THURSDAY, FEBRUARY 28, 1918.

THE NEW ERA IN MEDICINE.

Lord Lister. By Sir Rickman J. Godlee, Bart. Pp. xix+676. (London: Macmillan and Co., Ltd., 1917.) Price 18*s.* net.

THIS is a worthy biography of a very great man. Sir Rickman Godlee had to decide whether to write a literary biography in which the personality of Lister should be the central motive—a biography for the general reader—or, without neglecting this portrait, to build it, as wisely he has done, around his surgical and scientific occupations. The volume is, nevertheless, one to appeal not to medical readers only, but also to all men of science; and indeed to all those beyond who find an interest in the methods of discovery. The work is bulky, and some parts of it—for example the period of the failing light—might have been abridged; still on the whole this comprehensive book well reflects the life of toil and devotion which ransomed mankind from some of the most frequent and terrible of its pains and sorrows. Could the irony of things cut deeper than in that meeting of Lister in Pisa with a procession of the Archbishop in full dress, attended by ecclesiastics of various grades, chanting a prayer to Ranieri, the patron saint of the city, for his intercession against the cholera and the disease of the vines (p. 54). Now, as in all critical periods of medicine, surgery has led the way.

In the old maxim, to choose your parents wisely, Lister was not wanting. His father was a man of science of considerable and abiding distinction; and was moreover no inconsiderable scholar. The portrait of his mother speaks of a woman likewise of rare intelligence and refinement. And over the home rested the pure and gentle spirit of the Society of Friends.

Early in his life Lister was impelled to biological studies, and soon made his choice of the profession of medicine; but father and son were of one mind that, although scientific pursuits were by no means to be laid aside, yet a good literary and mathematical education should be pursued also, to the end of school life. Thus it was that Lister was well equipped as a scholar, and all through life he cherished not only that admiration which we all assume as we glance at our masterpieces sleeping in their presses, but also made them—Horace, Virgil, and Dante especially—the companions of his scanty leisure and holidays.

It has been said that Lister was but a plodder, a man rather of indefatigable industry than of imaginative genius. The truth is, imagination is of two chief kinds: the concrete, as in Reynolds, Turner, Keats, Rodin; the abstract, as in Newton, Maxwell, Pasteur, Darwin. In discoverers of this company, of which was Lister, the act of imagination consists, not in the building of æsthetic memories into an image, but in the conception and synthesis of principles, principles akin, but which, to ordinary vision, had been unseen or their kinship unrecognised. When on this perception of underlying affinity a new synthesis is revealed, it often comes in a flash, because the combining principles meet in the mind of a genius already vigilant and charged with prepared materials. Thus Pasteur's spark fell into a prophetic and impassioned mind already charged by vast and fertile labours, and by thought, experience, and foresight. The powder was ready and dry. The same essay by Pasteur that was shown to Lister by Prof. Thomas Anderson in 1865 had in the year before been shown to Spencer Wells, but the flash did not happen.

The "taking pains" part of genius, cherished, let us not forget, by his devoted wife, was in Lister almost stupendous. The present writer, who had the privilege of Lister's friendship, until he read this book had but an imperfect notion of its magnitude and variety; and behind it burned the sleepless passion of human love. He recalls one vivid conversation in which Lister described his restlessness, while house-surgeon to Syme, under this consuming passion. Driven by it, he would repair of an evening to the wards to reinvestigate the wounds, and again and again to scrape away fragments of tissues and discharges for examination by chemical and histological methods. Without this profound knowledge and experience of tissue perversions, controlled also by innumerable experiments, as upon the frog's web and bat's wing—methods devised by himself—he would have been as unprepared as were his surgical contemporaries to descry the power and the compass of Pasteur's discovery. We should add that in these preliminary researches he never ceased to proclaim his debt to Wharton Jones, and especially to Sharpey. And not only was Lister thus prepared beforehand, but his later bacteriological work also was far greater and richer than is generally appreciated. He invented the "hot box," and his were the methods of culture which held the field until they were superseded by Koch's solid media.

When the writer joined the honorary staff of the old Leeds Infirmary at least one-third of the amputations of the thigh were mortal. In the magnificent new building things were at first but little better; the ovariotomies—then a new and tentative operation, it is true—were so mortal that murmurs arose not only outside the hospital, but also within it. Yet in most instances these and such patients had been placed in single rooms apart, rooms as clean as housemaids could make them. What nevertheless that death-rate was I dare not try to remember. Suffice it to say that Erichsen was proud of results in which 25 per cent. of his major operations were mortal; of a certain 163 amputations Billroth lost nearly one-half—viz. seventy-five cases. In the hospitals of Paris generally the death-rate of major operations amounted to more than 50 per cent. In the London hospitals (1800 beds) the death-roll of all operations was no less than 38 per cent.!

We were all so proud of our housemaiding that when Rolleston, in his address on physiology at

Oxford, told us that much of the cystitis was due to our use of dirty catheters, and when Simpson proclaimed that our wards were so foul as to be fit only for a bonfire, we were incredulous and full of wrath. But in this book is told that story of the great magician under whose wand Syme performed his last twenty thigh amputations without a death! Erysipelas, septicæmia, gangrene, tetanus fled as gibbering ghosts before him.

But for a while these marvellous results were achieved only by the master and his reverent disciples; they were not bestowed upon the profane, or upon "slipshod surgeons." However, our limits forbid any discussion of the antiseptic and aseptic controversies, much of it a matter of words, or of the enthusiastic welcome of "Listerism" almost everywhere at home and abroad, except in London. For these and such stories we must be content to send the reader to Sir Rickman Godlee's book, in which every stage of the establishment of the gradually perfected system is described in its order, and the cardinal points developed in due proportion by an author who is almost silent upon the part played by himself in the new surgery. Moreover, in this case, that the life should have been written by a near kinsman proves to be altogether to our advantage. C. A.

MUSEUM MANAGEMENT.

The Museum: A Manual of the Housing and Care of Art Collections. By Margaret Talbot Jackson. Pp. xi+280. (London: Longmans, Green, and Co., 1917.) Price 6*s.* 6*d.* net.

IN the absence of any comprehensive handbook of museum management, this book serves a useful purpose. It is by no means exhaustive, and is written (quite naturally) from the point of view of American museums; but it contains many hints which the directors of English museums will find helpful. The author does not appear to have paid much attention to English museums; only ten are mentioned in her list of places visited (the Fitzwilliam and all provincial museums except Liverpool are omitted), as compared with forty-one German and seventy-nine Italian; and, apart from references to the print-mounts of the British Museum and a lighting device at the Ashmolean, practically no use is made of their experience. This, however, is no disadvantage from the point of view of museum officials in this country, but rather the contrary. We know our own practice, and what is helpful is to hear the experience of others, even though it may need adaptation before it is applied here.

Miss Jackson deals almost wholly with what may be called the body of a museum, not its soul. Only seven pages are devoted to the chapter on the formation of collections; but she has much to say, and says it sensibly, on the situation and architectural plan of a museum, on its walls, floors, and decorations, on the treatment and conservation of various fabrics and materials, and on questions of internal organisation and administration. On some points within this compass more might usefully be said; for example, on the relative advantages of small and large rooms. Small rooms are restful for the careful student who wishes to examine a few things and to examine them minutely; but they are wearisome to the general visitor, and are less easily warded. The true solution appears to be to have fair-sized galleries for the ordinary visitor, in which carefully selected objects are set out in the most instructive manner; and small rooms for the study series, and for a few special treasures, such as a Madonna di San Sisto or a Venus de Milo, which deserve the honour of solitary worship. There are few museums which are planned in this way, or which can spare the necessary space to set out objects with sufficiently wide intervals; but the ideal should be before the designers of new buildings.

A few other points may be noted. A word of caution is needed against the cross-lights and reflections which come from low windows on either side of a gallery and glass cases at right-angles to them. If peripatetic lectures are given in the galleries, some floor covering (such as cork linoleum) will save the lecturer's voice and the listeners' tempers. Variations of level between galleries, necessitating a step or two up or down, are a great obstacle to the transport of objects on trollies or barrows. More might have been said about designs of show-cases; the contents should not looked naked and unframed, but the case should provide a frame for the contents, without overpowering them by too much heaviness. If the museum is to be used at night, much thought is needed for the lighting, whether by ceiling lights or lights within the cases. But the omission which seems most serious is a fuller discussion of the labels and guide-books on which the main value of the museum as an educational agency depends. In America perhaps more reliance is placed upon lectures. In this country the lecturer is making progress as a museum institution, but he by no means replaces the descriptive label or the cheap, well-illustrated guide-book.

These are the few suggestions which space allows towards the improvement of a book for which museum curators should be grateful.

F. G. KENYON.

PLANT-ANATOMY IN RELATION TO EVOLUTION.

The Anatomy of Woody Plants. By E. C. Jeffrey. Pp. x+478. (Chicago, Ill.; The University of Chicago Press; London: Cambridge University Press, 1917.) Price 4 dollars net.

BOTANISTS for several years past have felt the need of a comprehensive text-book on the anatomy of plants worthy to take the place of de Bary's classic book published in 1877. As Prof. Jeffrey says: "In de Bary's text-book both palæobotany and development are deliberately eschewed." The omission of any account of the anatomy of extinct plants would in these days

be a much greater defect than it was forty years ago, and whether one agrees or disagrees with the conclusions stated by the author, he cannot be accused of undervaluing the importance of palæobotanical data. The study of the development of organs is deliberately omitted on the ground that it throws little light on the processes of evolution. The researches of Schwendener gave a stimulus to the study of anatomy from a physiological point of view, and the last edition of Haberlandt's "Physiological Plant Anatomy" admirably represents the present state of our knowledge in this branch of botany. It is surprising that Prof. Jeffrey makes no reference to Haberlandt's work.

"The Anatomy of Woody Plants" cannot be said to be a comprehensive text-book; the treatment is essentially eclectic, and the subject-matter is to a large extent limited by the scope of the author's well-known and invigorating researches. The main object is to interpret the structural features of recent and fossil woody plants in terms of descent. An anatomical treatise on broader lines, in which the anatomy of the lower plants receives adequate treatment, has still to be written.

Prof. Jeffrey believes that the herbaceous type of dicotyledon is derived from ancestors with woody stems, and in this connection the different types of medullary rays are fully discussed. The illustrations are excellent, the great majority being new. Chaps. i.–x. treat of the cell, tissue-systems, fibrovascular tissues, the epidermis, and fundamental tissues. Special attention is given to the structure of the secondary xylem. "We have," says the author, "in the woody structures past and present an almost perfect biological document, carrying back the history of plants in relation to their changing conditions of environment into remote epochs of our earth's history."

Much interesting and to a large extent new information is given about the elements of woody tissue, tracheids, vessels, fibres, etc., based on the examination of macerated material. Arguments are adduced in support of the view that "the distinction between spring and summer tracheids did not exist in the case of Palæozoic woods," a statement—implying, as it does, the prevalence of uniform climatic conditions throughout the Palæozoic era—scarcely consistent with the geological and botanical evidence afforded by the Glossopteric flora and the rocks associated with the Permo-Carboniferous plant-beds of Gondwana-land. Rings of growth, though generally lacking in Palæozoic stems from European localities, are far from being universally absent. An annual winter period of rest is believed to be the cause of the appearance of longitudinal parenchymatous elements in wood. Attention is paid to the root, stem, leaf, microsporangia, and seeds, and there is an interesting chapter on the canons of comparative anatomy. Chaps. xviii.–xxix. are devoted to the Lycopsida, Pteropsida, Gymnosperms, and Angiosperms; chaps. xxx.–xxxii. include anatomical structure and climatic evolution, evolutionary principles exhibited by the Compositæ, and a very useful account of anatomical technique.

Prof. Jeffrey's book, which is admirably produced by the Chicago Press, is an original and stimulating contribution to botanical literature. The author discusses various controversial questions and raises many points on which there is considerable difference of opinion. His views on the primitive nature of the Abietineæ and their greater antiquity than the Araucarineæ are stated with an assurance that is almost pontifical. Too little weight is attached to the study of reproductive organs, and the very strong evidence of the records of the rocks in favour of the greater antiquity of the Araucarian stock is either ignored or very partially treated. There are no references to the published work of other authors, and no bibliography—a very serious blemish in a book which is presumably intended for students unfamiliar with the widely scattered original literature, and ought to be a guide to those who wish to go further along particular lines of inquiry and to see what has been said on the other side.

The fact that Prof. Jeffrey is an original investigator whose position entitles him to speak with authority increases one's regret that his attitude is not more in keeping with the best traditions of scientific exposition. A. C. SEWARD.

OUR BOOKSHELF.

Telegraph Practice: A Study of Comparative Method. By J. Lee. Pp. ix+102. (London: Longmans, Green, and Co., 1917.) Price 2*s.* 6*d.* net.

OF books on the art of electric telegraphs, covering more or less completely technical details and principles of the numerous types of apparatus, there has been an increasing, and it may be even a more than ample, supply. That the science of telegraphy has not been equally well served is probably due to the artificial elimination in England of the engineer from any sufficient practical direction of the method of utilising the machines which he designed and installed. However that may be, the appearance of Mr. Lee's book at once brings the fact into prominence and goes a long way towards filling the gap which it reveals. Mr. Lee's long association with the traffic control organisation of the British Post Office has placed him in an excellent position to ascertain all the factors of the numberless problems of the science of telegraphy; and his admirable powers of grasping the facts and of presenting them in a concise and cogent manner render this little book of 100 pages a storehouse of valuable details and a veritable handbook for the expert. It is withal a very attractively readable description of one of the most valuable of modern "utilities." It is a "study" of telegraph practice which, while glancing at the past, deals in a comparative sense with the present, and indulges in illuminating conjecture in regard to the future. The author regrets that the name of the originator of an ingenious method of classifying Press telegrams is unknown; if he should wish to know who originated the "indicator" word of

registered telegraphic addresses which he describes on another page the present writer might be able to enlighten him.

