of the United States. Throughout it aims at teaching first principles, avoiding technical terms so far as possible.

The first chapter gives an epitome of the types of rock on the earth's surface, with such details as are of interest to the engineer. This is followed by a few pages on earth movements, with excellent diagrams of the effects of faulting, etc. The space allotted to this subject is so restricted that only the most general outlines can be given. The chapter ends with a "summary of engineering considerations related to rocks." Chap. ii. deals with rock weathering, explaining how the strata mentioned in the previous chapter became altered when exposed to atmospheric agents. The next three chapters deal respectively with streams, lakes, and water supply. Most of the information contained in these chapters is such as should be known by everyone who expects to live or journey beyond a city where water is merely obtained by turning a tap and disposed of by means of drains.

Under the heading of water supply several pages are given to military requirements. In dealing with the volumes of water required by an army the demands from all sources—men, horses, washing, etc.—are added together and divided by the number of men in the unit; the result is then given in gallons per soldier. The figure 10–50 gallons per day per soldier is thus arrived at. A point which is not brought out is that a distinction can often be drawn between water for horses and water for human consumption. Emphasis is rightly laid on the importance of the time-factor in military water-supply schemes. Schedules for entering up details of wells, springs, etc., given on pp. 152–56, are those in use by the United States Geological Survey, and therefore have the advantage of having been tested by actual use.

Chap. vi., on land forms, gives, with the help of excellent small diagrams, a good introduction to the study of the relationship of geological structure to the topography of an area. At the end of the chapter is a page of military problems. These are good in showing how geology should be considered in conjunction with other details of a military nature. Unfortunately, only a very small space is devoted to this side of the subject.

Chap. vii. will be found useful in the teaching of map reading and map interpretation. The chapter deals with topographical, and not geological, maps, but shows how the general geological structure of an area can often be foretold by a study of the topography. The book ends with short notes on various minerals, with special reference to their uses in war.

The work throughout is designed for teaching, and it is in some ways unfortunate that it bears the word "military" in such prominence, for the book will be found to be of value to all who wish to have some of the everyday practical applications of geology put before them in an elementary way, or to those who desire a well-illustrated text-book for teaching purposes. From the military point of view it should be noted that the book is designed to help all officers to understand the elementary facts regarding the ground on which they are, or expect to be, fighting. No mention, however, is made of the need for a special geological section of the Engineers composed of experts who can have access to published works and maps, and be in personal touch with men who have worked in the area. There is no doubt that much time and energy would frequently have been saved during the war if all officers had known the principles set forth in this book. It should be borne in mind that unless expert advice is obtained for the larger engineering undertakings, the little knowledge which is a dangerous thing may lead to the starting of impracticable schemes. W. B. R. K.

OUR BOOKSHELF.

A Century of Science in America. With Special Reference to the "American Journal of Science," 1818–1918. By Edward Salisbury Dana and Others. Pp. 458. (New Haven: Yale University Press; London: Oxford University Press, 1918.) Price 17*s.* net.

THOUGH the "prefatory note" makes no mention of the fact, this handsomely produced work appears to be a reproduction for the library-shelf of the number of the *American Journal of Science* issued in July, 1918 (see NATURE, vol. cii., p. 50). The numerous portraits of American men of science give it distinction, and Clerk Maxwell, Huxley, and Charles Darwin are also represented. It is not stated that the portrait of Huxley is from Collier's famous painting. Some of the articles, as previously noticed, cover the progress of a particular science in the world at large during the century commemorated, 1818–1918.

The *American Journal of Science* originated in the widely cultured mind of Benjamin Silliman, professor of chemistry and mineralogy in Yale College, New Haven, and it is natural that from the first it had as "a leading object" the illustration of "American natural history, and especially our mineralogy and geology." Silliman was fortunate in having James Dwight Dana as a son-in-law, and to this day men of science throughout the world look to the *American Journal of Science* for the publication of original researches on such subjects as fossil reptiles, coral-reefs, and especially synthetic mineralogy. This memorial volume appeals, then, particularly to the geologist, who will find that half its pages are devoted to subjects with which he has some direct acquaintance. It will, moreover, supplement the various published summaries of the history of chemistry, physics, zoology, and botany by bringing into prominence the happy flow of communications that has moved in both directions across the Atlantic during the past hundred years of human thought and observation.

G. A. J. C.

La Genèse de la Science des Cristaux. By Hélène Metzger. Pp. 248. (Paris: Félix Alcan, 1918.) Price 5.50 francs.

THIS is a history of the science of crystals during the seventeenth and eighteenth centuries—that is, during the period of its origin and early development. The earliest serious attempts at a study of crystalline forms were those of the Dane, Nicolaus Steno (1669), and M. A. Cappeller (1723), but the first real advance was made by the French crystallographers, Romé de l'Isle (1772) and the Abbé Haüy (1784). Many quotations are given from the old authors, and their theories and quaint ideas are compared and commented upon. In different sections the subject is considered in its relations to (1) mineralogy, (2) biological sciences, and (3) physical sciences. Although the formation of snow and ice crystals and the growth under the microscope of crystals from mineral waters and saline solutions attracted much attention during this period, the study of crystals has always been more intimately associated with mineralogy. The book concludes with a long list of authors quoted, and a more or less complete bibliography, in which there are several misprints. A rather discursive table of contents takes the place of an index, and, as is often the case in French books, there are no head-lines to the pages. The author is a member of the French Mineralogical Society, and has contributed to its Bulletin under her maiden-name of Bruhl.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Cultivation of Sponges.

THERE appeared in NATURE of April 20, 1916, an abstract of an article by me on sponge culture which was published in the *West Indian Bulletin* towards the end of 1915. In this article an account was given of Moore's work in Florida, and of a more recent commercial undertaking at the Caicos Islands, in which marketable sponges had been reared from cuttings on cement discs in comparatively shallow sea-water.

This interesting, and alleged highly profitable, industry is now attracting serious attention in the Bahamas, where there has been considerable depletion of the natural beds. Farther south, in the Lesser Antilles, the Imperial Department of Agriculture for the West Indies, with which I am connected, has been trying for some time to arrange sponge-growing experiments at islands like Antigua and Barbados, where, even though the locally occurring sponges are of inferior quality, suitable conditions may be found for growing introduced types of better quality by the culture method.

The uncertainty of our knowledge concerning the behaviour of sponges amid different environments, and the paucity of our knowledge of West Indian sponges and their distribution, make a proper scientific inquiry into sponge culture very desirable. Moreover, the prevailing scepticism in certain quarters regarding the profitable character of sponge culture calls for a technical report on the economic side.

At present steps are being taken with the view of securing two marine zoologists for the British West Indies; one of them may be attached to the staff of the Imperial Department at Barbados, and the other will probably be stationed in the Bahamas. It seems, however, that some considerable time will elapse before anything is definitely settled, and even then the investigation of a subject like West Indian sponges and their culture requires careful planning and special qualifications on the part of the observers.

When in London recently I took the opportunity of bringing the matter before Dr. Harmer at the British Museum (Natural History) and Prof. Dendy at King's College. There can be no objection to stating that these authorities consider that sponge culture in the West Indies presents problems of great scientific interest, and they suggest that the inquiry might well be pushed from the purely scientific aspect. It is obvious to the least imaginative that a study of sponges along the West Indian chain through 20° of latitude (1200 miles), and including environmental experiments with different types, would be most valuable. Prof. Dendy is of opinion that the inquiry is worthy of a special expedition, for we know very little about West Indian sponges in this country.

It is intended to bring these views to the notice of the Colonial Office, and to submit that an official application for financial assistance and scientific guidance should be made to the Department of Scientific and Industrial Research. Suggestions as to any other steps desirable will be appreciated.

In concluding this letter, it may be pointed out that during the war, owing to the naval occupation of the Mediterranean, this country has been largely dependent upon the West Indies for its supply of sponges, which are essential to a large number of important industries. We can keep this increased trade only if we maintain West Indian production and, what is quite as urgent, improve West Indian grades so that they can compete with the Mediterranean. This may or may not be achieved by means of sponge culture, but it is worth trying. The Americans have undoubtedly made progress with sponge culture in Florida, and a significant fact is recorded in a recent British Colonial Report on the Turks and Caicos Islands to the effect that at one of these islands 8000 acres of sea for sponge culture has been conceded to a capitalist from New York. While we should prefer to see British enterprise of this nature, particularly in a British Possession, we have to recognise a certain consistency in United States action. Most of the marine investigation in the West Atlantic has been American; for instance, Prof. Nutting's recent and former expeditions, the study years ago on the fishes of Porto Rico by the U.S. Government, and the quite recent oceanographic work in the steamer *Bache*. It is to be hoped that Great Britain will see its way to take up the sponge question, first from the scientific, and then from the commercial, point of view, and that a start will be made at the earliest possible date.

W. R. DUNLOP.

Seaholme, Hythe, Kent, April 23.

Wasps.

THE warm spring weather which made its advent on Good Friday (April 18), and was continued on following days, brought out numbers of humble-bees, a few wasps, and butterflies of various kinds. I have usually observed that the humble-bees precede the wasps by a week or two.

A wasps' nest (*Vespa germanica*) situated in the garden here in 1915 was a rather strong one, and on digging it out in October I estimated the number of cells as 12,900. A nest of the same species which I had in 1918 was much stronger. In 1915 the hourly number of wasps flying in and out of their nest was 6500 at the most abundant period, while in 1918 the rate was no fewer than 15,500. The record heavy rains of September last, however, swamped the nest and brought it to a premature termination, when but few of the young queens had taken to flight. If the nest of 1918 had a number of cells proportionate to that of 1915, according to the hourly rate of wasps flying to and fro, then the total number of cells must have been about 30,000; but I prefer to take a more moderate estimate, and to put the aggregate at 25,000. I could not, however, actually determine the number by observation, the layers of comb being so soaked with the wet that they did not admit of detailed investigation. If each cell produces three generations of wasps, then my nest of 1918 must have been responsible for quite 75,000 wasps. Needless to relate, house-flies were not troublesome in this neighbourhood during last summer! But which pest of the two, wasps or house-flies, is the more tolerable? For my part, I greatly prefer the wasps!

Can any reader inform me as to the number of wasps supposed to be associated with a very strong nest?

W. F. DENNING.

Bristol.

THE LUNAR TIDE IN THE ATMOSPHERE.

TIDAL theory was first applied with any success to the atmosphere by Laplace, and he also first attempted to determine the tidal variation of pressure from barometric observations. His material consisted of 4752 measurements of the height of the mercury column at Brest (lat. 49° N.). These were far too few for the purpose, however, and his result, given in tome v. of the "Mécanique Céleste," cannot be regarded as a determination of the quantity sought for, which is much smaller than Laplace's value. Another lunar reduction of barometric data from Brest was made about thirty years ago by Bouquet de la Grye, but his series of observations (consisting of hourly values extending over a few years), while larger than that used by Laplace, still seems to have been inadequate. He arrived at a lunar daily inequality of pressure which was not by any means nearly semidiurnal in type, though the semidiurnal component—$0{\cdot}020 \sin(2t+100^\circ)$ mm. of mercury—was larger than the probable true value of the tidal variation at Brest.

The atmospheric tide was determined from a *tropical* series of barometric records so early as 1847. There now exist more or less trustworthy determinations for five tropical stations—St. Helena, Singapore, Samoa, Hong-Kong, and Batavia. The results for the two last are from long series of hourly observations, extending over thirty or more years, and are therefore of considerable accuracy. Though the tidal barometric variation has its maximum value at the equator, its magnitude there is very small. At Batavia (6° S.) it may be represented by the formula

$$0{\cdot}065 \sin(2t+65^\circ) \text{ mm. of mercury,}$$

where t denotes time reckoned from lunar transit at the rate of 360° per lunar day. The phase angle 65° indicates that maximum pressure occurs nearly an hour after the moon crosses the meridian.

