THURSDAY, JUNE 12, 1919.

CATALYTIC CHEMISTRY.

(1) *Catalysis in Industrial Chemistry.* By Prof. G. G. Henderson. (Monographs on Industrial Chemistry.) Pp. x+202. (London: Longmans, Green, and Co., 1919.) Price 9*s.* net.

(2) *Catalytic Hydrogenation and Reduction.* By Dr. E. B. Maxted. (Text-books of Chemical Research and Engineering.) Pp. viii+104. (London: J. and A. Churchill, 1919.) Price 4*s.* 6*d.* net.

BOOKS on analysis are legion. The ionic theory has helped the chemist to appreciate the anion and cation in electrolysis, but the term catalysis has only recently been deemed worthy of appearing on the title-page of a chemical text-book.

In the "Dictionary of Applied Chemistry," 1916 edition, issued by the same firm of publishers as that of Prof. Henderson's "Catalysis in Industrial Chemistry," there is no separate article on catalysis, the reader being referred to "Chemical Affinity" for the definition, whilst Dr. Maxted's "Catalytic Hydrogenation and Reduction" as a special branch of the wider subject received only indirect mention.

Both books are for the industrial reader, and show the rapid development of applied science without attempting to trace the growth of the fundamental idea from the early conceptions of Davy and Faraday, although Prof. Henderson has unearthed an early patent of Phillips in 1831 for the production of sulphuric anhydride from sulphur dioxide and oxygen through the catalytic action of platinum, which may be regarded as the precursor of the modern contact process as developed at Freiberg and by Squire and Messel in London. The Dobereiner lamp of 1822 was an early industrial application of a metallic catalyst to hydrogen oxidation, and the stability of hydrogen peroxide in presence of acids, as shown by Thenard in 1818, is still a commercial illustration of negative catalysis which should be added to Prof. Henderson's review.

If a catalyst is simply an unalterable substance which modifies the velocity of the reaction, all solvents must be looked at catalytically, as pointed out by Ostwald, and Prof. Henderson gives us his first catalyst water both in heterogeneous solution, as in the inversion of cane-sugar, and in a homogeneous gaseous system, as shown by Dixon in sparking dry carbon monoxide and oxygen. The work of Sabatier and his pupils on the hydrogenation and reduction of organic compounds has activated within the last decade an industrial development of those catalytic processes which involve the use of free hydrogen, so that at the present time they are yielding results of considerable commercial value which are not confined to the soap industries. Although these are sufficiently summarised in two of Prof. Henderson's chapters, they are much more interestingly elaborated in Dr. Maxted's little book of 104 pages.

Wielands' interesting work with oxygen-free palladium in order to differentiate between catalytic oxidation and dehydrogenation, as, for example, in the conversion of hydroquinone into quinone, is not referred to by Prof. Henderson, although its bearing on the function of water as a catalyst in carbon monoxide oxidation is important, and, as pointed out by Dr. Maxted, these results throw quite a new light on the necessity for, and *rôle* of, water in oxidation reactions generally.

The extended use of these hydrogenation processes has necessitated a consideration of the methods for manufacturing a suitable hydrogen free from poisons to benefit the equally important catalytic synthetic ammonia and nitric acid processes essential for the future explosive and fertiliser industries. It is remarkable that here, again, the interaction of water-gas and steam in presence of the right catalyst points the way to economic hydrogen production for these big catalytic industrial operations, so that, in the words of Berzelius, "it is proved that several simple and compound bodies, soluble and insoluble, have the property of exercising on other bodies an action very different from chemical affinity. I will call this force the catalytic force, and catalysis the decomposition of bodies by this force in the same way that one calls by the name analysis the decomposition of bodies by chemical affinity."

The two books are welcome additions to the literature of the subject. S. RIDEAL.

CALIFORNIAN GAME BIRDS.

The Game Birds of California. Contribution from the University of California Museum of Vertebrate Zoology. By Joseph Grinnell, H. C. Bryant, and T. I. Storer. (Semicentennial Publications of the University of California.) Pp. x+642+16 coloured plates. (Berkeley: University of California Press, 1918.) Price 6 dollars net.

THE game birds of all parts of North America are of special interest to residents on the other side of the Atlantic, since they, unlike so many of the Passerine forms of the country, are closely akin to those of Europe. Moreover, from our earliest years we have been attracted by a large number of the names. The Pilgrim Fathers used many picturesque expressions, and their descendants continue to do so. The "Heath Hen of Martha's Vineyard" makes us want to know who Martha was and all about her vineyard, while the "Prairie Chicken of the Foothills of the Rockies" might be the title of the villain of a melodrama. Thus we take up a book on Californian game birds with a predisposition in its favour.

In the present case the predisposition is thoroughly justified, but the work covers far more than what are most commonly known as

game birds, for it runs from ducks and geese to sandpipers, plovers, grouse, and doves, while it includes all that are sold as game in the local markets. It aims at furnishing full information, from collected records, often much scattered in print, from local sources, and from personal observation, to the game-hunter, the naturalist, the legislator, and those concerned in bird preservation; and with this object in view is compiled by three of the best ornithologists in the State, who have had the further advantage of the use of the unpublished papers of Mr. L. Belding on the birds of the region.

In a general review it is unnecessary to enter upon details of the special part of the work, relating to the particular species; but we may express our appreciation of the thorough way in which this is carried out, a way reminding us of Baird, Brewer, and Ridgway's "Birds of North America." A glossary and keys to the main groups and species are followed by full descriptions, not only of adults, but also of the young, while useful marks for identification in the field are added, to precede the excellent accounts of habits, distribution, and so forth.

Obviously the main object of the writers is economic; they devote their attention most closely to that point of view, and emphasise strongly the need for the protection of birds which form part of the food supply; they examine and list the local game laws, and study their effect on the preservation of species. Moreover, the work is issued as a publication of the University of California, with the important aid of its zoological collections, and also with the hearty co-operation of the Fish and Game Commission of the State.

The economic factors are thoroughly discussed under separate headings. A study of the list of laws, coupled with Federal regulations, will show the great importance attached to the subject of this book in the United States, where, more than in any other country, bird protection has become necessary, and, as a matter of fact, has been ungrudgingly granted.

A goodly number of line drawings are distributed throughout the letterpress to explain important points of structure, while sixteen coloured plates decorate the pages, though the coloration is perhaps scarcely up to the standard of the text. Nine are the work of the well-known artist, L. A. Fuentes.

WAR SURGERY.

Surgery at a Casualty Clearing Station. By C. Wallace and John Fraser. Pp. xi+320. (London: A. and C. Black, Ltd., 1918.) Price 10*s.* 6*d.* net.

MAJOR-GEN. CUTHBERT WALLACE and Major John Fraser have written a very interesting book. Gen. Wallace was consulting surgeon to the 1st Army, B.E.F., and remained in France during practically the whole war. His experience entitles him to discuss the various phases of casualty clearing station work, since he has seen the C.C.S. compelled, by the *force majeure* of war, to undertake and adapt itself to surgery, for which it was never originally intended, and for which it only gradually acquired the equipment and *personnel*. The idea that surgical operations could be performed near the firing line was not accepted at the beginning of the war. It was anticipated that casualties would be dressed and fed at the C.C.S., and sent to base hospitals for operative treatment. The appearance of gas gangrene on a widespread scale in wounds of all sorts, even the most trivial, made it imperative that the surgeon should be brought nearer to the fighting zone.

Delay of even a few hours meant loss of limbs and loss of lives. If, however, every wounded man could have his wound excised (not merely dressed, but the damaged tissues cut clean out) within a few hours of receiving his wound, gas gangrene was practically abolished. This question and its solution were not merely problems of academic interest to the surgeon; they were of vital moment to the authorities responsible for the Army as a fighting machine. A shortened period of invalidism is fully as important in maintaining the numerical strength of an army as is the keeping up of a supply of fresh reinforcements. The researches of Gen. Wallace and Major Fraser into the causes and methods of dealing with gas gangrene threw most valuable light on the whole subject. Chaps. iii. and iv., on "General Wounds and their Treatment" and on "Antiseptics," are particularly interesting in this connection. Although many antiseptics and their modes of application are described, the summary of all experience is probably contained in the last sentence of the following passage: "One may completely excise the wound, wash the wound surface with a fluid antiseptic, and immediately suture the wound, hoping to get healing by primary intention; it is possible that the washing with the antiseptic may even be omitted." Before the war ended probably no surgeon felt the least doubt that the ceremonial washing with an antiseptic could be omitted, and that the thing which mattered was the completeness of the excision.

The chapter on "Injuries of Bones" goes fully into the different types of splints in vogue, but the illustrations are singularly inadequate.

Abdominal wounds are excellently dealt with; the combined experience of the authors enables them to speak with judgment and authority. Injuries of the chest, of the head, and of the spine are carefully considered and discussed.

In the treatment of hæmorrhage it is interesting to notice the change in teaching as regards the application of the tourniquet. Gen. Wallace does not go so far as to say that the man who leaves a tourniquet on a limb is guilty of criminal neglect, but he points out the extreme dangers which attend anything more than a purely temporary use of this means of arresting hæmorrhage.

The closing chapter, on "Tetanus," describes one of the greatest triumphs of preventive medicine. In the early days of the war tetanus constituted one of the greatest terrors that the wounded man had to face and the surgeon to witness. The routine use of anti-tetanic serum as a prophylactic injection in every case of a wound or abrasion caused this dreadful complication to disappear almost entirely.

With the cessation of hostilities there will be less occasion to practise surgery as described in this book, but every medical officer to whose lot it may fall in the future to take part in any military campaign will be well advised to include Wallace and Fraser's handy little volume in his kit.

OUR BOOKSHELF.

A Star Atlas and Telescopic Handbook (Epoch 1920) for Students and Amateurs. By Arthur P. Norton. New and enlarged edition. Pp. 25+16 maps. (London and Edinburgh: Gall and Inglis, 1919.) Price 3*s.* 6*d.*

IT is not surprising that a second edition of this work has been called for, remembering the growing interest in astronomy and the necessity that every follower of the science feels for a good star atlas. The first edition appeared in 1910, and we have no reason to depart from the opinion of its merits then expressed in these pages. Fifty years ago R. A. Proctor gave in the Monthly Notices (vol. xxviii., p. 188) the conditions with which a work of this kind should comply: (1) A moderate number of maps; (2) not too large for convenient use; (3) uniform in size and shape; (4) on the scale of an 18-in. globe at least; (5) with little distortion; and (6) with little variation of scale or area.

Mr. Norton's atlas contains eight double maps —that is to say, each forms a double-page opening of a book 11 in. by 9 in. Two of them cover a cap of 40° radius round each pole, whilst each of the remaining six covers a lune from 60° N. to 60° S. declination, about 5 hours of right ascension in width, the distance from pole to pole in the maps being about 23 in., from which it will be seen how well the first three of the above conditions are satisfied. Stars to the sixth magnitude, nebulæ, and clusters are shown to the number of more than 7000, and a feature that will appeal to many students of the heavens is the reference to catalogues of various kinds and other useful information given by the lettering.

It has not been found necessary to make any alteration in the maps, which are as they were in the first edition, but the prefatory notes have been considerably amended and enlarged. The addition of a paragraph on the classification of star spectra is to be noted, and another of a list of novæ, which includes that of last year. A small table of the effects of atmospheric absorption is now given, and the sketch map of the moon has been furnished with an index, both of which add to the usefulness of this moderately priced work.

Board of Agriculture and Fisheries. Guides to Smallholders. No. 1: *Pig-keeping,* pp. 32. No. 5: *Farm Crops,* pp. 32. No. 6: *Soils and Manures,* pp. 30. No. 7: *Fruit-growing on Small Holdings in England and Wales,* pp. 30. No. 9: *Potato-growing on Small Holdings,* pp. 32. (Board of Agriculture and Fisheries, 3 St. James's Square, S.W.1, 1919.) Price 2*d.* each.

IT is always difficult to cater for smallholders because of their great variation; in their ranks are found many types of men, some fairly well educated, who, for one reason or other, have taken up farming late in life, while others are shrewd, capable labourers who have risen in the ranks, and, but for their lack of education, would long ago have been successful farmers on their own account. The booklets before us are designed particularly for the first type of men, but they will also prove helpful to the second.

The information is sound, and put in the colloquial form now so much in favour in extra-official publications. The soil is described in one place in Tull's picturesque phrase as "the pasture of plants"; it is elsewhere likened to "the plant's kitchen," and the organisms producing the useful nitrates are called the "domestics that serve the crops." "When the land becomes waterlogged things go wrong in the plant's kitchen. The unhealthy yellow colour of corn crops so often associated with cold weather in spring is not really so much due to cold as to epidemics among the 'domestics' and a stoppage of the plant's supply of food." Such descriptions at least show the cultivator that the soil is more complex than it seems, and must be treated with respect. The practical advice is quite good: the smallholder is told how much seed to sow, in many cases—especially fruit and potatoes—he is told what varieties to select from, and useful hints are given on the general management of the crop.

The publications are in the form of booklets of large postcard size, and they are well got up; they represent a serious attempt, which we hope will be successful, to help the smallholder on many of the technical points that are likely to trouble him.

Inorganic Chemistry. By Prof. James Walker. Pp. viii+327. Eleventh edition. (London: G. Bell and Sons, Ltd., 1919.) Price 5*s.* net.

PROF. WALKER has recast his popular elementary text-book of inorganic chemistry. The general and systematic portions are in this edition less strictly separated. All the common elements now receive brief systematic treatment, and the theoretical sections have been enlarged. In its new form the book should be even more widely adopted than hitherto.

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.]*

Wireless Telephony.

