THURSDAY, JULY 31, 1919.

## APPLIED CHEMISTRY.

(1) *Boiler Chemistry and Feed-Water Supplies.* By J. H. Paul. Pp. ix+242. (London: Longmans, Green, and Co., 1919.) Price 14*s.* net.

(2) *Reports of the Progress of Applied Chemistry.* Issued by the Society of Chemical Industry. Vol. iii. Pp. 495. (London: Society of Chemical Industry, 1918.) Price 10*s.* 6*d.*

(3) *Trinitrotoluenes and Mono- and Dinitrotoluenes: their Manufacture and Properties.* By G. Carlton Smith. Pp. vii+133. (London: Constable and Co., Ltd., 1918.) Price 8*s.* 6*d.* net.

(1) MR. J. H. PAUL is a well-known authority on the chemical principles involved in the management and control of steam-boilers, especially in regard to the nature and selection of their feed-waters and of their treatment in the prevention of boiler-scale and corrosion.

In the book before us, which has been written mainly for the use of engineers and practical men possessing, presumably, a limited knowledge of chemistry and of chemical terminology, the author has sought to explain, in non-technical language, the character of the reactions which occur in natural waters containing a variety of soluble saline substances, when heated for the purpose of steam-raising at the relatively high temperatures and pressures of modern boiler practice. The nature of the changes which may occur under these conditions is probably more complex than is usually assumed, and certain of them are possibly complicated by the circumstance that they are of the character of reversible reactions, and subject to the laws of mass action and to the variable influence of temperature and concentration.

In some seventeen chapters the author describes the various forms of natural water, with special reference to their suitability for steam-raising; the nature of their saline constituents; the composition of the various scales and boiler deposits; modes of softening water; the character and influence of the permanently soluble salts; the action of carbonic acid; its behaviour towards iron; the general question of boiler corrosion, its causes and prevention; good and bad boiler practice, etc. The book is largely based upon personal experience, and contains the results of numerous original analyses of water-supplies of all kinds and from all parts of the world, and of various deposits, internal and external. It can be recommended as a trustworthy guide to those concerned in boiler work. It will be gathered that it deals more with practice than with theory, and it must be stated that the rational explanation of certain of the phenomena given by the author is open to question; indeed, it is admitted that the section of the work dealing with the action of carbonic acid on iron is largely speculative, and may have to be modified when more is known on the subject. In spite of his avoidance, as a rule, of technical language, the author is constrained at times to express reactions by means of chemical equations, of some of which the validity cannot be considered as established, and it somewhat savours of dogmatism to neglect the evidence of other observers. "It has been felt that the principle of giving authorities is a subterfuge for passing on to others a responsibility an author has not the courage to assume on his own account." This is surely a very unscientific attitude of mind. There should be here no question of subterfuge or of courage or the lack of it. He who wishes to gain, as fully as possible, a knowledge of the facts desires to have an independent corroboration of them, and for Mr. Paul to arrogate to himself an *ex cathedra* position as the sole authority detracts from, rather than enhances, the weight of his testimony. As a searcher for the truth it is incumbent on him to cite whatever evidence bears upon it.

(2) Vol. iii. of the annual reports issued by the Society of Chemical Industry deals with the progress of applied chemistry made during 1918. As in the case of the two previous reports, it is mainly based upon material published by the society in its fortnightly journal issued during that year. Its plan is practically identical with that of its predecessors, and many of its contributors are the same as in previous cases. Two important sections are added, viz. agricultural chemistry and foods. On the other hand, three are omitted, viz. ceramics, building materials, and fermentation industries, as the compilers of these sections failed to send in their copy in time to be included in the present volume. Considering the range of material to be dealt with, and the number of contributors engaged, *lâches* of this kind are probably unavoidable, but they detract, of course, from the value of the report as a comprehensive and complete summary of the particular year's work, and necessitate, as in the present case of the added sections on foods and agricultural chemistry, the compression of the work of several years in a single report. There is, to this extent, a certain lack of uniformity in treatment and an absence of continuity which are to be regretted, but for which the editor and the publication committee are scarcely to be held responsible.

In the present volume the various departments of applied chemistry treated of are grouped under twenty-two sections. It is obviously impossible, in the limited space at our disposal, to deal with them all in detail, and we propose to select those for the purpose of comment which are of general interest or of particular importance at the present time of "reconstruction."

The value of these annual reports is greatly increased when particular sections are handled in successive years by the same author, provided that he is competent and has the necessary critical skill; and the excellence of his summary is augmented if he prefaces it by a general statement of the more striking marks of progress which

have characterised the year's work. Such a statement is probably best put together after the detailed account of the year's literature has been compiled, and when, as it were, the material has been brought to focus. The greater number of the contributors, especially those who have been engaged on previous reports, actually make these general surveys, but the practice is not uniform, and the surveys are neither of the same interest nor show the same grasp and critical skill. This perhaps is to be expected. Progress in some departments of applied chemistry is very slow, especially in minor industries, and such developments as do occur are often not particularly striking.

Of the new contributors, Dr. Dunn, of Newcastle-upon-Tyne, contributes an admirable *résumé* on "Fuel," in which he deals with a wider range of literature than is noted in the society's journal; Mr. Alwyne Meade, of the Commercial Gas Co., Wapping, treats of "Gas-destructive Distillation-Tar Products" in a well-arranged and succinct digest of some twenty pages; while Mr. Arnold Philip, the Admiralty chemist at Portsmouth, occupies about the same space with an excellent *résumé* of the present position of the mineral oil industry, with special reference to its applications as fuel. Although the matter is not, strictly speaking, relevant to the title of this particular section, Mr. Philip is naturally led to discuss the question of the possible substitution of alcohol, wholly or in part, for petrol as a motor-fuel—a question which is again being actively ventilated owing in great measure to the present high price of petrol. The author is evidently not very sanguine that alcohol is likely to play any considerable part as a motor-spirit unless some form of co-operation on the part of motor users, or some form of control by the State, as in Germany, checks the destructive competition between the producers of alcohol and of petrol which will inevitably set in. As matters stand at present the great petroleum corporations can at any time afford to undersell alcohol, and can undoubtedly ruin any undertaking engaged in the manufacture of industrial alcohol for motor-fuel. The question has engaged the attention of a Departmental Committee, and a report upon it has recently been issued. The whole matter is beset with administrative difficulties, and will presumably need legislative action, if any practical effect is to follow from the Committee's report.

Other new contributors are Capt. Nash, of the Chemical Warfare Department, on "Paints, Pigments, Varnishes, and Resins"; Dr. Twiss, of the Dunlop Rubber Co., on "Indiarubber"; Mr. F. C. Thompson, of the Leather Industries Department of the University of Leeds, on "Leather and Glue"; Dr. E. J. Russell, of the Rothamsted Experimental Station, on "Agricultural Chemistry"; Mr. I. P. Ogilvie, the technical editor of the *International Sugar Journal*, on "Sugars, Starches, and Gums"; Dr. Bywaters, lecturer on general metabolism at the Bristol University, on "Foods"; Dr. Ardern, the chief chemist of the Manchester Corporation's Rivers Department, on "Water Purification and Sanitation"; and Prof. Barger on "Fine Chemicals, Medicinal Substances, and Essential Oils." It will be seen that in all cases the editor has been fortunate in securing the co-operation of recognised authorities in the particular sections entrusted to them.