The author's outlook on telegraphy is that of the optimist who knows, and of the prophet who, by a balanced consideration of the past, can foresee and frame a just conception of the future, and is thereby enabled to point forward "to a time when telegraph practice will . . . serve the economic and industrial and social needs far more vitally and far more intelligently than it has been called upon to do in the past." A. J. S.

Thomas A. Edison: The Life-story of a Great American. Pp. 216. (London: G. G. Harrap and Co., 1917.) Price 3*s.* 6*d.* net.

THE name of no great man of science or inventor is so familiar to the "man in the street" as that of Thomas Alva Edison, and the anonymous volume before us purports to give some account of his life and work. The eight chapters bear no titles, but are prefaced by rather sensational contents-headings, including such phrases as "Apprenticed to Magic," "Edison the Napoleon of Modern Times," "Let there be Light," "And this Light emanated from America," etc. The author succeeds in conveying a vivid picture of the manifold activities of his hero, but, while tracing in chronological order Edison's various achievements, the text consists largely of a series of thumb-nail sketches of the man and of episodes in his career, interspersed with extravagant eulogies which will grate a little on the minds of sensitive readers.

The descriptions of the inventions will convey very little to readers who are not already familiar with them, and those who are will regret the neglect to give credit to any but Edison and his personal assistants. Thus, while ample space is accorded to Edison's world-wide search for a suitable fibre for his incandescent lamp, Swan's name is not mentioned. Again, one would imagine that the kinematograph was wholly Edison's invention. As a matter of fact, he was preceded on the photographic side by Muybridge and by Marey, and did not, in the first instance, carry his apparatus beyond the peep-show stage. The credit of first projecting the pictures upon a screen from a film belongs to R. W. Paul in England and to Lumière in France. E. C.

French Scientific Reader. Edited, with Introduction, Notes, and Vocabulary, by Dr. Francis Daniels. Pp. xvii+748. (New York: Oxford University Press; London: H. Milford, 1917.) Price 10*s.* 6*d.* net.

DR. DANIELS has compiled a judicious anthology from the great scientific papers of a number of distinguished French men of science, among whom, to name a few, may be mentioned Laplace, Pasteur, and Fabre. The book will serve several purposes: it provides ample material for a course in scientific French for students preparing for graduation in science; it brings out convincingly the peculiar fitness of the French language to serve as a medium of scientific expression; and it will give readers sound ideas of the development of modern science.

The selected passages cover very fairly the various branches of physical and biological science; the copious vocabulary will largely dispense with the need for a dictionary; and the notes, of which there are sixty-five pages, will provide teachers of French with the information necessary to enable them to understand the text.

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.*]

British Scientific Instrument Makers' Research.

READERS of NATURE may be interested to hear that the recommendation made by Mr. E. S. Hodgson in the issue of February 7 has been anticipated by the optical trade.

The British Optical Instrument Manufacturers Association is an organisation which was formed in the early part of the war, and includes almost all the important manufacturers. This association has co-operated with the Ministry of Munitions in increasing the output of optical munitions with a degree of success that could not have been expected. It has energetically assisted in the formation of the new Opto-Technical Educational Institute under the Imperial College of Science and Technology at South Kensington, and has now so far completed negotiations with the Department of Scientific and Industrial Research that it is scarcely premature to say that a Scientific Instrument Research Association under the auspices of that Department will be in existence almost immediately.

The trade association is for the present fully occupied with the new requirements for military and naval purposes, but it has a Technical Committee, which includes the best expert optical knowledge of the country, that would be glad to place its experience at the disposal of all departments which require problems to be investigated or requirements to be met.

Applications should be made to the Secretary, 6 Moorgate Street, London, E.C.2.

CONRAD BECK,
President, British Optical Instrument Manufacturers Association, Ltd.

Alcohol Fuel and Engines.

IN the sympathetic notice in NATURE of October 18, 1917, of the first report of the Special Committee on Alcohol Fuel and Engines of the Australian Commonwealth Advisory Council of Science and Industry attention is directed to the part that benzol, obtained from the distillation of coal, may play, after the war, as a substitute for petrol. Undoubtedly in Great Britain very large quantities of this fuel will be available for peaceful purposes, but in Australia very small quantities of it will be produced.

The terms of reference of the Committee specify the use of fuel that may be produced in Australia, and hence, as the writer of the article in NATURE supposes, practically do not cover the use of benzol.

At the same time the Committee has not neglected the possibilities of using mixtures of alcohol and benzol which, as is well known, enable the engine to be started with greater ease than if alcohol alone were used.

THOMAS R. LYLE,
Chairman of Special Committee on Alcohol Fuel and Engines.
314 Albert Street, East Melbourne, January 8.

THE PREFECT OF THE NILE.[1]

THE name of Sir Colin Scott-Moncrieff is inseparably associated with irrigation, and pre-eminently with Egyptian irrigation—not in the sense, perhaps, of an initiator or pioneer, but as one who found a great undertaking in a state of almost hopeless ruin and decay, and by dint of indefatigable exertions and unremitting toil restored it to a position of efficiency and importance far exceeding anything in its previous history. Sir Colin did not himself design or build the great barrage at the head of the Nile Delta, which, for more than a generation prior to the erection of the more renowned structure at Assuan, furnished Egypt with fertile inundations, rich in potential crops of corn and cotton and sugar: this was the achievement of an accomplished French engineer, Mougel Bey, who towards the close of his life unfortunately sank into poverty and obscurity. It is narrated in the biography before us that Sir Colin took a keen delight in hunting up the old man to acquaint him with the fact that his *magnum opus* had been successfully repaired and was holding up 10 ft. of water.

"Ten feet!" Mougel repeated several times, deeply moved, and then cried out: "I knew that my design was sound. I knew it would be justified in the end."

It is thoroughly characteristic of Sir Colin that he not only refrained from the least depreciation of the labours of his predecessor, but, urging the merit of the latter's services, he secured for him a welcome pension.

Yet, despite the absence of originality, the work actually carried out by Sir Colin was scarcely less important than the execution of the primary design. He found the barrage had been so neglected that the whole fabric was decrepit, the masonry being cracked by unequal settlement, the timber rotten, and the ironwork a mass of rust. Pressed on all sides to abandon as hopeless any idea of its restoration, he refused to be deterred, and, aided by certain engineers of the Indian Public Works Department—Major Justin Ross, Major (now Sir R.) Hanbury Brown, Mr. (now Sir) W. Willcocks, and Mr. E. P. Foster—he had the piers underpinned and the superstructure renewed until, as stated above, a serviceable degree of staunchness was obtained and the water once more began to fill the distributary canals. "My Nile is behaving itself," he wrote proudly to his sister, Mrs. Robertson, in September, 1885.

Nile Barrage, Damietta branch. From "The Life of Sir Colin C. Scott-Moncrieff.'

The service rendered to Egypt, and especially to Egyptian agriculture and commerce, can scarcely be overrated. From a state of acute depression and chronic lethargy, cultivation steadily increased in extent and importance, until, before he quitted his post, Sir Colin had the satisfaction of seeing his expectations realised and the country once more set on the way towards a prosperity which it had not experienced for many centuries. The qualities which enabled him to achieve such a result were "a high degree of practical wisdom,

[1] "The Life of Sir Colin C. Scott-Moncrieff." Edited by his Niece, Mary Albright Hollings. Pp. xii+374. (London: John Murray, 1917.) Price 12s. net.

energy, decision, promptitude, discernment"—this is the judgment of the Under-Secretary for Scotland, Sir James Miller Dodds.

The Nile is unique in its interest for the geographer, the man of science, and the engineer. India and other semi-arid countries have some rainfall, however scanty. In Egypt there is none: the Nile compensates for the deficiency. The floods of the great river, carrying down alluvial detritus from the mountain slopes of Abyssinia, and mud from the marshy tracts of Central Africa, sweep over the fields of Lower Egypt and saturate them with fecundity. So soaked is the soil that, as soon as sown, wheat and barley spring up to maturity without a single drop of further moisture. To a natural endowment, so profuse and plentiful, there is only one drawback—its intermission. It fell to Sir Colin's lot to regulate and control, to distribute and allocate the precious waters, and he discharged the duty thoroughly and well.

Of his operations of a similar nature in India, scarcely less important in scope, though perhaps not so notable in execution, there is not room here to speak. Both it and the other outstanding events of an eminently useful and busy life will be found recorded in the biography, edited by his niece, the perusal of which has been full of interest. In the strict sense of the word Sir Colin Scott-Moncrieff was, perhaps, not a great engineer, but he was undoubtedly a great administrator, having a wonderful capacity for organisation, rare tact, and unlimited patience. Could anyone desire a better epitaph than the simple words of Lord Milner which conclude the volume: "He leaves a fine record of work, and will be remembered as one of the best beloved of men"?

BRYSSON CUNNINGHAM.

A NEW BRITISH OIL INDUSTRY.

THE strenuous and anxious times through which this country is now passing have been fruitful in many lessons which, it is earnestly to be hoped, will have a profound and permanent influence upon its national character and habits. Now that we are in one of the most critical epochs in our history, we have become painfully conscious to what an extent our negligence and short-sightedness in the past have contributed to our present jeopardy. We see plainly enough now that if we had only paid greater heed to many things that affect our national well-being, our resources in the contest and our confidence in its outcome might have been enormously strengthened. The struggle has been prolonged in large measure by the fact that we were unprepared for it, and we are constrained to admit that the lack of preparation has not been creditable to us as a prudent, well-ordered, and right-thinking community.

We see the evidences of this at almost every turn, and nowhere is it more apparent than in the manner in which we waste our natural resources, or at least imperfectly utilise them. The present condition of our food supply is, of course, the greatest and most outstanding instance of our neglect of an industry which is at the basis of our welfare, and even of our very existence as a nation. But there are other, even if less important, matters in which we have shown ourselves negligent of our opportunities and to which we have, at length, been awakened partly by the insidious dealings of our enemies, and partly by our recognition of their greater energy and alertness in the application of science and scientific method to industry and the practical affairs of life. Thus we have been so wrapped up in the production of iron and steel that we have paid little heed to the non-ferrous metals, although by a little more energy and enterprise we could just as readily as Germany have contributed our fair share to the world's requirements. So, too, in the manufacture and utilisation of the by-products in the coking of coal, there can be no question that the manner in which we have squandered our greatest natural asset in the past has been nothing short of a national scandal.

It has needed the pressure of our present emergency to induce us to quicken our attempts to remedy a condition of things which should never have been allowed to arise. Our immediate shortage of mineral oils as illuminants and as fuel is a further instance of our neglect of the potential sources of supply existing in our own country, and it is only the submarine menace that is, apparently, impelling us to exploit them. The attempts to utilise the Kimmeridge shales of Dorset and Norfolk have as yet led to no practical result; there are difficulties with the Treasury and the Legislature; it may be also that the technical difficulties of desulphurisation have proved to be almost as insurmountable. But there are other oil-shales than those of Kimmeridge, and also cannels and torbanites, as well as blackband ironstones and lignites, which might be turned to account as indigenous sources of mineral oils. Some of these are, of course, worked by the Scottish shale-oil companies, which, after a long struggle with adverse conditions, are now, in the special circumstances of the time, exceedingly prosperous. But there is still room for a considerable extension of the industry, as the production of these companies, not only in oil, but also in the by-products of sulphate of ammonia and paraffin-wax, falls far short of the country's needs.

In a series of papers communicated to the Institution of Petroleum Technologists on February 19 attention was directed to certain sources of supply of oil which have hitherto been entirely neglected; these are the deposits of cannels, torbanites, and blackband ironstones—many of them cheaply and easily obtained and readily worked. Mr. Cunningham Craig described the characteristics and mode of occurrence of these "kerogenous" or petroliferous materials, and explained how their petrographic analysis serves to reveal the nature of the products of their distillation. He pointed out how wasteful has been the method of treating the blackband ironstones, whereby all the valuable volatile contents of the

intermingled carbonaceous matter have hitherto been dissipated in air. It can be shown that the oil contents of a blackband seam, as well as the ammonia, can be extracted by distillation, and fixed carbon left in intimate association with the ferric oxide, so that the ironstone is in a better condition, both chemically and physically, for treatment in the blast-furnace, leading to a considerable saving of coke, a readier extraction of metal, and less wear-and-tear of the furnace. Mr. Craig boldly faced the economics of the question, and explained in detail the conditions upon which the commercial success of treating the cannels and associated minerals by the method he indicated must depend; and he showed how it compares, as a business proposition, with the well-established Scottish industry.

Dr. Mollwo Perkin contributed a short paper on the relative merits of high- and low-temperature carbonisation, with special reference to the production of fuel-oil; and gave the results of a number of trials with different coals at low temperatures, say 450–550°, showing the very great variation in yield under substantially the same conditions. The average quantity of fuel-oil obtainable from one ton of cannel may be put at 20 gallons. If 15,000 tons of cannel were carbonised per diem, it would amount to 105 million gallons of oil per annum, working the plant for 350 days in the year—no inconsiderable proportion, therefore, of our present needs.