IT may be of interest to state that the Marconi Co.'s demonstration at Chelmsford of wireless telephony on May 28, alluded to in NATURE for June 5, was clearly heard on wireless apparatus in this house. Every word could be clearly recognised, the speaking being most distinct and very loud. What was heard included the reading of several newspaper paragraphs, the playing of gramophone records, and some remarks by Mr. Godfrey Isaacs, in which he said that no one would be able to overhear the conversation, as it required very special apparatus to pick it up!

Since then other speech has frequently been heard and understood. This apparently emanates from some military wireless station, where the operator is addicted to long poetical quotations, which he declaims with much gusto.

It is quite fascinating to listen to these voices from the æther. A. A. CAMPBELL SWINTON.

40 Chester Square, London, S.W.1, June 6.

The Age of the Stars.

THE arguments detailed by Mr. Poole (NATURE, April 3) relative to the astronomical tests of the suggestion that radiation passes only between bodies are essentially those I had in mind in remarking on the difficulties with "the ultimate trend of planetary temperatures." The ways of getting around these difficulties to me seem too artificial to make the "solid-angle" hypothesis a reasonable one astronomically, even though it may be the "rather preferable" type of selective radiation from the point of view of a corpuscular theory. The difficulties, however, might be removed, or at least much lessened, if only a diminution of radiation in the empty angle is postulated, for the diminution would probably be a function of temperature.

But the point I hoped chiefly to emphasise by the data and arguments in my former letter is that we now have various direct astronomical observations indicating that the sidereal time-scale is enormously longer than is generally acknowledged. If these results from studies of Cepheid variables and globular clusters, with the strong support of geological considerations, are accepted, I desired also to emphasise that the problem of accounting for the origin of stellar energy and for concomitant phenomena of radiation is of the highest importance, whether the solution involve denying that radiation at high temperatures is propagated uniformly regardless of material surroundings, or whether it lie in the discovery (or acceptable description) of other properly operative sources of energy—such, for instance, as might be provided by the "general physics" suggested by Mr. Jeans, which is to allow direct mass-energy transformations through setting aside the accepted principles of conservation.

HARLOW SHAPLEY.

Mount Wilson Observatory, Pasadena, California, May.

Globular Lightning.

As well-authenticated cases of globular lightning are comparatively rare, the accompanying note by Mr. Gilmore may be of interest to your readers. Mr. Gilmore is a research student working in this laboratory. He is at present engaged on a research dealing with the electric charge on rain, and when he saw the first luminous ball described in the note he had stepped outside his rooms to decide whether it was likely to rain soon. He then went to the laboratory and was busy with his observations during the thunderstorm. When the rain ceased he was standing at the door of the laboratory looking at the clearing sky, and then saw the second ball. In the circumstances, we must regard his observations as in every way trustworthy.

I should mention that I have met two other persons who claimed to have seen luminous balls during the same storm. Their descriptions were, however, rather vague. In neither of these two cases did the time agree with the times of Mr. Gilmore's observations. Taken in conjunction with Mr. Gilmore's observations, these further rather vague descriptions afford evidence that this thunderstorm was rich in phenomena of the globular lightning type. J. A. MCCLELLAND.

Physics Department, University College, Dublin, May 28.

ON the night of May 14 a thunderstorm took place over Dublin. A shower of rain fell after 9 p.m., but between about 9.25 and 9.40 there was practically no rain, only a few drops falling. At about 9.50 I went outside, and when I had gone about two steps from the door I suddenly saw a luminous ball apparently lying in the middle of the street. It remained stationary for a very brief interval—perhaps a second—and then vanished, a loud peal of thunder occurring at the same time. The ball appeared to be about 18 in. in diameter, and was of a blue colour, with two protuberances of a yellow colour projecting from the upper quadrants. It left no trace on the roadway. The street is about eight yards wide from footpath to footpath, with houses on both sides, the total distance across the street between the houses being about twenty yards. There are no tram-lines on the street. When I observed the ball its distance from me was about ten yards. The thunder was heard just at the disappearance of the ball, but the sound seemed to come from overhead rather than from the place where the ball was. This was the first peal of thunder that I heard, and there was no more thunder or lightning until after 10.15. From 10.40 onwards the thunderstorm was rather violent and the rain heavy. The rain ceased about 12 midnight, but sheet lightning continued to play over the sky. I was looking towards the north at about 12.15, where the sky was fairly clear, with small white clouds scattered over it, when I saw a yellow-coloured ball which appeared to travel a short distance and then disappear. This ball was high up in the sky, and appeared smaller than the first ball described above.

G. GILMORE.

WAR AND WASTE.

WAR, however conducted, is, from its very nature, a wasteful business, and, if carried on *more teutonicum,* is flagrantly so. Nothing affronted the righteous instincts of civilised humanity more profoundly than the shameless and unbridled lust of destructiveness in which the Germans indulged so long as Belgium and Northern France remained within their grasp; and nothing has excited universal contempt so much as the way in which they are shuffling now they are compelled to make good, so far as is possible, the damage they so causelessly and wantonly inflicted.

But, considering what war is essentially and how it must be fought, whatever be the mentality of the combatants, there is a certain element of comedy in setting up an organisation during the actual course of a war in order to ascertain, not how the waste of war may be minimised, but how the waste of peace-time operations may be reduced or possibly altogether obviated. It is doubtful if any other nation than ourselves would have thought of such a consideration at such a juncture. But the Munitions Inventions Department, on the principle presumably of compounding for sins they were inclined to, created in 1918 a small Committee, under the chairmanship of the principal of the Heriot-Watt College, Edinburgh, to make inquiries concerning chemical waste products throughout the country, and to carry out investigations with a view to their utilisation. That waste should be obviated is a sound general proposition applicable at all seasons, but why the particular instances of it which engaged the Committee's attention should be specially urgent in 1918 is not very obvious, as they were wholly without bearing on the conduct of the war, and were of small importance from the point of view of economy, even in peace-time.

The Committee, however, has now reported,[1] and we may best learn from its own statements what it has accomplished, and what useful results are likely to follow from its labours. In the first place, the Committee communicated with the Association of British Chemical Manufacturers, inviting assistance in collecting information concerning chemical waste products, and later it sent out a circular letter to chemical manufacturers asking if they made any waste products not at present utilised, and, if so, what was their nature and quantity. Of those who replied, rather less than half stated that they had no waste products; 220 manufacturers said they had waste products, and indicated their character. The Committee gives a list of those brought to its notice—some sixty-eight in number. With one or two exceptions, they arise in old-established industries, and are in no wise connected with the war.

In its circular letter the Committee stated that one of its objects was to save overseas tonnage. It is difficult to see how the consideration of the special instances brought to the knowledge of the Committee would even appreciably influence the tonnage question. Perhaps the subject of waste materials for paper-making is the best example that could be quoted, considering the admitted shortage of such materials during the later periods of the war. The Committee accordingly directed its attention to two unutilised products, viz. spent mimosa bark—a residue from the tanning industry—and the waste wood due to the felling of timber trees in this country. With the assistance of Prof. Huebner, of the Manchester Technical College, the Committee is able to report that it is possible to make brown paper from waste mimosa bark, as, indeed, might have been anticipated, and this fact was communicated to the tanners using the bark, as well as to the paper manufacturers, but it does not appear that any practical result has followed. Nor did anything practical follow from the investigation into the possible use of scrap timber.

It was scarcely necessary to make an experimental investigation in order to arrive at the decision to which the Committee came. Inquiry from the trade showed that the cost of the necessary plant, combined with fuel conditions and uncertainty as to the duration of the war, rendered it inexpedient to recommend any extension of the existing means in this country of using wood pulp in the manufacture of paper—a conclusion which might have been foreseen without the formality of a special Committee. At the same time, the Committee states it is in a position to supply information as to shredding plant, and will communicate to those who may be interested the results of Prof. Huebner's investigations into the best conditions both for boiling soft waste wood from pine, birch, and oak, and for treatment with caustic soda.

The Committee further reported on the recovery of the chemicals used in discarded gas helmets; on the utilisation of the maize residues in the manufacture of butyl alcohol, which were found to be unsuitable for cattle food, but could be used as a fertiliser; on the possible use of sphagnum moss as a cattle food—an inquiry eventually handed over to the Food Production Department; and on the utilisation of waste chrome-tanned leather, dealt with by Mr. Lamb, of the Leather Sellers' Technical Institute, who devised a process for converting it into glue.

The de-arsenication of oil of vitriol made from pyrites results in the accumulation of considerable quantities of arsenic sulphide in a form troublesome to deal with. The Committee caused experiments to be made as to the best method of treating this product with a view to the recovery of arsenic from it, and with outside assistance worked out a process which it supplied to those chemical manufacturers who asked for information concerning it. It is not stated whether the process has found application in chemical industry.

In the treatment of bauxite for the manufacture of aluminium a large amount of ferric oxide is left, for which only a limited use has been found. Its application to the purification of coal-gas naturally suggests itself, and a number of patents for this purpose have been granted, but with no very satisfactory result.

The Committee has taken up the problem, but is not yet in a position to report concerning it.

The use of burnt pyrites in the manufacture of oil of vitriol also suggested itself to the Committee as a possible gas-purification material, but, as might be anticipated, few samples were found to present the proper physical condition for em-

[1] Munitions Inventions Department. Report on the Investigations carried out by the Chemical Waste Products Committee.

ployment in the purifiers. Certain of the samples resulting from the operations of the Gas Light and Coke Co. were, however, found to give excellent results, and Dr. Evans, of the South Metropolitan Gas Co., is at present engaged in their further investigation.

Ferric hydrate precipitated by lime from the acid liquors used in the pickling of iron in the tin-plate and galvanising industries is also capable of being used in gas-purification. The utilisation of the waste pickle has been the subject of many patents, and various processes are in use, especially in the Midlands.

Attempts were made to recover selenium from the flue-dust from pyrites burners, and the residues from the Glover towers and vitriol chambers, but with no practical result. The amount in the flue-dust was found to be negligible, whilst that in the Glover tower and chambers varied between 0·3 and 0·7 per cent. In some exceptional cases it was as high as 4 per cent.

Other subjects which received the attention of the Committee were so-called bichromate of soda residues—that is, the residues left after the oxidation of organic substances by sodium bichromate and sulphuric acid; the residues from the manufacture of acetic anhydride; the tarry residues obtained in the rectification of benzol; residues containing calcium sulphate; residues from the manufacture of brucine; peat-tar residues, etc. But no specific information is given concerning the results which have been obtained, or as to the extent to which industry has benefited by the Committee's attempts to utilise these waste products.

It will be obvious from this summary that the Committee has been able to deal with only a few of the large number of such products brought to its notice, and of these few it remains to be proved that any results of permanent value have been obtained. Other inquiries are in progress, and it is suggested by the Committee that it should be developed into a permanent organisation similar in character to that of the National Physical Laboratory, with an Advisory Committee in association with a director and chemical staff with its own laboratories.

Of course, it is conceivable that the work of such an organisation might be largely extended, and that an institution might be created to subserve the higher interests of chemical technology. But the report of the Committee affords no evidence that results at all commensurate with the expense of such an institution are likely to accrue. Indeed, it may be questioned whether the kind of subjects with which it has concerned itself should fall to the cost of the taxpayer. It is primarily the duty of the manufacturer to deal with the by-products of his industry. He will utilise them if he sees that it is to his advantage to do so, and it is surely not the business of the State to teach him how to do it. In some cases there is no reasonable hope that these products are capable of being utilised, but in that event the expense of getting rid of them is no proper concern of the taxpayer.

Practically all the subjects to which the attention of the Committee was directed, in response to its circular letters for information, are long-standing problems which have taxed the energies of chemists and chemical engineers for many years past, and where men of proved technical skill have failed it is scarcely to be expected that a Committee constituted like that which has now reported will succeed. Committees are, in fact, cumbrous organisations to deal with questions of this character, unless, indeed, they are of the single-member type, which a bureaucratic Committee seldom or never is.

EDUCATION: SECONDARY AND UNIVERSITY.[1]

"WE end where we began; with an appeal to educational enthusiasts to temper their enthusiasm with charity. Let the advocates of classics, of history, of natural science, try, while exalting the value of their own subjects, to avoid reflections which hurt the feelings and provoke the opposition of the advocates of other subjects." Such is the exhortation with which Sir Frederic Kenyon concludes his interesting pamphlet, which embodies a report of conferences between representatives of literary, historical, and scientific aspects of education. Such aspirations may well receive sympathy and approval from all liberal-minded people, while they recognise that final agreement on all points under discussion has not even yet been reached.

A few only of these questions can be referred to here. Most people would be disposed to agree with the view that "universities have the right to require that every student who enters them shall be intellectually qualified to profit by the education which they offer," and it is to be hoped that this condition will be made practically operative. It is true that all young minds do not develop at the same rate, and many a boy or girl supposed to be dull at school has shown at maturity unexpected activity and powers. But with the present sufficient choice of subjects and methods the age of eighteen or thereabouts should afford time for the display of sufficient of those qualities which justify the admission of the student from the school stage to the university stage of his education. There has been too much of this in the past, with corresponding waste of educational resources and effort, and it has yet to be fully recognised that all young people are not inclined to intellectual pursuits, and for those who are not so disposed there is plenty of other useful work to do. "Common sense appears to indicate that a student should show some aptitude for a subject before he embarks on a university course of education in it."

1 "Education: Secondary and University." A Report of Conferences between the Council for Humanistic Studies and the Conjoint Board of Scientific Societies. By Sir Frederic G. Kenyon. Pp. 47. (London: John Murray, 1919.) Price 1s. net.