The remaining sections have been undertaken by previous contributors. Prof. Morgan continues his admirable series of reports on "Colouring Matters and Dyes"; Mr. Briggs deals with "Fibres, Textiles, Cellulose, and Paper"; Mr. Higgins with "Bleaching, Dyeing, Printing, and Finishing"; Dr. Auden with "Acids, Alkalis, Salts, etc."; Mr. Rees with "Glass and Refractories"; Mr. Bannister with "The Metallurgy of Iron and Steel"; Mr. Patchin with the "Non-ferrous Metals"; Mr. Hale with "Electrochemistry"; and Messrs. Revis and Bolton with "Fats, Oils, and Waxes."

There is much in this excellent series of digests of general interest, and had space permitted we should have been tempted to direct attention to many points of novelty and importance. Certain of the sections overlap to a slight extent, and, as might be anticipated when we are dealing with matters at the very frontiers of progress, authorities occasionally differ, as, for example, concerning the importance or otherwise of the presence of vitamines in certain articles of food, as in margarine. But these reports are, or should be, generally accessible to all who are concerned with the multifarious applications of chemical knowledge, and the price at which they are issued brings them within the reach of all who are interested in the progress of applied chemistry.

(3) Mr. Carlton Smith's little monograph on the nitrotoluenes is, like its subject, a product of the war. Its author is on the staff of the School of Applied Science of the Pittsburgh Carnegie Institute of Technology. The book is mainly concerned with the history, modes of manufacture, and properties of the trinitrotoluenes, and particularly of T.N.T., which, under the various names of trolyl, tolite, trilite, trinol, tritolo, etc., is now largely used as an explosive in war by practically all nations in substitution for picric acid. During the late war the demand for it was enormous, and large quantities of it were made by American manufacturers on account of the high price it commanded. Mr. Smith's book is mainly concerned with the methods of production as carried on in the United States. It is presumably written for the information of the manufacturer; as a scientific treatise it has few merits; the explanation of the theory of nitration is confused and misleading, and the historical account is incomplete. Literary composition is evidently not the author's strong point, and his orthography and punctuation are occasionally erratic. For Walters (p. 6) read Walter; for Hoffman (p. 7) read Hofmann; for Rosenstill (p. 12) read Rosenstiehl; for Lampricht (p. 16) read Limpricht; for Nolting and Witte (p. 16) read Noelting and Witt; for Astro-

misslewsky read Ostromisslensky. "Roberite" (p. 108) is usually written "roburite"—at least on this side of the Atlantic; and "Anallen" in the list of references should be "Annalen." These are blemishes which should not occur in a book written by an instructor in general chemistry in so important a school as the Carnegie Institute of Technology.

## THE PRINCIPLES OF RADIO-COMMUNICATION.

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

IT is no easy task to keep a large treatise on electric wave telegraphy and telephony abreast of the advances that have been made during the last few years. In this fourth edition the author has been very successful. He does not load up the book with descriptions of all kinds of technical apparatus, or attempt to describe all the methods used in practice. There is now quite a small library of highly technical works which give the required detailed information to the engineer, and to these Prof. Fleming refers the reader. What he does give is a comprehensive view of the subject, particularly on its scientific side. He also dwells fully on quantitative measurements and their theory, which he himself has done so much to develop.

In part i. a discussion is given of electrical oscillations. The mathematical proofs given are rigorous and straightforward, and will be appreciated even by those who are beginning to forget their knowledge of the calculus. The mathematical formulæ for the high-frequency resistance and inductance of circuits are given, and the author's successful experimental methods of testing these formulæ described. When the wires are curved, the mathematical difficulties in the way of computation are so great that engineers will welcome the experimental verification of the formulæ.

The tables given of spark-voltages between spherical electrodes are somewhat antiquated. The reviewer had occasion recently to analyse the experimental results on spark voltages published in the standardisation rules of the American Institute of Electrical Engineers (1918). The Institute used spheres varying in diameter from 3.125 cm. up to 50 cm., and the spark voltages go up as high as 400 kv. The results plainly show that when the voltages of the electrodes are equal and opposite at the instant of discharge, the maximum electric stress, R, at this instant, the temperature being 25° C. and the pressure 76 cm., is given by

$$R = 27{\cdot}4 + 14{\cdot}1/\sqrt{a}$$

kilovolts per centimetre, where $a$ is the radius of either spherical electrode in centimetres. It was of interest, therefore, to see whether the results (p. 188) obtained by Heydweiller in 1893 on spheres of 0·5, 1, 2, and 5 cm. were in agreement with this formula. We find that when we correct for temperature and pressure they are in most excellent agreement. It follows, therefore, that if V be the spark voltage when the distance between the electrodes is $x$, we have

$$V = (R/f)x,$$

where $f$ is a mathematical factor depending on $x$ and $a$, a table of the values of which is given on p. 145 of this book. This is at least true for spheres varying in diameter from 0·5 up to 50 cm., values of $x$ less than about a millimetre being excluded. Various theories have been given to explain why R should be the sum of two terms as shown above, but in the reviewer's opinion those theories which neglect the effects of the convection currents of air flowing round the electrode prior to the discharge are wrong.

In part ii. electric waves are discussed, and a very complete account is given of methods of measuring and detecting them. The remainder of the book is devoted to radio-communication. It begins with a short history of the subject. Then various long-distance telegraphic stations are described, the salient points of the systems of working being pointed out. The theory of transmission is given. Full descriptions are given of several of the latest developments of the art, such, for instance, as the Marconi military set for wireless apparatus, and the Marconi sets used in aircraft.

The final chapter treats of radio-telephony, and is perhaps the most interesting in the book. It is extraordinary what rapid progress is being made in this branch of the subject, and how different are the methods employed by the various experimenters. Marvellous results have been obtained by the Fleming oscillation valve. The almost incredible sensitivity attained in receiving apparatus by the use of thermionic amplifiers warrants the most sanguine hopes for the future of radio-telephony.

We ought to mention that, although additions have been made to the book to bring it up to date, yet by the deletion of antiquated matter and the use of smaller type the total bulk of the volume has been reduced. This is an advantage, as the earlier editions were beginning to get unwieldy. We can recommend this book to everyone interested in radio-telegraphy. To the scientific radio-telegraphist it is a necessity.

A. RUSSELL.

## GEOGRAPHICAL ASPECTS OF WORLD POLITICS.

*Democratic Ideals and Reality. A Study in the Politics of Reconstruction.* By H. J. Mackinder. Pp. 272. (London: Constable and Co., Ltd., 1919.) Price 7*s.* 6*d.* net.

THERE is no lack of ideas in this book. From beginning to end it is full of striking conceptions which arrest attention even if some of

them fail to meet with acceptance. Mr. Mackinder has exercised to the full his ability to see the broad issues of history in terms of geographical influences, and he has produced a fresh and stimulating commentary on the world politics of to-day. Seeking fundamental generalisations, he sees a world-island comprising Europe, Asia, and Africa, and a heartland covering all continental as opposed to coastal Asia and European Russia. As the world-island is the base of sea power, so the heartland is the home of land power. In the antagonism between the two—that is, between German and Slav—Mr. Mackinder sees one of the fundamental causes of the war. There was no immediate quarrel, he contends, between East Europe and West Europe. Germany's object was to gain control of the heartland, and if she had thrown her main strength against Russia and stood on the defensive towards France, this aim, he thinks, might have been achieved before the peoples of the West realised its strategical danger.