Mr. Berry and Dr. Dunstan dealt more particularly with the chemical and analytical questions involved, such as the modes of sampling the cannel; the determination of the yield of oil; the products of retorting; the chemical nature of cannel oil; effects of temperature on its character; its refining, and fractionation; calorific values and other physical data.

The papers together form a valuable contribution to a subject of special importance at the present time; they serve, moreover, to direct attention to the possibility of a new and permanent British industry, and deserve, therefore, the thoughtful consideration of all who are interested in the development of our national resources.

THE ORGANISATION OF RESEARCH IN AGRICULTURE.

OF the results of the war, not the least remarkable is the awakening of interest in the application of scientific research to economic objects and the readiness of the State to endow industrial investigations of all kinds; and yet the admitted pre-eminence of Germany in the technical applications of scientific knowledge does not jump to the eyes in the apparatus or operations of war. She cannot even claim priority in her inhumanities. The use of poison-gas was suggested to our War Office soon after the Crimean War and unhesitatingly rejected. Nor has the extraordinarily lavish expenditure of Germany on abstract, as well as industrial, research been productive of very marked new additions to knowledge. The root of the matter must be sought elsewhere. In a paper read by M. Georges Wery [1] at a conference held in Paris last June and presided over by the Minister of Agriculture, one finds attention directed to what is really the dominant characteristic of the German people in relation to this matter—a characteristic to which much of their recent advance in efficiency may be ascribed.

The German people, as a whole, believe in the economic value of knowledge, respect the scientific method, are eager to give practical effect to the results attained by that method, and, as a result, are ready to submit their industries to scientific direction. It will avail us little to endow scientific research unless scientific knowledge is deferred to more than it has been in the past. The fond belief that scientific results can be ordered and paid for like goods, and that the knowledge which gave these results birth has no continuing industrial value, must be abandoned, if we set out to compete with the German in his own field. The attitude of the public generally, and particularly that of the leaders of industry, must change.

The main purpose of M. Wery's paper is to give an account of the organisation of research in agriculture in foreign countries, and to contrast the comparatively meagre provision made in France for this object with that made in Germany and America. He points out that Germany has no fewer than ninety-nine institutions, comprising 162 distinct laboratories, devoted to research in agricultural subjects, all of which are in receipt of State subventions. Prussia alone has fifty-eight institutions of this nature, all of which have large staffs, "luxurious" laboratories, and ample equipment. As evidence of the hold which scientific work has gained on the German agriculturist, M. Wery cites the remarkable fact that some years ago the German farmers and landowners raised a sum of a million and a half sterling, which they presented to the Emperor for the purpose of founding industrial and agricultural laboratories. No better evidence could be given of the fundamental difference between the attitude of the German agriculturist to science and that taken up by the English farmer. The gross revenue of the agricultural research stations in Germany approaches 400,000*l.*—a sum which M. Wery effectively contrasts with the parallel figure in France of 60,000*l.*; he might have added the corresponding English figure, which is less than 40,000*l.*! But even the German figure pales before the American total of 1,000,000*l.*

It is pointed out that the German organisation of research was not without what may be termed a publicity value in the past. The admiration which it excited, if not calculated to assist the sale of German goods, at any rate led to the exploitation of German "Kultur" in England and created a demand for the German savant outside his own country—results which, no doubt, were indirectly of economic value to the Fatherland. M. Wery is on sure ground when he proceeds to

[1] *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* No. 5, 1917.

Agricultural research / xx Research (ms) xx Scientific research (ms)

dwell on the limitations of German scientific work in its useless elaboration of details, its devotion to the accumulation of mere data, and its purely material objects and results; and when he claims for France a greater number of discoveries of the first rank, a greater love of knowledge for its own sake, we can heartily agree. "The bright sunlight," he says characteristically, "which illumines the footsteps of Descartes, Lavoisier, and Pasteur will indeed be obscured, if the fogs which rise from the plains of Germany come our way."

We may also quote the author's plea for a minimum of State interference. "Discoveries," he says, "are not made by the stroke of a magician's wand. *L'esprit souffle où il veut.* What the State should provide for the savant is the *means* for research. It should not impose methods or predetermined ideas; otherwise all initiative will be stifled." We may join with M. Wery in hoping that his plea in the interests of the extension of scientific research in agriculture in France will prove successful. The country which produced a Boussingault and a Pasteur must not be suffered to lag behind.

NOTES.

IN the course of his statement on the Army Estimates, in the House of Commons on February 20, Mr. Macpherson directed attention to the health of the troops in the various theatres of war. In the Napoleonic campaigns 97 per cent. of the total deaths were from disease and only 3 per cent. were on the battlefield. In the South African campaign 67,000 cases of disease were admitted into hospital, of whom more than 8000 died. In France up to November last the deaths from disease were only one-fourth of the number that died from the same cause in South Africa. In Macedonia conditions are not so satisfactory, but as a result of the hygienic measures taken the amount of sickness in 1917 was reduced to two-thirds, and the death-rate to one-third, of what it was in 1916. A well-deserved tribute was paid to the Army Medical Service and to the services which had been rendered by the retiring Director-General, Sir Alfred Keogh.

DR. FLEMING SANDWITH, C.M.G., died suddenly and unexpectedly on February 17. He was in his sixty-fourth year, and had been invalided home after two strenuous years in Egypt. Few civilian medical men could show such a record of military service. He had worked in the Turko-Serbian war of 1876, and in the Russo-Turkish war in the following years. He had been on Baker Pasha's staff, and was senior physician to the Imperial Yeomanry Hospital in the South African war. In December, 1915, he was appointed temporary colonel in the Royal Army Medical Service, and proceeded to Egypt, a country well known to him, for in 1883 he was appointed for preventive work there against cholera. In Egypt Dr. Sandwith remained many years engaged in sanitary work and private practice, acquiring a considerable reputation in tropical medicine. After the South African war he settled in London, and became lecturer in tropical diseases to St. Thomas's Hospital, physician to the Seamen's Branch Hospital, Albert Dock, and lecturer in the School of Tropical Medicine there. He was also Gresham professor of physic, and his lectures on such subjects as plague, Pasteur's life and work, insect carriers of disease, etc., were deservedly popular. A man of genial and kindly disposition, Dr. Sandwith will be missed by a wide circle of patients and acquaintances.

THE Minister of Reconstruction, Dr. Addison, has appointed an Advisory Council to assist him in considering the many proposals that come before his Department for review. The work of the Council is to be discharged through four sections, each of which will advise the Minister on specific questions referred to it by him within the general subjects allocated to the several sections, namely:—Section I.: Finance, transport, and common services; Section II.: Production and commercial organisation; Section III.: Labour and industrial organisation; Section IV.: Social development (including rural reconstruction). The Council at presents consists of thirty-seven members, among whom are the following:—Mr. C. R. W. Adeane, late president, Royal Agricultural Society; Sir Richard Glazebrook, director of the National Physical Laboratory; Mr. H. J. Mackinder; the Hon. E. G. Strutt, an authority on agricultural questions; and Prof. T. B. Wood, professor of agriculture, Cambridge University. Mr. Eustace Davies, of the Ministry of Reconstruction, has been appointed secretary to the Advisory Council. It is noteworthy that while engineering, agriculture, industry, labour, the law, finance, and politics all have their representatives, pure and applied science, other than engineering and agriculture, is represented by one member only. Presumably Section IV. will be concerned with such problems as the welfare of workers and housing for the people, yet there is not a single member representing medicine and hygiene or architecture.

SIR G. CAVE announced, in the House of Commons on February 20, that for the present year summer-time will be brought into force on the morning of Sunday, March 24, and will continue until the night of Sunday, September 29, an arrangement that will give an additional five weeks of summer-time this year. He added:—"As regards the suggestion that during the midsummer period the time should be advanced by an additional hour, there is no power under the statute to make this further change, and I may add that the Committee which had the proposal before them reported unanimously against it." The agricultural correspondent of the *Times* points out in Tuesday's issue, what we urged on many occasions when the "daylight saving" principle was under discussion, namely, that agricultural interests were ignored by it. Referring to the introduction of summer-time in the fourth week of March, he remarks:—"The drawback is that much of the early morning work at the homestead—the grooming and feeding of horses, the feeding and milking of cows, and the dispatching of the milk—will have to be done by artificial light, which means additional expense, and the prolongation of the period of dark mornings makes the farm less attractive for those whom it employs. The dairy farmer is especially affected, and there are cases in which milk production has been abandoned chiefly because of the labour trouble arising from the operation of the Daylight Saving Act. The most serious disadvantages suffered by the farmer, however, occur from June onwards. The early dews that are no great hindrance at seed-time are a definite hindrance to progress when the work of saving the crops begins. From the time when haymaking is begun in June until the last of the cereals is gathered in September or later, an hour in the late afternoon is often worth two in the morning; yet the farmer finds himself compelled to make good at the cost of overtime the hour that has been deducted from the morning of his normal day. Because of the ad-

verse effect on the harvesting of the crops the extension of the period in September is far more perturbing than the earlier beginning, although both are prejudicial to the farmer and his work."

MR. THOMAS TYRER, who died suddenly on February 20, at seventy-five years of age, received his early chemical training under Hoffmann at the Royal College of Chemistry. In 1862 he was employed as works chemist by Messrs. May and Baker, manufacturers of fine chemicals, of Battersea, and later became managing director of the firm. For the past eighteen years he controlled the works bearing his name at Stratford, established in 1844, where a number of fine chemicals and pharmaceutical preparations are manufactured. Mr. Tyrer was very intimately associated with the Society of Chemical Industry since its foundation in 1881. He was a member of the original Publication Committee, on which he served continuously until his death, for many years hon. secretary of the London Section, and president for the session 1897–98, as well as having been chairman of the London Section, and serving on the council during the greater part of the existence of the society. Since 1907 he had been hon. treasurer of the society, a position which he filled with great ability. His devotion to the society throughout was very notable, and he spent a large amount of time in furthering its interests. In recognition of his services to the society and to chemical industry, the society's medal was presented to him in 1910. Mr. Tyrer served on the governing board, and also on the executive, of the National Physical Laboratory, and he was a member of the council of the Association of British Chemical Manufacturers. For many years, too, he took a very active part in the efforts to secure relief from the duty on alcohol for use in arts and manufactures, which eventually resulted in considerable concessions being obtained from the Inland Revenue. He was keenly interested in the Chemical Section of the London Chamber of Commerce, of which he was chairman at one time, and took an active part in the work of the Alcohol Motor Transport Council. It may also be mentioned that he was one of the first members of the old London School Board. Mr. Tyrer was a man of remarkable personality and great energy; he was widely known in chemical, industrial, and pharmaceutical circles, and will be greatly missed.

DR. C. D. WALCOTT, secretary of the Smithsonian Institution at Washington, has been elected correspondant of the Paris Academy of Sciences in the section of mineralogy in succession to Sir Archibald Geikie, who has been elected foreign associate.

DR. FRANK SCHLESINGER, director of the Allegheny Observatory, has been appointed aeronautical engineer in the U.S. Signal Corps. He will have charge of the instruments that go on aeroplanes, and will form the connecting link between the corps and the National Research Council. During his temporary absence from the observatory Dr. Frank C. Jordan will be in charge.

THE work hitherto done by the Economy Section of the Ministry of Food has now been allotted to four new branches of the Ministry, as follows:—(1) Public Services Food Consumption Branch: Director, Major G. Henderson; (2) National Kitchens Branch: Director, Mr. C. F. Spencer; (3) Public Catering Branch: Director, Mr. A. Towle; (4) Educational Branch: Director, Prof. E. H. Starling. The co-ordination and control of the policy of these Departments will be exercised by a Board to be called the Food Survey Board, of which Lt.-Col. A. G. Weigall will be chairman.

WE record with regret the death, on February 23, of Lord Brassey, in his eighty-third year. Lord Brassey was best known, perhaps, for his voyages in the *Sunbeam*. In 1879 he was president of the Royal Statistical Society, and in 1893–95 president of the Institution of Naval Architects. He was the founder and first editor of the *Naval Annual*, and the author of several works on social economics.

WE regret to see, in the *Chemical Trade Journal*, the announcement of the death, from injuries caused in a cycling accident, of Prof. E. A. Letts, professor of chemistry in the Queen's University, Belfast. He was a fellow of the College of Surgeons and of the Royal Sanitary Institute. In 1876 he was appointed the first professor of chemistry in University College, Bristol. Among his numerous writings are "The Pollution of Estuaries and Tidal Waters" and "Some Fundamental Problems in Chemistry."

THE death is announced, in his seventy-third year, of Mr. C. E. Faxon, who had been assistant director of the Arnold Arboretum, Jamaica Plain, Mass., since 1882. Mr. Faxon was best known as a botanical artist. He was selected by the Smithsonian Institution to make the drawings for Sargent's "Silva of North America." He had also illustrated Sargent's "Forest Flora of Japan" and "Manual of the Trees of North America," Eaton's "Ferns of North American Garden and Forest," and many other botanical publications.

MR. C. R. DODGE, who for ten years was in charge of the museum of the U.S. Department of Agriculture, died recently in his seventy-first year. In 1890 that department appointed him as its special agent to conduct important fibre investigations. He was the author of twenty special reports on that subject, and also of a "Dictionary of the Fibre Plants of the World." Mr. Dodge represented the United States at the Paris Exposition of 1900 as director of its agricultural commission. He was a chevalier of the Legion of Honour.

THE annual general meeting of the Institute of Metals is to be held on March 13 and 14 in the rooms of the Chemical Society, Burlington House, Piccadilly, W.1. On the first day, when the meeting begins at 8 p.m., the president-designate, Prof. H. C. H. Carpenter, will be inducted into the chair, and the presidential address will be delivered. On March 14, beginning at 4 p.m., several technical communications will be submitted and discussed.