"Historically," it is said, "there is no doubt that the institution of examinations did much to raise the standard of education in this country in the last century. It is equally certain that, while they are good servants, they are bad masters." There is no doubt that schoolmasters chafe because all schools do not teach the same subjects along the same lines, and when a general examination is set some inequalities are imposed. This in many cases, however, implies lack of care or skill on the part of the examiners rather than inapplicability of the examination test.

The object of the conference, however, was to advocate principles, without formulating details, and concessions from both sides will help towards progress. Thus the suggestion that candidates for science scholarships should offer an historical or other literary subject as subsidiary to their main one is met by a resolution in favour of allowing a knowledge of science to count in history scholarships. This is quite as it should be, for the ignorance of literature and philosophy displayed by men of science in the past could only be matched or surpassed by the ignorance of the literate, not only of the physical world and the details of life around them, but also of all the great conclusions of science concerning man's origin, nature, and destiny.

Another subject dealt with by Sir Frederic Kenyon is the question of the relation of school to university and the shortening of school life. Notwithstanding some difference of opinion between Sir J. J. Thomson's committee and the conference, there is reason for thinking that many of the great schools possess both staff and apparatus which qualify them to carry out effectively the work undertaken in the first year of a university course. "The student," says the conference, "on coming to the university should come under the influence of the great teachers of the subject (instead of being placed, as is sometimes the case, in the hands of junior lecturers or demonstrators), and should be inspired with the views and the spirit of those teachers." What, then, it may be asked, is the use of a junior staff if it is not to be employed, and what was the advantage to the mass of undergraduates of the majority of the great men of the past, whose teachings they were unable to follow?

Clerk Maxwell, Stokes, Kelvin, and others who might be named were not, and could not be, appreciated by more than the select few, and by them chiefly for the sake of general illumination rather than for specific instruction. Historical and literary subjects afford a better field, but originality is sometimes bewildering to the beginner, and the professor eminent in research is the best leader in most subjects only when the student is able to follow at the same pace.

The report affords interesting reading, and it contains an appendix which gives a summary of the main facts regarding the distribution and value of scholarships to the universities, with suggestions which will doubtless lead to further consideration.

SIR BOVERTON REDWOOD, BART.

SCIENCE and the petroleum industry have suffered a severe loss in the sudden death of Sir Boverton Redwood, Bart., which occurred at his residence, The Cloisters, Avenue Road, Regent's Park, on June 4. Despite his profound knowledge of the subject he had made his own, Sir Boverton Redwood will perhaps be best remembered by those of us who had the privilege of being associated with him in any of his numerous interests for the charm of his individual personality. The unique position he occupied in the petroleum world was doubtless in large measure due to this personal attraction, which, as chairman of committee, or as witness, or in mere friendly discussion, exerted an influence the value of which in giving expression to his views it would be difficult to over-estimate. His death leaves a blank which it is safe to say will never be completely filled.

Born in April, 1846, Sir Boverton was in his seventy-fourth year when he died—an age which would have fairly justified his retirement from active work. This, however, was the last thing he desired, and it is more than probable that the strain of four years of war, during which he gave of his best to the Admiralty and to the Petroleum Executive, seriously reduced his power of resistance to the illness to which he succumbed.

It was in the year 1869 that, as a young analytical chemist, he was appointed secretary of the Petroleum Association and thereupon determined to specialise in this subject. That he was soon recognised as a leading authority is evidenced by his appearance in 1872 as a witness before a Select Committee of the House of Lords; and a few years later, when it was decided to replace the somewhat untrustworthy open "flash-point" testing apparatus by the Abel instrument, it was Boverton Redwood who, by a series of more than a thousand separate tests, demonstrated that the equivalent of the existing legal standard of 100° F., open test, was, by the new close test, 73° F., and this figure was adopted in the amending Act of 1879. In 1883 he accompanied Sir Vivian Majendie in an extended tour on the continent of Europe to study the methods employed by foreign Governments in dealing with the storage of petroleum oil and spirit, and a few years later he paid a similar visit to the United States. There was, indeed, scarcely an oil-bearing district in the world that he had not visited.

For many years Sir Boverton was technical adviser to the Corporation of the City of London and to the Port of London Authority, and honorary adviser to the Home Office, the Admiralty, the India Office, and the Colonial Office, and in 1912 he was appointed a member of the Royal Commission on Oil-fuel presided over by Lord Fisher. He had already served as a member of the Committee appointed by the Home Secretary in 1908, with Sir Henry Cunynghame as chairman, to report on the existing legislation regarding petroleum spirit.

In 1896 Sir Boverton made a most valuable contribution to the industry he had so much at heart by the publication of his great work, "A Treatise on Petroleum." This has already passed through three editions, and a fourth was in course of preparation at the time of his death. He was also primarily responsible for the foundation of the Institute of Petroleum Technologists, of which he was the first president. In 1873 he married the eldest daughter of the late Mr. Frederick Letchford, who survives him. His only son, Bernard Boverton, died in 1911, leaving a son, Thomas Boverton, born in 1906, who now succeeds to the baronetcy. A. C. K.

NOTES.

AMONG the additional honours conferred on the occasion of the King's birthday we notice the following:—*G.C.B.:* Sir H. Llewellyn Smith, Secretary, Board of Trade. *K.C.B.:* Mr. Stanley M. Leathes, First Civil Service Commissioner. *C.B.:* Mr. R. J. G. Mayor, Principal Assistant Secretary (Universities), Board of Education, and Prof. S. J. Chapman, Senior Assistant Secretary, General Economic Department, Board of Trade. *Knight:* Col. G. P. Lenox-Conyngham, Superintendent of the Trigonometrical Survey, Dehra Dun, India.

THE following medical men are among those whose names are included in a list of further honours and appointments made on the occasion of the King's birthday:—*K.C.B.:* Col. W. Taylor and Lt.-Gen. Sir W. Babtie. *K.C.M.G.:* The Hon. Sir John McCall (Agent-General in London for the State of Tasmania), Col. W. T. Lister, Major-Gen. H. N. Thompson, Brig.-Gen. J. Moore, and Major-Gen. Sir W. P. Herringham. *K.C.V.O.:* Mr. J. O. Skevington. *K.B.E.:* Col. H. A. Ballance, Col. R. H. Firth, Col. C. G. Watson, Major-Gen. G. B. Stanistreet, Col. H. Davy, Lt.-Col. and Bt. Col. G. Sims Woodhead, Lt.-Col. Sir S. F. Murphy, Lt.-Col. D'Arcy Power, Lt.-Col. J. L. Wood, Lt.-Col. H. McI. W. Gray, Lt.-Col. Sir A. W. Mayo-Robson, Col. C. J. Symonds, Maj. and Bt. Lt.-Col. F. W. Mott, F.R.S., Major-Gen. Sir Robert Jones, Lt.-Col. A. D. Reid, Col. H. G. Barling, and Col. J. Swain.

AIRCRAFT crews are speeding up for the eastward flight across the Atlantic, and, weather permitting, fresh attempts will be made very shortly. The *Times* of June 10, in a cablegram from St. Johns (N.F.) dated June 9, says:—"The Vickers-Vimy machine ascended for its trial flight at 8.17 a.m. (Greenwich mean time). It descended after a spin of about forty minutes. . . . The airmen report that everything was working satisfactorily. . . . The machine will now await suitable weather for the Atlantic flight." The crew of the Handley-Page machine had earlier expressed the hope to be ready for the flight by June 15. There is the advantage now of the full moon. At the time of going to press the weather conditions over the eastern Atlantic were not very favourable. There were cyclonic disturbances in the Atlantic at no great distance from the Irish coast. If the aeroplanes which are being prepared had been ready on June 3, they would probably have experienced very favourable weather for the flight. At St. Johns a very light north-east wind was blowing and the weather was clear. During the night of June 3-4 no wireless weather message from the open Atlantic reported more than a fresh wind, and the direction was uniformly from the westward. There was a good deal of cloud with some rain and mist on the British coasts, which seemed the only unfavourable factor. "The Life-History of Surface Air-Currents," published by the Meteorological Office, giving the trajectories for mid-June, 1883, from some Atlantic synchronous charts, shows the surface wind from Newfoundland to travel up the Davis Strait and down to the eastward of Greenland, striking fairly southwards to the equator, so that all June weather is not favourable to the trans-Atlantic flight. Current weather conditions alone can be of use for safe guidance.

THE thirtieth annual conference of the Museums Association will be held in the University Museum, Oxford, on July 8–10, under the presidency of Sir Henry Howorth. The chief subjects for discussion are the question of transferring the control of museums to the education authority and the desirability of a diploma for museum curators and the necessary course of training. Among papers with a scientific bearing will be "Suggestions for Preparing and Mounting Museum Specimens," by L. P. W. Renouf; "The Pitt-Rivers Museum," by H. Balfour; and "Timber Collections for Museums," by H. Stone. Prof. Sollas will demonstrate the arrangement of the geological collections and his section-cutting machine, Prof. Poulton will elucidate the collections in his care, and contributions are promised by Prof. J. L. Myres and Dr. H. M. Vernon, among others. Visits will be paid to other museums and places of historic interest in Oxford. Each museum subscribing one guinea may send three delegates, and individuals can join on payment of half a guinea. The secretary (whose resignation we regret to see announced) is Mr. W. Grant Murray, Art Galleries, Swansea, and the local secretary, to whom inquiries about accommodation should be addressed as soon as possible, is Miss W. Blackman, of the Pitt-Rivers Museum, Oxford.

THE joint session of the Aristotelian Society, the British Psychological Society, and the Mind Association, to take place at Bedford College on July 11–14, promises some communications of present scientific interest. Dr. Rivers will expound a new theory of the repression of instinct in normal conscious life, to which he has been led in the study of war neuroses in the military hospitals. He is to open a symposium on "Instinct and the Unconscious," in which Dr. C. G. Jung, the leader of the Zurich school of psychopathology, will take part. The important neurological discoveries of Dr. Head will also be discussed in their bearing on the metaphysical problem of the nature of the ultimate data of science. This symposium will be presided over by Sir J. Larmor. It will be opened by Prof. Whitehead, who, with Sir Oliver Lodge and Prof. J. W. Nicholson, will represent different views on the questions raised by the recent relativity and quantum theories. In pure philosophy Mr. Bertrand Russell will expound a new view of what propositions are and how they mean, the result of a recent critical examination of the new behavourist psychology. Lord Haldane is to preside over a symposium on the relation of the finite to the infinite mind, which the Dean of Carlisle will open, and in which the Bishop of Down will take part. The theory of knowledge will be discussed in a symposium on "Knowledge by Acquaintance," at which Prof. Sorley will preside. The arrangements announced in the programme do not exhaust the interest of the session, as there are to be informal meetings for the reception of short communications and discussions on present controversies.

THE ladies' *soirée* of the Royal Society will be held at Burlington House on Wednesday, June 25, at 8.30.

THE general board of the National Physical Laboratory will meet at Bushy House, Teddington, on Tuesday, June 24.

DR. J. J. SIMPSON has been appointed keeper of zoology in the National Museum of Wales, and Dr. Ethel N. Thomas keeper of botany.

THE Bakerian lecture of the Royal Society will be delivered on June 19 by the Hon. R. J. Strutt, F.R.S., on "Phosphorescence and Fluorescence in Metallic Vapours."

WE regret to announce the death on June 10, at sixty-nine years of age, of the Ven. William Cunningham, D.D., Archdeacon of Ely, and fellow of Trinity College, Cambridge. Dr. Cunningham was the author of a number of important works on the economic aspects of the history of commerce, and from 1891 to 1897 was professor of economics at King's College, London.

IT is announced in *Science* that the Edison medal for meritorious achievement in electrical science or electrical engineering has been awarded to Mr. Benjamin G. Lamme, of the Westinghouse Electric and Manufacturing Co., and was presented to him at the recent annual meeting of the American Institute of Electrical Engineers.

WE learn from the *Times* that an International Hydrographic Conference will meet in London on June 24. The conference will be representative of all maritime nations, except the Central Powers, Turkey, and Russia, and it is hoped that the hydrographic experts will settle many differences in respect to charting, hydrographic publications, and hydrography generally.

THE following have been nominated as officers and council of the Wild Bird Investigation Society for the year 1919–20:—*President:* Mr. J. H. Gurney. *Vice-Presidents:* Dr. F. G. Penrose, Prof. D'Arcy W. Thompson, and Mr. E. Wheler-Galton. *Council:* Mr. W. Berry, Mr. L. Greening, Mr. L. A. L. King, Dr. S. H. Long, Dr. Graham Renshaw, and Dr. F. Ward. *General Secretary and Editor:* Dr. W. E. Collinge.

THE presentation of the Albert medal of the Royal Society of Arts to Sir Oliver Lodge on June 6, "in recognition of his work as the pioneer of wireless telegraphy," has given much gratification to men of science. The developments of wireless telegraphy have been so remarkable that the early demonstrations of its practicability by Sir Oliver Lodge are likely to be forgotten except by the people who witnessed them. We are glad, therefore, that the Royal Society of Arts has by its award given public recognition of his pioneer work, and has distinguished itself by being the first to confer an honour so fully merited.

ON account of the very large number of applications that have been received by the organising committee of the forthcoming British Scientific Products Exhibition, to be held under the auspices of the British Science Guild, all the space available at the Central Hall, Westminster, has now been allotted, and no further applications can be considered. The exhibition will be open to the public from July 3 to August 5. Its scope will be more extensive than was possible at last year's display, when war conditions made it necessary to withhold from public view much of the scientific and technical work carried on in Great Britain. Striking testimony will be furnished of the enterprise of British manufacturers, and the uses they have made of science and invention in new industries and in the development of old.