Until recently the only determination of the tide which could be considered as probably an approximately true one, among the results for extra-tropical stations, seems to be that obtained by Morano from five years' hourly barometric observations at Rome (42° N.). Though the series of data was not large, the resulting amplitude and phase agree with what might be expected in this latitude. Many other attempts to determine the tidal barometric variation in European latitudes have been made without success. The most important of these investigations was due to Airy, who dealt with as many as 160,000 hourly observations of the barometer at Greenwich (51° N.), ranging over the twenty years 1854-73.

The barometric pressure is affected by a solar semidiurnal variation as well as, and of much greater amplitude than, the lunar tidal variation. Unless the former is properly abstracted from the hourly values before deducing from them the lunar inequality, the determination of the latter may be seriously affected by a residuum of the solar term. Two other causes operate to enhance the difficulty of detecting the lunar variation in the barometric records of stations in moderate and high latitudes. The first is the rapid diminution of the tidal amplitude as the latitude λ increases. The second is the increase in the irregular fluctuations of the pressure. At Brest or Greenwich these range over several millimetres (of the mer-

Atmospheric pressure | X Barometric pressure
X Atmospheric tides

cury column) in the course of a day, far exceeding not only the lunar, but also the solar, diurnal variation.

Even after abstracting the latter periodic oscillation from the hourly values, the elimination of the irregular changes requires the use of a large amount of observational material. Airy's discussion shows that even twenty years' data might prove insufficient. The Greenwich records of atmospheric pressure now extend over sixty years, but this threefold enlargement of the available material does not by itself ensure very much reduction in the accidental error affecting the determination. Hence, in attempting a new investigation, improvement was sought by excluding all but relatively "quiet" days from its scope, on the ground that the diminution in the number of days used is outweighed in advantage by their better quality for the purpose in hand. Rather lunar diurnal inequality of pressure to be deduced. Wherever possible, simplifying devices were used in computation, and the solar diurnal variation was duly removed from the data to rid the results of this important source of error.

The accompanying figure (taken from the Q.J. Roy. Met. Soc., vol. xliv., p. 271, 1918) represents the mean lunar daily inequality of atmospheric pressure which was finally obtained. The unbroken curve, which is almost entirely semidiurnal, as tidal theory would predict, is the one deduced from the observations (the inner two vertical lines mark out a complete lunar day, on either side of which a small portion of the curve is repeated); on harmonic analysis its semidiurnal component proves to be

$$0{\cdot}0090 \sin(2t+114^\circ) \text{ mm. of mercury,}$$

represented in the figure by the broken curve.

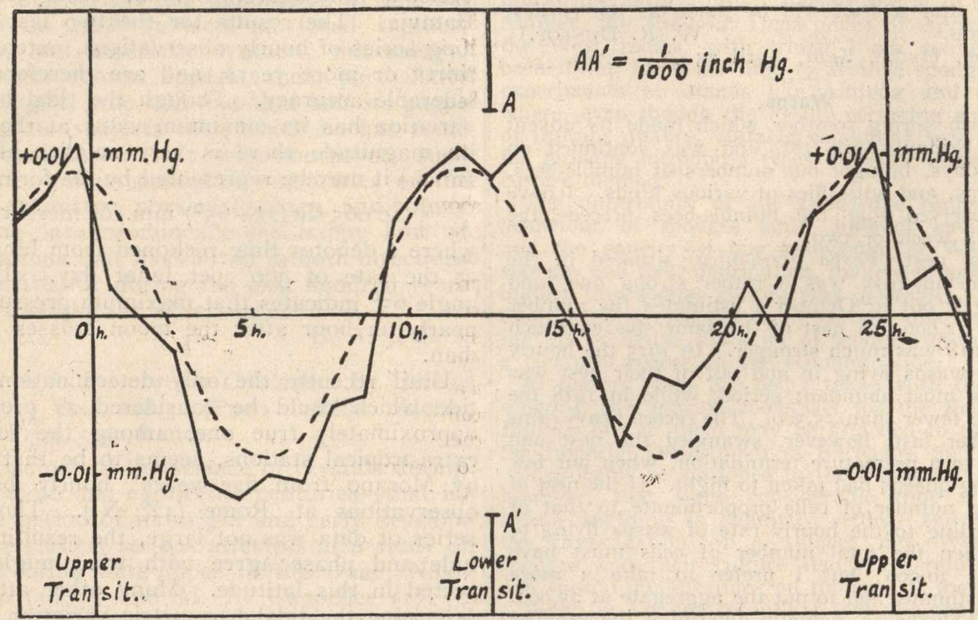

FIG. 1.—The lunar semidiurnal tide in the atmosphere at Greenwich, as determined from the Greenwich Records of Barometric Pressure, 1854–1917.

less than one-third of the whole number of days in the sixty-four-year period 1854–1917 were retained, being those on which the range of pressure did not exceed 0·1 in. The hourly values consequently totalled about 160,000, as in Airy's work.

There are approximately twenty-five solar hours in a lunar day, so that the twenty-four-hourly values on each "quiet" solar day were supplemented by the last hourly value on the preceding day. Each such series of twenty-five observations was broken into two parts, preceding and following the lunar transit on the day in question. The preceding portion was transposed so as to succeed the other, in order that the rearranged series might correspond with intervals of, in the average, $0\frac{1}{2}$, $1\frac{1}{2}$, $2\frac{1}{2}$, . . . $24\frac{1}{2}$ solar hours after lunar transit. These series were written in rows, and the numbers in each hourly column were then added up, so as to enable the mean The whole range of this, in inches, is 0·00071, appreciably less than one-thousandth of an inch (indicated in the diagram by AA′). The original observations were made to 0·001 in. of mercury (from a photographic record giving a fourfold magnification); in the computations, however, the last figure in each hourly value was omitted (the previous digit being raised when necessary), the entries on the lunar sheets being made to 0·01 in. only. In the circumstances, considering the (relatively) large irregular changes of pressure, even on these "quiet" days, it is somewhat remarkable that so small a variation can be detected so clearly.

In such an investigation it is needful to guard against obtaining a fictitious result which merely happens to be of semidiurnal type. This point may be tested by subdividing the data and examining the internal agreement of the results from the separate sub-groups. In the present case the sixty-four years were divided into three periods, 1854–73, 1874–93, 1894–1917; the semidiurnal components obtained by analysis of the three corresponding mean hourly inequalities of pressure were, in mm. of mercury,

$$0{\cdot}0080 \sin (2t + 96^\circ)$$
$$0{\cdot}0089 \sin (2t + 112^\circ)$$
$$0{\cdot}0104 \sin (2t + 127^\circ),$$

between which there is sufficiently satisfactory accordance.

On comparing the determinations for Batavia and Greenwich it appears that the amplitude of the lunar atmospheric tide varies approximately as $\cos^4 \lambda$, where λ is the latitude. At Greenwich the tide is nearly an hour in advance of the moon, whereas at Batavia the order is reversed. It is possible that the amplitude and phase are subject to some modification from local causes. The fact that the observed tide is larger than the equilibrium tidal theory would predict may be attributed to the occurrence of resonance with a free period of atmospheric vibration of rather shorter duration. But, as Laplace suggested, the rise and fall of the oceans may also be partly responsible for the observed tide, and, if so, some differences might be expected between the results from oceanic and continental stations in the same latitude. The lunar tidal range of pressure is equivalent to the weight of a column of air of normal density of height 4·4 ft. at Batavia and about 7 in. at Greenwich. Hence in northern latitudes quite a small tide, existing over a considerable area, might suffice to affect the tide in the atmosphere to an appreciable degree.

S. CHAPMAN.

INTER-ALLIED CO-OPERATION IN CHEMISTRY.

INTER-ALLIED co-operation in chemistry, of which a brief notice appeared in NATURE for April 24, should be of interest to all men of science, for what is true of chemistry is very largely true of all branches of science. Men of genius have developed in all countries, and of the really important scientific discoveries the Allies have contributed at least their due proportion, if not more. But the total volume of scientific work turned out by Germany during the last fifty years has been immense, and in the application of scientific discoveries to chemical manufactures the Germans have been easily first. Moreover, in the laborious and useful work of abstracting, indexing, and publishing, the Germans have displayed their usual methodical industry; and they have not by any means under-estimated their achievements, or neglected to give them world-wide advertisement.

A good deal of antipathy to Germans and German ways now prevails, especially in those countries which have experienced German methods of devastation. French chemists and chemical manufacturers can scarcely be expected during this generation to co-operate in any way with their eastern neighbours, and they have invited the Allied chemists, pure and applied, to join them in undertaking a mass of work which hitherto has been done, and, on the whole, well done, by Germany. In chemical matters there has been during the war a considerable amount of real co-operation between the Allies. The French, Americans, and British have been of great help to each other in solving chemical problems, both of research and manufacture. It is felt that the Allies will all gain by continuing, so far as is possible, the co-operation thus begun.

Prof. Moureu presided over the recent conference in Paris, and among his French colleagues were Profs. Haller, Béhal, and Matignon, MM. Kestner, Poulenc, Marquis, and Gérard. The British delegates were Prof. Louis, Sir William Pope, Messrs. Chaston Chapman, W. F. Reid, E. Thompson, and S. Miall. America was represented by Mr. Henry Wigglesworth, Lt.-Cols. Bartow, Norris, and Zanetti, Dr. Cottrell, and Major Keyes; Italy by Senator Paternò, Drs. Pomilio, Giordani, and Parodi-Delfino; and Belgium by MM. Chavanne and Crismer.

It was unanimously decided to form an Inter-Allied Federal Council of not more than six representatives of each of the countries mentioned above, the members to hold office for three years, one-third to retire annually and be eligible for re-election. The executive body is to consist of a president, a vice-president, and a general secretary. M. Jean Gérard will provisionally act as the secretary. In addition to the council a consultative committee will be formed, consisting of as many sections as may be necessary to secure the complete representation of pure and applied chemistry. The objects of the confederation are: To strengthen the bonds of esteem and friendship existing during the war between the Allied peoples; to organise permanent co-operation between the associations of the Allied nations; to co-ordinate their scientific and technical resources; and to contribute towards the progress of chemistry in the whole of its domain.

Neutral countries may be admitted later. The next meeting of the conference will be held in London on July 15–18, that being the date of the annual meeting of the Society of Chemical Industry.

So far as Britain is concerned, the choice of representatives and the supervision of the arrangements for the first meeting will be in the hands of the Federal Council for Pure and Applied Chemistry, of which Sir William Pope is president and Prof. H. E. Armstrong the honorary secretary. Until the various nations concerned have chosen their representatives, little can be done, but Sir William Pope and Prof. Louis are provisionally acting as the British representatives, and are in communication with their French colleagues.

The meeting in Paris was held under the auspices of the French chemical societies, especially the Société de Chimie Industrielle, the president of which, M. Paul Kestner, presided at some of the meetings. The final meeting of the members of the conference was held at the Palais d'Orsay at a banquet presided over by M. Loucheur, the Minister of Industrial Reconstruction, at which Lord Moulton was also present.

During the meeting of the conference some interesting papers were read. Prof. H. Louis gave an excellent summary of the magnetic concentration of poor iron-ores, a subject of special importance to our Allies at the present moment.

Dr. F. Cottrell reported fully on the recent production of helium in the United States, describing the new plant which has been erected in the U.S.A. for the freezing of gases by the cylinder-expansion process. Helium is one of the most recent and best illustrations of the co-operation of science and practice. First detected in the sun by Sir Norman Lockyer by means of its spectrum, and afterwards found in the earth by Sir William Ramsay, it was detected in gases from subterranean sources by various observers, especially by Prof. Moureu, who published his results in the *Annales de Chimie* in 1915 and 1916, and gave some further particulars of his researches in the discussion on Dr. Cottrell's paper. At the commencement of the armistice the practical work done in the United States, following that carried out in connection with the British Admiralty Board of Invention and Research (see NATURE, February 20), had resulted in the accumulation of a large quantity of helium, which is now available for other than warlike purposes.