The issue between German and Slav is still unsettled, and the danger of German control of the heartland still remains. To obviate this danger a balance must be held between German and Slav in East Europe. Certainly there is no indication that German psychology has undergone any change by the defeat of Germany in the West, and it might well be argued that the Allies' victory marks merely a respite in the world-war. Severe as are the terms imposed on Germany, her economic resources will eventually lead to her complete recovery, and her old ambitions may be reborn. Mr. Mackinder's solution of the problem is to break up Eastern Europe into self-governing States, so that there is a tier of independent States between Russia and Germany. Poles, Bohemians, Hungarians, Southern Slavs, Rumanians, Bulgars, and Greeks are each, he believes, people with the capacity for a strong independent national existence and capable of self-government. That is possible, but at the same time it is equally possible that such buffer-States, if weak, might become bones of contention and eventually lead to war on a large scale. It should be added that the volume was written last winter, and so is in no sense a criticism of the Peace Treaty.

## OUR BOOKSHELF.

*The Annual of the British School at Athens.* No. xxii. Sessions 1916–1917, 1917–1918. Pp. vii+272+xi plates. (London: Macmillan and Co., Ltd., n.d.) Price 25*s.* net.

THE most interesting paper in this valuable review is that by Mr. E. Norman Gardiner on "The Alleged Kingship of the Olympian Victor." Two theories have been suggested to explain the origin of the Olympian games: one, that they were derived from funeral games held in honour of Pelops; the other, that they represent a ritual contest for the throne. As regards the first, the writer points out that the evidence in its favour is not to be found in any theory of the origin of funeral games in general, but in the fact that such games are of very early date, earlier than Homer, and reaching back to Achæan or Dorian times. The real objection to the funeral theory is that it does not explain any of the peculiar features of the Olympic festival, and that the evidence for it is inadequate.

The second theory depends on the supposition that the victor received honours regal and divine, such as riding in the chariot of the sun-god, being crowned with an olive wreath, like Zeus, and being pelted with fruit and flowers, like a tree spirit; and that hymns were sung and statues erected in his honour. Mr. Gardiner shows that these marks of honour will not bear the suggested explanation. "Students of religion are," he says, "apt to exaggerate the importance of the religious motive to the neglect of equally important secular motives." Athletic sports are already fully developed in Homer, the natural recreations of a race the business of which was fighting. In historical Greece they are naturally associated with festivals, held in times of holiday and peace, when the people met in friendly union.

Another important paper is that by Mr. F. W. Hasluck on "The Mosques of the Arabs in Constantinople," in which it is shown that the two so-called "Arab" mosques do not go back to the early date attributed to them, and that the Arab saint is often the successor of the Arab or negro Djinn well known in the folklore of the Nearer East.

*An Introduction to the Study of Science: A First Course in Science for High Schools.* By Wayne P. Smith and Edmund Gale Jewett. Pp. xi+620. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1918.) Price 7*s.* 6*d.* net.

IN the presentation of their subject the authors have followed "the psychological rather than the traditional logical or dogmatic method"—as the preface puts it. The principles of science have to be looked for in the text or verified in the laboratory by the young student for whom the book is written. There is little doubt that when they are discovered they will make a far stronger appeal to his intelligence and his memory than if they were thrust upon his unwilling attention in the traditional manner.

The bearing of science upon human life and activities is kept constantly in view. The first chapter is about weather, the last, about the protection of health; and a quarter of the book is devoted to biological problems. The purist in science may find points at which to cavil, but the authors have run the risk of that, and are to be congratulated on writing a book which is within the scope of those for whom it is intended and can be read with profit and pleasure by the young.

Most of the illustrations are taken from the United States, for the book is intended primarily for students in the schools of that country. Another disadvantage, for English boys and girls,

is that the spelling is American. "Sulfur dioxid" looks strange in print. But teachers on this side of the Atlantic have much to learn from America in the way of presenting science informally, and they may be willing to overlook these minor points.

*Manual of Vegetable-garden Insects.* By Cyrus Richard Crosby and Mortimer Demarest Leonard. Pp. xv+391. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1918.) Price 12*s.* 6*d.* net.

IN this "Rural Manual" the authors give clear and concise accounts of the insects which, in North America, may be regarded as pests on vegetables grown in gardens. Each chapter is, as a rule, assigned to a particular species or group of vegetables, but "cutworms" (Noctuid caterpillars), blister-beetles, and flea-beetles are treated respectively in three special chapters, while another chapter is devoted to "unclassified pests." Most of the insects described are distinctively American species, but some—such as the cabbage-fly (*Phorbia brassicae*)—are common in British and European gardens. It is interesting to notice that in several cases an American insect attacks a cultivated plant in a manner like that adopted by an allied insect in Europe with the same plant; for example, the caterpillars of *Hydroecia* (*Papaipema*) *nitela* and *H. cataphracta* bore potato-stems, as those of *H. micacea* and *H. ochracea* do in these countries, while the damage by the American potato flea-beetle (*Epitrix cucumeris*) to foliage is closely comparable with that of our *Psylliodes affinis*.

The authors give a useful concluding chapter on the structure of insects, with special reference to their modes of feeding, this subject naturally leading to a consideration of insecticides. The book is illustrated with a number of well-drawn figures supplemented by photographs somewhat unequal in execution. G. H. C.

*Fauna Brasiliense. Peixes.* Archivos do Museu nacional do Rio de Janeiro, vol. xvii. (Rio de Janeiro: Papelaria Macedo, 1915.)

THE bulky volume under notice contains a monograph, illustrated with excellent photographic plates, of the physoclistous fishes of Brazil by Prof. A. de Miranda Ribeiro, brought out in parts from 1913 to 1915. It is well got up, but the contents will be difficult to quote, as there is no continuous pagination and the numerous plates are not numbered. The classification and nomenclature are in accordance with the views of modern American ichthyologists; it is, however, a matter for regret that no sort of synonymy, not even a reference to the original descriptions of the species, should have been given, as by this omission the value of the monograph is greatly impaired, correlation with standard works of older date being thus rendered extremely difficult.

It is well that attention should be directed to this work, as only a part of it has been quoted in the "Zoological Record," no mention of it, or of the new species therein described, having appeared in the Reports for 1914, 1915, or 1916.

## 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.*]

### Labour and Scientific Research.

ENCLOSED is a copy of a resolution which has just been unanimously adopted by the American Federation of Labour at its Atlantic City convention. I trust that you may consider this of sufficient interest to the readers of NATURE to warrant its publication.

P. G. AGNEW.

Scientific and Technical Branch, Federal Employees' Union, No. 2, National Federation of Federal Employees, Washington, D.C., June 28.