THE *Engineer* for February 22 announces the death of three well-known members of the Institution of Engineers and Shipbuilders in Scotland: Mr. W. Cuthill, who was late works manager of the Blochairn Works of the Steel Company of Scotland; Mr. J. Kennedy, who for forty years was superintending engineer with the firm of R. MacAndrew and Co., and was a founder and chairman of both the Glengall Ironworks and the British Arc Welding Co.; and Mr. J. A. McKie, who founded the firm of McKie and Baxter, engineers and shipbuilders, of Copland Works, Govan.

THE officers and council of the Physical Society of London for the ensuing session are to be as follows:—*President*, Prof. C. H. Lees; *Vice-Presidents* (in addition to those who have filled the office of president), Prof. J. W. Nicholson, Prof. O. W. Richardson, Dr. S. W. J. Smith, and Dr. E. W. Sumpner; *Secretaries*, Prof. W. Eccles, City and Guilds Technical College, Leonard Street, E.C.2, and Dr. H. Stanley Allen, King's College, London, W.C.2; *Foreign Secretary*, Sir R. T. Glazebrook; *Treasurer*, Mr.

W. R. Cooper; *Librarian*, Dr. S. W. J. Smith; *Other Members of Council*, Prof. E. H. Barton, Mr. C. R. Darling, Prof. G. W. O. Howe, Dr. D. Owen, Mr. C. C. Paterson, Mr. C. E. S. Phillips, Dr. S. Russ, Mr. T. Smith, and Mr. F. J. W. Whipple.

MR. H. G. BEASLEY describes, in the February issue of *Man*, a remarkable form of wooden hook, known as Matau Hokori, from Greenwich Atoll, the greatest length of which is $7\frac{3}{4}$ in. It is the crudest specimen hitherto received from the Pacific, formed from a natural root of a pale-coloured wood, of light weight. The maker scarcely troubled even to remove the notches, and in many places has left the bark intact. The barb is of similar wood, and shows a certain amount of skill in the way it is scarfed to the shank; it was apparently finished with some blunt implement and afterwards with a rasp. The hook is a poor specimen of Polynesian art, but this is not surprising considering the remoteness of this little group of islands and the smallness of the population.

"RECONSTRUCTION and Public Health" is the subject of an article by Mr. E. J. Lidbetter in the *Eugenics Review* for January (vol. ix., No. 4). Mr. Lidbetter points out that public health administration has hitherto been based upon prevention in the economic sense, and is not concerned with the individual, who is dealt with under the Poor Law. He pleads for co-ordination between the public health service and organisations for the treatment of individual sickness, *e.g.* the hospitals, and the divorce of Poor Law administration in the treatment of the sick independent members of the community.

IN the November issue of the Journal of the Quekett Microscopical Club (vol. xiii., No. 81) Mr. W. M. Bale describes a method for the measurement of magnifying powers. The method is as follows:—Measure the exact diameter of the magnified field projected with a camera lucida or Beale reflector at a distance of 10 in. Measure also with the stage micrometer the actual diameter of the field. Then the first figure divided by the second gives the magnifying power. But a small correction has to be made, because in the camera image the magnification is appreciably greater at the marginal portions of the field than near the centre. This varies from 1 mm. with a 4-in. field (101 mm.) to 9 mm. for a 9-in. field (203 mm.), being at the rate of 1 mm. for every $\frac{1}{2}$-in. increase in the diameter of the field. Mr. Maurice Ainslie gives some further notes on this method, and describes an alternative method by the measurement of the Ramsden disc.

THE annual report on the Agricultural Department, St. Vincent, for the year ended March 31, 1917, contains a further account of the work being done to control the ravages of the cotton-stainer (*Dysdercus delauneyi*, Leth.), which is so serious a pest of cultivated cotton in this island and elsewhere in the West Indies. The life-history of the insect has been carefully studied, and it has been found that the eggs are deposited in masses in the ground and carefully covered over, where they take seven and a half to nine days to hatch. Destruction of eggs in the field unfortunately does not appear to be practicable, and the campaign against the insect has to take the form of destruction of its native food plants. A special Ordinance has been passed, and between August, 1916, and April, 1917, 1542 silk cotton trees (*Eriodendron anfractuosum*), 11,570 "John Bull" trees (*Thespesia populnea*), and several thousand seedlings have been destroyed. Collection of insects, etc., is also suggested among other measures, as the insect has no natural enemy of importance.

THE question of the precise fertilising value of the basic slags of low solubility which are commonly obtained in the manufacture of steel by the basic open-hearth process has attracted considerable attention during the past few years. The annual production of such slags has been recently computed at 750,000 tons, and with the projected extension of the iron and steel industry this output will steadily increase. The low solubility of the phosphate in these slags is partly attributable to the use of fluorspar in the manufacture, and there is some reason to think that the conventional method of assessing the solubility of slags by means of weak citric acid solution is liable to lead to an undervaluation of their merits in comparison with the more highly soluble slags obtained in the Bessemer process. This view apparently receives considerable support from the results of field trials in Essex, the results of which are contributed by Mr. G. S. Robertson to the January issue of the *Journal of the Board of Agriculture*. At each of three experimental centres in the two years of experiment the hay crops obtained with the fluorspar slags compared very favourably with those obtained by the application of the same weight of phosphoric acid (200 lb. P_2O_5 per acre) in the form of slag of high solubility. Results almost as good were also obtained with equivalent dressings of ground mineral (Gafsa) phosphate. At one centre, however, other plots were added on which the phosphates were applied at one-half the above rate, and the fact that the yields on these plots were fully equal to those obtained with the heavier applications suggests that the latter were too heavy to furnish a decisive test of the citric solubility criterion. It is noteworthy, however, that with the lighter application the fluorspar slag showed a distinct advantage over the more highly soluble slag.

THE Summary Report of the Geological Survey of Canada for 1916 (Ottawa, 1917), a volume of 420 pages, records good war service on the part of the staff, both in the forces in Europe and in the ever-widening field of mineral discovery. Tungsten ores, especially scheelite, are recorded from alluvial deposits on granite in the Yukon plateau, where the climate prevents the concentrates that are secured in one summer from being available until the following winter—that is, until they can be removed on sleighs. A similarly interesting touch is given to operations on the tungsten ores (wolfram and scheelite) of New Brunswick, when it is stated that a mill cannot be remodelled until snow makes haulage of material practicable. Magnesite attracts attention in British Columbia (Bridge River district), where it occurs, with separable veins of chalcedony, in serpentine. The Arctic expedition organised by the Survey reports an extensive copper region on Bathurst inlet. In Banks Peninsula native copper occurs amygdaloidally throughout lavas 350 ft. in thickness.

IT is known from the work of Prof. Barkla that the scattering of ordinary X-rays by light elements agrees well with the view that the number of scattering electrons in an atom is about equal to the atomic number of the element as given by Moseley, and that each electron acts as an independent radiating centre; the scattering of the penetrating γ rays of much shorter wave-length is, however, markedly less than the value to be expected on the simple theory, and the scattered radiation is mostly in the direction of the incident rays. In a recent paper Mr. A. H. Compton (Journ. Wash. Acad. Sci., January 4) attacks this problem from a new point of view. He supposes that the simple theory of scattering no longer holds when the wave-length is comparable with the linear dimensions of the electron. For purposes of calculation he takes the electron to consist of a sphere of positive electricity, each part of

which can scatter independently, and may be capable of rotational motion. On these assumptions he is able to explain the diminution of scattering with decrease of wave-length, and to account for the asymmetry of the scattered rays. Mr. Compton concludes that the electron must have an effective radius of $2{\cdot}3 \times 10^{-10}$ cm. —a value nearly a thousand times greater than the ordinarily accepted radius, calculated from the apparent mass of the electron. He uses in these calculations the data given by Sir Ernest Rutherford and Dr. Andrade on the wave-length of the γ rays, and does not seem to have known of a recent paper by the former in which it is estimated that the wave-length of the most penetrating γ rays from radium is probably less than one-tenth of the lowest value recorded by Rutherford and Andrade. This would make the estimated radius of the electron about one-tenth of the value given by Mr. Compton, but still much larger than the usual value.

In a series of communications to *Terrestrial Magnetism*, Prof. Carl Störmer, of Christiania, has described his photographic determination of auroral heights made in 1913. An account of the earlier communications has already appeared in our columns. The two most recent papers of the series, appearing in March and September, 1917, give an account of Prof. Störmer's theoretical investigations. In a brief historical note he assigns to Goldstein the distinction of having been the first to suggest that an electrical discharge from the sun is the common cause of aurora and magnetic storms. The mathematical problem which Prof. Störmer has set himself treats the earth as an elementary magnet, and as the sole source of a magnetic field traversed by electric corpuscles. A complete solution has not been found even of this simplified problem, but trajectories can be calculated by graphical and numerical integration, and conclusions as to the limiting forms of trajectories can be derived from the general equations. Prof. Störmer accepts for the observed angular radius of the zone of maximum auroral frequency 23°. The values given by his calculations are, for cathode rays 2° to 4°, for β rays 4° to 6°, and for α rays 16° to 19°. The calculated values assume, for the respective rays, such properties as have been actually observed in the laboratory. Prof. Birkeland, the chief supporter of the negative corpuscle theory, suggested, to meet the difficulty, that corpuscles from the sun had velocities very closely approaching that of light. Prof. Störmer thinks it makes fewer claims on the imagination to attribute aurora to α rays, the theory advocated by Vegard. The occasional appearance of aurora far outside the auroral zone is, he admits, a serious difficulty; but he suggests that during magnetic storms the earth may be encircled by a corpuscular ring of large radius, whose modification of the magnetic field may suffice to bring α rays emanating from the sun much nearer the equator than would otherwise be the case. The measurement of auroral streamers is looked to as likely to elucidate at once the penetrating quality of the rays and the constitution and temperature of the upper atmosphere. Further consideration of this aspect of the problem is reserved for a future paper. Prof. Störmer refers to the probable possession by the sun of a magnetic field and an electric charge as considerable complications of the mathematical problem.

The report of the Government Chemist on the work of the Government Laboratory shows that a total number of 258,456 samples were examined during the year ended March 31 last. This is an increase of more than 18,000 compared with the previous year. As might be expected, heavy demands upon the laboratory have been made by the departments specially concerned with war questions. For the Admiralty, the samples analysed included nearly 7000 specimens of metals—an indication of active constructional work by that department. The War Office samples, more than 22,000, were mainly specimens of foodstuffs examined in connection with the control of supplies for the expeditionary forces, together with anæsthetics and other drugs for the medical branch. Numerous questions relating to contraband trading were submitted by the War Trade Department, the Foreign Office, and the Treasury Solicitor. The services of the laboratory have also been extensively utilised by various committees on work arising out of war conditions. It is noted that there has been a very large increase in the use of alcohol in manufacturing operations during the year.

In a paper read before the Swiss Chemical Society, and quoted in *La Nature* for January 26, M. Stettbacher discusses the most powerful explosives which it is possible to obtain. Nitro-glycerine, which is now considered as one of the most violent of explosives, develops but 1580 calories per kilogram. Liquid-air explosives, or oxyliquite, give as much as 2200 calories, since the liquid oxygen combines directly with the carbon and hydrogen. The combinations of hydrocarbons with ozone (ozonide of ethylene and benzene triozonide), although they do not liberate more heat of explosion, are more "brisant," because of their rate of decomposition. It is thus possible to conceive of still higher explosives. A glycerine trichlorate should develop 3000 calories (twice as much as nitro-glycerine), while a mixture of liquid hydrogen and liquid ozone, if it could be realised in practice, would give about 4500 calories. In considering the relative power of explosives other factors than simply the heat generated must be taken into account, the volume of the gaseous products in relation to the original volume of the explosive, and the time factor being important. With liquids there are strict limitations to their practical applications.

A series of "Monographs on Industrial Chemistry" is being edited for Messrs. Longmans and Co. by Sir Edward Thorpe. The volumes are intended to show how essential is the relation of principle to practice. They will afford examples of the application of recent knowledge to modern manufacturing procedure. They are not intended to cover the whole ground of the technology of the matters to which they relate, and will not be concerned with the technical minutiæ of manufacture except in so far as these may be necessary to elucidate some point of principle. Three of the volumes, viz. "The Scientific Use of Coal," Prof. W. A. Bone, "Organic Compounds of Arsenic and Antimony," Prof. G. T. Morgan, and "Edible Oils and Fats," C. A. Mitchell, are announced for appearance in April. "The Zinc Industry," E. A. Smith, and "Colour in Relation to Chemical Constitution," Dr. E. R. Watson, are in the press, and "The Applications of Electrolysis in Chemical Industry," A. J. Hale, "The Natural Organic Colouring Matters," A. G. Perkin and Dr. A. E. Everest, and "Liquid Fuel for Internal Combustion Engines," Sir Boverton Redwood, Bart., and Prof. J. S. S. Brame, are in preparation. In addition, a number of other works have been arranged for.

Messrs. G. Routledge and Sons, Ltd., are about to publish in their "Efficiency Books" "Applied Motion Study: The Efficiency Method Applied to Industrial Preparedness," by Mr. and Mrs. F. B. Gilbreth. Another work for appearance in the same series will be "Wealth from Waste: Elimination of

Waste—A World Problem," by Prof. H. J. Spooner. The same firm also announces "Synthetic Products," by A. R. J. Ramsey and H. C. Weston.