On April 16 many of the delegates visited the devastated region of Chauny, Tergnier, and St. Gobain. This is classic ground for the chemist, as it was here that the Leblanc soda process was first installed on a large manufacturing scale, and the Gay-Lussac tower was also originated there, its inventor being a director of the St. Gobain Company. The date, 1665, on the ruined portal of the glass factory shows its antiquity. The ruin wrought by the invaders was systematic and complete; in the villages not even the humblest cottage remained uninjured, and what was an industrious and prosperous community has been totally ruined: let us hope for a short time only.

The Inter-Allied Council has a big task in front of it, and the first thing will be for the various members of the council and committees to get to know each other. Not only has the work to be done, but the right men have also to be chosen to do it. It will be some time before the different nations, speaking different languages and looking at matters from different points of view, can so organise themselves that they can accomplish their task smoothly and efficiently. But the goodwill and determination which exist should be sufficient to enable them to achieve success. The various chemical societies in this country will no doubt communicate their wishes and ideas to the Federal Council, and by the end of this summer it should be possible to put forward some practical scheme and a carefully considered programme.

THE ROYAL ACADEMY.

A VISIT to the Royal Academy cannot fail to be of interest to those who take pleasure in the ways of Nature, the varying moods of which are shown in so many of the pictures exhibited. Unfortunately, it has to be admitted that while there is much of interest to the scientific worker in each year's exhibition, there is also much that is jarring by reason of its lack of adherence to the truth. So much adverse comment is passed upon the works of the exhibitors by artistic critics at the opening of the exhibition each summer that it is perhaps natural for artists to make greater efforts to meet this criticism than a purely scientific criticism, which in general, though well deserved, remains unvoiced. To the man of science no result can be pleasing which is produced merely for the sake of effect and in its production overrides the laws of Nature. As an example of this type may be cited "Off the Western Land" (198) in the exhibition which opened at Burlington House at the beginning of the present week. It is difficult to believe that the combination of colours there depicted on the sea and in the sky could ever be approached in Nature. In the same way the colouring of the clouds in "The House on the Sea Wall" (309) cannot be passed over without comment. The complete semicircular rainbow in "Passing Storm" (232) seems to be independent of the presence of raindrops in its formation. While rain is seen to be falling in one part of the sky, the artist appears to have gone out of his way to indicate that there is no rain in another part of the bow, the cumulus cloud behind showing up with absolute clearness.

A study of the landscapes in successive exhibitions reveals the fact that an artist may often be known by his clouds, just as surely as by the type of country which he chooses for his subject. The typical cloud in a Leader is the soft cumulus, always produced with admirable effect. Arnesby Brown is another whose works may readily be distinguished by the cloud forms depicted, though the meteorologist is not always able to pass an entirely favourable verdict upon the result. The cloud effect in "A Village by the Sea" (96) by this artist deserves, however, its meed of praise. Peter Graham's mountain scenes generally show patches of mist amongst the hills, while this year, in "A Shower across the Hills" (150), falling rain has been introduced with a very pleasing result. A study of the fairly numerous pictures in which a portrayal of rain is attempted leads to the conclusion that the subject is far from an easy one to treat successfully. In "By the Woodside" (H. Sylvester Stannard, 673) an unpretentious but natural sky showing through the trees adds much to the success of the picture. Snow scenes have attracted an unusually large share of attention in this year's exhibition, and they are generally dealt with successfully. In "Through the Woodland Snow" (J. Farquharson, 19) the soft, moist look of the snow which half covers the ground allows of no other conclusion than that a thaw has set in, and that the snow covering will not long remain. In "Day Departing in the West" (171) the same artist has another attractive snow picture. There is a curiously unnatural appearance about "The Bathers' Pool" (765). Here a sandy beach is depicted, but the sand, instead of sloping gently to the sea, is cut away in an almost vertical "cliff" at the water's edge, the face standing at an angle which looks most unreal.

The sea scenes which appear in numerous pictures call for little comment, and, though some are pleasing, few are of outstanding excellence. In this branch of painting, the gap left by the death of C. Napier Hemy seems to remain unfilled. Now that the scientific spirit is beginning to permeate the world, and is no longer confined to a few specialists, it may be hoped that artists will come to realise that a true representation of Nature may be not inconsistent with the highest artistic success, while a travesty of Nature must fail to satisfy a large and growing section of the general public.

J. S. D.

ROBERT CHAPMAN DAVIE.

OF the sad fates that have befallen so many who have helped to win the war for us, the succumbing to an attack of influenza on return home after years of physical hardship in the war zone is of the saddest. That has come to Capt. Robert Chapman Davie, R.A.M.C., a botanist from whom much was expected as teacher and researcher. Capt. Davie crossed the Channel on his way home on January 25, was attacked by influenza two days later, and after a week's struggle died of pneumonia at Largs on February 4.

Born in Glasgow thirty-two years ago, Davie was educated at the Glasgow High School and at the University of Glasgow, where he graduated M.A. in 1907, obtaining a first class in English literature. Later, in 1909, he took the degree of B.Sc., distinguishing himself particularly in botany and in chemistry. In botany he was Dobbie-Smith gold medallist and also Donaldson research scholar. Whether botany or chemistry was to attract him for his life-work he had difficulty in deciding. The enthusiasm of his botanical teacher, Prof. Bower, finally determined his devotion to botany, and he became an assistant in the botanical department of his *alma mater*. In 1912 Davie migrated to fill the post of assistant in the botanical department of the University of Edinburgh, and in 1913 he was appointed lecturer on botany in the University. In 1915 he graduated D.Sc. of the University of Glasgow. His appointment a couple of years ago as one of the secretaries of the botany section of the British Association pleased him greatly, and was an apt choice of a man with much business capacity and wide botanical knowledge. An attack of rheumatic fever in early life had somewhat undermined his health, causing him frequently some heart trouble, and in consequence of this he was able to join the Army only in 1917 to fill a post where scientific knowledge rather than physical endurance was required, and he was at the time of his death senior chemist in the 4th Water Tank Company in France.

A prominent characteristic of all that Davie did, whether as teacher or as researcher, was that of precision, and his literary gifts enabled him, alike in the lecture hall and in his writings descriptive of his scientific research, to present his facts and arguments with a fluency of diction and a grace of style that ensured lucid exposition. His chief research was in the domain of the Pteridophyta, a natural consequence of his upbringing in the home of work in the group under Prof. Bower. An investigation of the East Asiatic ferns of the genera Paranema and Diacalpe was his first essay (1912), and in the course of settling disputed points of their relationships he entered the controversial field of the "fern stele and pinna-trace," wherein he reaped largely then and also later, carrying on his line of research from the ferns, through the Cycads, into the Angiosperms.

Davie's grouping of the ferns by the form of the leaf-trace in his last paper, published so recently as 1918 during his absence, is essentially in harmony with groupings to which Prof. Bower and others had been led by analysis of other characters, and shows that amidst the laborious examination of the dry bones of anatomy Davie's research was inspired throughout by thought of origins and adaptations. How, why, when, are its keynotes, and the facts, bald statement of which as evidence of difference or likeness satisfied many of the older writers on the same subject, interested Davie solely from the point of view of interpretation. This attitude finds expression in his most important paper—delayed in publication through the manuscript having been destroyed by a fire at the printers', and having to be rewritten—in an interesting analysis of the relative degree in which phyletic factors and those of specific adaptation have been operative in bringing about the forms of leaf-trace development in connection with water supply in plants. If the precision of his mind led him at the moment to segregate factors in the several groups and classes of vascular plants with a definiteness of generalisation which addition to the few data as yet available outside the ferns may show to require modification, the attempt and its methods are suggestive, and, carried further, as was his intention, must, in his hands, have thrown much light upon the proper appraisement of the value of anatomy in questions of obscure relationships of the higher plants, and given clues helping to the understanding of their phylogeny in relation to cosmic history.

On removal to Edinburgh, Davie took up the study of the Proteaceæ from the phyletic point of view; their conjectured relationship to Leguminosæ fascinated him. Assisted by a grant from the Royal Society, he spent some months of 1914 in Brazil making observations and gathering material, especially of Roupala, which, through its heterophylly, promised enlightening information on the subject of the leaf-trace. Beyond an account of plants other than Proteaceæ which he had collected, Davie had not been able to complete the record of the results of his exploration. Alert in body and in mind, keen and undemonstrative in his work, thorough in everything, Davie gave promise of taking a prominent place amongst those upon whom rests the responsibility of scientific education and of extending the boundaries of science. Botany loses in him a talented and devoted adherent.

NOTES.

ON Friday, May 2, the Animal Anæsthetics Bill passed its second reading in the House of Commons. The object of this Bill is to insist on the use of anæsthetics in a large number of cutting operations on horses and dogs. The operations to which the Act should apply are specified in a schedule to the Act, in which a distinction is drawn between those which should be performed under general anæsthetics and those for which a local anæsthetic is required. It is worth noting that the Act does not apply to farm animals, on which operations for the improvement of their market value can continue to be performed without anæsthetics. Of the legislators who have been prominent in endeavouring to suppress experiments on animals performed with a view to prevention of human disease and suffering, we notice only the name of Sir J. G. Butcher as taking part in the discussion or supporting the Bill—another proof, if proof be needed, that the leading motive in these people is not kindness to animals or regard for their fellow-creatures, but opposition to the advance of science in general, and in our knowledge of the processes of life in particular.

IN the House of Commons on May 2 the Bill to control the importation of goods infected, cr likely to be infected, with anthrax, and to provide for the disinfection of any such goods, was read a second time. Sir Hamar Greenwood, in moving the second reading, outlined the incidence of anthrax in this country and the findings of the Anthrax Committee. The Bill contains two principal provisions. It gives power by Order in Council to prohibit the importation of goods infected or likely to be infected, either absolutely or except at any specified ports, and it empowers the Secretary of State to provide and maintain the necessary works for the disinfection of goods. It is also likely that, under the auspices of the League of Nations, international action may be taken with a view to the control of anthrax.

IN the course of a discussion in the House of Commons on April 30 upon the subject of agricultural policy, the Parliamentary Secretary to the Board of Agriculture announced that the Government has decided to appoint a Royal Commission forthwith, and that all parties materially interested will be represented. He pointed out that a quick report is needed to enable the Government to frame a policy in the next few months. This may be obtained by an interim report on the more important branches of agriculture. It must be ascertained what guaranteed prices are necessary in order that, while good wages are paid, the industry is in a position to pay them. With such guarantees the farmer will have some idea of his economic position during the next few years which he has lacked during the past.

AEROPLANES waiting at St. John's, Newfoundland, for the Atlantic flight are still weather-bound, and, so far as can be judged from information issued as we are going to press both by the Meteorological Office and by the Air Minstry, there are storm areas in the Atlantic over a considerable portion of the route which would be followed in the flight. So far as possible choice should be made of a period at which the Atlantic high-pressure area is centred over the Azores, when for the route eastwards the winds would probably be westerly and generally of no great strength; the disturbances so commonly travelling eastwards would, under these conditions, be pushed to the northwards by the region of high barometer. However unsatisfactory it may be to get no wireless information from ships over the Atlantic, it seems much more unsatisfactory to contemplate starting without such information, since the chances of bad weather greatly preponderate. Settled weather on the western and eastern sides affords no idea as to the weather in mid-ocean. Under the auspices of the United States naval authorities, Curtiss seaplanes are now being entered for the Atlantic flight. It is intended to span the Atlantic by a succession of "hops." The start had been timed for the early part of this month, flying from Long Island to Halifax, thence to Trepassey, Newfoundland, and with fair conditions it was hoped to leave Trepassey for the Azores within ten days of the start from Long Island, and Lisbon was to be the next stop. A report in the *Times* of May 6 from New York says: "On the eve of their departure for Newfoundland two of the American trans-Atlantic seaplanes were seriously damaged by fire."