"Whereas scientific research and the technical application of results of research form a fundamental basis upon which the development of our industries, manufacturing, agriculture, mining, and others, must rest; and

"Whereas the productivity of industry is greatly increased by the technical application of the results of scientific research in physics, chemistry, biology, and geology, in engineering and agriculture, and in the related sciences; and the health and well-being not only of the workers, but of the whole population as well, are dependent upon advance in medicine and sanitation; so that the value of scientific advancement to the welfare of the nation is many times greater than the cost of the necessary research; and

"Whereas the increased productivity of industry resulting from scientific research is a most potent factor in the ever-increasing struggle of the workers to raise their standards of living, and the importance of this factor must steadily increase, since there is a limit beyond which the average standard of living of the whole population cannot progress by the usual methods of readjustment, which limit can only be raised by research and the utilisation of the results of research in industry; and

"Whereas there are numerous important and pressing problems of administration and regulation now faced by Federal, State, and local governments, the wise solution of which depends upon scientific and technical research; and

"Whereas the war has brought home to all the nations engaged in it the overwhelming importance of science and technology to national welfare, whether in war or in peace, and not only is private initiative attempting to organise far-reaching research in these fields on a national scale, but in several countries governmental participation and support of such undertakings are already active; therefore be it

"Resolved, by the American Federation of Labour in convention assembled, that a broad programme of scientific and technical research is of major importance to the national welfare, and should be fostered in every way by the Federal Government, and that the activities of the Government itself in such research should be adequately and generously supported in order that the work may be greatly strengthened and extended; and the secretary of the Federation is instructed to transmit copies of this resolution to the President of the United States, to the President *pro tempore* of the Senate, and to the Speaker of the House of Representatives."

### Behaviour of a Cuckoo.

A PAIR of pied wagtails built their nest beneath the crest-tile at the end of the roof of a cowhouse. The entrances to the nest were two, one at the gable end where the mortar was loose, the other on the roof itself beneath the tile. On June 24, at 5.30 p.m. (G.M.T.), a female cuckoo circled round the building, and presently, settling beneath the crest-tile, attempted to effect an entrance through the larger opening. But the opening was too narrow, and the bird could not force its body in beyond the shoulders. It therefore flew away and settled upon an adjoining building, but, returning in less than a minute, made a further attempt and failed again. These efforts were repeated a number of times without success. Two attempts were then made through the smaller opening on the roof, which, of course, also failed, and so the bird returned to the main opening and made still further and more determined efforts to enter, and the impulse to attain its end seemed to be increasing gradually in strength.

At 6 p.m. the bird betrayed symptoms of distress; its bill was often widely opened, and its efforts were more frequent and more prolonged. At 6.10 p.m. a final attempt was made; turning upon its side, it tried to force or scratch its way through the aperture, as a terrier forces its way down a rabbit-hole, but still it could not enter beyond its shoulders. A strange thing then happened. In addition to its muscular efforts there were distinct signs of emotional manifestation; its wings were spread and waved and its tail was outspread, and at the height of this manifestation the egg was protruded through the vent and fell to the ground. All excitement forthwith vanished, and the bird flew away and did not return. The emotional manifestation, similar to that which occurs so frequently in bird-life during sexual emotion, evidently coincided with the violent contractions of the cloacal walls.

There is a deal of evidence to show that the cuckoo sometimes lays its egg upon the ground, and then picks it up in its bill and deposits it in the nest, and sometimes actually lays it in the nest. Here we have a case in which, one would think, the former method would have been employed; yet there was no mistaking the fact that the activities of the bird were dominated by a single impulse, the impulse to enter the nest. Do some cuckoos employ one method and some the other; and is there a relationship, determined by racial preparation, between the mode of behaviour and the type of nest selected? If these questions can be answered in the affirmative, must this particular cuckoo be regarded as a prospective failure in the inevitable struggle for existence? H. ELIOT HOWARD.

Hartlebury, June 26.

### Sparganophilus: A British Oligochæt.

BENHAM created the genus Sparganophilus in 1892, and gave a description of a new worm found at Goring-on-Thames, under the title *S. tamesis*. Since that time other species have been added to the genus, but no one has been able to confirm, extend, or confute Benham's statement that it was "a new English genus of aquatic Oligochæta" (*Q.J. Micr. Sci.*, N.S., 34, 1892–93, p. 155).

Looking over my collections to-day, I have had the good fortune to find some well-preserved specimens of Sparganophilus collected in Cornwall in April, 1910. I noted the worm at the time, and recorded it provisionally as *Helodrilus elongatus*, n.sp. Until now it has been hidden away and forgotten.

The Cornish species differs from that found in the Thames in several ways, and resembles somewhat closely *S. eiseni*, Smith, found in America, and *S. benhami*, Eisen, from Mexico. At present I look upon it as a new species, and propose to retain the trivial name already applied to it, and describe it as *S. elongatus*. It is nearly twice as long as *S. tamesis*, has from 200 to 250 segments, and is destitute of a pygidium. The anus is not dorsal, but agrees in position with that of the earthworm. The girdle also is longer, extending over segments 15–27, but I have only once been able to find any traces of tubercula pubertatis. HILDERIC FRIEND.

"Cathay," Solihull, July 9.

### The Brent Valley Bird Sanctuary.

THE Brent Valley bird sanctuary of the Selborne Society has been carried on for sixteen years, and, apart from the experimental work which has resulted in the sending of nesting-boxes all over the country and to different parts of the world, much pleasure has been given to very numerous visitors of all classes. The committee has, until recently, been able to keep things going on the profits obtained from the sale of nesting-boxes, together with occasional donations.

The war upset all arrangements, and turned the balance in hand in 1914 into one due to the secretary, so that it has been found necessary to make an appeal for direct contributions. These may be sent to me at "The Hermitage," Hanwell, W.7, together with orders for nesting-boxes.

With a greatly increased amount of land under cultivation, and in view of the Government's afforestation scheme, the need for augmenting the number of insect-eating birds is manifest, and the importance of bird sanctuaries greater than ever.

In these circumstances it may not be out of place to express the hope that someone may come forward and put the Brent Valley bird sanctuary upon a permanent basis. WILFRED MARK WEBB,
Chairman.

83 Avenue Chambers, W.C.1.

## THE STRUCTURE OF THE SOLAR ATMOSPHERE.

SOME of the extraordinary revelations of the spectroheliograph, in its application to the structure of the solar atmosphere, may be gathered from the accompanying photographs, which have been courteously placed at our disposal by Prof. G. E. Hale, director of the Solar Observatory at Mount Wilson, California.

As is now well known, the spectroheliograph yields monochromatic images of the sun in light of any desired wave-length, and shows the distribution of the clouds of hydrogen, calcium, or other vapours, which are not apparent in direct observations by the integrated light. Further, by a suitable adjustment of the second, or isolating, slit of the instrument, different portions of the same spectral line may be separately transmitted to the sensitive plate, and the structure of the solar atmosphere at different levels above the photosphere may thus be investigated. In recent years the red line of hydrogen, Hα, has been largely utilised, and the photographs obtained with the central portion of this line are believed to represent the highest levels at present attainable. The work at Mount Wilson has been carried on for several years with a spectroheliograph of 5 ft. focal length, but during the last few years

a new instrument having a focal length of 13 ft. has also been employed.