MR. EDWARD ARNOLD announces "Aeronautics in Theory and Experiment," by W. L. Cowley and H. Levy, in which will be chapters on the mathematical theory of fluid motion, the aerofoil, structural parts and controls, strength and construction, the air-screw, and stability.

OUR ASTRONOMICAL COLUMN.

NOVÆ IN THE ANDROMEDA NEBULA.—Including that which appeared in 1885, five novæ in the Great Andromeda Nebula have now been recorded. Two were found by Ritchey on plates taken in 1909, their maximum brightnesses being magnitudes 16·3 and 17·0; these are no longer visible. Another nova, of magnitude 17·5, at a distance of 10′ from the nucleus, was found by Shapley on photographs taken in September last year. The latest discovery was made by Ritchey on a negative taken on October 16, 1917 (Publications Astr. Soc. of the Pacific, December, 1917). This star was of about the 18th magnitude, and the distance from the nucleus approximately 255″ south and 26″ west. On this plate Mr. Shapley's nova was observed to have diminished in brightness by at least two magnitudes in the interval of a month. All the photographs in question were taken with the 60-in. reflector at Mt. Wilson.

NEW VARIABLE STARS.—In Circular No. 201 of the Harvard College Observatory Prof. E. C. Pickering gives details of nineteen new variable stars which have lately been discovered by photographic methods, and of two which were found visually. The brightest images observed range from 8·4 to 13·0, and the faintest from 8·8 to <16. One of the variables is of the Algol type, with a period of 2·89570 days, and two others are Cepheids, with periods of 0·4786 day and 0·365 day. As illustrating the enormous wealth of material available for these investigations, the numbers of photographs examined with reference to the three stars mentioned were 292, 537, and 350 respectively.

Circular No. 202 gives the estimated dates during 1918 of maxima and minima of a large number of long-period variables.

TWO SPECTROSCOPIC BINARIES.—The orbits of the spectroscopic binaries γ Phœnicis and σ Puppis have been investigated by Mr. R. E. Wilson with the aid of photographs taken at Santiago, Chile (Lick Observatory Bulletin, No. 303). γ Phœnicis is a star of magnitude 3·3, Class K5, and has been found to complete a revolution in 193·79 days, the orbit being essentially circular. The semi-amplitude of the velocity-curve is 15·8 km., and the system is receding at the rate of 25·8 km. per sec. γ Phœnicis is the only late-type star at present known to be moving in an orbit of very small eccentricity. σ Puppis is of magnitude 2·99, Class K5, and has a period of 257·8 days. The semi-amplitude is 18·55 km., and the velocity of recession of the system 87·3 km. In this case the eccentricity of the orbit is 0·17.

PROPER MOTION STARS.—In *Astronomische Nachrichten*, No. 4922, Dr. Max Wolf gives particulars of nineteen proper motion stars in the region of the Great Andromeda Nebula, and of five which are near δ Arietis. One of the latter is remarkable as showing the large annual proper motion of 1·74″, in the direction 130°; the star is of the 14th magnitude, and is situated in R.A. 3h. 6m. 10s., decl. +18° 23·1′ (1875).

MILITARY AERONAUTICS.

MAJOR BAIRD, in introducing the Air Service Estimates to the House of Commons on February 22, gave an outline of the work which had been done in creating the new Air Force. The works and lands used by the R.F.C. and R.N.A.S. have already been taken over, and co-ordination between the Air Ministry, the War Office, and the Admiralty has been secured by holding weekly conferences of the three staffs. Among the more interesting details of the speech from a scientific point of view are the particulars which Major Baird gave of the activities at the front. After all, the real measure of the success of scientific investigation in aeronautics at home is to be sought in the results achieved in the fighting area. These results were expressed in very concrete form in the speech, and we quote some figures given. In one day on the Western front 127 enemy batteries engaged were under aerial observation, twenty-eight gun-pits were destroyed, eighty more were damaged, and sixty explosions of ammunition were caused. In reconnaissance work nearly 16,000 photographs were taken in one month. Our bombing machines, in short-range operations, dropped an average of 6500 bombs per month, representing a weight of about 120 tons. In addition to these activities, about 150,000 rounds of ammunition per month were used in attacking troops from the air. Such figures as these cannot fail to awaken a sense of the extreme importance of the Air Services in modern warfare; and the first item, viz. the destruction of 127 batteries in a single day, brings home in a very convincing manner the effectiveness of aircraft for the control of artillery. Major Baird warmly commended the work of the Advisory Committee for Aeronautics in furthering the technical side of the subject, and expressed the hope that its valuable labours would add to the efficiency of the new Air Force in the future. The speech met with an enthusiastic reception, which it well deserved, for a more remarkable record of progress in so new a branch of the Services could scarcely be imagined.

La Nature for February 9 contains an interesting article from the pen of Lieut. Jean Abel Lefranc under the title "L'évolution de l'aviation allemande." The author traces the general lines of development of German machines since the beginning of the war. At the commencement of hostilities the most prevalent German type was a heavy biplane of very robust construction as compared with the much lighter machines developed in France. The main tendencies towards improvement in this type have been directed towards a reduction of head resistance by the simplification of the lines of the machine, the adoption of stream-lined fuselages made from three-ply wood, and the elimination of all unnecessary struts and tie-wires leading to the very "clean" design of the present-day machines, but necessitating a somewhat heavy construction. The light single-seaters of the Nieuport type, against which our enemies had to contend, led to the development of the Fokker machine, which in turn gave place to the Albatros D III. of the present time. The failure of the Zeppelins to realise the aims of their inventor led to the necessity of a heavy bombing machine, and the development of this type has resulted in the Gotha of to-day. M. Lefranc points out the various technical improvements made by the Germans as time went on, such as the adoption of appropriate fin surfaces instead of the large dihedral angle and swept-back wings of the earlier machines, and the introduction of balanced controls to obtain flexibility. The importance of standardisation has been clearly recognised, and the result is seen in the three main types now in use, represented by the Albatros D III., a light single-seater

capable of a speed approaching 120 miles per hour; the Aviatik L.V.G., a two-seater with a speed of about 100 miles per hour; and the Gotha, a three-seater bombing machine, with a speed of ninety miles per hour. The general type of construction is still heavier than that of French aeroplanes, requiring a larger engine for a machine of the same performance. M. Lefranc's contributions to *La Nature* have been commented upon several times in these columns, and the present article, like its predecessors, is well worth reading.

By permission of the Air Board, the *Engineer* is publishing full particulars and illustrations of the "Maybach" motor as used by the Germans in their Zeppelin airships, and of the "Mercédès" engine as used in the Gotha aeroplanes. The first article, which appears in the issue for February 22, is descriptive of the Maybach engine, particulars of which were obtained from a study of the motors of the German airship S.L.11, which was brought down at Cuffley in September, 1916, by Lieut. W. L. Robinson. The Mercédès engine described is one of two recovered from the wreck of a Gotha biplane of the pusher type, brought down in Flanders last April. Each of the four Maybach engines carried by the airship had six vertical water-cooled cylinders, giving about 200 b.h.p. at 1200 revolutions. Each engine drove an 18-ft. two-bladed propeller. The circulation of water in the jackets is believed to have been achieved by means of a thermo-syphon system, working in conjunction with a large honeycomb radiator for each engine, and assisted by an accelerator driven from the engine crank-shaft. The exhaust pipe is also water-jacketed, presumably in order to prevent an accidental fire. Drawings of all the more important details are included in the article.

THE ASSOCIATION OF TECHNICAL INSTITUTIONS.

AFTER an interregnum of three years, owing to the war, the Association of Technical Institutions resumed its annual meeting on Friday last, February 22, in the hall of the Worshipful Company of Drapers, in the City of London. The meeting was numerously attended, and was comprised of representatives of the governors, together with the principals of most of the technical institutions of the United Kingdom. Sir Alfred Keogh, G.C.B., who has been president of the association since 1914, was re-elected for 1918. He has now resumed his duties as rector of the Imperial College of Science and Technology, having resigned his position as director of the Army Medical Service. In his presidential address he emphasised the value of science and scientific training, as demonstrated in the great results which, during the course of this deplorable war, have been achieved in the sphere of medical and surgical practice, in relation to the health of the soldier suffering from sickness and wounds, and especially in dealing with diseases which worked such terrible havoc in the military campaigns of past history. The medical profession has rendered splendid service not only in the treatment of disease, but also in its prevention.

Sir Alfred Keogh believes that the nation has come at last to recognise the place that science must occupy in the domain of industry, and also in the sphere of administration, both local and Imperial, which cannot achieve its best and greatest results unless its *personnel* be guided by the spirit and discoveries of science. The new Education Bill of Mr. Fisher marks an immense step forward. The education of the children of the nation, especially in view of the immense sacrifice of the best of our young manhood, has become a question of most serious moment, since they must now assume, at an unusually early age, grave responsibilities, far in advance of their time, in the conduct of affairs. The effective training and the due reward of the teacher are also matters of most grave concern, since, unless these are provided, and the teacher placed beyond anxiety, no education worthy of the name can possibly be ensured.

The training of teachers for technical institutions and for day continuation schools and classes was the subject of a paper read by Principal Watson, of Keighley. Mr. Watson showed how considerable the demand would be, illustrating by the submission of statistical data derived from inquiries made in Keighley, a town of 45,000 inhabitants, from which it appeared that in that town provision must be made for at least 2800 young persons between fourteen and eighteen years of age, requiring at least twenty-five specially trained additional teachers, from which it is deduced that at least 20,000 more teachers will be required of especial character in England and Wales to give adequate effect to the provisions of the Bill with respect to day continuation schools. This is in addition to the extra provision required in the elementary day schools, due to the large number of children who will, under the provisions of the Bill, now be in constant attendance in the schools up to fourteen years of age. The feeling that the education of pupils in the day continuation classes should be based upon liberal lines without vocational bias found strong expression.

Sir Philip Magnus opened a discussion on the best means of continued education, advocating that much advantage is to be gained from a half-time system extending from the age of fourteen until sixteen, with provision for continued education up to eighteen outside the ordinary working hours for at least six hours a week; but the feeling that the association should give unwavering support to the continued education clauses of the Bill as they stand received practically unanimous support. With a view to a more adequate scale of salaries for teachers in technical institutions and with the purpose of securing the services of men of high attainments and ripe technical experience, and to the provision of a suitable scheme of pensions and disablement allowances, it was urged by the association that much larger State grants should be forthcoming in aid of the work of technical institutions.

The regulations for junior technical schools were the subject of much adverse criticism. It was demanded that the course of instruction should be of a liberal character, that it should include a language other than English, that it should not have reference to a special trade or industry, and that the pupil should not be required to signify his intention to adopt a special branch of industry or commerce. The association, in a memorandum on "Education after the War," recently issued, urges that there should be a large increase in the number of scholarships with adequate maintenance grants to enable candidates to proceed to day technical colleges, that the technical departments of universities and technical colleges should be encouraged to undertake research in co-operation with manufacturing firms, and, having regard to the national importance of technical education, should bear a much larger proportion of the cost, and that the Government grants in aid of technical research should be largely increased. In view of the difficulty many institutions have experienced in obtaining necessary supplies, the Ministry of Munitions has empowered the council of the association to endorse applications to which priority will be granted under the order of the hon. secretary. The association extends its warm support to the proposals

set forth on the co-ordination of engineering training at the Conference of Engineers and Educational Associations held at the Institution of Civil Engineers, London, on October 25 last, with the object of securing increased efficiency in the training of apprentice engineers and a wider appreciation of the value in industry of education of university rank.

THE EXPLOITATION OF THE SEA-FISHERIES.

THE sea-fisheries as a source of food was the subject of an interesting series of letters published by the *Times* between February 8 and 18. First of all, Dr. W. S. Bruce directed attention to the abundance of whales and seals in Antarctic seas, and inquired whether Lord Rhondda and "the National Service" had sought advice about all this. Ought not "canning factories and refrigerating vessels to be started immediately in the rich Antarctic whaling grounds"? There are, he stated, whale meat there which "is better to eat and tastes better than beef"; seals and penguins, also an additional meat supply; and "millions and millions of new-laid penguin eggs, larger and better than hen's eggs." Other correspondents supported these remarks, but they did not suggest where the canning factories and refrigerating vessels were to be constructed, nor did they show that it was sounder economics to send fishermen and large vessels to high Antarctic latitudes rather than employ men and small motor-driven vessels to obtain the fish that is plentiful enough just now a few miles away from our own shores.

About the same time Lord Morris and others had an interesting discussion at the Aldwych Club with reference to Newfoundland fisheries and other matters. The remarkable quantities of plaice and soles existing there were mentioned. Letters in the *Times* from Dr. Shipley and Mr. C. Tate Regan rather dulled the alluring picture, and cast doubts on the knowledge of the speakers, by showing that there are *no* plaice or soles in Newfoundland waters. Whether it is better policy to send men and vessels there after the war or to employ them here was not discussed at the Aldwych Club. Before the war British fishermen caught so much sea-fish in British waters that about one-half was exported. The remainder worked out as a ration of about 1½ oz. a day for all persons above five years old. Even then the fishing trades had to organise a "fish as food" campaign to promote the demand.

To the same correspondence remarks were contributed by Capt. Howell, (late) Director of Fisheries for the Punjab, contrasting this country with the United States. We fail because we do not do artificial fish culture on the American scale—fish culture which has been studied here and in Norway as intensely as it is in the United States. Because of this lack of application of science, we are told in the letter of Capt. Howell to the *Times* that "dogfish have ousted plaice as the staple fish of the English Channel." Also, our Governments have lagged behind America in promoting the study of "the pure science of marine biology." America appropriates 8000*l.* a year for that purpose; had any British Government ever voted half that amount? Capt. Howell apparently does not know that, before the war, the Imperial Parliament gave 42,000*l.* a year to the scheme of international exploration of the sea.