THE Army Medical Department announces the institution of two new appointments—a Director of Pathology and a Director of Hygiene. According to the *Times*, it is understood that Sir William Leishman is to be nominated to the former and Sir William Horrocks to the latter. The object of the scheme, which originates with the Director-General, Sir John Goodwin, is "to link up under a definitely planned organisation the activities of the different departments and individuals hitherto concerned with the various problems of preventive medicine, pathology, and tropical diseases bearing upon the health of the Army in peace and war." Advisory committees are to be set up in each directorate, consisting of the Director as chairman, a deputy director, and the following members:—*Hygiene:* The professor of hygiene at the R.A.M. College, a representative of the War Office and of the Directorate of Fortifications and Works, a sanitary engineer, a civil professor of hygiene or medical officer of health of a county or large city, a physiologist, and a representative of the Local Government Board. *Pathology:* The professors of pathology and of tropical medicine at the R.A.M. College, two civilian pathologists, a civilian professor or expert in tropical medicine, and a representative of the Medical Research Committee. The scheme is a thorough one, and should increase the efficiency of the Army Medical Department.

THE death of Dr. Edmund Weiss, director of the Vienna Observatory for thirty-two years, occurred so long ago as June 21, 1917, but was not announced to the Paris Academy of Sciences, of which he was a correspondant, until March 24 last. Dr. Weiss was born at Freiwaldau, in Austrian Silesia, on August 26, 1837, but some years of his early life were spent in England, for his father held an appointment as a physician in a health institution in this country. On the death of that relative Dr. Weiss returned to his native land, and, after a course of education at Troppau and the Vienna University, he was appointed assistant at the observatory in 1858, and on the death of Karl von Littrow in 1878 he succeeded to the directorship, which he held until 1910. In his early years as an observer Dr. Weiss took part in important geodetic work, and retained an active interest in that branch of science, being a prominent member of the International Geodetic Organisation. In 1872 he visited England and North America for the purpose of studying the methods of observatories and optical works, and thereby gained knowledge which was of great value to him; for though von Littrow had the satisfaction of seeing the building of the new Vienna Observatory at Währing begun as the result of his efforts, he did not live to see its completion, and the planning of the equipment was largely due to his successor. Dr. Weiss observed the transit of Venus of 1874 from Jassy, and took part in several eclipse expeditions. He made many contributions to the literature of astronomy through the usual channels on the subjects of comets, meteors, and orbits, besides others of a popular kind. Also he prepared a revised edition of Oeltzen's catalogue of Argelander's zones from 15° to 31° S. declination, published in 1890. Dr. Weiss was elected a fellow of the Vienna Academy in 1878, and an associate of the Royal Astronomical Society in 1883.

DR. PAUL CARUS, the distinguished editor of the *Monist* and the *Open Court*, died on February 11 at his home in La Salle, Illinois, at the age of sixty-seven. Dr. Carus was born and educated in Germany, his father being the Superintendent-General of the Prussian State Church. He studied first at Strasburg and afterwards at the Theological College of Tübingen, where he obtained his doctorate in philosophy in 1876. He went to Chicago in 1887 to become managing editor for the Open Court Publishing Co., an institution founded and richly endowed by his father-in-law, the late E. C. Hegeler. At the outbreak of the war Dr. Carus was notorious for his warm advocacy of the German view of the origin of the war. Yet he lived to rejoice in the defeat of Germany, the development of the conflict having served to enlighten him. His sons fought in the American Army against Germany. Dr. Carus's own writings show a wide and varied scholarship and range over many topics, taking the form sometimes of poetry, sometimes of philosophy. His chief interest was Oriental philosophy and religion, and he pursued it with the ardour of a propagandist. The Religion of Science Library which he founded has made available at a low price a number of religious and scientific books, and also many reprints of philosophical classics. Particularly to be noted are his English translations of Dedekind, Hilbert, Mach, and other distinguished mathematicians and physicists.

THE current number of the Kew Bulletin gives particulars of the career of M. H. Léveillé, who died on November 25 last in his fifty-sixth year. M. Léveillé was for a time professor of science at Pondicherry. He was the founder and permanent secretary of the Académie Internationale de Géographie Botanique, and edited for it *Le Monde des Plantes*, since renamed the *Bulletin de Géographie Botanique*. He was particularly interested in the flora of China, and published, among other works, a "Catalogue des Plantes du Yun-Nan." The same issue of the Bulletin also records the death of Mr. C. K. Bancroft, until recently Assistant Director and Government Botanist, British Guiana. Mr. Bancroft received his early scientific education at Harrison College, Barbados, and was the first to win a natural science scholarship in the West Indies, being awarded the Barbados scholarship in 1905. After graduating at Cambridge he devoted his attention to botany, especially mycology and plant pathology, and worked for a time at diseases of plants in the Jodrell Laboratory. In 1910 Mr. Bancroft was appointed Assistant Mycologist in the Federated Malay States, and three years later was made Assistant Director and Government Botanist, British Guiana, which position he occupied until breakdown in health brought about his resignation.

THE death of Sir Frank Crisp, Bart., on April 29, in his seventy-seventh year, removes from public life an eminent exponent of commercial law, and also a real force in scientific circles. Early in his career Sir Frank Crisp joined the Royal Microscopical Society, and in 1878 became one of its secretaries. He speedily improved the Journal of that body by enlisting the help of experts and publishing abstracts of biological articles, thus rendering a real service to science. He was unsparing of pains or purse, and when in 1889 he was compelled to end his secretarial labours he left the Journal established on a firm basis. Not less noteworthy was Sir Frank Crisp's influence on the conduct of the Linnean Society. From 1879 to the day of his death he served practically continuously on its council, and from 1881 to 1905, a period of twenty-four years, he was treasurer. His quick grasp of essentials, strong common sense, and generous disposition were of the greatest value during his long term of office, and his memory will be cherished as a large-hearted and clear-sighted adviser. His alpine garden at Henley is world-famous.

THE death, on April 30, of Dr. F. J. Smith, honorary consulting physician to the London Hospital, has removed from the medical profession in London one of its best-known and most popular members. Born at Castle Donington, Leicestershire, on August 17, 1857, Dr. Smith was educated at the University of Oxford, where he was a scholar of Balliol, at the London Hospital, and at the Universities of Leipzig and Halle. He was Radcliffe fellow during the years 1885–88. Dr. Smith's professional work lay particularly in the direction of pathology and of medical jurisprudence. In the former subject he paid special attention to diseases of the heart, while in the latter he attained a deservedly high reputation as the editor of the last three editions of Taylor's authoritative text-book. In 1904–6 he was president of the Hunterian Society, and was the orator of the society in 1900.

THE death is announced, at eighty-eight years of age, of Prof. E. Townsend, late professor of engineering and Registrar of University College, Galway.

THE Electrical Research Committee has appointed Mr. E. B. Wedmore as director of research.

NEXT Thursday, May 15, Prof. F. Keeble will deliver the first of a course of two lectures at the Royal Institution on intensive cultivation. The Friday evening discourse on May 16 will be delivered by Dr. S. F. Harmer on sub-Antarctic whales and whalings.

AT a recent meeting of the council of the Marine Biological Association of the United Kingdom it was announced that Dr. G. P. Bidder and Mr. E. T. Browne had each undertaken to contribute a sum of 500*l*. towards a fund for the extension of the laboratory at Plymouth. The new building will be commenced at once, and the scheme, when completed, will provide both a new and larger aquarium and special laboratories for physiological work.

THE British Scientific Research Association is about to appoint an assistant director of research at a salary of 1000*l*. per annum. The person appointed will be mainly responsible, under the director of research, for the researches arising out of the needs of the electrical scientific instrument, the X-ray, and the electromedical instrument industries. Applications for the appointment, accompanied by not more than three testimonials or references, must reach the secretary of the association, 26 Russell Square, W.C.1, by, at latest, May 21.

AT the meeting of the Institution of Civil Engineers on April 29 H.M. the King of Italy and H.R.H. the Prince of Wales were elected as honorary members of the institution. It was announced that the council had made the following awards for papers read and discussed at the meetings during the session 1918–19:—A Telford gold medal to George Hughes (Horwich), a Telford gold medal and an Indian premium to R. B. Joyner (Bombay), a Watt gold medal to W. S. Abell (London), a George Stephenson gold medal to the Hon. R. C. Parsons (London), a Webb prize to F. E. Gobey (Horwich), Telford premiums to James Caldwell (London), H. B. Sayers (London), J. Reney Smith (Liverpool), and F. W. Scott (Benoni, Transvaal), and a Manby prize to E. L. Leeming (Manchester).

IN the March issue of *Man* Mr. A. C. Breton describes some Mexican small clay heads found in great numbers on the site of Teotihuacan. Almost every site in that region has its distinctive type of these little heads. Although much battered and archaic in style, they deserve reproduction for the treatment of the eyes, which consist of double hollows separated by a ridge, with no pretensions to represent the actual eye. Another figure in stone represents a frog, and is apparently a rain-charm, the frog being in Mexico and elsewhere intimately associated with the coming of the rain. In this example the frog is depicted with hands uplifted in a praying attitude, while the tongue hangs out as if with thirst. Mexicans say that the frogs pray for the rain, and in Yucatan the croaking of the large frog is a sure sign of rain within three days.

IN the *Rivista Italiana di Sociologia* (vol. xxi.) Prof. Giuffrida-Ruggeri attempts to analyse into its component elements the population of Abyssinia and the Italian colony of Eritrea. He claims that what he calls the "prehistoric stratifications" were composed of small negroes (pygmies), who came from the west and south, and the proto-Ethiopic people. To these were added the "historic stratifications," Semites from Arabia and the "deutero-Ethiopians" or Gallas, who entered the Abyssinian domain in the sixteenth century. Abyssinia may be regarded as an immense fortress or crucible in which these four racial ingredients were mixed. In conformity with the popular dogma of ethnology, Prof. Giuffrida-Ruggeri attempts to associate certain types of culture with the different *races*, ignoring the fact that in the course of the development of any invention it has always happened that the leaven of a new discovery is diffused abroad among the intelligent minorities of other peoples long before it has permeated the unintelligent lump of the bulk of the population in the home of its birth, so that by the time a practice or belief has been definitely shaped it is no longer the property of one "race," but of many peoples. Prof. Giuffrida-Ruggeri attributes the invention of agriculture, hut-construction, and the use of the bow to the primitive negro stratum; and to the proto-Ethiopians the practice of erecting dolmens and monoliths, and the worship of the sun and stars, of fire and water, of trees, serpents, birds, elephants, etc., as well as of the force of fertility. No adequate reasons are suggested for these daring speculations.

THE Journal of the American Museum of Natural History (part 1) contains a delightful article on the water-birds of Louisiana, illustrated by some very remarkable photographs. Thanks to very efficient measures of protection, the white egret, until lately the victim of the cruelty and greed of the plume-hunters, is now recovering its numbers, even though it had been reduced to the verge of extinction. The author, Mr. Alfred Bailey, is also able to report that the roseate spoonbill, similarly terribly reduced in numbers by the plume-hunters, is now in a fair way to recovery. Their guardian is an ex-plume-hunter! Finally, this number contains a series of "In Memoriam" articles on the late Col. Theodore Roosevelt, John Burroughs and Prof. H. F. Osborn being among the contributors.

THE report of the National Park Board, Tasmania, has just reached us. We gather from it that in 1917 some 27,000 acres were enclosed to form a reservation for the native fauna and flora of Tasmania. Though late in the day, this reservation, if it can be adequately protected against poachers—about which there seems to be some doubt—should perform a very real service to the State and the world at large from the point of view of the man of science. The larger lakes in this enclosure, we are told, have been "restocked with fish. The Fisheries Commission assisted by defraying half the cost of distributing 12,000 rainbow-trout fry." We trust that this experiment will not be at the expense of the native fish, which would defeat the avowed ends of the Board. The Government was asked for an annual grant of 500*l*. in order to develop the area. As a result 150*l*. was voted for the first year.