Fig. 1 is a typical photograph showing the whole of the sun's disc when the second slit is set on the centre of the Hα line. By comparison with Fig. 1*a*, which is an ordinary photograph of the sun taken at the same time, it will be seen that, in addition to the granulation over the general surface, there are both bright and dark "flocculi" in the vicinity of the various spot groups, and numerous dark markings in other parts of the disc. It is now generally agreed that both the bright and dark flocculi represent prominences in projection on the disc, the bright areas corresponding with bright eruptive prominences, and the dark ones representing masses of gas at the highest levels, where the temperature is so reduced as to cause the hydrogen to show its presence by absorption. This view has been strongly supported by the stereoscopic examination of pairs of photographs taken at intervals of about 7 mins., in which absorption markings have appeared as high ridges. The long, dark flocculi, which have been called "filaments" by Deslandres, are therefore now regarded as long ranges of prominences at a high elevation, but it is probably only the denser prominences which reveal themselves in this way.

The wealth of detail in such photographs can only be properly appreciated by suitable magnification of the original negatives, as in the other examples reproduced. Fig. 2 is an interesting case, showing several conspicuous prominences as absorption markings, and the generally disturbed state of the solar atmosphere in the region surrounding a group of sun-spots.

The small flocculi which appear all over the sun's disc have been carefully studied by Prof. Hale, who finds a general correspondence with the granulations of the photosphere which are familiar to all observers of the sun (Proc. Nat. Acad. Sci., Washington, vol. ii., p. 95). The coarse "rice-grains" of the solar disc were resolved by Langley into clusters of minute and intensely bright granules, not more than 0·3″ (about 135 miles) in diameter, and Langley regarded these as the upper extremities of long, thin filaments which exist vertically all over the sun, and are revealed more completely in the

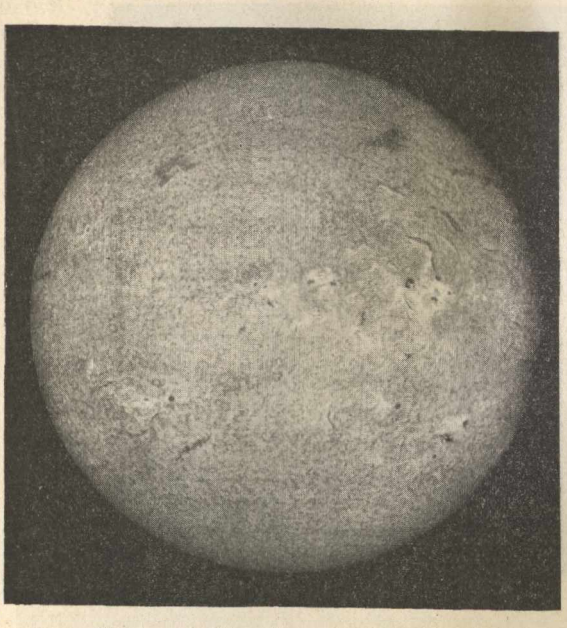

FIG. 1.—Slit on centre of Hα, 5-ft. spectroheliograph, August 12, 1917.

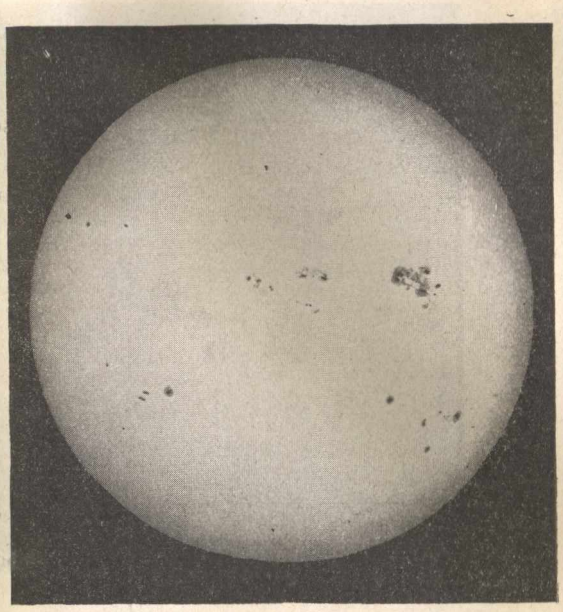

FIG. 1*a*.—Ordinary photograph of the sun, August 12, 1917.

FIG. 2.—Slit on centre of Hα, 13-ft. spectroheliograph, September 9, 1915.

penumbræ of sun-spots, where they are drawn out nearly parallel to the solar surface. It was further supposed by Secchi that these photospheric granules were closely related to the radial filamentary structure of the chromosphere, and this relation is strongly supported by the results obtained for the cross-sections at different levels with the spectroheliograph. Photographs in low-level calcium ($H_1$ or $K_1$) correspond with a level somewhat below that observed visually at the sun's limb, and here the granules are relatively small. At the higher level represented by the $H_2$ and $K_2$ lines, the structure is generally similar to that of the photosphere, but the average size of the small, bright flocculi is rather greater than that of the granules found by Langley. At the still higher levels depicted when the second slit is set on the centre of Hα, the corresponding granules are dark, and the smallest of them are about 2″ in diameter, or twice the size of the smallest calcium flocculi. The filaments thus appear to expand as they rise, and Prof. Hale considers that these observations support the view that the photosphere and the gaseous atmosphere above it are formed of columns of hot gases, rising by convection from the interior of the sun. In order to explain the change from the continuous spectrum of the photosphere to the bright-line spectrum of the chromosphere, it seems necessary to suppose that precipitation of refractory materials occurs at the photospheric level, or that the conditions may be such as to cause the gases to emit a continuous spectrum.

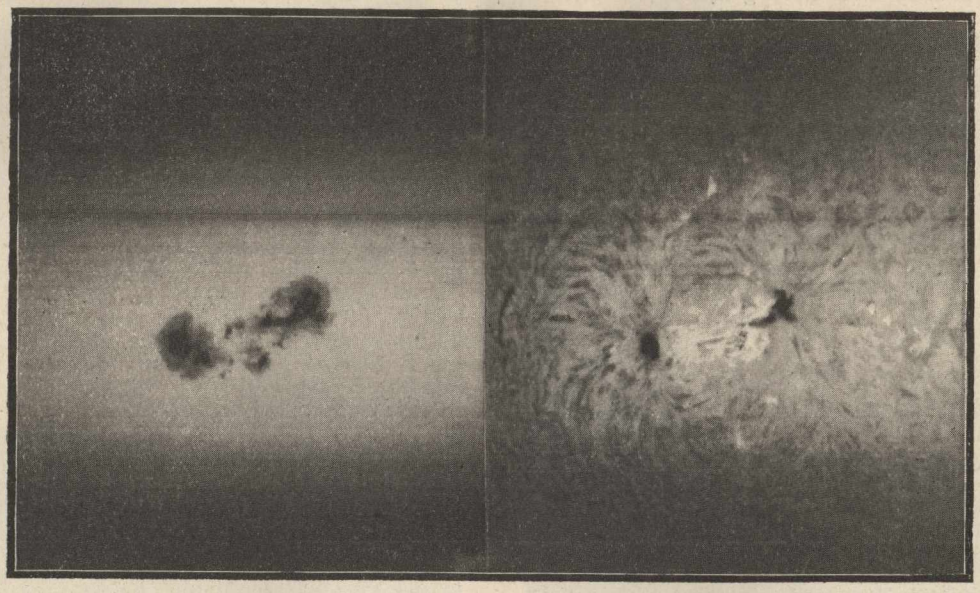

FIG. 3.—Bi-polar spot group. (*a*) Slit on portion of continuous spectrum; (*b*) slit on centre of Hα, 13-ft. spectroheliograph.