A COPY of the annual report for 1918 of the council of the Philosophical Institute of Canterbury, New Zealand, has been received. From it we learn that early in the year the Government voted the sum of 500*l.* to the New Zealand Institute for research work. Five applications for allotments were made through the Institute of Canterbury, and the following grants were made to members:—200*l.* to Dr. W. P. Evans, for investigation of New Zealand brown coals; 50*l.* to Dr. Chas. Chilton, for investigation of New Zealand flax (phormium); and 30*l.* to Mr. L. J. Wild, for a soil survey of the Canterbury Plains district. The principal action of the institute in the direction of the co-ordination of science and industry during the past year led to the establishment by the board of governors of Canterbury College of a technological section in the public library. The need for modern technical literature has been felt very much during the past four years by those engaged in the many attempts to establish industries of a chemical, or more or less scientific, nature. This section, though yet small, will, if adequately supported, eventually prove of great industrial value. The institute's representative on the board of trustees of the Riccarton Bush reports that the Bush has been open to the public during the year at the usual times, and has been visited by large numbers. The Bush continues to be of great use to the botanical students in the neighbourhood of Christchurch and to members of the institute.

THE preparation of lac, one of the oldest Indian industries, has recently been investigated by the Imperial Government. Though other countries, notably Japan and German East Africa, have attempted the cultivation of lac, their efforts have so far proved fruitless, and India retains the monopoly of this important industry, which supplies exports amounting to 4 crores of rupees, or about 260,000*l.* The collection of the product is still largely confined to the wilder forest tribes, and their methods are careless, imperfect, and wasteful. The same may be said of the present methods of making shellac. There is a real danger that it may be replaced by a synthetic product, and the example of indigo shows the possibility that the industry may ultimately disappear. Not long ago the forest chemist at Dehra Dun worked out a method of extracting the pure lac-resin with a wood spirit. This and other suggestions for improvement of the manufacture are now being considered by the Government of India, and there seems reason to anticipate that, in the immediate future, India will be able to meet the ever-increasing demand for shellac.

A COMPREHENSIVE paper on the Orthoptera of Nova Scotia has been recently published by Mr. H. Piers (Proc. and Trans. Nova Scot. Inst. Sci., vol. xiv., part 3, 1918). In addition to careful diagnoses of the twenty-eight species enumerated, the author gives valuable distributional, bionomic, and economic notes. It is rather surprising that, with the exception of the imported cockroaches, no member of the Nova Scotian orthopteran fauna is found in Great Britain.

MR. W. DWIGHT PIERCE has published (Proc. U.S. Nat. Mus., vol. liv., No. 2242) a second supplement to his monograph on the Strepsiptera. He brings forward additional arguments for his contention that

these curious parasites should be regarded as a distinct order of insects, describes their effects on various hosts, gives important morphological details (especially of the fascinating triungulin larvæ), and furnishes the student with extensive systematic revisions, including a diagnostic table of all known female Stylopidæ and a new summary of the geographical range of the 166 species of the order at present recognised. Of the sub-regions of A. R. Wallace, the South African, Siberian, Chilian, and New Zealand are still without records of these insects.

WE have received the seventy-ninth annual report, for the year 1918, of the Crichton Royal Institution, Dumfries—a mental hospital. With regard to admissions it is noted that there was a distinct increase in the proportion of cases attributed to such factors as emotional stress, overwork, and bodily ill-health, and a progressive decrease in the proportion of alcoholic cases. Influenza also accounted for some admissions. Various experiments on potato-growing, cattle-breeding and feeding, and sugar-beet growing were conducted at the farm. The institution possesses a completely equipped meteorological station, and a summary of the observations and records for 1918 is included in the report.

AN interesting paper on X-ray demonstration of the vascular system by injections is contributed by Mr. H. C. Orrin to the March issue of the *Archives of Radiology and Electrotherapy* (No. 224). It is claimed that such radiographs would be of the greatest value in the study of anatomy, showing the relative positions of various structures in a manner impossible by dissection alone. By using different injection fluids, veins and arteries may be shown by a gradation of tone. Mr. Orrin also hopes to be able to demonstrate nerves and lymphatics by this method. The plates which accompany the paper support the claims made, the minute ramifications of vessels in the hand, heart, viscera, etc., being beautifully demonstrated.

IN a paper on "The Cassiterite Deposits of Tavoy" (Rec. Geol. Surv. India, vol. xlix., p. 23, 1918), Mr. J. Coggin Brown points out that wolfram becomes separated from tin ore when washed out of a decaying lode on account of its rapid comminution and ultimate solution. As the author somewhat quaintly remarks, it "disappears long before its journey is ended." Much of the granite in the Tavoy district has been denuded to a level below that of the original lodes, the cassiterite being now represented only in the marginal contacts and the placer deposits. Another interesting mineral occurrence recently described in India is that of aquamarine in rich abundance in pegmatites in Kashmir (C. S. Middlemiss, *ibid.*, p. 161).

NO. 6 of vol. iii. of the *American Mineralogist* (price 50 cents) is devoted to the memory of René-Just Haüy, and includes a valuable series of portraits, otherwise difficult to obtain. The articles deal with various aspects of the life and work of "the father of crystallography," and Prof. E. T. Wherry shows how Fedorov's "crystallo-chemistry" and his own extension of Fedorov's layer-theory into the field of optical properties are developments of Haüy's principle of rationality. Appropriately enough, Prof. A. Lacroix has recently given us a careful biography and appreciation of Haüy's contemporary, Déodat Dolomieu (*Revue Scientifique*, No. 2, 1919), in which interesting details are given of Dolomieu's imprisonment in Palermo after Bonaparte's Egyptian expedition, and of the efforts of scientific men for his release. Finally, he was included by name in the terms of a treaty of peace.

DR. H. A. TEMPANY, director of agriculture, Mauritius, communicates to the *Agricultural News* (February 22, 1919) an account of the Casuarina woods in Mauritius. Since 1807 the whole of the lands along the sea-coast to a minimum depth of 81 metres from high-water mark have been Government property, and the habit of planting them with trees, mainly *Casuarina equisetifolia*, to ensure a supply of fuel for the sugar industry, and also as shelter belts for inland cultivation, gradually became general. Since 1895 the leasing of these lands has been carefully regulated, and conditions for cutting and replanting strictly specified. About two-thirds of the area, representing 4440 acres, are now planted with Casuarina, and the remainder is under coconuts or mixed species of trees. The Casuarina woods have also been utilised for pasturage; a grass (*Stenotaphrum glabrum*) will thrive luxuriantly in the shade of the trees, growing right up to the base of the trunks. Dr. Tempany states that, apart from their economic importance, these Casuarina plantations have great value from an æsthetic point of view, making the littoral of Mauritius the most charming that he has ever seen in any tropical country.

THE annual report of the Weather Bureau at Manila for 1916, with hourly meteorological observations, has only quite recently reached this country. The Philippines are said to have been extraordinarily free from typhoons, although the weather map of the Far East shows that the number of typhoons was not much different from the average. Wireless weather messages are received from the vessels of the Asiatic Fleet at sea, and they are said to be of the greatest value in forecasting the weather. The closest co-operation exists between the Weather Bureau and the aviation officers. During the year the seismograph at Manila registered 395 disturbances; of these only 75 originated within 100 kilometres of the observatory. At Batuan there were 1022 disturbances, which is the highest number of records from any station. The year 1916 was magnetically disturbed beyond the normal. Astronomical work was well maintained. Hourly readings of most meteorological elements are "read directly between the hours 6 a.m. and 7 p.m., while for the hours from 8 p.m. to 5 a.m. they are taken from self-registering apparatus." The metric system is followed throughout, as in former years, no cognisance being taken of the new units of measurement. There is an absence of rainfall and sunshine observations in the annual volume.

DURING the last three years a good deal of attention has been directed to the question of protecting the eyes of furnacemen from the injurious effects of the strong light from the furnaces. The United States Bureau of Standards has found it necessary to issue a third edition of its Technological Paper No. 93, first issued in November, 1917, on the properties of the various glasses now available. The paper contains curves showing the transmitting properties of a large number of glasses, and the following general conclusions are drawn:—For protection from ultra-violet light, black, amber, green, greenish-yellow, and red glasses are efficient. Against the infra-red rays, deep black, yellowish-green, sage-green, bluish-green, and gold-plated glasses are best.

IN a paper presented at the meeting of the physics and chemistry section of the Franklin Institute of Philadelphia in January last, and reproduced in the March and April issues of the Journal of the institute, Mr. Luckiesh gives the results of the work which has been done at the research laboratory of the General Electric Co. on the reduction of the visibility of aero-

planes. Visibility from above when an aeroplane is seen against the ground is best reduced by using on the top of the wings a very dark shade of green for the high lights, and a bluish-black for the shadows. The surfaces when finished should reflect between 4 per cent. and 5 per cent. of the incident light. Visibility from below in the daytime is best reduced by the use of translucent fabrics and dopes. By a suitable blue tint an aeroplane can be rendered almost invisible against a clear sky. Visibility at night is best reduced by painting the aeroplane a matt black.

THE Cambridge Scientific Instrument Co. has issued two lists of thermometers suitable for industrial use. List No. 114 deals with glass thermometers for steam plant, the chemical trade, jam- and sugar-boiling, bakeries, breweries, cold stores, and the metal industries. The instruments are well protected, and range from −40° to 540° C. List No. 195 deals with distance thermometers required when the temperatures at a number of distant points are to be observed or recorded at some central office. They are of the resistance type, and for observation purposes are connected by plug switches to a current indicator in series with a small storage cell. The current is rendered independent of the change of electromotive force of the cell by the aid of a test-switch. For recording the temperatures continuously a thread-recorder is used. With both an indicator and a recorder installed any thermometer may be connected to the recorder and give a continuous record, while the other thermometers can, as desired, be connected to the indicator. In both lists full details as to construction and use of the instruments are given.

AN article in *Engineering* for May 30 makes reference to the Still combined internal-combustion and steam engine which formed the subject of a paper read before the Royal Society of Arts on May 26 by Capt. F. E. D. Acland. This engine is an internal-combustion engine, the cylinder of which is jacketed with hot water at constant temperature. Heat abstracted from the combustion cylinder is employed in converting the jacket-water into steam. The jacket is connected to the water-space of a steam boiler, and this water, on its journey to the jacket, passes through a tubular heater, through which the exhaust gases pass. The steam and water leaving the jacket are led to the steam space of the same boiler. The exhaust gases on leaving the tubular heater are taken through a second heater, through which the feed-water is drawn. The steam from the boiler is used in a steam cylinder which forms the underside of the combustion cylinder. There is but one cylinder, the upper part of which is an internal-combustion cylinder, and the lower part a steam cylinder. The down stroke is an internal-combustion stroke, and the up stroke is a steam stroke. Remarkable economies are claimed. Thus a Still-Diesel engine with compounded steam side had a consumption of 0·302 lb. of Admiralty shale oil per brake-horse-power over one hour's run. Full test figures were not given in Capt. Acland's paper, which is somewhat unfortunate in view of the important features of the new engine. It is to be hoped that a complete record of engine dimensions and tests will be published in the immediate future.

THE special catalogues of Messrs. H. Sotheran and Co., 140 Strand, W.C.2, are always of interest and value, and the latest one (No. 772), entitled "Bibliotheca Viatica," is no exception. It gives particulars of upwards of nine hundred second-hand works dealing with, among other subjects, maps and atlases, road, railway, and hydraulic engineering. There is also a section, necessarily not very lengthy, on books relating to ballooning and aeronautics. The catalogue contains many items likely to appeal to readers of NATURE, and should be seen by them.

Messrs. Longmans and Co. have nearly ready for publication Dr. J. F. Spencer's "The Metals of the Rare Earths" and a new edition of J. F. Colyer's "Dental Surgery and Pathology." They have also in the press Dr. R. A. Houstoun's "The Elements of Physics" and E. W. Blocksidge's "Ships' Boats: Their Qualities, Construction, Equipment, and Launching Appliances." *Messrs. G. G. Harrap and Co., Ltd.*, are issuing "General Science," by L. Elhuff, and *Messrs. Baillière, Tindall, and Cox* promise a "Popular Chemical Dictionary," by C. T. Kingzett.

MESSRS. W. HEFFER AND SONS, LTD., Cambridge, offer in their latest catalogue (No. 179) some four hundred books in new condition at substantial reductions on pre-war prices. The list is a general one, but there is a section devoted to books on natural history and other branches of science. In it we notice Prof. J. C. Adams's "Scientific Papers," 2 vols.; J. G. Hagen's "Atlas Stellarum Variabilium," six series; R. Braithwaite's "The British Moss-Flora," 3 vols.; W. C. Hewitson's "Exotic Butterflies," 5 vols.; H. Seebohm's "The Turdidæ, or Family of Thrushes," edited and completed by R. Bowdler Sharpe, 2 vols.; Wilson and Evans's "Aves Hawaiienses," in parts; and sets of "Biologia Centrali-Americana." The catalogue is sent free upon application.

OUR ASTRONOMICAL COLUMN.

AN INTERESTING METEOR.—A small fireball was seen on May 19, 11.39 G.M.T., by Mr. Denning at Bristol and by Mr. Mattey at Woolwich; it moved very slowly from a radiant point hitherto unknown in May at about 68°+63°. The Rev. M. Davidson has computed the real path, and finds that the height of the object was from 53 to 32 miles, the length of the observed luminous course 46 miles, and the velocity about 10 miles per second. The theoretical velocity is 14 miles per second, but atmospheric resistance must have greatly impeded the flight of the meteor. Mr. Mattey saw several other meteors during the latter half of May from the same radiant in Camelopardalus.