IN February last the New Zealand Institute, which consists of eight affiliated societies located in different centres of the Dominion, held a science congress at Christchurch under the presidency of Dr. L. Cockayne. The arrangements seem to have been modelled on the lines of the British Association, with public lectures, papers and discussions, excursions and a garden-party, the congress being opened by his Excellency the Governor-General. Apparently the New Zealand scientific workers no longer find the Australasian Association for the Advancement of Science adequate for their requirements, but we hope that the interchange of ideas and hospitality between the scientific workers in Australia and those in New Zealand will not suffer any diminution as a result of this interesting new departure.

THE study of cytology, and more especially of the mitotic phenomena that accompany the division of the nucleus, has made such rapid progress in recent years that the question of terminology has become a very troublesome one, and the student who is not a specialist in this department is apt to find some difficulty in following the voluminous literature of the subject. In a memoir on "The Somatic Mitosis of *Stegomyia fasciata*," published in the *Quarterly Journal of Microscopical Science* (vol. lxiii., part 3), Miss Lucy A. Carter, at the request of the editor, has given a glossary of the principal terms employed. Some of these terms are, no doubt, already sufficiently familiar to ordinary students, but the idea is one which should be welcomed by many. The derivation of "synizesis"—"syn," with; "hizo," place—is not very satisfactory, for the word clearly means "assembling together" or "placing together."

A SUB-COMMITTEE of the Food (War) Committee of the Royal Society has recently issued a report on the composition of potatoes grown in the United Kingdom. The report is based on the results of determinations of nitrogen and dry matter in 227 samples of ten varieties collected from sixty-five growers in eighteen English, seven Welsh, six Scottish, and twenty-three Irish counties. In addition to these, twenty "miscellaneous" samples were received and analysed. The report gives much valuable information as to the average composition of the potatoes grown in the United Kingdom, and discusses the variations in composition due to such causes as climate, soil, manuring, and size of tuber. The composition of different varieties and of different groups of varieties is also compared. Further work on many of these points is in progress. Perhaps the most important point raised by the issue of this report is the need for accurate information as to the composition of almost all home-grown foods. When the Royal Society Food (War) Committee was engaged in making its survey of the food supplies of the nation (Cd. 8421), one of the chief difficulties was the dearth of accurate systematic analyses of all kinds of home-grown foods, and the committee was forced to rely for the most part on American figures, which may not accurately express the composition of British-grown products. The report in question removes this difficulty for British-grown potatoes. It is to be hoped that reports on similar lines may follow dealing with other home-grown foods, but, unfortunately, work of this kind does not appear to be anybody's business. It is high time some organisation was set up to maintain on a permanent basis the survey of the food resources of the nation initiated by the Food (War) Committee of the Royal Society.

IN the March issue of *Terrestrial Magnetism and Atmospheric Electricity* Dr. L. A. Bauer and Messrs. H. W. Fisk and S. J. Mauchly complete their examination of the magnetic observations taken during the solar eclipse of June 8, 1918, and come to conclusions which may be summarised as follows:—Appreciable effects were observed during the eclipse at all stations within the zone of visibility, and warrant the statement that a solar eclipse causes a variation of the earth's magnetic field. The magnitude of the variation is from a tenth to a fifth of the solar diurnal variation of the element on a normal day. Its direction is, in general, opposite to that of the daylight portion of the solar diurnal change. The effects are seriously modified by the altitude of the observing station.

PARTICULARS of a large oil-fuel reservoir at Rosyth are given in the *Engineer* for April 4. The reservoir is in two sections, having a combined capacity of 60,000,000 gallons, and is constructed of concrete on a rock foundation. The retaining walls have an average height of 35 ft., and are reinforced with steel rods; each wall is in sections ranging from 54 ft. to 58 ft. in length, with expansion joints between. The concrete floor has a minimum thickness of 2 ft. 9 in., and the reservoir is covered with the roofing system known as the Belfast lattice-timber truss, with spans of 50 ft. Every precaution to secure oil-tightness was observed in the construction, with satisfactory results in the finished structure. The complete work occupies $11\frac{1}{4}$ acres, and the roof area is $7\frac{1}{2}$ acres.

THE *Times* Engineering Supplement for April contains an article by Sir George Greenhill on geometrical and mechanical fit. The principles of geometrical fit were enunciated fifty years ago in the first edition of Thomson and Tait's "Natural Philosophy," but the message therein does not appear to have reached the mechanical engineer yet. The method of producing a geometrical rifle-rest described in Thomson and Tait appears to be too simple and subtle for the official mind to grasp, so the old-fashioned sealed pattern manifold point-rest is still at work, destitute of scientific theory, working against an excessive number of spring supports, and the rifle never returning exactly to the same position. It will be conceded by most people who have had business relations with instrument-makers that the principles of geometrical fits are still not generally understood. This is due, in part at any rate, to the conservative class of workmen employed. Sir George mentions the Cambridge Scientific Instrument Co. as using the geometrical fit principle, and might have added also the name of the firm of Barr and Stroud. There is no finer example of what can be done by geometrical appliances than the range-finder made by this firm.

AN illustrated account of a pulverised-fuel locomotive appears in the *Engineer* for April 25. The appliance has been invented by Mr. J. G. Robinson, chief mechanical engineer of the Great Central Railway, and, owing to the success already obtained, one of the large 2–8–0 engines is under construction with this apparatus. Up to the present the fuel employed consists of the settlings from the exhaust of the fans over the screening apparatus of the collieries, and has not received any treatment with the view of increasing its fineness, which is such that 80 per cent. will pass through a screen of 200 meshes per lineal inch; the ash content is about 10 per cent. Before being placed in the tender the fuel is dried by being stored for a few days over the flues of a battery of boilers. Considerable alterations have to be made in the internal arrangements of the fire-box in order to adapt it for burning pulverised fuel. The fuel is contained in a hopper in the tender, and fed to the furnace by conveyer screws driven by a small engine. On leaving the conveyers the fuel is met by a blast of air supplied by a fan driven by a de Laval steam turbine, and is led through pipes to the furnace. It would appear that this system of firing locomotives is at last attaining to a practical solution in this country as in America.

THE second report issued by the Conjoint Board of Scientific Societies states that the number of constituent societies is now fifty-four, and a list of these bodies, together with the names of their representative, is presented. A summary is given of the work of the various committees dealing respectively with (1) the Catalogue of Scientific Literature, (2) the application of science to agriculture, (3) national instruction in technical optics, (4) education, (5) the prevention of overlapping among scientific societies, (6) the metric system, (7) anthropological survey, (8) iron-ore, (9) water-power in the British Empire, (10) timber for aeroplane construction, (11) glue and other adhesives, (12) joint buildings for technical societies, (13) the foundation of a geophysical institute, (14) oxides and silicates, and (15) patent laws. The report issued by Committee No. 1 is at present confidential. No. 2 is considering the design, construction, and testing of electrical tractors and other agricultural machines. The committee dealing with education directs attention in a report on Civil Service examinations to the undesirable tendency to encourage mathematical studies to the detriment of other scientific subjects. In dealing with the scientific needs of the Civil Service the preponderance of appointments carrying literary rather than scientific qualifications demands attention, and as appointments are at present made largely by nominations, suitable men with scientific knowledge should be selected for appropriate administrative posts. The report issued on water-power in the British Empire has already been mentioned in these columns, and useful work has also been done in regard to the supply of timber for aeroplanes, glue, paper, etc. The foundation of a geophysical institute, which is to deal with geodesy, tidal phenomena, seismology, and allied matters, has been approved, and a small committee is now formulating a definite scheme.

WE notice the following among forthcoming books of science:—"Air Navigation Notes and Examples," Instructor-Capt. S. F. Card; "Tacheometer Tables," Prof. H. Louis and G. W. Caunt; "The Principles of Electrical Engineering and their Application," Prof. G. Kapp, vol. ii., Application (*Edward Arnold*); "The Pituitary," Blair Bell; "The Heart: Past and Present," Dr. E. Lea; "Injuries to the Head and Neck," Dr. H. Lawson Whale (*Baillière, Tindall, and Cox*); "The North Riding of Yorkshire," Capt. W. J. Weston; "Dumbartonshire," Dr. F. Mort, each in the Cambridge County Geographies Series (*Cambridge University Press*); "Economic Farm Buildings," E. P. Lawrence; "The Universal Wages Calculator," C. E. Lewton (*The Library Press, Ltd.*); "Kræpelin's Psychiatry," vol. iii., Dementia Præcox, translated by Dr. R. Mary Barclay, edited by Dr. G. M. Robertson; "A Handbook of Surgery (Civil)," C. R. Whittaker (*Edinburgh: E. and S. Livingstone*); "The Principles of Child Physiology, Pure and Applied," Dr. W. M. Feldman (*Longmans and Co.*).

OUR ASTRONOMICAL COLUMN.

DETERMINATION OF PROPER MOTIONS.—In Circular No. 43 of the Union Observatory, Johannesburg, Mr. Innes publishes the result of an examination with the blink microscope of pairs of plates of eighty astrographic fields lent to him for the purpose by the Astronomer Royal, the plates of each pair being separated by an interval of nearly twenty years. The fields cover the zone of the sky from declination 65° to 67° N. through the whole twenty-four hours of right ascension, and out of the whole number of stars examined, estimated at 20,000, Mr. Innes has found nearly four hundred which have a measurable P.M., the large majority of which were previously unknown. The largest motions are 290″, 179″, and 167″ centennial on a Great circle. There are five between 50″ and 100″, sixty-seven between 20″ and 50″, and more than 300 less than 20″ centennial. Two hundred and fifty of the stars are in the Bonn Durchmüsterung, and are, therefore, of all magnitudes down to 9·5 or 10 visual, whilst the remainder are of photographic magnitude 10 to 12, with a few fainter. It will be realised that the motion of a star thus determined is relative to the stars in a limited area surrounding it, and not to the heavens as a whole. The systematic character of the figures in the table gives assurance that Mr. Innes's work forms a useful contribution to stellar statistics.

THE BLINK MICROSCOPE.—The fundamental principle of this instrument is somewhat obscured by its name. Having two similar photographs of the same field of stars taken at some interval of years apart, the obvious method of determining motion would be to superpose these plates with identical images fitting one on the other so far as possible, and then to search for those images which do not fit. As actual superposition is difficult, or impossible, for practical reasons, a method only slightly less simple is to adjust the plates side by side and measure the distances between identical images with a measuring bar. This is the principle of more than one type of instrument now being used to determine proper motion. In the blink microscope the images of the same star on the two plates are seen alternately by rapidly closing and opening shutters. Hence the name. Two images which fit fall on the same spot of the retina, but those of a star which has motion do not, and give the sensation of a jump. The method of detection is therefore simple, but it is clear that the measurement must be made with discretion lest errors occur because of imperfect adjustment or lack of exact similarity of the plates.

CALCULATION OF OCCULTATIONS OF STARS BY THE MOON.—Mr. Arthur Snow publishes some tables for this purpose in *Popular Astronomy* for February, which should be of great use to those who do not live near one of the stations (Greenwich, Washington, etc.) for which special lists are available. He directs attention to the fact that the region of visibility of an occultation is a belt about half as wide as that for a total solar eclipse, crossing the parallels of latitude at a considerable angle, so that by no means all the places that lie between the published latitude limits enjoy a sight of the phenomenon. He gives full directions, which enable the limits of visibility to be laid down on a map.

Gt Brit — Industries

X-RAYS AND BRITISH INDUSTRY.

THE war has furthered the progress and development of many industries, but probably no department of science has received greater impetus than that of radiology, using the word in the general sense which it ought usefully to convey, and not in that restricted sense which the medical world has attached to it. The science and art of X-rays have developed enormously during the war, and nothing but good can result from the fact that the general medical practitioner has had his eyes opened to the vista which the X-rays have revealed. He now realises, as never before, that radiology is a new instrument of attack for him—a veritable handmaiden, whether he be physician or surgeon. The new diploma of radiology which Cambridge and other universities are about to establish is tacit recognition of the importance of X-rays in a medical curriculum. We welcome the suggestion that a chair of radiology should be established at one of the universities in memory of the late Sir James Mackenzie Davidson.