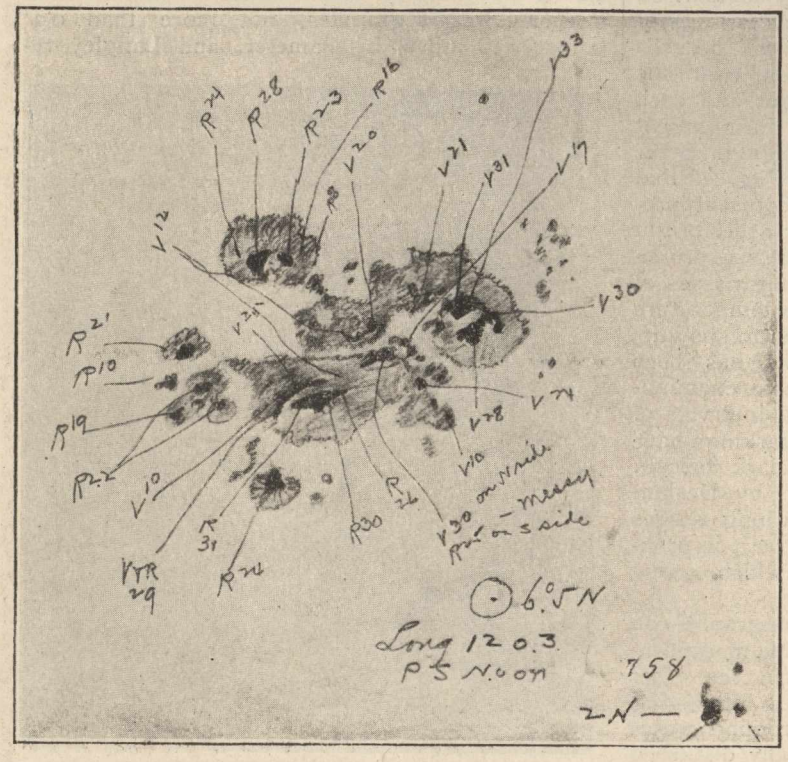


FIG. 4.—Record of magnetic polarities and field-strengths in different parts of a spot group, August 10, 1917.

In many cases, as shown in Fig. 3, the small, dark hydrogen flocculi surrounding spots present a well-defined vortex structure, and it is now well known that the hypothesis which associates a sun-spot with an electric vortex has been brilliantly confirmed by Prof. Hale in the discovery of Zeeman effects in sun-spot spectra corresponding with the magnetic field produced by the whirling ions. A large percentage of sun-spots are double, and the two members have been found to be of opposite polarity, as indicated by the polarisation phenomena of the components of the complex lines produced in spot spectra by the magnetic field, and by the opposite direction of whirl over the two component spots. Such groups are called bipolar groups. In the case of Fig. 3 two isolating slits, side by side, were employed; one was set on a portion of the continuous spectrum, and thus shows practically an ordinary image of the spot group, while the other was adjusted to the middle of Hα so as to bring out the structure of the overlying atmosphere. The two photographs were obtained simultaneously in this way.

The polarities of sun-spots have been extensively investigated by the Mount Wilson observers, and arrangements have lately been made for the rapid *visual* determination of the polarities and field-strengths of all sun-spots as part of the daily programme of observations. The 150-ft. Tower telescope, giving a 16-in. image of the sun, and the 75-ft. spectrograph, with a compound quarter-wave-plate placed over the slit, are utilised in these observations. The method of recording the phenomena is shown in Fig. 4, representing a bipolar group observed on August 10, 1917. In this diagram, R means that a given strip of the compound quarter-wave-plate, used with a Nicol prism, transmits the red *n* component of the Zeeman triplets, of which λ 6173 is selected for observation, and the appended figures indicate the

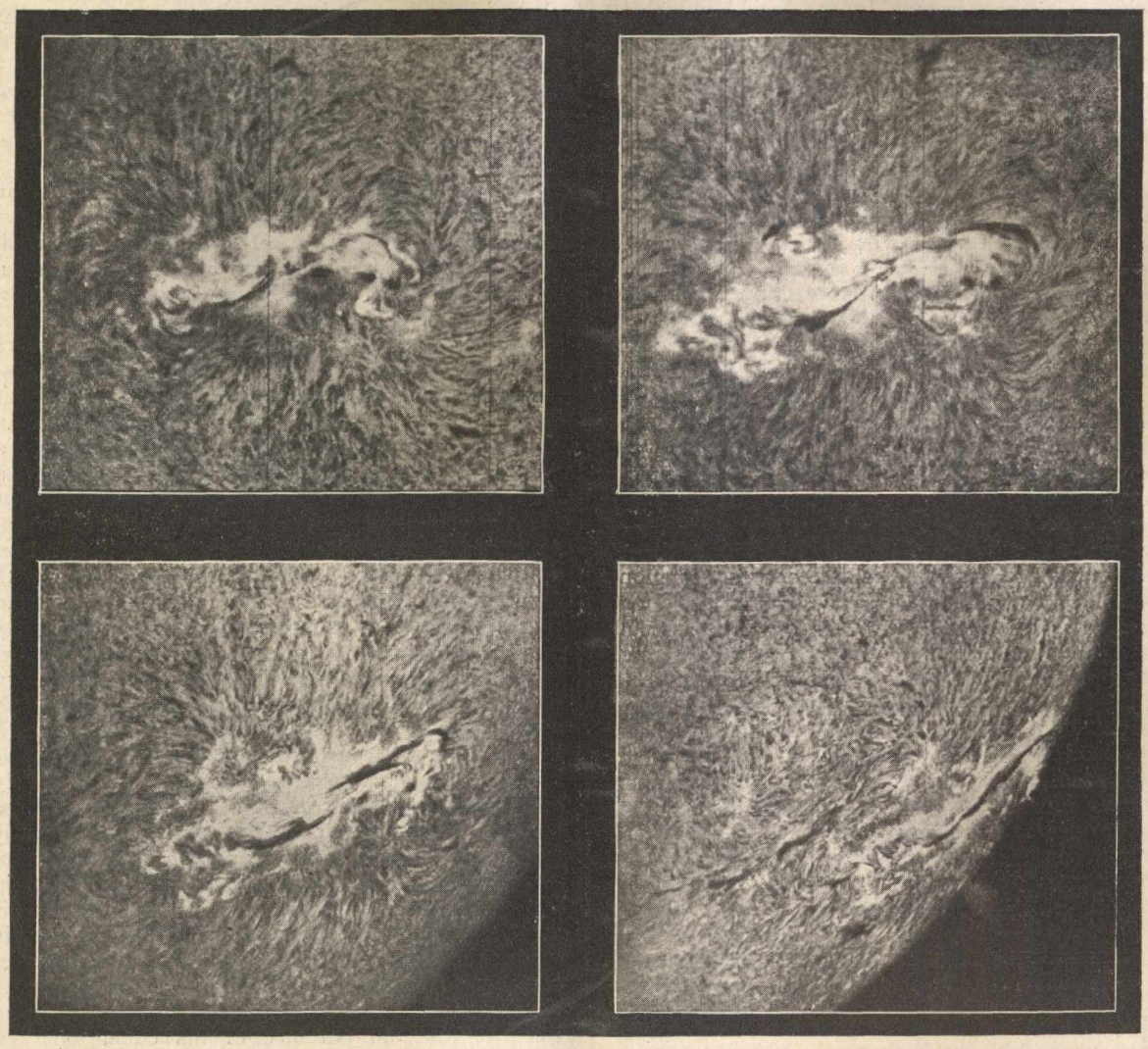

FIG. 5.—Hydrogen flocculi surrounding a group of sun-spots. (*a*) 1915, August 3; (*b*) August 5; (*c*) August 7; (*d*) August 9, 13-ft. spectroheliograph.