Finally, Dr. J. T. Cunningham directed attention to the failure of the Fish Food Committee to promote the general use of pickled herrings as food—a matter about which most people have heard a great deal during the past few months. In further letters Mr. Cecil Harmsworth and Mr. Geo. M. Tabor gave an account of what had been done in this way. Mr. Tabor points out that the stocks are already nearly exhausted. (There were, we believe, some 250,000 barrels of pickled herrings in stock last Easter.) They were offered at "artificially low prices," Mr. Tabor says. These prices were (wholesale):—

Scottish pickled herrings, mean of 1904–13, 24*s.* per barrel; 1913, 36*s.* per barrel; April, 1917, 80*s.* per barrel; September, 1917, 65*s.* per barrel; February 1918, 42*s.*–48*s.* per barrel.

Mr. Tabor's own advertisement (*Fish Trades Gazette*, February 16) points out that Scottish pickled herrings can be bought for 48*s.* per barrel and sold at 4*d.* per lb., making a profit of 30*s.* per barrel, while Norwegian pickled herrings (bought in order to prevent Germany from getting them, Mr. Tabor says) can be had at 29*s.* per barrel and sold at 3*d.* per lb., making a profit of 20*s.* per barrel. The controlled maximum price for pickled herrings is 6*d.* per lb., and that is now also the general minimum price. J. J.

SEISMIC DISTURBANCES CONNECTED WITH THE GUATEMALA EARTHQUAKE.

IN view of the widespread destruction caused by the earthquake in Guatemala, the accompanying notes, written by Dr. Crichton Mitchell, superintendent of Eskdalemuir Observatory, are of interest. We are indebted to the Director of the Meteorological Office for these notes, and are glad to be able to publish them.

From December 25, 1917, until January 4, 1918, a number of seismic disturbances were recorded at Eskdalemuir Observatory by means of the Galitzin seismographs. Some of these were without doubt connected with the disastrous earthquake in Guatemala. But the epicentral distance, about 8500 kilometres, is so great that except in favourable circumstances it is difficult to detect the primary and secondary waves which form the preliminary phases and from which a determination of epicentral distance is usually obtained. It must also be remembered that the Galitzin instruments are of such high sensitiveness that they record microseismal movements and also local tremors due to wind effects on the building.

The following notes have been drawn up from the seismograms for the period referred to above:—

December 25, 1917.—From 11h. 15m. until 20h. wind effects on the record make it impossible to say whether there was any true seismic effect or not. Otherwise there was no disturbance recorded.

December 26, 1917.—After 5h. a faint disturbance was recorded. Its maximum on the E.-W. instrument occurred at 5h. 15m. 47s.; its period was 19s., and the amplitude was 1·5 μ. These were long waves due to some distant earthquake, but no preliminary phases were noticeable. Similar waves were recorded on the E.-W. instrument from 6h. 4m. to 6h. 22m.

Between 9h. and 10h. the long-wave phase of a disturbance, the preliminary phases of which were too feeble to be identified, was recorded. The first noticeable portion consisted of a slight impulse in a direction nearly from S.W. to N.E. at 9h. 26m. 11s. Fairly well marked long waves began at 9h. 28m. 55s., with a period of 18s. and a maximum amplitude of 10·6 μ at 9h. 29m. 28s. The end of this slight disturbance came about 15m. afterwards.

Another series of long waves of low amplitude occurred from 14h. 5m. to 14h. 15m.

December 27, 1917.—A slight disturbance with no distinctly marked phases began at 7h. 52m., and lasted until 8h. 8m.

December 28, 1917.—A large disturbance was re-

corded between 21h. and 22h. The timings of the preliminary phases are somewhat doubtful, first, because the motions connected with them were very slight; secondly, because wind and microseismic effects masked the true earthquake effect. The following may, however, be taken as approximately correct:—Primary, 21h. 24m. 44s.; secondary, 21h. 34m. 4s. The beginning of the long-wave phase was about 21h. 49m. These times correspond with an earthquake at the distance of Guatemala. The following maxima were recorded:—

	Time	Period	Amplitude
N.-S. component	21h. 57m. 33s.	19s.	18·5 μ
E.-W. component	21h. 58m. 13s.	18s.	17·1 μ

The largest vertical motions occurred about the same time. The displacements due to the horizontal waves were in the S.W.–N.E. direction. The disturbance continued until about 24h.

December 29, 1917.—Another large disturbance occurred on the evening of this day. Very unfortunately, the light failed about an hour before the earthquake began, a minute particle of soot having blocked the acetylene jet. In consequence, the photographic record for the horizontal components is too faint to be read with accuracy. The vertical instrument gave a very fine record, however, and from it the following times are taken:—Primary, 23h. 2m. 43s.; secondary, 23h. 12m. 39s. The maximum displacements were at 23h. 37½m., and had a period of 21s. The disturbance did not die down until 1h. 30m. on December 30.

December 30, 1917.—A faint disturbance was recorded from 16h. 41m. until 17h. 9m.

January 1, 1918.—From about oh. until 15h. a somewhat unusual record was obtained from the horizontal instruments. Ordinarily, on a seismically quiet day, the trace shows nothing but the regular microseisms. But, superposed on these, there was, during the interval referred to, an almost continual movement of an irregular kind, due most probably to a large number of minor shocks at some distant epicentre.

January 3, 1918.—From oh. 19m. to oh. 42m. a faint disturbance occurred. From 14h. 0m. to 14h. 21m. a slight disturbance, including two groups of long waves, was recorded. The first group had a period averaging 26s., the second averaging 20s.

Wind effects obscured the seismogram about midnight, but the trace shows signs of faint disturbance.

January 4, 1918.—A larger disturbance was noticed four hours later. The primary wave occurred at 4h. 44m. 37s., the secondary at 4h. 54m. 38s., and the long-wave phase began about 5h. 9m. These timings indicate an epicentre at the distance of Guatemala. The maximum displacement occurred at 5h. 19m. on the E.-W. instrument, its period being 20s., and the amplitude 4·2 μ.

At 16h. 30m. a slight, indefinitely marked disturbance began and lasted for nearly an hour.

All the above times are G.M.T.

THE PITTSBURGH MEETING OF THE AMERICAN ASSOCIATION.

THE seventieth meeting of the American Association for the Advancement of Science was held in Pittsburgh, Pennsylvania, December 28, 1917–January 3, 1918. The total registration at the office of the permanent secretary was 692.

The impressive keynote of the whole meeting was war preparation and efficiency. This was borne out not only in a number of symposia devoted to specific war topics, but also in other discussions, and in other papers, the titles of which would not necessarily lead one to expect a development along the line of war preparation.

The opening general session of the association was held on Friday night, December 28, in the lecture hall of the Carnegie Institution. The president of the association, Prof. T. W. Richards, of Harvard University, was absent, and Dr. G. H. Perkins, of the University of Vermont, senior vice-president, presided. Mr. H. M. Irons, city attorney of Pittsburgh, gave an address of welcome on behalf of the mayor of Pittsburgh, to which Dr. Perkins replied.

Dr. C. R. Van Hise, retiring president of the association, in his address on "Some Economic Aspects of the World War," set the note for the entire meeting. Certain special items on the programme of the week may be especially mentioned on account of their war bearing.

Section C held a symposium on "Education in Chemical Engineering." Section M held an important symposium on "Factors Concerned in an Increased Agricultural Production." Section I listened to a paper by the Hon. John Barrett on "The War and the New Pan-America," and before the same section Mr. H. E. Coffin, President of the Aircraft Board at Washington, spoke on the subject of "General Standardisation." Section B held a general interest session on the subject of "Relationship of Physics to the War." Section G, with the Botanical Society of America and the American Phytopathological Society, held a joint session on "War Problems in Botany." Dr. Vernon L. Kellogg, formerly of the Belgium Relief Commission, and now with Mr. Hoover's board in Washington, gave an exceedingly strong address before the Entomological Society of America on "The Biological Aspects of the War." Section I held a special symposium on "War Problems." Section F held a symposium on "Contributions of Zoology to Human Welfare," in which many war problems were discussed. Section K held a very important symposium on the subject of "Medical Problems of the War." This symposium included an address by Lieut. George Loewy, of the French Army, on "The Treatment of War Wounds by the Carrel Method," which was illustrated by moving pictures. The School Garden Association of America held a symposium on "Organisation of War Gardens." The Association of Economic Entomologists discussed the two following topics at length: "Insects and Camp Sanitation" and "How the Entomologist can Assist in Increasing Food Production." The Botanical Society of America and the American Phytopathological Society held a symposium on "Phytopathology in Relation to War Service."

It was decided to hold the next meeting of the association in Boston, Massachusetts, the meeting to begin on Friday, December 27, 1918. The following officers were elected:—*President*, J. M. Coulter, of the University of Chicago; *Presidents of Sections*: A, G. D. Burkhoff, Harvard University; B, G. T. Hull, Dartmouth College; C, Alex. Smith, Columbia University; D, I. N. Hollis, Worcester Polytechnic Institute; E, D. White, U.S. Geological Survey, Washington, D.C.; F, W. Patten, Dartmouth College; G, A. F. Blakeslee, Cold Spring Harbour; H, (no election); I, J. Barrett, Washington; K, F. S. Lee, Columbia University; L, S. A. Courtis, Detroit, Mich.; M, H. P. Armsby, Pennsylvania State College.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The council of the University and the Principal (Sir Oliver Lodge) have issued, for presentation at the annual meeting of the Court of Governors, their reports for the session 1916–17. The war has reduced the total number of students to about 63 per cent. of the normal. The diminution affects all facul-

ties, but the chief sufferers have been the faculties of commerce and science, which show reductions to 33 and 37 per cent. respectively of the figures for 1913–14, whereas the corresponding strengths of the faculties of arts and medicine are respectively 69 and 81 per cent. It is noteworthy that in the faculties of science, arts, and commerce, taken together, women constitute 68 per cent., and in the faculty of medicine 41 per cent. The reports show that the University is taking its share in the application of science to war purposes, and that steps are being taken to bring the faculty of science into closer contact with the industrial world. In the concluding part of his report the Principal deals with after-war conditions. He says:—"One of the many problems which must press for attention after the war is the closer linking of science with industry—in other words, a more determined attack on practical problems and an application to useful purposes of what is known. But it will behove us in the University vividly to remember that pure science must precede applications of science, and that unless pure science is cultivated in universities it is not likely to be pursued with adequate attention anywhere. . . . We must have faith that all real knowledge, as soon as it becomes familiar, can be made useful by those who have opportunity to apply it. For it is impossible for a university to pursue knowledge for its own sake with adequate resources unless the community recognises this as its duty, and has faith enough in the ultimate outcome to be willing to make provision, even lavish provision, for its pursuit without expectation of an immediate pecuniary result. . . . Nevertheless, demands are likely to be made upon us, as now during the war, for specific research into problems arising in design and manufacture. Up to a point this is quite proper and to be encouraged, for such problems are often informing, and their solution may lead to fresh developments. Science and its applications interact on each other, and a sharp dividing line is neither feasible nor wanted, but as a rule universities should specially cultivate pure learning of every kind."

LONDON.—The following doctorate in science has been conferred by the Senate:—*D.Sc. in Botany*, Mr. Cyril West, an internal student, of the Imperial College (Royal College of Science), for a thesis entitled "A Contribution to the Study of the Marattiaceæ."

The Senate has appointed the following fellows of University College and King's College respectively:—*University College:* Mr. Wedgwood Benn, Mrs. Elsie Blackman, Dr. Harriette Chick, Dr. E. M. Cowell, Dr. C. A. Lovatt Evans, Dr. David Heron, Mr. W. H. Lister, Mr. E. K. Martin, and Mr. E. T. Paris. *King's College:* Prof. Arthur Dendy, Mr. F. Lydall, and Mr. L. J. Robertson.

The report of the Military Education Committee of the University of London for 1917 has been presented to the Senate. The number of commissions in the Army and Navy granted to cadets and ex-cadets of the University O.T.C. up to the end of 1917 was 3618, and, in addition, 308 graduates and students of the University obtained commissions in the early months of the war upon the recommendation of the committee, making a total of 3926 officers. Of the 3618 former cadets of the University of London O.T.C. who have proceeded to commissions, 440, whose names are recorded in the report, have fallen in the war, and 508 have gained distinctions, including:—V.C., 3; M.V.O., 1; D.S.O., 15; Military Cross, 292 (including 3 with two bars and 7 with one bar); Distinguished Service Cross, 3; Croix de Guerre, 8; Médaille Militaire, 1; other foreign Orders, etc., 7; mentioned in despatches, 291 (mentioned thrice, 4; twice, 21). The number of distinctions gained by former cadets is 663. The strength of the University O.T.C., as given in the report, shows some decrease on the strength in the previous year, due mainly to the reduction of the age for military service in the Army from nineteen to eighteen. In consequence of this, the committee states, "the resources of the University, which were so freely drawn upon in the earlier years of the war for the education and military training of future Army officers, cannot under present conditions be fully used for the same purpose." Particulars are given in the report as to the conditions at present in force for enrolment in the University O.T.C.