But it is not our purpose at the moment to dwell on the medical aspect of the rays. We are more concerned with a development to which the Germans, Americans, and ourselves have given considerable attention during the past year or more. We refer to the examination of materials and built-up structures by X-rays—a subject to which a joint meeting of the Röntgen and Faraday Societies in the meeting-room of the Royal Society devoted its attention on April 29.

It is a very far cry from the days of Röntgen's famous discovery some twenty-two years ago to the present time. The technique has advanced amazingly, but it can scarcely be said that apparatus and equipment have made corresponding strides, although it is, of course, not denied that considerable progress has been made. We refer to this point later, but the question is tied up with the attention the subject has received at the hands of the physicist and electrical engineer.

The meeting to which we have referred served admirably to set out the development and present limitations of the industrial uses of X-rays, and those of our readers who are interested may be referred for details of the meeting to the journals of the two societies concerned.

The great advantage of radiography is, of course, the fact that we can spy out the interior of an opaque body without injuring it in any way. Chief among the materials which have been examined by the X-rays is steel, both carbon and alloy. Naturally, the question of blow-holes and flaws in castings and forgings and ingots has received attention, and, provided that the thickness is not too great, the method works well. X-ray scrutiny has also suggested improvements in methods of casting and welding, as well as modifications in the composition of alloys, with a view to the surer production of sound castings.

Heavy alloy steels, such as tungsten steels, are, by reason of their greater opacity to X-rays, readily distinguishable from carbon steels. The method has also been applied, with, however, little or no success, to the detection of hair-cracks in steel castings. These cracks (which are of the order of 1/1000 in. across) have caused great trouble during the war in connection with the crank-shafts of aeroplane engines. The only way of attacking the problem would be to send the rays along the direction of the crack, but the difficulty is that these cracks refuse to confine themselves to one plane!

So far as the thickness of steel is concerned, several workers have taken radiographs through about 2 in. of steel, and this figure may be taken as the practical limit at the moment. Not that greater thicknesses have not been penetrated, but the exposure becomes intolerably long. In the case of aluminium and its alloys, thicknesses of 4 in. or 5 in. have been radiographed with ease. Incidentally, the method is very sensitive to minute differences in thickness—for example, the tool-marks used to face specimens are often clearly shown in radiographs of metals.

The voltages normally employed have ranged between 100,000 and 150,000 volts, and the currents through the tube from 4 to 15 milliamperes. The question of protecting the operator in this work needs particular attention.

In steel examination there is no possibility of using the fluorescent screen. Practically all workers have used photographic methods, and, furthermore, have been driven to adopt methods of reinforcing the image on the plate by the use of intensifying screens, metal-backing, or other devices. Pilon and Pearce have obtained good results with photographic films sensitised on both sides and sandwiched between two intensifying screens. They found it possible to determine a thickness of 1/10 mm. through 45 mm. of steel. All workers have found it important to cut out all extraneous radiation.

The X-ray method of examination is naturally very useful in examining explosive objects—for example, the details of the internal construction of torpedoes, shells, fuses, bombs, grenades, and cartridges. Aircraft construction demands both workmanship and material of the highest class, and a new grade of timber is now specified for this work of a quality such as has never been demanded previously. Knox and Kaye have turned the X-rays to account in inspecting aeroplane timber parts and plywood for faults which cannot be seen by ordinary visual examination. Concealed knots or gum-pockets, bad gluing, or poor workmanship are readily revealed. Only soft rays are necessary, and the great transparency of wood permits fluorescent-screen examination—a necessity for routine inspection—and allows any thickness likely to occur in practice to be radiographed readily.

The motor manufacturer has radiographed carburettors and magnetos while in operation, and so has been enabled to detect elusive faults. The Hadfield Research Laboratory, which has done much work on radio-steel examination, has extended the method to the scrutiny of carbon electrodes for electric steel furnaces. The Post Office has used the rays for testing the amount of mineral matter in gutta-percha. Woolwich Arsenal has also used the method. Radiography would doubtless prove to be a convenient means of detecting hidden corrosion in metals—for example, in gas cylinders, in ferro-concrete, or in the armouring of cables. Mention should be made of the coming importance of stereoscopic radiography.

There is one other and entirely different way in which X-rays may supplement the radiographic method of examining material. Prof. W. H. Bragg, to whom the subject owes so much, has shown that the X-rays enable us to examine in detail the nature and extent of the crystallisation of a body. Now it appears to be the case that there is little in Nature which is not crystalline to a greater or less degree, and, further, it is certain that crystalline structure is of first importance in determining the quality of certain substances such as steel. A large field of research is here indicated.

We do not anticipate any startling developments in the use of X-rays for the examination of steel until the present apparatus for generating X-rays has been vastly improved. We are led to inquire what part this country has played in the past in the development of either the high-potential generator or the X-ray tube. The answer is not very gratifying. The British generator is almost always an induction coil of which the present-day model differs but little in essentials from its predecessor of Spottiswoode's day, except that it is capable of a "fatter" spark and greater output generally. It breaks down less frequently owing to closer attention to the insulation of both primary and secondary coils. But what of design? How many British coil-makers employ a designer who can honestly say that he is not working mostly empirically, by trial and error, by "hit and miss," or whatever you like to call it? The fact is, the man who could do things any other way—by reasoned calculation and experiment—has so far not had it made worth his while to work at the subject. Moreover, how and where are men to be trained in the ground-work of the subject? In how many university physical or electrotechnical laboratories does the matter receive even the smallest attention?

What would prove to be the result of reasoned investigatory work on the induction coil? Compared with other types of high-tension transformer the present-day induction coil is not efficient, and the chances are that it never will be. At any rate, our American cousins have come to that conclusion, and are concentrating on closed-circuit, interrupterless transformers which can operate with any commercial A.C. supply, and are generally used in conjunction with some type of hot-cathode "rectifier" to suppress the "inverse" phase of potential. The British answer has mostly been to point out that the sinusoidal potential wave is not so efficient an X-ray producer as the peaked wave of an induction coil. Of the degree of practical importance of this difference we have no experimental knowledge. It is probably on a par with the oft-repeated, but untrue, statement that a Coolidge tube is not so good as an ordinary gas tube for securing first-class radiographs.

This leads us to the question of the X-ray tube. Its present efficiency is of the order of 1/1000. We are led to inquire in what outstanding points has the British tube made progress since Sir Herbert Jackson's introduction of the concave cathode in 1897—itself identical with one used by the late Sir William Crookes some twenty years previously. Again, has the British tube ever been superior to either the German or American? We know the answer most radiographers would give us. Before the war we could not even make the glass for the bulb. But that is another story. From the point of view of the Old Country, it is a regrettable fact that it should have been left to America to develop (in the shape of the Coolidge tube) pioneer research work done by

Englishmen. The latest model of the Coolidge tube acts efficiently as its own rectifier, and the high-tension outfit is correspondingly simplified.

In simple justice one must add that the scientific energies of this country have been far more distracted and dislocated by the war than have those of America. But the Department of Scientific and Industrial Research ought to have no hesitation in adding to the list of investigations it has tackled during and since the war.

To return to the question of future developments of the X-ray scrutiny of metals. The question of the light alloys is relatively simple, but for the heavier metals we need photographic plates and fluorescent screens of much higher efficiency. In addition, we need a method of generating X-rays in far greater abundance and of far greater hardness (*i.e.* shorter wave-length) than we have at present. In this connection every investigator and user ought to develop the habit of precise measurement of both current through the tube and, more important, the potential difference across the terminals. The voltage is commonly left to be inferred as well as may be from the alternative spark-gap between electrodes the size and shape of which are rarely mentioned. Or, more frequently, the hardness of the rays is given in some arbitrary unit difficult to define or reproduce. But radiology generally rejoices in a wealth of indefinite units and measuring instruments, mostly introduced by workers who had enthusiasm but little physics. The subject of practical radiology has, unfortunately, been severely ignored by the physicist and the electrical engineer. Their assistance in this matter is earnestly needed both by the medical man and by the workers in this new field of the application of X-rays to the examination of materials. The Röntgen Society has on its roll of members most of the younger X-ray physicists in the country, and we suggest that it should take early steps to co-ordinate the unrivalled experience and equipment of its physical and medical members for the ultimate benefit of British industry.

G. W. C. KAYE.

RADIO-TELEGRAPHIC INVESTIGATIONS IN CONNECTION WITH THE SOLAR ECLIPSE OF MAY 29, 1919.

IT will be remembered that in a letter to NATURE of February 13 last Sir Oliver Lodge, chairman of the British Association Committee for Radiotelegraphic Investigation, explained that his committee did not contemplate taking a very active part in organising wireless observations during the forthcoming solar eclipse, and hoped that parties travelling to the eclipse zone for the observation of astronomical, meteorological, and magnetic phenomena might be able to make wireless telegraph observations also. Later it was found that the various parties charged with the other observations would be too fully occupied to give any attention at all to wireless telegraphy, and therefore the committee has arranged for the carrying out of the experiments to be described below.

The umbra intersects the earth's surface in an approximate circle of diameter of about 234 km. (126 sea-miles), and it moves at the slowest at a speed of about 0·57 km. (0·31 sea-mile) per second. Between 11.30 and 12 (Greenwich mean time) it travels across Bolivia and Brazil, and crosses the Atlantic close to the equator between 12 and 14.20. It then crosses the African continent from the French Congo to Mozambique. During the eclipse various wireless telegraph stations will emit signals consisting of letters of the alphabet changed according to a definite plan at the end of each minute; the programme of letters is so arranged that no two come together in the same order more than once. They will be accurately timed at selected receiving stations. By this arrangement the transmitting stations are relieved of the responsibility of timing the signals accurately, and the receiving operators have nothing to do but to write down each letter as they receive it and the number denoting its strength on the scale (0 to 9) familiar to all wireless telegraphists. On the day before the eclipse the stations will send practice signals for a short time near noon (G.M.T.).

The British Admiralty stations at Ascension and the Azores will send continuously during the transit of the umbra across the Atlantic Ocean. Observing stations north of the equator will, for the most part, be asked to listen to Ascension for at least an hour round about the time when the umbra passes between themselves and Ascension. Similarly, observers south of the equator will be asked for the most part to listen to the Azores. Certain selected stations north of the equator will be asked to listen to the Azores so as to afford check observations upon the variations that may be observed in signals passing across the central line of the eclipse, and similarly selected stations south of the central line will be asked to listen to Ascension. The great American station at Annapolis may also transmit a programme during a portion of the period of the eclipse, and it is hoped that arrangements may be made for special experiments between a few pairs of stations, such as Darien and the Falkland Islands, and an Egyptian station and a South African station.

The main portion of the experiment hinges upon Ascension. The umbral cone passes from west to east, and may be expected to affect in succession the strength in which signals are received at such stations as Demerara, Jamaica, the stations on the coast of the United States and Canada, and stations in Ireland, England, France, Italy, the Mediterranean, and Egypt.

It is by the kindness of the American Government and of our own Admiralty that the stations at Darien and Annapolis, and at Ascension and in the Azores, are being used for the sending of the experimental waves. The Admiralty has, besides, provided many of the receiving stations both on land and sea, and other receiving stations are being put to work by the American, French, and Italian Governments, by our own Army and Air Force and also by the Marconi Co. in several parts of the globe.

The observers' results will be collated with the view of finding if the passage of the shadow cone between a sending and a receiving station causes any regular change in the strength of signals. According to some writers, the propagation of waves over long distances is greatly affected by the ionisation of the upper atmosphere. During a solar eclipse the cone of densest shadow removes all sunlight from the atmosphere within it, which may stop the ionising actions of sunlight and allow the recombination of separated ions to take place. This process starts in the penumbra, but it is accomplished fully, or to its fullest extent, only in the umbra. Thus at any particular fixed place in the air the penumbra, it is thought, first starts a gentle recombination of ions, and as the eclipse at that place progresses and darkness increases, recombination of ions takes place more and more quickly until the time of complete totality. Afterwards the onward passage of the umbral cone allows sunlight to begin again its ionising action. Something of this kind is, at any rate, supposed to be taking place at sunset and sunrise every day, and to be the main cause of the enormous variations experienced in signal strengths at those times.