intensity of the field, at the point marked, in hundreds of gausses; R 21, for example, refers to a field-strength of 2100 gausses. V similarly means that the violet *n* component is transmitted, indicating an opposite polarity.

It has been found that the preceding members of bi-polar groups in the northern and southern hemispheres are of opposite polarity, indicating opposite directions of the whirling motion, as in the case of cyclones in our own atmosphere. There was a reversal of the polarities of the preceding members of the groups in the two hemispheres after the sun-spot minimum of 1912, and the polarities of spots would therefore seem to be connected intimately with the underlying cause of the sun-spot cycle (Proc. Roy. Soc., A, vol. xcv., p. 235).

Fig. 5 represents the successive appearances of a group of spots at intervals of two days, as it passed from near the central meridian towards the western limb. These photographs show a striking resemblance to Langley's drawings of sun-spots and the photosphere, and Prof. Hale considers that the resemblance can scarcely be devoid of significance, though the small hydrogen flocculi are somewhat larger than the minute grains of the photosphere. At some distance from the spot group it will be seen that the granules are replaced by slender filaments extending towards the axis of the group, recalling the penumbral filaments as they extend towards the umbra in the case of a sun-spot. These filaments stop abruptly at the edge of a bright region of honeycomb structure, from the middle of which the long, dark flocculus is seen to rise as a high ridge when viewed in the stereoscope. The dark flocculus itself appeared as a bright prominence when it was brought to the limb by the sun's rotation.

While the principal features shown in the photographs obtained with the spectroheliograph may now be considered to have received a satisfactory interpretation, it will be evident that the photographs include a vast amount of material for further research on such questions as those referring to the dimensions of the columns of ascending gases, and the movements of the vapours around and above the sun-spots.

## *PROF. EMIL FISCHER, FOR.MEM.R.S.*

THE death of Emil Fischer will be deeply regretted throughout the world of chemists; his achievements alone suffice to belie the attempts too frequently made of late years, during the war, by speakers in no proper way conversant with the subject, to belittle German scientific performance and originality. No act is so dangerous as that of underrating the intelligence of an enemy: but this we persistently did in the past, notwithstanding the warnings that were given by those few who were alive to the facts; and this we are boastfully doing at the present, before we have made any effective progress in overcoming the difficulties by which we were hampered in the past and while we are still almost leaderless and unorganised.

Emil Fischer was one of Germany's great academic experts—a man who was listened to and used by his Government and supported in every necessary way; he was simply worshipped by industry. We can but envy the position he enjoyed. Our Government has still no use for the expert; indeed, the Board of Trade has officially declined, only recently, to give academic chemical science any voice in connection with so ultra-chemical a subject as the dyestuff industry —an industry which is simply the laboratory writ large; and the industrial worker still too often scoffs at the academic worker instead of treating him as his boon companion—perhaps sometimes with show of reason, as the latter is apt to get on stilts.

When the present writer first met Fischer in Strasburg in January, 1882, he all but fell in love with him on the spot. A Rhinelander, tall, well-built and well-dressed, with eyes of wonderful brightness and manners of most engaging frankness and courtesy, Fischer had scarcely any of the attributes of the pedagogue, although, as years went on and he grew in importance, his impatience with those who ventured to question his opinion became more obvious—but no German can escape from this. If not the prototype of a new academic genus, Fischer was certainly a mutant of the original German species. A far greater chemist than his predecessor, Hofmann, he lacked Hofmann's diplomatic qualities and love of influence; and though he filled his office with dignity and distinction, he in no way courted publicity; indeed, for the most part he lived the austere life of the recluse, spending his time, other than that given to necessary official duties, entirely either in his laboratory or in his study. He systematically overworked himself and there is little doubt that his frequent complaints of his health—of his *Magen* particularly—were largely conditioned by overwork. No chemist has secured success to a greater extent through constantly enforced intellectual effort and the determination, having once conceived an object, to win through. He was a striking contrast, in this respect, to his wonderfully alert contemporary, Victor Meyer, in whom the faculty of immediately seeing and seizing an opportunity was perhaps more highly developed, though he had neither the fixity of purpose nor the patience of his colleague; but Meyer was a Jew, hence the difference. The two men made parallel discoveries, almost at the same time, the one by developing the use of phenylhydrazine, the other that of hydroxylamine, as differential analytical agents: but phenylhydrazine became the Rosetta stone with the aid of which Fischer unlocked the story of the sugars and justified Pasteur's prediction that life is an asymmetric process.

It is impossible to overrate the value of the three great series of investigations which are inseparably linked with Fischer's name, as, by his work on the Sugars, on the Proteins and on Uric

derivatives (each an inquiry of unparalleled magnitude and importance), he made biology, on the chemical side, a science.

Fischer appears to have continued to exercise his academic activity throughout the period of hostilities, as communications bearing his name have been published at frequent intervals. It is difficult to imagine that he can have taken any part in the hellish work of war. The loss of such a man at such a time is greatly to be deplored, as he would probably have been one of the few to exercise an ameliorating influence. He died at the comparatively early age of sixty-seven.

Fischer received the Davy medal from the Royal Society in 1890 and was elected a Foreign Member of the society in 1899. He was awarded the Nobel prize in 1902. He had many competent English and American workers among his students, who rendered him no slight assistance. His laboratory has been one of the limited number in which, of late years, experience of real value, both technical and moral, could be gained; few men have set so high an example to their students and no one was more mindful in spirit of his countryman Kekulé's saying, "Nur keine unreifen Früchte." He would recommend no one who was not sufficiently trained. Many are now seeking entry into practice here who are not only under-trained but also unaware of their ignorance: herein lies our danger—we have yet to attach real meaning to the term "chemist" and to follow Fischer's example. As representative of the genus in its most highly developed modern form, he is to be placed at the very apex.

From the time of Liebig onward English students have visited German laboratories and these have undoubtedly afforded them valuable opportunities. But the Germans have also been gainers thereby and they have yet to realise what they lose by our withdrawal. The change of circumstances will be to our advantage in many ways. The object of higher training should be to promote originality and individuality, but instead of being trained on individualistic lines, of late years students in Germany have been led to worship authority rather than to be freethinkers.