THE SUN-SPOT MAXIMUM.—In reporting on the sun-spots observed in the year 1918 Mr. Evershed, director of the Solar Physics Observatory, Kodaikánal, remarks that the maximum spot activity of the present cycle took place during the second half of 1917 for both hemispheres. This judgment may be accepted as correct, for though some hesitation has been felt in accepting this early date lest a secondary maximum should occur after a temporary decline, as has happened in previous cycles, these circumstances do not seem likely to occur. The date of the previous maximum has been placed in the early part of the year 1906, though the sun-spot activity of that year was inferior to that of 1905 and of 1907. Adopting these estimates as correct, the length of the period just ended is slightly above the average.

THE MOUNT WILSON OBSERVATORY.—The stellar observations in the programme of the institution of which Prof. Hale is director, hitherto called the Mount Wilson Solar Observatory, California, or sometimes the Solar Observatory of the Carnegie Institution of Washington, have lately been increasing in importance. In view of this fact, and of the practical completion of the 100-in. reflector, which will add greatly to the range and number of night observations, it is proposed that the word "Solar" shall be dropped, and

that in future the designation "Mount Wilson Observatory" will be employed, as it is in Prof. Hale's report for 1918.

SUN-SPOTS AS ELECTRIC VORTICES.—Adopting the hypothesis that sun-spots are vortices in which electrified particles produced by ionisation in the solar atmosphere are whirled at high velocity and thereby give rise to magnetic fields, Prof. Hale has built up a research in which he determines the polarity of the field or direction of rotation of the vortex by observation of the Zeeman effect in the spectrum of the spot. In the early stages of this research, before the minimum of 1912, it was found that in the case of groups which consist mainly of two large spots these components were of opposite polarity, and that, in general, the polarities of the leading spots, and consequently of the following spots, were of opposite sign in the northern and southern hemispheres of the sun. After the minimum the surprising fact emerged that the polarities were reversed in both hemispheres—that is to say, the preceding spots of northern bi-polar groups which before the minimum were of the same polarity as the north magnetic pole of the earth were of the opposite polarity after the minimum. This state of things endured, and the interesting question arose whether a similar reversal would occur at or near the sun-spot maximum, but in Prof. Hale's report for 1918 it is stated that no general change of polarity has been observed since the maximum, which occurred in the latter half of 1917.

SCIENCE AND WAR.

ON Thursday, June 5, in the Senate House of the University of Cambridge, before a distinguished audience, Lord Moulton delivered the Rede lecture on science and war. After pointing out generally how the advances in scientific knowledge had revolutionised the methods of warfare since the last great European conflict in 1870–71, the lecturer dealt specifically with some of the more conspicuous examples of what had been achieved during the present war through the application of science to military problems. Beginning with explosives, he recalled the discovery some seventy years ago of guncotton and nitroglycerine, and showed how it led to the production of the smokeless powders that have revolutionised tactics both by land and sea. At first it was found impossible to use guncotton and nitroglycerine for anything but blasting or like destructive purposes until the discovery was made that, by the aid of certain volatile solvents, the two substances could be incorporated so as to produce a material resembling gelatine, which could be formed into pieces of any shape or size. While these gelatinised powders burn with extreme rapidity, they are poor conductors of heat. Thus when the charge is fired all the pieces begin to burn on the surface, and the combustion spreads itself through each piece of the material more rapidly than the high temperature can pass inwards by conduction of heat. Hence the pieces always burn from the outside, and by making the amount of the surface large or small compared with the bulk the rate of burning of the powder can be controlled.

Besides providing a perfect propellant, science had also given the high explosives needed for shells. These are distinguished by the high rate of rise of the pressure which they produce on explosion. The rate at which the pressure comes on in a 6-in. gun is about 10,000 tons per square inch per second, so that it rises to the full pressure of 15 to 20 tons in something under the five-hundredth part of a second. In a good high explosive the rate of rise per second was several millions of tons per square inch, and the period was a fraction of a thousandth part of a second. Hence the shattering effect of these high explosives. High explosives show the remarkable peculiarity that there are two distinct ways in which they can explode. One gives rise to a comparatively mild explosion which opens out the shell, but does little more; the other is a fierce detonation by which the shell is rent to pieces. The cause of this is not understood, but it is undoubtedly connected with the intensity of the initial disturbance which sets the explosive off. By the commencement of the present war we had learnt how to detonate with fair, but not absolute, certainty the high explosives then used in the Service. But the prospect of the supply of toluene failing to equal the enormous demands of our shells necessitated a change of high explosive, and the one that was taken required special study before detonation could be ensured. It was achieved through the unremitting labours of those scientific workers who, little known to the public, have had to face and solve the innumerable problems that have presented themselves during the war. Through their labours we arrived at a degree of excellence which reduced the proportion of shells which failed to detonate from all causes to so small a figure that it was, the lecturer believed, little more than one-fifth of that of our adversaries.

Lord Moulton then referred to the changes in artillery which the new explosives had brought about, mentioning our howitzers, which, at ranges such as eight to fifteen miles, could be relied on to fire shot after shot with a variation of a few yards only, and also making some interesting statements with regard to the long-range gun which the Germans used to bombard Paris. Amongst other things, he pointed out that the distance passed over by the projectile was so great that if the Germans had taken the trouble to aim at any particular building they must have allowed nearly half a mile for the fact that during the flight the rotation of the earth would to that extent carry the target further towards the east than it would carry the gun.

The most hateful chapter of the work of science in the war was the introduction of chemical warfare. The first gas attack was on April 22, 1915, and it was not until the following September that we were able in any way to retaliate. But our immediate reply was one that did honour to science. Due to the splendid work of the late Col. Harrison, a system of defence by gas-masks was established, in which we were for the greater part of the war far ahead of our adversaries, who succeeded in coming up to us only by learning and copying our methods.

Finally, the lecturer paid an eloquent tribute to the assistance rendered by science in the war in dealing with disease and wounds, with particular reference to the success which had attended the use of anti-tetanus serum, to the reduction of the rate of mortality in spotted fever to one-tenth of its former value, and to the complete elucidation of the mode of transmission of bilharziasis, a disease with which we were faced through the presence of large contingents of our troops in Lower Egypt. Lord Moulton's conclusion was that one overmastering lesson was to be derived from the contemplation of all that science had done in the war. She had made mankind too formidable a being to be permitted to have recourse to it. The uncontrolled indulgence on the part either of a nation or of an individual in the exercise of the power that science had placed within reach was too directly fatal to civilisation itself. It was easy to criticise the League of Nations and to point out the difficulties, and even impossibilities, with which it was faced, but we should never forget that some combined action of that type was an imperative necessity.

INDIAN SURVEY REPORT.

THE records of the Survey of India, vol. xi. (supplementary to the General Report, 1916–17), including the Annual Report of Parties and Offices, 1916–17, contain little that can be considered as matter of wide scientific interest or of great importance from either the geodetic or the geographical point of view. It is the usual summary of excellent work completed by the officers of the Survey of India Department, amply illustrated by special charts and tables of the results of scientific observations, which occupy a very large space in the report.

The department was necessarily short-handed owing to the absence on active service of many of its officers, and one or two of those special branches of research which have been systematically undertaken by the scientific experts of the Trigonometrical Survey have been temporarily suspended. Thus there are no fresh records of pendulum, or of latitude, observations such as have lately added so much valuable evidence to investigations dealing with the force of gravity; but there is a useful summary of the conditions under which some of the early pendulum observations were taken (notably those of Col. Basevi at Moré), which will serve as a guide to future investigators. The conclusion expressed by Col. Lenox Conyngham is to the effect that "the Moré observations are too uncertain for any argument to be based on them"—a conclusion which was more or less anticipated by Prof. Borrass, of the Prussian Geodetic Institute, and Mr. R. D. Oldham. It is a question of instrumental stability, not of personal accuracy in observation.

No new base line was measured during the year under review. There are, on the other hand, very complete tables of the results of the Magnetic Survey under Mr. Bond, a subject which has lately derived increasing public interest from the investigations of Mr. E. A. Reeves, of the Royal Geographical Society's staff, who has published the results of a new method of reduction of the dip angle to a common line of reference provided by the axis of the earth's rotation, and proved that curves of equal dip are approximately coincident with parallels of latitude. Mr. Reeves's views on this subject, fully illustrated, will be found in the March issue of the Journal of the society.

First-class triangulation appears to have been confined to the Madura Series, and some useful hints may be derived from the report as to methods of dealing with those flat, jungle-covered regions of which there is such a superabundance in the untriangulated spaces of the earth. This is really a far more important matter for investigation and discussion than it may appear to be at first sight. The topographical section of the report confines itself to the details of the most practical side of surveying. There is nothing of an exploratory nature about them. The work of transfrontier reconnaissance is in abeyance, and nothing is said about Mesopotamia.

An illustrated section of the report, which deals with the representation of "relief" in maps by means of a series of coloured plates, would perhaps meet with a certain amount of criticism if it were brought a little more into public view by inclusion in some well-known periodical. One great fault of the Indian Survey reports is that the popular side of them is not sufficiently within reach of the public. Map reproduction generally, and the best way of representing relief, are, in these days of a greatly increased interest in geography, subjects on which there are many opinions and wide divergences of view. The methods adopted by the Indian Survey are admittedly not entirely satisfactory, and the difficulties in the way of making them satisfactory are fairly well explained in this report. It would certainly be useful if such an important map-producing department as that of the Survey of India could inaugurate a discussion (especially on the subject of a colour scheme) in which the public which uses its maps could express a free opinion.

T. H. H.

SUB-ANTARCTIC WHALES AND WHALING.[1]

THE history of whaling in northern waters, and of the hunting of sperm whales in warmer seas, has often been written, and some of the principal facts relating to these subjects are matters of common knowledge. There is reason to believe that the existence of a whaling industry, which was inaugurated just outside the South Polar circle after the commencement of the present century, is by no means generally known. Although Capt. Cook, Sir James Ross, and others had many years before reported the presence of whales in those latitudes, no practical advantage was taken of the information until fourteen years ago; and since that date the industry has eclipsed in importance all that had been done previously, even when the Greenland whale "fishery" was at its height.

In 1892 Capt. C. A. Larsen left Norway for the Far South, which he reached in the October of that year. No whaling was done, and an expedition to the same regions, fitted out by Capt. Svend Foyn in the next year, was also unproductive of whales, mainly for the reason that it had been intended to hunt right whales and sperm whales. The Norwegian captains brought home, however, a very vivid impression of the enormous number of whales frequenting sub-Antarctic waters; and the fact that they at first made no further ventures was due to the profitable nature of the whaling in the neighbourhood of the Norwegian coasts. Dr. W. S. Bruce had simultaneously (1892) accompanied four vessels of the Dundee whaling fleet to the Antarctic, and had been similarly impressed with the abundance of whales in these waters. A meeting was shortly afterwards held in the rooms of the Royal Scottish Geographical Society at Edinburgh to advocate the use of the modern Norwegian methods of whaling in the South; but the proposal was not carried, and no practical steps were taken.

Capt. Larsen afterwards became the commander of the *Antarctic*, the exploring vessel of Dr. O. Nordenskjöld's Swedish South Polar Expedition, 1901–3. The *Antarctic* was wrecked; and Capt. Larsen, on his return journey, found himself at Buenos Aires, where in 1904 he founded the Compania Argentina de Pesca, the first whaling company which undertook operations in the Far South. This company commenced work at South Georgia in 1905, while the South Shetland Islands were visited with the same object in 1906, and the South Orkney Islands in 1911. The operations have proved so successful that there are now numerous companies whaling at South Georgia and the South Shetlands, a large proportion being Norwegian. While the most successful whalers in the Greenland industry from the seventeenth to the nineteenth centuries were the British and the Dutch, the Norwegians have almost a monopoly of the art at the present time, and nearly all the skilled workers are of that nationality.

The older whalers hunted with hand-harpoons from small boats, provided with sails and oars, which were

[1] From a discourse delivered at the Royal Institution on Friday, May 16, by Dr. S. F. Harmer, F.R.S. (Published by permission of the Trustees of the British Museum.)

launched from the parent ship on sighting a whale. The objects of their chase were principally the Greenland whale, the Atlantic right whale, and the sperm whale; and they were unable to attack and capture the larger and swifter rorquals.

About 1865 the Norwegian whaling captain Svend Foyn invented the modern whaling-gun, which was fitted with an explosive tip and a barbed harpoon carrying a strong rope. The explosion was regulated so as to occur immediately after the harpoon hit the whale, which is sometimes killed at once, and in any case is severely injured by a successful shot. The gun is carried in the bow of a steam-whaler, which chases the animal until a favourable opportunity for shooting occurs. These methods have revolutionised whaling, and there is now no whale which is too large to be captured.

In the prosperous days of the Greenland whale "fishery," 1437 whales were caught by seventy-six ships in 1814—an average of not quite twenty whales to each vessel—and this is mentioned by Scoresby (1820) as a specially good year. At the present day the number of whales caught by a single vessel during the whaling season of six months may rise to more than three hundred; and the total number caught off South Georgia and the South Shetlands together has exceeded 10,000 in one year. Bearing in mind the universal history of whaling in the past—a period of prosperity succeeded by a rapid decline and a final abandonment of the industry—the question arises whether there is not a serious danger that sub-Antarctic whaling will have a similar experience.

The question of the disappearance of the whales is not merely a sentimental one, though zoologists would naturally view their extermination with deep concern on scientific grounds. The plea for their preservation may be strengthened, however, by emphasising the fact that they are of the highest economic importance. The baleen or whalebone of the right whales is a material of much practical utility for many purposes; but its importance is almost negligible compared with that of the oil which is derived from the blubber and other parts of whales. Whale-oil can be readily transformed into soap and glycerine, while it is possible to prepare from it a fat which is perfectly inodorous and is utilised in the manufacture of margarine. During the war it has been of vital importance. Enormous quantities of glycerine derived from it have been used for the manufacture of explosives, and it has been scarcely less important in its relation to the food supply. If whale-oil had not been obtainable, the glycerine which was essential for our national security must have been derived from other animal fats or from vegetable oils, and the shortage of fat required as food would have been very serious. After the oil has been extracted on the whaling grounds, the remainder of the carcass may be dried and ground down into "guano," which is valuable as a fertiliser for crops, and is also utilised for the preparation of cattle-foods. It is not always possible to carry out this part of the process, and an enormous waste of valuable material may result from this omission. Since it is well known that the flesh of Cetacea is fit for human food, it is by no means impossible that a part of the enormous quantity of meat which might be obtained from them may be so utilised in the future.