It is sometimes supposed that the electric waves carrying signals take a curved trajectory in the atmo-

Eclipses, Solar Wireless telegraph
Radio-activity

sphere from one point to another. In this case signals passing between two stations at a short distance apart will traverse lower levels of the atmosphere than those passing between stations separated by a great distance. The eclipse probably affects the ionisation of the upper and lower layers of the atmosphere differently, and therefore we may expect to get different effects on long- and short-range signals. Moreover, it has been shown to be probable that long waves are more affected than short waves by changes of the ionisation of the air through which they travel. The elucidation of this point is one of the aims of the observations.

Anyone desirous of obtaining further information should communicate with Dr. W. Eccles, honorary secretary of the committee, City and Guilds Technical College, Leonard Street, London, E.C.2.

THE BUREAU OF STANDARDS AND THE WAR.

THE most obviously noteworthy feature of Dr. Stratton's report on the work of the U.S. Bureau of Standards for the year ended June 30, 1918, is the very extensive field of investigation covered. A large part of the work was necessarily related to the war; the expenditure increased from about 140,000*l.* in 1916–17 to more than 600,000*l.* in 1917–18, of which 220,000*l.* appears under the head of "National Security and Defence," and is made up mainly of sums expended on new buildings and laboratories, additional to the growth of ordinary expenditure due to war conditions. The value of the tests made, chiefly for the Government, is given as 20,000*l.*; and the number of persons employed as 1405, of whom 839 were engaged in research and investigations specially authorised by Congress. The figures are useful as an indication of the expansion which has taken place.

The report opens with a brief account of the functions and organisation of the Bureau, which, if space permitted, it would be interesting to review in detail. It affords a valuable study in these days of reconstruction. The functions of the Bureau are stated to be the "development, construction, custody, and maintenance of reference and working standards, and their intercomparison, improvement, and application in science, engineering, industry, and commerce"; while the standards are classified under the five headings: standards of measurement, standard constants, standards of quality (of materials), standards of performance (of machines and devices), and standards of practice. The relations of the work of the Bureau to the public and to the Government service are examined in a manner which brings out prominently the important *rôle* the institution plays in connection with the national life and industry.

The remainder of the report, some 180 pages, deals, for the most part in short paragraphs, with the innumerable items of research and test work which have received attention in the various scientific and technical divisions. These departmental reports contain little more, in many instances, than a concise statement of matters investigated; in turning over the pages, among the many points of interest, a few only can be selected for comment. A new equipment has been provided for measuring expansion up to temperatures above 900° C. The examination of mine-scales, used for weighing coal mined, led to the detection and removal of serious errors due to faulty weights, improper installation, and neglect in maintenance. The testing of gauges for the Ordnance Department was undertaken by the Bureau, as in this country by the National Physical Laboratory, though on a much smaller scale than here. Branches were established at New York and elsewhere, and the manufacture of gauges was commenced.

In the electrical department ignition in petrol engines was studied, and improved porcelains for sparking plugs, developed by the ceramic laboratory, were put into production. A special method was devised for determining the velocity of projectiles. The method of "magnetic analysis" as a criterion of the quality of steel has been further investigated and applied in practice. The photometric work included tests of field searchlights and the investigation of gas-filled standards of spherical candle-power. For wireless work a new building was nearly completed. Sound-ranging was among the problems taken up by one of the electrical sections. An account is given of the relation of the Bureau to municipalities and public service commissions in securing safety and standardisation in connection with electricity and gas supply; some particulars are included of the national electrical safety code. The subject of electrolysis of underground pipes, cables, and other metal structures from stray earth-currents is prominently mentioned, and may need to be taken up actively in this country.

In the work of the heat department may be noted the determination of refrigeration constants, including the thermal constants of ammonia. The fire-resisting properties of structural materials, reinforced concrete, etc., under load were examined. An apparatus was completed for strength tests of metals at temperatures up to 800° C. The work on aeroplane power plant included the construction of an altitude laboratory for engine tests under reduced pressure and at various temperatures, and a number of tests on engines have been carried out. The construction of radiators has also been the subject of research.

The researches in the optics department have included much spectroscopic work, dealing especially with the red and infra-red regions of the spectrum, landscape photography with red-sensitive plates, colour-filters, etc. The great value of red-sensitive plates in penetrating haze has been demonstrated, and another important characteristic of these plates is said to be their power to detect *camouflage* designed to defeat the eye. Quantitative, as well as qualitative, methods of spectroscopic analysis have been employed. Polarimetry has received much attention, especially in connection with the estimation of sugar, and interesting results have been obtained with regard to the natural rotation of quartz at high temperatures; an abrupt change was found to occur at about 574° C. In connection with the polarimetric work intense monochromatic light sources were necessary, and, after experiment with cadmium amalgam lamps, a lamp using a new alloy has been produced. A novel method for the production of artificial daylight makes use of the rotatory dispersion of quartz.

A considerable amount of attention in the optics and chemistry departments has been given to the production of optical glass. The Bureau is said to be shipping glass in quantity for the manufacture of optical instruments. Some seven or eight varieties of the most used glasses are being produced, including a dense barium crown. For this work a new glass laboratory was erected in 1917. Much investigation has necessarily been devoted in this connection to the production of pots for melting.

The work of the chemistry section has included the study of electroplating and electrotyping; the improvement of the electrolytic method of estimation of carbon in steel so that an accurate determination can now be made in $4\frac{1}{2}$ minutes; the testing of balloon fabrics and the investigation of balloon gases, together with chemical work on oils, rubber, paper, textiles, ink, glue, cement, bitumen, and other materials. It is noted that in the testing of balloon fabrics no satisfactory equivalent for exposure to weather has been found, confirming experience in this country. There was a greatly increased demand for standard analysed samples as furnished by the Bureau.

The engineering section of the Bureau is responsible for the control of a large amount of routine testing work of various kinds, some of which is carried out in branch laboratories. For work in aerodynamics a new building and wind-tunnel have been provided; the latter is octagonal in section, the distance between opposite faces being $4\frac{1}{2}$ ft., and a wind-speed of ninety miles per hour is obtained with an expenditure of 85 h.p. Autographic instruments for measurements on aeroplanes in flight have been designed. Much work has also been done on materials for aircraft construction and the strength of aeroplane parts. The inspection and testing of cement and concrete for the Government and the public are on a large scale, and have included investigations relating to concrete ships. Stress reversal tests on reinforced concrete beams have been carried out. Lubricating oils have been investigated. The textile division has given attention to aeroplane and balloon fabrics; a cotton fabric for wing-covering was produced with the aid of the manufacturers which was considered superior to linen, and has been widely used.

In the metallurgy division considerable developments have taken place, and a brief description is given of the new laboratories and equipment installed, which will be found of interest. As at the National Physical Laboratory, light alloys for the construction of aircraft and aircraft engines have received a great deal of attention, and evidence of co-operation appears in the adoption of a programme to supplement work done here. Stress is laid on the necessity for the systematic study of constitution to secure further progress. The properties of metals at high temperatures are being investigated. Ceramics is also a subject on which much research is in progress.

This brief survey will suffice to show that the report contains evidence of a vast amount of scientific and industrial research which will be of the greatest interest and importance to those who are working on parallel lines in this country. A special feature of the work of the Bureau is the attention given to methods of making available for ready reference throughout the country the results of the various investigations. Four separate series of publications are issued: (i) scientific papers, (2) technologic papers, (iii) circulars, and (iv) miscellaneous publications; these are widely distributed to institutions and libraries. The need in this country of more effective means for the rapid dissemination of technical information among those to whom it is of value has been very apparent during the war, and in the consideration which is now being given to this matter the methods adopted by the Bureau will be found to merit careful examination.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—Dr. S. W. J. Smith, F.R.S., assistant professor at the Imperial College, South Kensington, and for many years secretary of the Physical Society of London, has been elected to the Poynting chair of physics in the University.

CAMBRIDGE.—Sir Ernest Rutherford, Cavendish professor of experimental physics, has been elected to a fellowship at Trinity College.

Dr. H. Hartridge, of King's College, has been appointed demonstrator of physiology until September 30, 1921.

Mr. Bennett Melvill Jones and Mr. James Wyvill Lesley have been elected to junior fellowships at Emmanuel College. Mr. Jones was placed in Class I. of the Mechanical Sciences Tripos, 1909, and has been awarded the Air Force Cross for his work with the Royal Air Force, of which he has been a temporary lieutenant-colonel. Mr. Lesley was placed in Class I., Part I., of the Natural Sciences Tripos in 1910, and obtained the agricultural diploma. He was awarded a scholarship of the Board of Agriculture in 1911, and was a student of the John Innes Institution, 1912. He was temporary captain in the K.R.R.C., gained the Military Cross, and was a prisoner in Germany, 1917–18.

DR. BOON has been appointed to the chair of chemistry at Heriot-Watt College, Edinburgh.

MR. R. W. H. HAWKEN has been appointed to succeed Prof. A. J. Gibson as professor of engineering in the University of Queensland.

WE learn from the *Morning Post* that a donation of 10,000*l.* has been given to the Cape University by the National Bank of South Africa.

MR. W. J. JOHN, formerly a wireless telegraphy engineer under the Admiralty, has been appointed lecturer in electrical engineering at the East London College.

THE *Times* announces that Dr. James Younger and his wife have given 30,000*l.* to provide the University of St. Andrews with a memorial hall. The main hall, to be used for University purposes, is to have an organ and to accommodate a thousand. There will also be a smaller hall.

AN ingenious astronomical model for schools and colleges, devised by Dr. W. Wilson, was described in NATURE of May 2, 1918, p. 173. Demonstrations on the uses and working of this model are being given by the inventor in the show-room of Messrs. George Philip and Son, Ltd., 32 Fleet Street, and the concluding one will be on Saturday, May 10, at 11.30 a.m.

MRS. ELLEN MORGAN has bequeathed 1000*l.* to the University of Liverpool for a John H. Morgan scholarship to be awarded to students of the University who have passed the Matriculation Examination and intend to proceed to a degree of faculty of engineering, and who or whose parents are too poor to defray the ordinary expenses of pursuing an academic career at the University.

BY the will of Dr. J. Percival, late Bishop of Hereford, the following bequests will be made:—1000*l.* to Appleby Grammar School; 2000*l.* to Clifton College; 1000*l.* each to Queen's College, Oxford, and Trinity College, Oxford, all for helping scholars of distinguished ability who are in need of assistance to meet educational expenses; and 1000*l.* to the Bishop of Hereford for the education of one or two boys or girls.

THE President of the Board of Education has appointed a Departmental Committee to inquire into the position occupied by English (language and literature) in the educational system of England, and to advise how its study may best be promoted in schools of all types, including continuation schools, and in universities and other institutions of higher education, regard being had to (1) the requirements of a liberal education; (2) the needs of business, the professions, and the public services; and (3) the relation of English to other studies. The chairman of the Committee is Sir Henry Newbolt, and the secretary Mr. J. E. Hales, to whom all communications should be addressed at the Board of Education, Whitehall, London, S.W.1.

AFTER an interval of four years, due to the circumstances of war, the eighth annual general meeting of the Old Students Association of the Royal College of Science, London, will be held on Saturday, May 24, at 3.30 p.m., at the Imperial College Union, Prince Consort Road, South Kensington. The meeting will discuss the important questions raised by the petition to the governing body of the Imperial College, signed by past and present students of the Royal College of Science, requesting it to take immediate steps to raise the status of the college to that of a university of technology, empowered to confer its own degrees in science and technology. At the conclusion of the regular business an address will be given by the retiring president, Prof. H. E. Armstrong. The eighth annual dinner of Old Students will be held at the Café Monico after the general meeting. Tickets may be obtained from the secretary, Mr. T. Ll. Humberstone, 21 Gower Street, W.C.1.