MANCHESTER.—The University has recently benefited by the foundation of new scholarships and prizes. Amongst these are industrial research scholarships intended to enable graduates and others to obtain training in the methods of research with the object of rendering them better qualified to enter industry. The first of these scholarships was instituted in organic chemical research by Messrs. Levinstein, Ltd. The firm of Messrs. Simon-Carves, Ltd., has now instituted a second scholarship in inorganic chemical research. The scholarships are of the value of 100*l.* per annum, tenable in the first instance for one year. The work of the scholar is determined by the professor concerned with the subject of research. During the tenure of the scholarship the scholar is required to devote his whole time to research.

A prize has been founded by Mr. Ernest A. Knight, of Knutsford, to be known as the Knight prize and intended for the encouragement of the study of the part played by psychological factors in the development of the symptoms of mental disturbance. The prize will be of the value of 50*l.*, and offered annually. It will be open to the competition of persons who have entered upon the course for the diploma in psychological medicine of the University.

Under the will of the late Mrs. Selina Mary Bright a scholarship in physical science has been instituted, to be called the Samuel Bright scholarship. The course of study pursued by the scholar is not to include vivisection. The regulations for the scholarship are not yet finally approved, but will be published shortly.

MR. FISHER'S Education (No. 2) Bill to make further provision with respect to education in England and Wales, and for purposes connected therewith, was presented formally to the House of Commons on Monday, February 25, and was read a first time.

PROF. D. DRUMMOND has been elected president of the University of Durham College of Medicine in succession to the late Sir G. H. Philipson, and the Chancellor has appointed him pro-Vice-Chancellor of the University.

THE Morison lectures of the Royal College of Physicians of Edinburgh will be delivered on March 4, 6, and 8 by Dr. J. J. Graham Brown, who will take as his subject certain disorders of the sympathetic and parasympathetic systems.

IT is reported in the *Revue scientifique*, on the authority of the *Temps*, that the excavation of the ruins of the University of Louvain, destroyed by the Germans, has been commenced under the direction of a committee including MM. Oehler, Bersy, Lemaire, and Vingerhoedts. The excavation of the ruins of the library, in which the historic books and manuscripts were housed, has led to the recovery of nothing of value. It is feared that the bibliographical treasures are irretrievably lost.

BY the will of Sir Edgar Sebright, his estate is charged with "such a sum as will produce a clear 315*l.* a year and expenses for the foundation of a scholarship at Eton College for a deserving scholar or Oppidan

for the usual three years' course at Oxford or Cambridge University."—Sir Edward Wood, of Leicester, who died on September 27 last, left 2000*l.* for a Sir Edward Wood scholarship at the Wyggeston Hospital Schools for sons of parents who require assistance in giving their sons a higher education.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 14.—Sir J. J. Thomson, president, in the chair.—Prof. E. W. **MacBride**: The artificial production of Echinoderm larvæ with two water-vascular systems, and also of larvæ devoid of a water-vascular system. In Echinoderm larvæ the change from bilateral to radial symmetry is due to a series of changes which are ushered in by the appearance of a small bud, termed the hydrocœle, on the left side of the larvæ. This bud is the rudiment of the water-vascular system of the adult. A number of instances have been recorded where, in an isolated specimen, a similar bud has appeared on the right side also, and the whole later history of the larvæ has been altered. The present communication describes a method for inducing the formation of a second hydrocœle. By exposing the larvæ to the action of hypertonic water at a certain critical period of their development, and by removing them afterwards to extremely favourable surroundings, in so far as concerns both food and space, it is possible to secure that a certain percentage of them will possess two hydrocœles. The development of the second hydrocœle may begin earlier or later. If it begin earlier the organs found in the normal larvæ on the right side (pedicellariæ) will not be formed, but if it begin later one or more of these organs may be formed. If larvæ be starved for the first week of their existence and then transferred to good conditions as to food and space, the formation of both hydrocœle and pedicellariæ will be inhibited, and larvæ perfectly bilaterally symmetrical will be produced which are provided on each side with a group of pointed spines in place of both hydrocœle and pedicellariæ. From this observation it seems to follow that the formation of pedicellariæ is dependent on the presence of a hydrocœle bud, so that this bud tends to induce the formation of pedicellariæ on the opposite side of the larvæ, and to inhibit their formation on the same side as itself. The formation of a hydrocœle bud on the right side involves profound modifications of the surrounding tissues. These tissues are forced to pursue a course of development totally foreign to anything that has been normal in the history of the race. In conclusion, the bearing of the facts adduced on the nature of the laws governing the building up of the bodies of embryos and larvæ is discussed.—Prof. J. B. **Farmer**: The quantitative differences in the water-conductivity of the wood in trees and shrubs. The paper deals with the efficiency of the wood regarded from the viewpoint of water-conductivity. About sixty species of plants, chiefly trees and shrubs, have been investigated. The method adopted consists in determining the amount of water passing in fifteen minutes, delivered at a head of 30 cm. of mercury through each square centimetre of wood of 15 cm. in length. The results show that wide differences exist between different species, but that for a given species there is commonly an ascertainable mean. Evergreens as a class are characterised by wood of low conductivity with often small absolute fluctuation. Deciduous adult trees and shrubs always possess wood of relatively high conductivity, but the sapling trees and stool shoots of coppiced woods exhibit low conductivity in their wood, even when that of the adult shoots is high. The results are of significance in throwing light on an aspect of xerophily and of transpiration which has hitherto been disregarded. It is also shown that the dying back of the leaders in some trees (*e.g.* ash) is correlated with the character of their wood. The sap wood of deciduous trees commonly fills up with water during the early autumn, and grounds are shown for observing caution in fitting conclusions reached in other climates to the circumstances that obtain in the British Isles. This matter is of some importance in its bearing on the conditions that affect the seasoning of timber.—Capt. M. **Greenwood**: The efficiency of muscular work. It is shown that the relation between total heat production, body mass, and external work can be expressed with sufficient accuracy for interpolation by a function of the first degree, the constants of which have been determined from the data by the method of multiple regression. The method is illustrated upon the data of Macdonald and those of Amar. When body mass is constant, the relation is $H=aW+b$, H being total heat production, W the thermal equivalent of the work, a a constant, and b a variable parameter dependent upon the speed of work performance. The parameters are calculated for the data of Benedict and Cathcart. It is pointed out that the relation necessarily involves an increase of efficiency with amount of work when efficiency is defined as W/H or as $W/(H-h)$, h being the "basal" heat production, and that this increase may be without biological significance. Reasons are given for doubting whether the general relation between heat production and muscular efficiency can be safely inferred from existing series of observations, and economy of thermogenesis is discussed.

Linnean Society, February 7.—Sir David Prain, president, in the chair.—Dr. B. Daydon **Jackson**: (1) The "Panphyton siculum" of Francesco Cupani (1657–1710). A few copies, none of which were complete, were issued in 1713 by Cupani's patron, the Prince Della Cattolica, the copy in the library of the Jesuit Fathers at Palermo being the nearest complete, and therefore cited by Gussone in his "Prodromus" and "Synopsis"; it consists of three volumes with about 700 plates, without text; the copy in the Linnean Society's library has only 196 plates, two of which are in duplicate. (2) "L'Histoire et pourtrait des plantes," Lyon, 1561. The volume belonged to Linné, and a pencil note on the title-page by Smith refers to an entry in Haller's "Bibliotheca botanica," vol. i., p. 318, which proves to be copied from Adanson's "Familles des plantes," vol. i., p. 6, where the book is described from Jussieu's library, but Jussieu's copy is given as published at Rouen in 1555, and attributed to Du Gort; the brothers Jean and Robert Du Gort were printers at Rouen at that time, and probably drew up the volume from the Lyons issue of Fuchs's "Historia stirpium" of 1551, for nineteen of the cuts are identical in both books, with eight not yet traced.—H. B. **Guppy**: Plant-distribution from the point of view of an idealist. The paper began with an appeal for the mutual co-operation of the supporters of the original Darwinian theory of evolution and of the later hypothesis of mutation advanced by De Vries. If the view is correct that in the history of the Angiosperms we have two main eras—the era of the rise of the great families and the era of their later differentiation—the mutationist would find his most fitting field of work in the older era and the orthodox Darwinian in the later one. It is held that the distinction between the two schools is in degree rather than in kind, and that the age that witnessed the rise of the great families and the age that witnessed their later differentiation are things apart. Distribution is primarily an affair of the larger groups; and the problems that centre around the rise of the great families raise issues that cannot be stated in

terms of genera and species. Postulating the original existence of world-ranging generalised family types during an era of uniform conditions, it is argued that the differentiation of these primitive types was in response to the progressive differentiation of their conditions. The distribution of families is treated statistically, and it is shown that whilst they largely ignore the cleavage of the land into two great masses, diverging from the north, they respond in marked degree to the differentiation of the climatic zones. The paper ends with the statistical treatment of the larger groups behind the families, and it is shown that whilst the Dicotyledons display a much greater tendency to detachment from the tropics than do the Monocotyledons, the Sympetalæ stand foremost in this respect amongst all the primary groups.

Physical Society, February 8.—Prof. C. V. Boys, president, in the chair.—Prof. C. V. **Boys**: A recording thermometer. This instrument was designed and constructed to go into the case of a regulator clock. The thermometric element consists of a rod of ebonite within a glass tube. The differential expansion is determined by a pair of levers giving a movement of 1 in. for 10° F. The drum carries an ordinary barometer chart, and is driven at such a speed that a two-hour interval of $\frac{1}{8}$ in. is passed in twenty-four hours. The drum is driven by friction by means of a cord from below the driving weight of the clock by an $e^{\mu\theta}$ arrangement, in virtue of which when the clockweight descends the drum turns, but when the clock is wound the drum remains at rest. The instrument is designed with a view to easy construction and accuracy. It is extremely rigid, and much more magnification might be used. An alternative design on the same lines to go into a recording barograph is also given.—S. D. **Chalmers**: The primary monochromatic aberrations of a centred optical system. The paper describes approximate methods of treatment of the first-order aberrations of a centred optical system. Two methods are used, one primarily suited to the case where the separation of the surface is small, and the other more suited for use where the separations vitally affect the design. The aberrational defects are expressed as lateral aberrations—*i.e.* as defects measured in the focal plane of the system. The procedure adopted is to express the aberrational defect of a single surface in terms of the constants of the surface, and the perpendicular distance of the ray considered from the centre of curvature of the surface. The value of this perpendicular can be expressed in terms of the co-ordinates of the ray in any chosen medium, and thus the aberration due to each surface can be expressed in terms of the co-ordinates of the chosen ray, in such a way that the aberrations of the individual surfaces can be summed.

Optical Society, February 14.—Prof. F. J. Cheshire, president, in the chair.—T. Y. **Baker**: Reflecting prisms. The author advocated the use of prisms in place of mirrors as being easier to mount and as requiring, in many cases, no silvering. A series of suitable designs for certain double reflecting prisms, in which the light is made to deviate by a fixed amount, was shown for angles 0°, 15°, 30° ... 90°, the form in each case being that which gave maximum aperture to the prism. A special form of triple reflecting prism, with angles of 30°, 30°, and 120°, was described, which the author considered would be much more suitable for the horizon glass of a sextant than the customary plane mirror, as it would enable the telescope to be placed close up to the prism without any danger of cutting off light between the two mirrors. To avoid this happening in an ordinary sextant, the horizon glass has to be set at an angle of 75° to the axis of the telescope, and the latter set well back, so that the angular aperture is equivalent to 15°, whereas with the prism described the aperture would be about 50°, and angles could be measured up to 170°, in place of the maximum range of 150° in an ordinary sextant.

Royal Meteorological Society, February 20.—Sir Napier Shaw, president, in the chair.—F. A. **Bellamy**: The barometer record at the Radcliffe Observatory, Oxford, with special reference to Prof. Turner's suggested discontinuities. Prof. Turner has in several papers to the Royal Meteorological Society claimed that meteorological history is divisible into "chapters" of an average length of six and a half years each, and has assigned the dates at which a new "chapter" opens (when there are abrupt discontinuities in meteorological phenomena) with considerable precision for the last two centuries. The evidence has hitherto been based upon the monthly mean values of rainfall and temperature, and he has shown that these monthly means differ systematically in the "even" chapters as compared with the "odd." To examine whether such systematic differences extended to periods shorter than one month, Mr. Bellamy has analysed a series of sixty-two years' daily barometer records made at the Radcliffe Observatory, Oxford, many of them made by himself while there in 1891–92. He concludes from his analysis that for periods from one to six months there is a decided difference in the even and odd chapters for atmospheric pressure, even for one station, as there has been shown for rainfall and temperature from many stations in the world, and that the matter of discontinuities is supported.—Dr. C. **Chree**: The diurnal variation of barometric pressure at seven British observatories, 1871–82. The diurnal variation of atmospheric pressure, as of any other element, can be analysed in Fourier terms or "waves" of periods twenty-four, twelve, and eight hours. In the case of the mean diurnal variation from all months of the year combined, the twelve-hour wave appears of a very dominant character, the amplitude being nearly the same for all stations in the same latitude, and the phase referred to local mean time being everywhere nearly the same. The twenty-four-hour wave, on the other hand, is very variable, and the eight-hour wave small compared with the twelve-hour wave. Taking the seven stations, Valencia, Armagh, Glasgow, Aberdeen, Stonyhurst, Falmouth, and Kew, it is pointed out that the comparative unimportance of the eight-hour wave in the mean diurnal inequality for the year arises in great measure from the large difference that presents itself between the phase angles in two different seasons of the year. In individual months the eight-hour wave, though considerably smaller than the twelve-hour wave, is far from negligible, and the phenomena presented by the eight-hour wave at the seven British stations exhibit almost as close a similarity as those presented by the twelve-hour wave. The paper also considers a theory as to the nature of the twelve-hour wave recently advanced by Dr. G. C. Simpson.