Although a few right whales and sperm whales are captured by the sub-Antarctic whalers, who occasionally kill some of the smaller Cetacea as well, the industry in these waters is almost entirely confined to three species of the larger whales. Of these the humpback rarely exceeds 55 ft. in length, the fin whale is not much more than 85 ft., while the blue whale, probably the largest animal that has ever existed, is sometimes more than 100 ft. long. In the first few years of sub-Antarctic whaling the humpback constituted nearly the whole catch, even more than 96 per cent. in 1910–11, when 5299 individuals of this species were captured off South Georgia in the six months of the principal whaling season. In 1912–13 the number of humpbacks caught in the same locality, in the corresponding six months, fell to 2251 (about 53 per cent. of the total catch), and in 1913–14 it was reduced to 474 (about 18 per cent.). This diminution, which has persisted to the present time, has been due largely to a reduction of the number of humpbacks frequenting South Georgia; but it has been partly caused by an increase in the size of the whaling vessels and of the strength of the tackle employed, enabling the whalers to hunt the larger kinds, which naturally yield more oil and other products than the comparatively small humpback. The whaling industry thus depends at present almost entirely on the fin whale and the blue whale. It is noteworthy that the fin whale, of intermediate size, first rose to prominence on the decline of the humpback; but the gigantic blue whale has now surpassed it, and has become the favourite object of the whalers' pursuit. There is at present no certain evidence of the reduction in numbers of fin whales and blue whales.

In explaining the reduced number of humpbacks frequenting the whaling grounds, the whalers rely on the hypothesis that individuals of this species are of a timid nature, and are readily frightened away from a locality by pursuit. There is probably some truth in this view, but it is at least possible that the reduction is due to a diminution in number of the total stock of humpbacks. Whales are migratory animals, and their movements are almost certainly influenced by two causes: (1) the distribution of their food supply; (2) the position of their breeding grounds. The plankton organisms on which the whalebone whales subsist are present in vast quantities in polar waters during the summer, and the whales are accordingly found there at this period. Towards the end of the summer or the beginning of autumn most of them forsake high latitudes. The southern humpback executes extensive migrations northwards, along the coasts of the great southern continents, to the neighbourhood of the equator, and even beyond it. It is in these warmer waters that it is known to breed, and it afterwards proceeds southwards in the ensuing spring. One of the most alarming facts about this species is that it has been extensively hunted along the coasts of Africa, South America, and elsewhere. Although it is not possible to assert positively that the South Georgia humpbacks are thus affected, there are strong reasons for believing that this is the case; and it would thus follow that this species is persecuted in sub-Antarctic waters during the summer, and further north during other parts of the year. Remembering that the old whalers reduced the Greenland whale almost to the point of extermination by the use of what may now be regarded as primitive methods, and that a similar fate has befallen the once-flourishing whaling industries of other localities, it thus appears that there are the most urgent reasons for seeking to afford some immediate measure of protection to this and other species of whales.

In devising methods for the protection of animals, the principle of saving them from being hunted during their breeding season has been found specially effective. It is very difficult to get complete information on this subject with regard to whales, but one of the ways in which a conclusion may be reached is the examination of fœtal records, a method which has already been adopted with some success by Guldberg and others. By the study of a relatively large mass of statistics which has been supplied to the British Museum (Natural History) by the whaling companies

operating off South Georgia, I have found it possible to arrive at certain definite results which amplify or correct those of previous observers. These are specially clear in the case of the fin whale, which has provided the largest number of records. It is found that in a given month there is a particular length of fœtus which has the greatest frequency; that in the next month a greater length is most common; and so on for several succeeding months, after which the whaling season comes practically to an end, and the number of records is inadequate to give a normal result. Although there are certain irregularities needing explanation in the graphs constructed from the statistics, the general result has been arrived at that, in each of the three species principally hunted at South Georgia, pairing takes place with greatest frequency at a certain period of the year, and that a normal curve of pairing can be drawn. This result gives, in the main, a satisfactory explanation of the statistical records. The season when pairing is at its height falls in each case outside the period when whaling is actively carried on in the Far South; and the important conclusion is reached that if the whales are to be protected during their breeding season, it must probably be done in regions of the world farther north than South Georgia. The validity of the southern figures, which have, no doubt, been roughly recorded by the whalers, has been confirmed by obtaining corresponding results from the examination of the statistical fœtal records of northern whales.

It can scarcely be doubted that protective measures of some kind are urgently necessary now, or will at least become so in the near future; although it is by no means certain what form they should take. The British Government is, in some respects, in a specially favourable position with regard to this matter, since all the important whaling grounds of the sub-Antarctic region belong to the Dependencies of the Falkland Islands and lie in its jurisdiction. It is satisfactory to be able to conclude with the statement that the Government is fully alive to the necessity of taking steps before it is too late, and that an Inter-Departmental Committee is at present engaged, under the auspices of the Colonial Office, in framing a scheme for an expedition which is to investigate the whaling problem on the spot, with the view of obtaining information on which legislation may be based.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The governing body of Emmanuel College offers two exhibitions, each of the value of 50*l.* and tenable for two years, to research students commencing residence at the college in October, 1919. The exhibitions will be awarded at the beginning of October, and applications should be sent so as to reach the Master of Emmanuel (the Master's Lodge, Emmanuel College, Cambridge, England) not later than September 24.

LONDON.—A war memorial scheme for University College, University College Hospital and Medical School has now been settled, and an appeal for a sum of 30,000*l.* is being issued to all old students of the colleges whose addresses are known. The complete scheme as settled by a representative and influential committee, under the patronage of the Earl of Rosebery, Chancellor of the University of London, includes the following features:—A war memorial album, containing the records of the academic and Service careers of the 268 men who have fallen; memorial tablets recording their names; scholarships for the sons and daughters of the fallen; a great hall for the use of the college and medical school; and the endowment of University College Hall, Ealing. The hon. treasurer is Capt. Wedgwood Benn, who is a fellow of the college; donations sent to him at University College will be gratefully acknowledged.

OXFORD.—On June 10 the question of an application for a Government grant came before Convocation, and by 126 votes to 88 it was decided to authorise the Vice-Chancellor to apply for a Government grant or grants, and to accept the same on behalf of the University on condition that the University should co-operate with the Government in an inquiry to be made into its whole resources and the use which is being made of them.

It appears to be generally allowed throughout the University that a large accession of funds is necessary for the efficient working of the scientific departments under present-day conditions; nor does there seem to be any widespread objection to such an inquiry as is proposed. In several quarters, however, distrust is felt as to the possible effect of control by the Board of Education, which appears to be an unavoidable consequence of the acceptance of a grant of public money. The independence hitherto enjoyed by the University in educational and administrative matters is believed by a minority to be at stake. The view, however, has prevailed that these apprehensions are groundless, or at least are not sufficient to outweigh the positive advantages to be gained by approaching the Government, and the division just taken in Convocation shows that the University is prepared to face the risk.

MR. S. O. RAWLING has been appointed lecturer in chemistry at Robert Gordon's Technical College, Aberdeen.

THE resignation of Prof. W. M. Gardner of the principalship of the Municipal Technical College, Bradford, is announced.

IT is announced that the Most Rev. John Henry Bernard, D.D., Archbishop of Dublin, has been appointed Provost of Trinity College, Dublin, by the Crown in succession to the late Sir J. P. Mahaffy.

WE have received from Mr. H. Valentine Davis, "Noddfa," Wistaston, Crewe, a programme of a course of field-work in Snowdonia for the outdoor study of geography, botany, and geology, which he has arranged to conduct between July 30 and August 13 at Llanberis. Mr. Davis is prepared to receive applications from teachers and others who desire to attend the course.

THE executive committee of the Ramsay Memorial Fund reported to a meeting of subscribers on June 5 that a sum of 43,000*l.* is in hand and 70,000*l.* in view, so that the 100,000*l.* aimed at is within realisation. It was resolved that:—(1) A sum of 25,000*l.* be definitely allotted to the Senate of the University of London towards the provision of a laboratory of chemical engineering at University College, London, on the site proposed in close proximity to the existing engineering buildings. (2) The executive committee be empowered to employ the balance of the fund already subscribed, and all future donations to be received, to the foundation of Ramsay memorial fellowships to the number of three or to such smaller number as they may deem expedient until the fund is sufficient for founding fellowships. (3) If and when the amount of the fund exceeds the sum required for giving effect to resolutions (1) and (2), the division of such further sum between the augmentation of the sum allotted for the chemical engineering laboratory and the augmentation of the number of available fellowships be referred to the executive committee for decision.

THE University of Liverpool has recently established a Tidal Institute for the purpose of research into tidal questions, and to constitute a bureau of information on matters connected with tides. The work contemplated at present is mainly mathematical and computative, though doubtless this will lead in time to special schemes of observation, perhaps in co-operation with other bodies. The necessary funds have been provided by Sir Alfred Booth and Mr. Charles Booth, chairmen respectively of the Cunard and Booth steamship companies, while Dr. J. Proudman will be the honorary director of the institute. It is very satisfactory that this country should again have a centre of tidal learning and research at one of its universities, to continue, under a new form, some of the services rendered to the science by Sir George Darwin. It is not possible to judge as yet whether or not this makes unnecessary the inclusion of tidal matters in the larger scheme for a geodetic institute now being discussed, but in any case, through the wider range of activity on the part of the latter and the intensive theoretical studies of the Liverpool institute, each body may be expected to be advantageous to the success of the other.

THE almost universally conceded necessity for attracting well-qualified teachers into the profession by offering really adequate salaries and improved prospects does not appear to be appreciated by some education authorities. Recent advertisements in the *Newcastle Evening Chronicle* by a local education authority show that 170*l.* to 200*l.* per annum is thought to be an adequate and attractive salary for a well-qualified science master who is required for advanced course work, and that a "slinger" for loading machinery parts and engines can command a wage of 5*l.* per week (260*l.* per annum). The comparison does not accentuate the value of a good education, nor will it create enthusiasm in the minds of possible entrants to the profession. We may add that in many rural districts, especially in Wales, it is the exception to find secondary-school teachers, even with experience, enjoying a salary of more than 160*l.* per annum. The lamentable inadequacy of salaries has reacted upon the supply of teachers, which does not now approach the normal demand, and this renders all the more difficult the problems of staffing the new continuation schools provided for in the recent Education Bill, and of diminishing the size of classes in the secondary schools to the advantage of the pupils. We cannot urge too strongly that the provision of a really efficient system of national education depends, to a great extent, upon the payment of adequate salaries to the teaching staff, and that the question as to whether rates or taxes are to provide the additional cost should not influence the educational facilities offered to the youth of the country.

AT a meeting of the Yorkshire Natural Science Association at Sheffield on Saturday, May 24, Prof. Ripper, Vice-Chancellor of the University, speaking on "Science and Reconstruction," said that the task of those who wished to promote the extended use of science and scientific method in industry was to urge the importance of using them in all those industries which as yet were untouched by the spirit of modern scientific progress. Science could help in two ways: first, by the gift of new knowledge, built up by the scientific worker with no regard to its industrial value; and, secondly, by the application of scientific method and principles to problems of industry. No manufacture could afford to dispense with the services of the well-trained man of science, who was required wisely to direct the activities of the two partners, capital and labour. Prof. Ripper welcomed the formation of the Privy Council Committee for the purpose of establishing research associations in connection with national industries. The light trades and the glass industry of Sheffield were taking steps towards reorganisation and enlisting the help of the scientific expert. For the most part, the work of training these men of science would devolve upon the universities, and to that end their resources would have to be augmented. The staff and equipment were at present fully occupied in the teaching of the undergraduate, and better provision must be made for the advanced student. Governments were the servants of public opinion, and until public opinion was fully awake to its duty to the universities and recognised the need for an adequate supply of trained persons, the progress of industry would be severely handicapped.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, May 9.—Prof. C. H. Lees, president, in the chair.—A. E. **Bawtree**: A new colour transparency process for illustrating scientific lectures. The image is produced in a thin colloid film upon bare glass. Considerable experimenting led to the selection of a range of dyes and mordants by which practically any shade of the most brilliant colouring could be obtained. By suitable insulating films, images in any number of colours can be superimposed and accurately registered with one another. Thus diagrammatic slides can be prepared in various colours. The passage of a beam of white light through a prism can be shown spreading out into bands of colour, instead of merely initialled lines. Coloured mosaics can be placed in a diffusing lantern to show the preparation of additive colours, *e.g.* red and green producing yellow more convincingly and brilliantly than with the Maxwell disc.—F. J. W. **Whipple**: Absolute scales of pressure and temperature. The paper urges the general use of the new scales of pressure and temperature which have been adopted by meteorologists. In the pressure-scale the fundamental unit is the bar, the pressure due to a million dynes per square centimetre. The practical unit is the millibar. The temperature-scale is that known as the pseudo-absolute scale, obtained by adding 273 to the Centigrade scale. The author, however, considers that it would be advantageous to use the "integral freezing point" scale, in which the interval between absolute zero and the freezing point of water is divided into 273° exactly.—Dr. A. O. **Rankine**: The transmission of speech by light. Light from a point source is collected by a lens of about a metre focus, and an image formed on a small concave mirror, which is attached to the diaphragm of a gramophone recorder. The light diverges and passes through a second similar lens, which projects it to the distant station. Two similar grids are mounted, one in front of each lens. An image of the first grid is superposed on the second by reflection in the concave mirror. When the latter oscillates under the vibrations of speech, the dark spaces of the image move over the openings of the second grid, thus producing fluctuations of the intensity of the beam. The light is received by a collecting lens and focussed on a selenium cell in circuit with a battery and telephone receiver.