A CONFERENCE attended by representatives of the professorial and non-professorial teaching staffs of the university institutions of England, Wales, and Ireland, with Mr. R. D. Laurie, of the University College of Wales, Aberystwyth, as chairman, met at the University of Sheffield on April 11 to discuss the position with regard to superannuation, in view of the recent Act, which confers non-contributory pension benefits upon all teachers in State-aided institutions except university teachers. Since 1913 there has been a pension scheme for universities of a contributory character, known as the Federated Superannuation Scheme, under which the State pays one-half of the total contribution and the other half is paid by the beneficiary. This scheme, which in its present form compares very unfavourably with the non-contributory scheme under the Teachers (Superannuation) Act, is mainly applicable, however, to professorial staffs, as the majority of lecturers are in receipt of salaries so low that they cannot afford to make the necessary contribution. After discussion at the recent meeting, a motion, "That this conference wishes to urge strongly that the Teachers (Superannuation) Act, 1918, be extended so as to include the staffs of universities and university colleges," was carried with only one dissentient. A further resolution, carried unanimously, was :—"That this conference urges that before any modification of the Federated Superannuation Scheme for university teachers be adopted, an opportunity be given to the various sections of the staffs of the universities to place their views directly before the President of the Board of Education and the Treasury, and that this resolution be communicated immediately to the President of the Board of Education." It was also decided to communicate with all the associations of teachers in schools which come under the present Act to advise them of the action being taken by the conference.

A CONFERENCE to direct attention to the position of science in the educational system of the country was held at the Central Hall, Westminster, on April 30, under the auspices of the League for the Promotion of Science in Education. The chair was taken by Lord Leverhulme, who said that our system of education should take into the fullest possible consideration the means that science had placed at our disposal in the daily life and industries of the nation. Three resolutions were submitted to the conference and carried unanimously. The first of these emphasised the importance of having an adequate representation of scientific men in all Government Departments, and in proposing it Mr. Sanderson, the headmaster of Oundle School, deplored the lack of scientific outlook by Government officials, and criticised the new regulations for the Civil Service examinations. Sir Philip Magnus, M.P., in seconding, emphasised the fact that the league did not in any way desire to favour scientific teaching at the expense of so-called humanistic studies. They wished, however, to encourage the adoption of the scientific method in all branches of learning. Mr. Charles Bright supported the resolution, and suggested that men of scientific and business experience might well be introduced into the *personnel* of Government Departments. Mr. Arthur Lynch, in proposing the second resolution calling for a pronouncement by the Government as to its attitude towards the recommendations of Sir J. J. Thomson's report, criticised the lack of scientific knowledge of Members of Parliament in matters of general education. Lord Headley seconded this resolution, and attributed the indifference to matters of this nature to the lack of scientific education, which alone could produce action and organising ability. The third resolution was proposed in a forceful speech by Dr. H. B. Gray, formerly headmaster of Bradfield College, who expressed the view that the present public school and university system failed to produce that activity of mind and breadth of knowledge which were necessary for dealing satisfactorily with modern problems. Mr. Edward Berkeley, a member of the council of the National Union of Manufacturers, seconded this resolution.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Anthropological Institute, April 8.—Sir Everard im Thurn, president, in the chair.—Lieut. E. W. Pearson **Chinnery** : Reactions of certain New Guinea primitive people to Government control. It is the desire of Australia to put down cannibalism and general savagery and introduce civilisation among people of the Stone age in Papua without injury to them. Cannibalism and savagery are essential parts of the social and religious fabric of an uncivilised community. If they are to be suppressed without injury to the people, alternative practices of equal potency must be substituted to perpetuate material welfare and develop cultural institutions in accordance with the laws of the Government. Since the wild tribes of Papua received their first alien stimuli through the magistrates of their districts, progress depends on the ability of these officers to establish a proper relationship of mutual understanding and confidence between Government and subjects. When this is attained the officers, by intensive study of the culture of their people, can acquire a knowledge of the modes of thought that produce customs antagonistic to civilised standards, and safely guide the people through the stages of transition. If a system of training district magistrates in anthropological methods is added to existing methods of administration, Australia should, in the shortest possible time, achieve the credit of having conducted the savage of the Stone age, without injury to him, to an attainment of the ideals of civilisation.

PARIS.

Academy of Sciences, April 22.—M. Léon Guignard in the chair.—D. **Berthelot** : Notice on the work of Sir William Crookes.—G. **Bigourdan** : The work of Le Monnier at the meridian of Saint-Sulpice. The end of the observatory of the rue Saint-Honoré.—G. **Julia** : Some properties of integral or meromorphic functions.—A. **Guldberg** : The law of errors of Bravais.—G. **Guillaumin** : Certain particular solutions of the problem of sandy flow.—MM. **Jouguet** and **Crussard** : The velocity of deflagrations.—M. **Amans** : Equations of similitude in propulsive helices.—M. **Picon** : The action of the monosodium derivative of acetylene on some halogen esters of secondary and tertiary alcohols. The reaction differs from that shown by halogen esters of primary alcohols, and the corresponding acetylene compounds are not formed. Halogen acid is eliminated and ethylene hydrocarbons are produced.—J. **Amar**: The curve of pulmonary ventilation. A study of the effects of physical fatigue on respiration.

April 28.—M. Léon Guignard in the chair.—H. **Parenty**: Presentation of a miniature model of a steam recorder. The apparatus, a photograph of which is given, is based on the measurement of pressure in front and behind a constriction in the pipe.—A. **Righi**: Michelson's experiment and its interpretation.—M. **Carleman**: The conformable representation of multiply connected domains.—L. E. J. **Brouwer**: The enumeration of finite groups of topological transformations of a tore.—A. **Denjoy**: The true value of definite integrals.—R. **Biquard**: A modification of the fluorometric method of measuring X-rays and its application to the measurement of the radiation from Coolidge bulbs. Measurements with fluorescent screens cannot give a value of the radiation in absolute measure, since the fraction of the incident energy absorbed by such screens may vary, according to the nature of the X-rays, between 53 and 20 per cent. of the whole, and matters are not improved by increasing the thickness of the screen, since the observed brightness is due to the superficial layers only. This difficulty is avoided by the use of a sufficient number of thin screens (0·2 mm.).—M. **de Broglie**: The spectroscopy of the X-rays. The L absorption spectrum of radium.—J. **Bourcart**: The presence of the Priabonian in the Salonica region.

BOOKS RECEIVED.

Botany of the Living Plant. By Prof. F. O. Bower. Pp. x+580. (London: Macmillan and Co., Ltd.) 25*s*. net.

Premiers Eléments d'une Théorie du Quadrilatère Complet. By A. Oppermann. Pp. 76+plate. (Paris: Gauthier-Villars et Cie.)

Technic of Surveying Instruments and Methods, including General and Detailed Instructions for Field and Office Work of Extended Students' Surveys. By Profs. W. L. Webb and J. C. L. Fish. Pp. xvi+319. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 9*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, MAY 8.

INSTITUTION OF ELECTRICAL ENGINEERS (Joint Meeting with the Iron and Steel Institute), at 2.30.—T. Bibby: Developments in Iron and Steel Electric Furnaces.—W. H. Booth: The Booth-Hall Electric Furnace.—H. A. Greaves; Application of Electrical Energy to the Melting of Metals.—R. G. Mercer: Electric Furnaces in the United Kingdom, 1918.—Axel Sahlin: A New Type of Electric Furnace.—Victor Stobie: Large Electric Steel Melting Furnaces.

ROYAL INSTITUTION, at 3.—Dr. H. S. Hele-Shaw: Clutches.

INSTITUTION OF MINING AND METALLURGY, at 5.30.—Annual General Meeting.—Hugh K. Picard: Presidential Address.—H. Standish Ball: The Work of the Miner on the Western Front, 1915–18.

OPTICAL SOCIETY, at 7.30.—Prof. F. J. Cheshire: Presidential Address—Polarised Light.—J. Rheinberg: Graticules.

FRIDAY, MAY 9.

ROYAL ASTRONOMICAL SOCIETY, at 5.—A. W. Clayden: Note on the Blue Violet Absorption of Venus.—E. Doolittle: Note on Espin's List of New Double Stars.—A. N. Brown: Observations of U Persei in 1911–19.—A. Pannekoek: The Distance of the Milky Way.—*Probable Papers*: Rev. T. E. R. Phillips: Micrometrical Measures of Double Stars in 1918.—Rev. A. L. Cortie: The Spectrum of Nova Aquilæ, 1918, July 29.—W. M. Smart: Note on the Position Line of Navigation.

PHYSICAL SOCIETY, at 5.—A. E. Bawtree: Demonstration of a New Method of Producing Coloured Designs upon Glass.—F. J. Whipple: Absolute Scales of Pressure and Temperature.—Dr. A. O. Rankine: The Transmission of Speech by Light.

ROYAL INSTITUTION, at 5.30.—Sir George Macartney: Chinese Turkistan—Past and Present.

MALACOLOGICAL SOCIETY, at 6.—G. B. Sowerby: A New Species of Ampullaria in the Geneva Museum.—Dr. A. E. Boycott: Parthenogenesis in *Paludestrina jenkinsi*.—Tom Iredale: Notes on the Mollusca of Lord Howe Island.

SATURDAY, MAY 10.

ROYAL INSTITUTION, at 3.—Prof. H. S. Foxwell: Chapters in the Psychology of Industry.

MONDAY, MAY 12.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—A. Trevor Battye: Crete: its Scenery and Natural Features.

TUESDAY, MAY 13.

ROYAL INSTITUTION, at 3.—Prof. A. Keith: British Ethnology—The People of Ireland.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 5.—Sir Everard im Thurn: Dwellings and Costumes of Old Fiji, illustrated by Lantern Slides and Specimens.

ZOOLOGICAL SOCIETY, at 5.30.—Lt.-Col. S. Monckton Copeman: Experiments on Sex Determination.

WEDNESDAY, MAY 14.

ROYAL SOCIETY OF ARTS, at 4.30.—H. Kelway-Bamber: Railway Transport in the United Kingdom.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Major J. Erskine-Murray: Wireless in the Royal Air Force.

BRITISH PSYCHOLOGICAL SOCIETY (Medical Section), Medical Society of London, 11 Chandos Street, W.1, at 8.30.—Dr. W. H. R. Rivers: Inaugural Address—The Objects and Work of the Section.

THURSDAY, MAY 15.

ROYAL INSTITUTION, at 3.—Prof. F. Keeble: Intensive Cultivation.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Prof. W. H. Young: (1) The Area of Surfaces; (2) Change of the Independent Variables in a Multiple Integral.—Prof. W. A. Bone and R. J. Sarjant: Researches on the Chemistry of Coal. I. The Action of Pyridine upon the Coal Substance.—Prof. E. F. Burton: A New Method of Weighing Colloidal Particles.—W. E. Curtis: The Value of the Rydberg Constant for Spectral Series.

ROYAL SOCIETY OF ARTS, at 4.30.—Prof. H. E. Armstrong: Soil Deficiencies in India, with Special Reference to Indigo.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—E. A. Laidlaw and W. H. Grinsted: The Telephone Service of Large Cities, with Special Reference to London.

CHEMICAL SOCIETY, at 8.—B. Blount and J. H. Sequeira: "Blue John and other Forms of Fluorides.—G. M. Bennett: The Nitration of Diphenylethylenediamine.—D. L. Hammick: The Destruction of Picric Acid in Nitrating Acid.—J. C. Irvine and J. S. Dick: The Constitution of Maltose. A New Example of Degradation in the Sugar Group.—R. J. Manning and M. Nierenstein: The Tannin of the Canadian Hemlock (*Tsuga Canadensis*, Carr).

FRIDAY, MAY 16.

ROYAL INSTITUTION, at 5.30.—Dr. S. F. Harmer: Sub-Antarctic Whales and Whaling.

SATURDAY, MAY 17.

ROYAL INSTITUTION, at 3.—Dr. J. Wells: Cæsar's Personal Character as seen in his Commentaries.

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