MANCHESTER.

Literary and Philosophical Society, February 19.—Mr. W. Thomson, president, in the chair.—Dr. J. Stuart **Thomson**: The occurrence of *Cavernularia Lütkenii*, Köll, in the seas of Natal.—L. Stanley **Jast**: The necessity for a technical library for Manchester and district. Manchester should lead in that provision of technical libraries which must form a not inconsiderable part of our equipment for shouldering our due share of the commerce of the world after the war.

EDINBURGH.

Royal Society, February 4.—Dr. John Horne in the chair.—Dr. J. Stuart **Thomson**: The morphology of the Prosencephalon of Spinax as a type of Elasmobranch

fore-brain. The author describes the nerve-cell areas and the fibre tracts. The cell-areas definitely located are:—Tuberculum olfactorium, corpus striatum, formatio pallialis, primordium hippocampi, and the paraterminal body. The author describes twelve fibre-tracts, but he could find nothing to indicate the existence of a corpus callosum in Spinax.—Dr. J. M. **Thompson**: The anatomy and affinity of certain rare and primitive ferns. The genera Jamesonia, Llavea, and Trismeria were specially considered. The investigation seemed to show that the structural features of Jamesonia are relatively primitive, and the sporangial characters in particular are valuable guides in the consideration of relationship. The features of the plant are distinctive, and justify its maintenance as a distinct genus, with a high spore output and a Schizæoid origin. In the case of Llavea the anatomical state was considered transitional, but suggestive of primitive relationships, and the sporangia seemed to be of an advanced type in which a large spore output had not persisted. This plant was held to be a distinct genus. In Trismeria the anatomical and sporangial characters were considered more advanced, and comparison showed that the plant is in reality a Gymnogramme of Ceropterid type. With Jamesonia and Llavea it seemed to belong to a laxly associated group of "Acrostichoid" derivatives of some Schizæoid source. Among the comparative points raised was the marked variability of spore size seen in certain of the ferns considered. This variation in ferns of more or less clear Schizæoid source was considered suggestive of the origin of heterospory.—Miss M. I. H. **Ferguson**: A further study of the diets of labouring-class families in Glasgow in war-time. (This was a continuation of previous studies communicated to the society in 1916; see NATURE, vol. xcviii., p. 463.) One general result was that in spite of the increased cost of foodstuffs there was practically no change in the diets of February, 1917, and November, 1917. There was a marked increase in the consumption of potatoes in November as compared with their consumption in February, but this was not apparently accompanied by decreased consumption of flour. It appeared that no less than 80 per cent. of the energy was obtained from the rationed food, although in 1915–16 this yielded only 75 per cent. It is of interest to know that in certain families where the father was on military service the diet was more adequate than when he was at home.

DUBLIN.

Royal Irish Academy, February 11.—Mr. T. J. Westropp, vice-president, in the chair.—J. A. **McClelland** and the Rev. C. J. **Power**: Electrification by friction. The rate of production of charge on various metals when pressed against a rotating disc of tightly stretched linen or silk has been measured under various conditions. Results are given showing how the rate of production depends on the speed of the disc, the pressure between the rubbing surfaces, the condition of the metal surface, the temperature, and the humidity. The last section of the paper deals with experiments carried out in air at very low pressures.—G. H. **Carpenter** and F. J. S. **Pollard**: The presence of lateral spiracles in the larva of Hypoderma. The authors describe six pairs of minute lateral spiracles in the fourth-stage larva of *Hypoderma bovis* and *H. lineatum*. Each spiracle is open at the surface of the cuticle, but study of transverse sections shows that the vestigial air-tube connected with it is plugged by a core of solid chitin. These plugged tubes become continuous with branches of the tracheal system in which the normal spirally thickened lining can be clearly recognised. The anterior spiracles in Hypoderma closely resemble these lateral spiracles, and the forward ends of the tracheal trunks leading to them are also plugged with chitinous cores. The presence of vestigial lateral spiracles in specialised parasitic larvæ, like the warble-maggots, is remarkable. No description of such structures in any muscoid larva seems to have been published hitherto, though Pantel mentioned their existence in tachinine maggots in 1901.

PARIS.

Academy of Sciences, January 21.—M. Léon Guignard in the chair.—L. **Maquenne** and E. **Demoussy**: The influence of metallic salts on germination in presence of calcium. The presence of any salt at a concentration approaching a harmful dose in pure water reduces the favourable action upon germination which calcium salts exert alone. The effect is particularly marked with copper sulphate, which, in amounts 0·01 to 0·025 mgr. per seed, has no unfavourable action alone, whilst it reduces the root length by a quarter to a third in presence of 0·05 mgr. of calcium sulphate.—C. **Richet**, P. **Brodin**, and F. **Saint-Girons**: Some modifications in the treatment of pulmonary tuberculosis by antiseptic inhalations. Experiments were made with creosote, camphor, phenol, gomenol, iodoform, and terebene, dissolved in vaseline oil, the dose inhaled being controlled by the temperature of the oil. The same antiseptic was never inhaled on two consecutive occasions. Creosote and gomenol gave the best results, inhaled twice a day for one hour each time. There was a marked improvement after two months' treatment in severe cases, increase of weight and muscular strength, and reduction of expectoration and cough.—A. de **Gramont**: Researches on the line spectrum of titanium and its applications.—W. **Kilian**: The coalfield in the neighbourhood of Saint-Michel-de-Maurienne (Savoy). The layer of schist, rich in anthracite, has a flora characteristic of levels between the middle Westphalian and the Stephanian, the former predominating. There are numerous seams of anthracite, averaging one to two metres in thickness, and it is estimated that as a minimum there are five million tons available with horizontal adits.—R. **Garnier**: The irregular singularities of linear differential equations.—J. C. **Solá**: The study of stellar currents. Photographs were taken at intervals of from two to six years, and selected portions of the plates, sixty-two altogether, studied stereoscopically, and the direction of the current was determined for each. The results are given in tabular form.—A. **Véronnet**: The law of densities of a gaseous mass and internal temperatures of the sun.—L. **Bloch**: The theories of gravitation.—H. **Chaumat**: A phenomenon of super-voltage in a continuous-current circuit deprived of self-induction.—C. **Matignon** and F. **Meyer**: Invariant equilibria in the ternary system: water, sodium sulphate, ammonium sulphate.—L. **Gentil** and L. **Joleaud**: The great tectonic zones of Tunis.—A. **Mailhe**: New preparation of the fatty nitriles by catalysis. The method recently described for the catalytic preparation of aromatic nitriles has been extended to the fatty series, and details are given for isovaleronitrile, butyronitrile, and propionitrile. The reaction is a general one.—G. **Reboul**: The relation between variations of the barometer and those of the wind at the ground level: application to prediction.—R. **Leriche** and A. **Policard**: The histological mechanism of the formation of new bone during osseous regeneration in man. New bone substance appears to be formed by a process analogous with that described by Korff for dentine and some types of bone. With some reserves for certain points of detail and terminology, it would appear that Korff's conception is more in accord with the facts than the classical theory.—A. **Durand**: The sense of smell. This depends, according to the author, upon the following conditions: the

presence in the air of centres (*ions odorants*) capable of facilitating the condensation of atmospheric moisture, a suitable hygrometric state, and cooling of the air current produced by inspiration.—J. E. **Abelous** and J. **Aloy**: The necessity for a hydrogen acceptor and an oxygen acceptor for the manifestation of the process of oxido-reduction in organic liquids of animal and vegetable origin.—M. **Marage**: Contribution to the study of war *commotions*. Defining *commotion* as the lesions produced in a point of the nervous system either central or peripheral, it is shown that this arises from large pressures acting for very short periods of time on the whole of the body surface, and transmitted by the liquids of the organism to the cortical substance of the brain contained in an indeformable chamber, the skull.

BOOKS RECEIVED.

Transmission Gears, Mechanical, Electric, and Hydraulic, for Land and Marine Purposes. By E. Butler. Pp. xii+164. (London: C. Griffin and Co., Ltd.) 8*s*. 6*d*. net.

The Exploitation of Plants. By various writers. edited by Prof. F. W. Oliver. Pp. vii+170. (London and Toronto: J. M. Dent and Sons, Ltd.) 2*s*. 6*d*. net.

The Kiln Drying of Lumber. By H. D. Tiemann. Pp. ix+316. (Philadelphia and London: J. B. Lippincott Co.) 18*s*. net.

Field Sanitation. By C. G. Moor and E. E. Cooper and others. Pp. viii+220. (London: Baillière, Tindall, and Co.) 2*s*. 6*d*. net.

Western Live-Stock Management. Edited by Prof. E. L. Potter. Pp. xiv+462. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 10*s*. net.

A Manual of Physics: Theoretical and Practical, for Medical Students. By Prof. H. C. H. Candy. Second edition. Pp. viii+451. (London: Cassell and Co., Ltd.) 7*s*. 6*d*. net.

Lyon's Medical Jurisprudence for India, with Illustrative Cases. By Lt.-Col. L. A. Waddell. Sixth edition. Pp. xiii+783. (Calcutta and Simla: Thacker, Spink, and Co.; London: W. Thacker and Co.) 28*s*. net.

Directions for a Practical Course in Chemical Physiology. By Dr. W. Cramer. Third edition. Pp. viii+119. (London: Longmans and Co.) 3*s*. net.

The Baby. By Dr. S. Seekings. Pp. 63. (London: S.P.C.K.) 9*d*.

The Improvement of the Gregorian Calendar. By A. Philip. Pp. 30. (London: G. Routledge and Sons, Ltd.) 1*s*. 6*d*. net.

A Dictionary of Aircraft. By W. E. Dommett. Pp. 52. (London: Electrical Press, Ltd.) 2*s*. net.

Experiments in Psychical Research at Leland Stanford Junior University. By J. E. Coover. Pp. xxiv+641. (California: Stanford University.) 3.50 dollars.

Infinitesimal Calculus. By Prof. F. S. Carey. Section II. Pp. x+352+iv. (London: Longmans and Co.) 10*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 28.

ROYAL SOCIETY, at 4.30.—Scattering of Light by Dust-free Air, with Artificial Reproduction of the Blue Sky. Preliminary Note: The Hon. R. J. Strutt.—The Lommel-Weber Ω Function and its Application to the Problem of Electric Waves on a Thin Anchor Ring: Dr. J. R. Airey.—Investigations on Textile Fibres: W. Harrison.—Critical Loading of Struts and Structure: W. L. Cowley and H. Levy.

FRIDAY, MARCH 1.

ROYAL INSTITUTION, at 5.30.—The Modern Dye-stuff Industry: Prof. A. G. Green.

SATURDAY, MARCH 2.

ROYAL INSTITUTION, at 3.—Problems in Atomic Structure: Sir J. J. Thomson.

MONDAY, MARCH 4.

ARISTOTELIAN SOCIETY, at 8.—*Symposium*: Does the Knowing Mind Contribute to the Structure of the Object Known? Prof. G. Dawes Hicks and Dr. H. Wildon Carr.

ROYAL SOCIETY OF ARTS, at 4.30.—The Effect of the War on the Economic Condition of the United Kingdom: E. Cramond.

TUESDAY, MARCH 5.

ROYAL INSTITUTION, at 3.—The National Physical Laboratory: Sir R. T. Glazebrook.

ZOOLOGICAL SOCIETY, at 5.30.—The External Characters of the Lemurs and Tarsius: R. I. Pocock.—A Classification of the Pyralidæ, Subfamily Hypsotropinæ: Sir George F. Hampson.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—Modern Developments in Gasworks Construction and Practice: A. Meade.

ROYAL SOCIETY OF ARTS, at 4.30.—Portugal as a Colonial Power: G. Young.

WEDNESDAY, MARCH 6.

GEOLOGICAL SOCIETY, at 5.30.—The Igneous Rocks of the Lake District: J. F. N. Green.

ENTOMOLOGICAL SOCIETY, at 8.

ROYAL SOCIETY OF ARTS, at 4.30.—The Foundation of Industrial Peace: A. H. Paterson.

THURSDAY, MARCH 7.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—The Control of Large Amounts of Power: E. B. Wedmore.

INSTITUTION OF MINING AND METALLURGY, at 5.30.—The Application of Charcoal to the Precipitation of Gold from its Solution in Cyanide: H. R. Edmands.—Blast-furnace Smelting of Stibnite, with considerations on the Metallurgy of Antimony: W. R. Schoeller.—A "Responsive" Shaft Signal Device: B. Angwin.

LINNEAN SOCIETY, at 5.—(1) The Mimetic and Mendelian Relationships of the "White Admirals" of North America (with Lantern Slides). (2) A New Mimetic Form of *Pseudacraea poggei* (Dewitz) from ex-German East Africa, with other African Mimics of *Danaida chrysippus* (Linn.): Prof. E. B. Poulton.—Mimetic Species of the African Nymphaline Genus Pseudacræa and Lycænid Genus Mimacræa, together with their Acræine and Danaidine Models and Some of their Co-mimics: Lord Rothschild.

FRIDAY, MARCH 8.

ROYAL INSTITUTION, at 5.30.—Vibrations: Mechanical, Musical, and Electrical: Prof. E. H. Barton.

SATURDAY, MARCH 9.

ROYAL INSTITUTION, at 3.—Problems in Atomic Structure: Sir J. J. Thomson.

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MACMILLAN AND CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.
Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.