Geological Society, May 21.—Mr. G. W. Lamplugh, president, in the chair.—C. I. **Gardiner**: The Silurian rocks of May Hill. With an appendix by Dr. F. R. Cowper Reed. The district of May Hill comprises a small area of ashy grits, which Dr. Callaway in 1900 considered to be of pre-Cambrian age. The evidence now available does not seem to warrant any definite opinion as regards the age of these beds. Dr. Reed

describes a new species of Lichas from the Wenlock Limestone and a new variety of *Calymene papillata*.—Dr. A. **Gilligan**: The petrography of the Millstone Grit series of Yorkshire. Since the pioneer work of Sorby on this subject, published in 1859, the clastic deposits of the Carboniferous system have been unaccountably neglected by petrologists. The author has followed the usual methods of investigation, and collected a large number of pebbles and specimens from widely separated areas, which have been examined microscopically. Numerous separations of the heavy minerals have also been made from all types of rock, varying from coarse conglomerates to shales, which occur in the series. In Yorkshire the Millstone Grit forms the surface of 840 square miles; while, if that which lies beneath the newer rocks and that represented by outliers on the Pennine Fells were taken into account, it must have extended over at least 2000 square miles. If 1000 ft. be taken as its average thickness, the Yorkshire Millstone Grit would represent a volume of 400 cubic miles, the equivalent of a range of mountains 800 miles long, 1 mile high, and 1 mile wide at the base. The author shows that the most probable source of the material lay in a land-mass of continental extent, of which Scandinavia and the North of Scotland represent the remaining fragments. In these areas alone can the mineralogical demands of the Millstone Grit be satisfied, and the author institutes a comparison between the Torridon Sandstone and the Millstone Grit, which shows that their similarity of constitution is altogether too great to be merely fortuitous. He infers that, despite their disparity in age, they had a common source in that northern continent.

Society of Glass Technology, May 21.—Dr. M. W. Travers in the chair.—Dr. W. **Rosenhain**: Some phenomena of pot attack. Research was begun on the improvement of methods for the production of optical glass. The first step was to find a material to arrest the attack of molten glass, and to endeavour, if possible, to discover a container entirely insoluble in glass at high temperatures. A study of glass attack upon clay was begun, and the process by which glass attacks clay investigated. These processes, owing to the novel methods used, could be carefully controlled under standardised conditions. Small pots made of china clay cast by a special method were used in the research. The furnace was an electrical one, so constructed that temperature and atmosphere could be kept constant. The pot attack of several glasses known to be very violent in their action upon clay was studied. The amount of pot attack was measured exactly under various time and temperature conditions. The result showed that the attack was mainly on the bottom of the pot, and that holes were drilled in a rough, circular form. In many cases it was shown that the amount of attack was proportional to the depth of the clay beneath the glass surface. The explanation of the results was somewhat difficult to find, but a study of the solution of solids in liquids less viscous than glass led to the conclusion that the phenomenon was due to currents set up in the liquid by density changes. One of the portions of the research had been the microscopic examination of the glass and pot after attack. This portion of the work is still in progress. It had been proved conclusively that holes could be drilled in a pot without having actual defects in the pot to start with. Another very interesting feature recently developed was the application of X-rays to the examination of small pots.

Zoological Society, May 27.—Dr. A. Smith Woodward, vice-president, in the chair.—J. T. **Cunningham**: Result of a Mendelian experiment on fowls, including the production of a pile breed.—Miss Kathleen F. **Lander**: Some points in the anatomy of the Takin (*Budorcas taxicolor whitei*).—E. Phelps **Allis**: Certain features of the otic region of the chondrocranium of Lepidosteus, and comparison with other fishes and higher Vertebrata.

Aristotelian Society, June 2.—Lord Haldane in the chair.—Dean **Inge**: Platonism and human immortality. The Platonic doctrine of immortality rests on the *independence* of the spiritual world. The spiritual world is not a world of unrealised ideals over against a real world of unspiritual fact. It is, on the contrary, the real world, of which we have a true, though very incomplete, knowledge, over against a world of common experience which, as a complete whole, is not real, since it is compacted out of miscellaneous data, not all on the same level, by the help of the imagination. There is no world corresponding with the world of our common experience. Nature makes abstractions for us, deciding what range of vibrations we are to see and hear, what things we are to notice and remember. It is the substantiation and continuance of this makeshift construction that we are sometimes childish enough to desire. What is real in it is the thought of God transmuted into vital law. The operation of these forces we study mainly in transverse sections, since we have forgotten most of the past and are ignorant of the future. But since the soul is a citizen of the eternal world, we can, if we will, "be eternal in the midst of time," though our higher life is for most of us fitful, indistinct, and confused. It follows that salvation, for the Platonist, must be *deliverance* from a world of shadows and half-truths, *per tenebras in lucem*.

CAMBRIDGE.

Philosophical Society, May 19.—Mr. C. T. R. Wilson, president, in the chair.—F. W. **Aston**: The use of neon lamps in technical stroboscopic work. The standard method of calibrating and testing revolution indicators for aero-engines is by means of a stroboscopic disc or cylinder illuminated by flashes of a neon lamp. The latter is lit by a small induction coil interrupted exactly fifty times per second by a standard electrically driven tuning-fork. Neon tubes of the ordinary spectrum type give a flash of considerable duration, some thousandths of a second, and therefore are unsuitable. This flash when analysed by a rotating mirror is found to consist of a single practically instantaneous flash followed by a flame or arc. By means of a special form of lamp the whole of the energy of the discharge can be thrown into the first flash, the duration of which has so far defied measurement, and is certainly less than one ten-millionth of a second, making it ideal for stroboscopic work. By illuminating an engine running at full speed by means of such a lamp arranged to give 99 flashes per 100 revolutions of the crank-shaft, the engine will appear to rotate at one-hundredth its real speed, so that the most minute observations on its moving parts can be made. This method has also been extended to the examination of air-screws for strains when running at high speeds.—F. W. **Aston**: The distribution of intensity along positive-ray parabolas of atoms and molecules of hydrogen, and its possible explanation. This paper deals with the bright arcs or "beads" on the positive-ray parabolas of hydrogen which correspond with half the normal energy, and therefore cannot be due to multiple charges. Experiments seem to indicate that the discharge can be separated into two types. In the first or "atomic" type, which can be obtained practically pure under certain conditions, it seems possible that the whole discharge is carried up to the cathode by ions of atomic mass. The proposed explanation of the bright arc on the molecular

parabola seen in this type of discharge is that it is due to atomic rays colliding with and capturing slowly moving neutral atoms in the canal-ray tube, and so forming molecular rays of half-normal energy. The second or "molecular" type, which has only been obtained associated with the atomic, is characterised by a very bright patch on the molecular parabola corresponding with normal energy, and two fainter equal symmetrical positive and negative satellite patches on the atomic parabola apparently caused by some of the charged molecular rays being dissociated by collision with a neutralising electron into atoms of opposite charge each with half the normal energy.—C. T. R. **Wilson**: A micro-voltameter. Experiments were described with a mercury voltameter in which one electrode consists of a sphere of mercury deposited on the end of a fine platinum wire and measured by means of a microscope. Quantities of electricity varying from a few hundred electrostatic units to about one coulomb may be measured by it. The almost instantaneous change of size of the drop when a capacity of one-tenth of a microfarad, charged to one volt, is discharged through the instrument is easily observed. A magnet inserted in or removed from a coil connected to the terminals of the voltameter produces an easily measured effect. Experiments were also mentioned which suggest the possibility of its application in measurements of much smaller electrical quantities.—R. **Whiddington**: The self-oscillations of a thermionic valve. It has been found possible to produce oscillations of almost any frequency from a three-electrode vacuum valve without employing the usual capacity induction circuits. Thus a valve with two suitable batteries, one in the anode circuit, the other in the grid circuit, will produce quite powerful oscillations, the frequency of which will be determined by the value of the grid potential. The phenomenon can be explained by supposing that the oscillations are due to surges of mercury ions closing in on the filament from the grid with a frequency given by the approximate formula

$$n^2 = \frac{2e}{md^2} \cdot V,$$

where e/m is the usual charge to mass ratio, d is the radial distance filament to grid, and V is the positive-grid voltage. Experiments conducted so far indicate that the monatomic Hg ion with one live charge is mainly responsible.

DUBLIN.

Royal Dublin Society, May 27.—Prof. Carpenter in the chair.—Prof. W. E. **Adeney** and H. G. **Becker**: The determination of the rate of solution of atmospheric nitrogen and oxygen by water. Part ii. This paper gives further results obtained, using the method of experimenting described previously (Scientific Proceedings R.D.S., vol. xv., p. 385, 1918), *i.e.* passing a large cylindrical bubble of air up through a narrow column of de-aerated water repeatedly until saturation is reached, and measuring the loss in pressure after each ascent. An improved form of apparatus is described and used to determine the rates of solution of oxygen and nitrogen as pure gases between 2·5° C. and 35° C., and determinations of solubility within these limits are also given. It is shown that the rate of solution varies in accordance with the equation

$$\frac{dw}{dt} = SAp - f\frac{A}{V}w,$$

the values of f being given for the above limits of temperature between which S is nearly constant. The final results are given in the form

$$w = (100 - w_1)\left[1 - e^{-f\frac{A}{V}t}\right],$$

which gives the amount of gas dissolved (in percentages of saturation) after any time t, the initial gas-content being equal to w_1.

EDINBURGH.

Royal Society, May 5.—Dr. John Horne, president, in the chair.—Prof. C. R. **Marshall**: (1) Some conditions influencing the reaction-velocity of sodium nitrate on blood. Serum and alkalis have a marked retarding, and acids an accelerating, influence on the action of sodium nitrite on blood. The investigation was made with a spectro-photometer, the part of the spectrum observed being λ 571–577. The rapidity of the reaction was affected by the concentration of the blood and of the sodium nitrite. In the case of serum, ferment action played no part. It was found that with minimal concentrations of sodium nitrite an induction period, frequently varying with the specimen of blood used, occurred, which was increased by the addition of serum or sodium hydroxide. The duration of the reactive period was less influenced. The amount of sodium hydroxide necessary to delay the reaction varied with the concentration of sodium nitrite. The reaction occurred in, although it was greatly delayed by, moderately strong alkaline solutions, which seems to show that the action is not due to the formation of nitrous acid. The mode of action of sodium nitrite is promised in a future communication. (2) The mode of action of metal sols. This was an attempt to determine the way in which metal sols acted therapeutically by investigating the action of an electrolyte-free silver colloidal solution on bacteria. The action could not be explained by Brownian movement, surface phenomena, electric charge, catalytic power, or the concentration of ions in the dispersal medium. It appeared to be associated with the amicrons which, it is suggested, are taken up by the bacilli and probably converted into a soluble product.—Prof. W. H. **Metzler**: Factors of circulants.—Capt. T. Bedford **Franklin**: The cooling of the soil at night. This is a preliminary account of the observations made during the past winter in an endeavour to forecast the occurrence and severity of frosts. A relation was first established between the rate of radiation of the soil at night and the relative humidity of the air. The observations then showed the connection between the loss of heat in the surface of the soil by radiation and the gain of heat in the surface by conduction from the lower and warmer underground layers, together with the latent heat liberated when the surface freezes. It is hoped that in the near future it may be possible, early in the afternoon, to forecast the probability and severity of a frost on the coming night by means of readings of the relative humidity and of the underground temperatures and conductivity of the soil with a set of electrical resistance thermometers.—J. **Marshall**: An analysis of an electron-transference hypothesis of chemical valency and combination. In this paper an analysis is made of the electron-transference hypothesis of chemical combination put forward by Kelvin in 1902 and by Sir J. J. Thomson in 1904. The methods employed and the assumptions made are similar to those formulated by H. A. Lorentz in his discussion of the molecular refractive index of mixtures and compounds (*vide* "Theory of Electrons"). Part i. of the paper contains a discussion of the value of the atomic refractive index in the case of atoms from which electrons have been transferred, ignoring the contribution to this value arising from fields of electrical force due to the vicinity of other atoms or groups of atoms. In part ii. the author endeavours to obtain a formula for the molecular refractive index which will allow for the contribution due to the electrical action between the atoms of the molecule. It

is found that the assumption which best agrees with experimental evidence is that the external action of the atom which is electro-positive is equivalent to a doublet and a positive charge both situated within the atom.—Prof. W. **Peddie**: The thermo-dynamics of unstable states. It was pointed out that, although the usual thermo-dynamical definition of absolute temperature applies in all practical cases, the second definition, recently indicated by Sir Joseph Larmor as formally satisfying Carnot's conditions, has an interesting theoretical application in the case of unstable states of the working substance.

PARIS.

Academy of Sciences, May 19.—M. Léon Guignard in the chair.—G. **Humbert**: The measure of classes of ternary positive quadratic forms of given determinant.—A. **Gautier**: The influence of fluorides on vegetation. Preliminary trials in garden-pots. Of twelve species cultivated under similar conditions, with and without addition of fluorides, seven showed increased growth in presence of fluorides, three were indifferent, and three gave lower yields.—C. **Guichard**: A mode of generation of isothermal surfaces with plane lines of curvature in a system.—M. **Tilho**: A scientific expedition of the Institute of France in Central Africa (Tibesti, Borku, Ennedi).—M. Edouard Goursat was elected a member of the section of geometry in succession to M. Emile Picard, elected permanent secretary.—G. **Julia**: Integral or meromorphic functions.—E. **Kogbetliantz**: The developments of Jacobi.—H. **Muraour**: The determination of temperatures reached in explosive reactions. Both the methods in use presuppose that the composition of the gases at the moment of explosion is known. The temperature determined varies according as the methane is assumed to exist at the moment of explosion or to be formed during the cooling. Experiments with a modified bomb are described, and these prove that the greater part, if not the whole, of the methane is formed during the cooling period.—M. H. **Robert**: A new laboratory form of fractionating column and the measurement of its efficiency. The lower part of the column, a diagram of which is given, is vacuum-jacketed, whilst a similar upper column is cooled externally by a controlled air-current; the thermometer is surrounded by a vapour-jacket. Examples of the remarkable efficiency of the column are given. Pure hexahydrotoluene was isolated from Borneo petrol; pentane, hexane, and heptane from American petrol; acetic anhydride from its mixture with acetic acid.—G. **Claude**: An important consequence of the commercial synthesis of ammonia. Ammonium chloride has been proved by Georges Ville to be capable of replacing ammonium sulphate as a manure, and carries a higher percentage of ammonia. If in the ammonia-soda process the sodium bicarbonate and ammonium chloride are collected separately, the latter is available as manure, the chlorine of the salt is utilised, and the consumption of sulphuric acid avoided.—P. **Lesage**: The stabilisation of characters in plants grown in presence of salt.—H. **Coupin**: The place where water is absorbed by the root. From experiments detailed the conclusion is drawn that the root absorbs water exclusively through its tip, and not through the root-hairs.—M. **Dallori**: The Coal Measures on the coast of the province of Oran.—J. **Lévine**: Two hundred and twenty years of (meteorological) observations in Paris.—G. **Lusk**: The comparative calorimetry of the ingestion of meat, lactic acid, and alanine in the animal.—A. L. **Herrera**: The pseudo-organisms of calcium fluosilicates.—E. **Bourquelot** and M. **Bridel**: The biochemical synthesis of cellobiose with the aid of emulsin.—E. **Kohn-Abrest**: Apparatus for the rapid analysis of confined air and unhealthy atmospheres.

CAPE TOWN.

Royal Society of South Africa, April 16.—Dr. J. D. F. Gilchrist, president, in the chair.—J. R. **Sutton**: Some controversial notes on the diamond. The author discusses the spontaneous breaking of diamonds and reaffirms his previous conclusions on the subject. It is claimed that there is no fundamental difference of process between the spontaneous breaking of a pure colourless crystal containing an inclusion of foreign mineral and that of opaque or clouded diamond. The probable derivation of distorted diamonds (pseudo-cleavage) from groups and clusters is also considered. The hardness of the diamond is generally overestimated.

CALCUTTA.

Asiatic Society of Bengal, May 7.—N. **Annandale** and H. G. **Carter**: Notes on the vegetation of Seistan. The paper is based primarily on a collection of plants made, mainly in desert country and in the Hamun-i-Helmand or lake basin of Seistan, in November and December, 1918. A list of these plants is given and an attempt made to estimate the more conspicuous characters of the vegetation of several different types of environment, viz. the stony desert, the alluvial plain, the banks of streams of saline water, and the Hamun. Among the more interesting points brought out are the correlation between conspicuous colours and poisonous qualities in the plants of the desert, the different effects of soluble salts on the growth of different grasses, and the production of stiff, bayonet-like leaves in the same group in halophytic conditions.

BOOKS RECEIVED.

Mathematical Papers for Admission into the Royal Military Academy and the Royal Military College and Papers in Elementary Engineering for Naval Cadetships for the years 1909–18. Edited by R. M. Milne. (London: Macmillan and Co., Ltd., 1919.) 7*s*.

The Principles of Electric-Wave Telegraphy and Telephony. By Prof. J. A. Fleming. Fourth edition, revised. Pp. xvi+707+plates vii. (London: Longmans, Green, and Co., 1919.) 42*s*. net.

Mammalian Physiology: A Course of Practical Exercises. By Prof. C. S. Sherrington. Pp. xi+156+plates ix. (Oxford: At the Clarendon Press, 1919.) 12*s*. 6*d*. net.

Soils and Manures in New Zealand. By L. J. Wild. Pp. 134. (Auckland and London: Whitcombe and Tombs, Ltd., 1919.) 2*s*. 6*d*.

The America of To-day: Being Lectures Delivered at the Local Lectures Summer Meeting of the University of Cambridge, 1918. Edited by Dr. G. Lapsley. Pp. xxv+254. (Cambridge: At the University Press, 1919.) 12*s*. net.

The Evolution of the Dragon. By Prof. G. Elliot Smith. Pp. xx+234. (Manchester: At the University Press; London: Longmans, Green, and Co., 1919.) 10*s*. 6*d*. net.

The Chemists' Year-Book, 1918–19. Edited by F. W. Atack, assisted by L. Whinyates. Vol. i., pp. vi+422; vol. ii., pp. iv+423–1146. (London and Manchester: Sherratt and Hughes, 1919.) 15*s*. net two vols.

Studies in the Construction of Dams: Earthen and Masonry. Arranged on the Principle of Question and Answer for Engineering Students and Others. By Prof. E. R. Matthews. Pp. v+43. (London: Charles Griffin and Co., Ltd., 1919.) 4*s*. 6*d*. net.

National and International Right and Wrong: Two Essays. By Henry Sidgwick. With a preface by the Right Hon. Viscount Bryce. (Reprinted from

the author's "Practical Ethics.") Pp. 77. (London: G. Allen and Unwin, Ltd., 1919.) 1s. 6d. net.

La Sélection Humaine. By Prof. C. Richet. (Bibliothèque Scientifique Internationale.) Pp. iii+262. (Paris: Librairie Félix Alcan, 1919.) 6.60 francs.

Atlante di Geografia Fisica, Politica ed Economica. By Prof. A. Mori. Fasc. 1, maps 18. (Torino, etc.: Ditta G. B. Paravia E.C., n.d.)

Birdland's Little People: Twelve Nature Studies for Children. By Capt. O. G. Pike. Pp. 123. (London: The Religious Tract Society, 1919.) 4s. 6d. net.

Barbed-Wire Disease: A Psychological Study of the Prisoner of War. By Dr. A. L. Vischer. Translated from the German. Pp. 84. (London: John Bale, Sons, and Danielsson, Ltd., 1919.) 3s. 6d. net.

Practical Physiological Chemistry. By S. W. Cole. With an introduction by Prof. F. G. Hopkins. Fifth edition. Pp. xvi+401. (Cambridge: W. Heffer and Sons, Ltd.; London: Simpkin, Marshall, Ltd., 1919.) 15s. net.

Problems of National Education. By Twelve Scottish Educationists. Edited by John Clarke. Pp. xxvi+368. (London: Macmillan and Co., Ltd., 1919.) 12s. net.

British Ferns and How to Identify Them. By J. H. Crabtree. Pp. 64. (London: The Epworth Press: J. Alfred Sharpe, n.d.) 1s. 6d. net.

Commercial Forestry in Britain: Its Decline and Revival. By E. P. Stebbing. Pp. vi+186. (London: John Murray, 1919.) 6s. net.

A Gentle Cynic: Being a Translation of the Book of Koheleth, commonly known as Ecclesiastes, stripped of Later Additions; also its Origin, Growth, and Interpretation. By Prof. M. Jastrow, jun. Pp. 255. (Philadelphia and London: J. B. Lippincott Co., 1919.) 9s. net.

Air Navigation: Notes and Examples. By Instructor-Capt. S. F. Card. Pp. vi+140. (London: Edward Arnold, 1919.) 10s. 6d. net.

The Voyage of a Vice-Chancellor. Pp. ix+139. (Cambridge: At the University Press, 1919.) 6s. net.

Influenza: A Discussion Opened by Sir Arthur Newsholme. Pp. 102. (London: Longmans, Green, and Co., n.d.) 3s. 6d. net.

Leeds University. Fourteenth Report, 1917–18. Pp. 111. (Leeds: Jowett and Sowry, Ltd., n.d.)

The Annual of the British School at Athens. No. xxii. Sessions 1916–17, 1917–18. Pp. vii+272+plates xi. (London: Macmillan and Co., Ltd., n.d.) 25s. net.

DIARY OF SOCIETIES.

THURSDAY, JUNE 12.

MATHEMATICAL SOCIETY, at 5.—Prof. G. A. Miller: Groups Involving Three and only Three Operators which are Square.—L. J. Mordell: Some Series whose *n*th Term Involves the Number of Classes of Binary Quadratics of Determinant $-w$.—Dr. W. P. Milne and Dr. D. G. Taylor: The Significance of Apolar Triangles in Elliptic Function Theory.—C. V. H. Rao: The General Theory of Ruled Surfaces.

OPTICAL SOCIETY, at 7.30.—S. D. Chalmers: The Recognition of Detail.

FRIDAY, JUNE 13.

PHYSICAL SOCIETY, at 5.—B. Van der Pol, jun.: A Comparison of the Wave-form of the Telephone Current produced by a Thermal Detector and a Rectifier in the Heterodyne Reception.—E. Wilson and E. F. Herroun: The Magnetic Properties of Varieties of Magnetite.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Rev. J. G. Hagen: The Light Curves of Long-period Variables.—Miss E. Bellamy: A Curious Instance of Opposite Proper Motions.—H. S. Jones: Results obtained from Seven Years' Observations made with the Cookson Floating Zenith Telescope at the Royal Observatory, Greenwich.—J. H. Reynolds: The Distribution of Hydrogen and Nebulium in the Orion Nebula.—Rev. A. L. Cortie: The Spectrum of Nova Aquilæ, 1918, August 23 to October 23.—*Probable Paper:* W. Moss: The Eruptive Prominence of 1919, May 29—communicated by the Director of the Solar Physics Observatory, Cambridge.

MALACOLOGICAL SOCIETY, at 6.—G. C. Crick: *Ammonites navicula* (Mantell).—R. Bullen Newton: A Sandstone Cast of *Aturia aturi* (Basterot) from the Miocene of Western Australia.—A. S. Kennard and B. B. Woodward: The Generic Names for the Two British *Ellobiidae* [olim *Auriculidae*] *myosotis*, Draparnaud (=*denticulata*, Montagu) and *bidentata*, Montagu.—G. Despott: The Mollusca of Marsascirocco Harbour, Malta.—Tom Iredale: Notes on Polyplacophora. Part II.

MONDAY, JUNE 16.

VICTORIA INSTITUTE, at 4.30.—The Right Hon. the Earl of Halsbury, President: Annual Address.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.

TUESDAY, JUNE 17.

BRITISH ASSOCIATION GEOPHYSICAL DISCUSSIONS (Royal Astronomical Society), at 5.—Dr. C. T. R. Wilson and J. H. Jeans: Atmospheric Electricity.

ROYAL STATISTICAL SOCIETY, at 5.15.—Mrs. Walter J. Barton: The Course of Women's Wages.

ZOOLOGICAL SOCIETY, at 5.30.—E. Heron-Allen and A. Earland: Exhibition of Lantern-slides Illustrating the Cultivation of *Verneuilina polystropha*, Reuss., in Hypertonic Sea-water and Gem-sand.—C. Morley: Equatorial and other Species and Genera of African Ichneumonidæ.—Dr. C. W. Andrews: A Description of New Species of Zeuglodons and Leathery Turtle from the Eocene of Southern Nigeria.—G. A. Boulenger: (1) A List of the Snakes of West Africa from Mauritania to the French Congo. (2) A List of the Snakes of North Africa.

MINERALOGICAL SOCIETY, at 5.30.—A. Brammall: Andalusite (Chiastolite): Its Genesis, Morphology, and Inclusions.—R. H. Rastall: The Mineral Composition of Oolitic Ironstones.—L. J. Spencer: Eighth List of Mineral Names.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—J. Reid Moir: Flint Implements from the "Middle" Glacial Gravel at Ipswich.

WEDNESDAY, JUNE 18.

ROYAL METEOROLOGICAL SOCIETY, at 5.—Col. Sir Charles Close: Note on the Rainfall at Southampton and London during a period of 57 years (1862–1918), with Special Reference to the Monthly Means.—Lieut. J. Logie: Note on Tornadoes.—Capt. D. Brunt: A Periodogram Analysis of the Greenwich Temperature Records.—Lieut. G. Green: The Propagation of Sound in the Atmosphere.

THURSDAY, JUNE 19.

INSTITUTION OF MINING ENGINEERS, at 11.—Lt.-Col. D. Dale Logan: (*a*) The Difficulties and Dangers of Mine-rescue Work on the Western Front, and Mining Operations carried out by Men wearing Rescue-apparatus; (*b*) Accidents due to Structural Defects of Apparatus or Injury to Apparatus, and the Future of the Proto Apparatus.—M. W. Blyth and L. T. O'Shea: The Examination of Coal in Relation to Coal-washing.—Prof. F. W. Hardwick: Reply to the Discussion on his Paper on the Training of Students in Coal-mining, with Special Reference to the Scheme of the Engineering Training Organisation.—W. Maurice: The Education of Colliery Managers for Administrative and Social Responsibilities.

ROYAL SOCIETY, at 4.30.—Bakerian Lecture. Hon. R. J. Strutt: Phosphorescence and Fluorescence in Metallic Vapours.

INSTITUTION OF MINING AND METALLURGY, at 5.30.—W. H. Goodchild: The Genesis of Igneous Ore Deposits.

CHEMICAL SOCIETY, at 8.

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