A more serious consequence of the constant emigration of our students to German laboratories, however, was the effect this had in preventing the development of higher education in our own schools: until recently it rendered the systematic prosecution of chemical inquiry and the formation of schools of research in this country almost impossible. Our most capable workers were constantly withdrawn from us just as they were about to become valuable instruments—we were allowed to sharpen pencils but not to use them. In fact, we have allowed the Germans to monopolise not only the dyestuff industry but also the higher academic industry—and not only have our best students been encouraged to leave us but we have also done our utmost to sterilise the intellects of the remainder by a cast-iron system of examinations. The 1851 Commissioners, unfortunately, favoured this policy; indeed, at one time they almost forced their chemical scholars to go to Germany. As there was no interchange, we were left without helpers. The protests made as to the impolicy of the course were of no avail—we were told, in no halting terms, that we sought to keep students at home to serve as our assistants; yet the Germans were allowed to use them to their ends—in the eyes of our officials what was improper here was permissible abroad. Fortunately, during the past decade or two, we have been successful in gradually stemming the tide of emigration and our higher instruction has been developed apace, though hitherto it has never been otherwise than starved.

H. E. A.

## NOTES.

THE Forestry Bill, which was brought up in the House of Lords early in the month, has now passed its third reading. The Bill is the first attempt at forestry legislation to be brought before Parliament since the question of afforesting some of the waste lands in the country was first mooted more than thirty years ago. During this period numerous Commissions and Parliamentary Committees were appointed to consider this matter, but no planting was undertaken as a result of their deliberations. It is the war, and the enormous demands for timber, especially the soft woods of the trade, entailed by it, which opened the eyes of the Government to the dangerous position in which Great Britain stood in the matter of timber supplies. The Government Bill now before the country is closely based on the recommendations made by the Forestry Sub-Committee appointed by the late Minister of Reconstruction. It proposes the appointment of a Forestry Authority of seven (reduced to five in the House of Lords) Commissioners and the afforestation of 1,750,000 acres in eighty years, a quarter of a million acres to be planted in the first ten years at a cost of 3,500,000*l*. The total cost of the undertaking will certainly be far greater than the estimates laid before the House, these estimates being very nearly pre-war figures. The Bill was introduced by the Earl of Crawford. It was opposed by Viscount Haldane, whose chief arguments were the danger of erecting an authority of the kind proposed, which would not be subordinate to any Minister; and possessed of funds drawn from the Consolidated Fund, and not, therefore, placed on the Estimates, and consequently far less open to effective criticism in Parliament. The main point brought out by Lord Haldane, the one really weak part of the Bill from the scientific point of view, is the inadequate manner in which provision is made for future educational and research work and for the representation on the Board of Commissioners of forestry experts possessed of a sound scientific training. In the matter of scientific training and knowledge the proposed Board of Commissioners is a purely amateur one. Unless means can be devised to set up a Board truly representative of what is required—a Board which shall include a strong representation of men provided with a sound scientific training and a wide practical knowledge of forestry conditions throughout the Empire—there is a grave danger that the objects the Bill seeks to achieve will be doomed to failure from the outset, with the resultant disappointment and waste of public funds.

WE regret to learn of the death, at seventy-five years of age, of Antoine Paul Nicolas Franchimont, emeritus professor of organic chemistry in the University of

Leyden. After graduating there in 1871 he worked with Kekulé at Bonn and with Wurtz at Paris, and was appointed in 1874 professor of organic chemistry in his native town. During forty years he trained many Dutch organic chemists, and on his retirement in 1914 chairs in the other three Dutch universities were in the occupation of his pupils. Besides being an enthusiastic teacher, Franchimont was an indefatigable investigator. His principal work was concerned with the nitro-amides, which he discovered in 1883, and the aliphatic nitramines ($R.NH.NO_2$). For the preparation of these compounds, often highly explosive, he introduced the use of pure ("real") nitric acid, prepared by distilling a mixture of nitric and sulphuric acids *in vacuo*. The use of sulphuric acid and of zinc chloride as catalysts in acetylation is also due to him. Although some of his results (acetylcellulose, pure nitric acid) found technical application, he derived no material gain from them. Of an unworldly and retiring disposition, Franchimont did not often frequent scientific congresses, but those who met him at the Cambridge meeting of the British Association in 1904, or visited him at Leyden, will cherish the memory of a kindly man who lived for his science and for his pupils. His family associations gave Franchimont a command of the French language, and he was one of the founders, in 1883, of the *Recueil des Travaux chimiques des Pays-Bas*, in which journal nearly all his subsequent work was published. Outside his native country his merits were recognised by his election to the honorary membership of the Chemical Society and by his appointment to the Legion of Honour.

ON Wednesday, July 23, Mr. F. H. Carr, at a meeting of the British Pharmaceutical Conference, delivered a memorial lecture on the late Lt.-Col. E. F. Harrison, whose invaluable work on the development of the anti-gas respirator has lately been the subject of so much eulogy. No more fitting place could have been chosen for the lecture than the buildings of the Pharmaceutical Society in which Harrison received his training in the profession he had selected, and with which he was afterwards so intimately associated, nor could the delivery of a lecture in his memory have been entrusted to a better or more capable man than Mr. Carr. Most of the audience had been personal friends of Harrison's, some of them for upwards of twenty years, and they knew that the testimony that Mr. Carr bore to his sterling qualities, his upright nature, his sincerity, and the fearless manner in which he grappled with difficult problems, was only too well deserved. The details which Mr. Carr gave of Harrison's early life, his tenacity of purpose and remarkable self-denial, were interesting in the extreme, and went far to explain a certain austerity in his nature. The part which Harrison played in the final phase of his life, the development of the box-respirator, by which so many lives were saved and which contributed so largely to the victorious issue of the war, occupied the latter part of the lecture, which will long remain in the memory of those who were fortunate enough to hear it.

AT the meeting of the British Association in 1914 a wish was expressed for some organisation by which the breeders of plants and animals and those engaged in genetical research might be brought into closer contact with one another. The advent of war prevented the immediate realisation of these hopes, but in the present year, largely through the energy of Miss E. R. Saunders, the Genetical Society has come into being under the presidency of the Right Hon. A. J. Balfour. It is expected that the society will be mainly peripatetic, holding meetings on convenient dates at places where breeding work of interest is in progress, whether at scientific institutions or plant nurseries or stock-raising centres. Open-air demonstrations offer considerable difficulties in the case of large parties, and for this reason it was held advisable to limit the number of members of the society to 120, and to impose certain qualifications for membership. Candidates for admission must either be, or have been, engaged in genetical research, in the teaching of genetics, or in the practical breeding of plants or animals. It is proposed also to hold meetings from time to time for the reading of papers and the discussion of results. It was appropriate that the society should enter upon its active existence with a visit to Cambridge, the cradle of modern genetic studies. Between thirty and forty members attended the meeting on July 12, at which Miss Saunders gave a lucid and interesting account of the present state of knowledge of the genetics of stocks. The members present visited the garden where these experiments have been in continuous progress since the end of last century. Prof. Punnett gave an account of some experiments with sweet peas designed to test the validity of the chromosome hypothesis of heredity, and Prof. Biffen demonstrated wheat material in connection with the inheritance of immunity and susceptibility to rust. Mr. J. B. S. Haldane also described some experiments with two new colour varieties of rats which have recently come into existence, illustrating his account with living examples. The secretaries of the society are Miss C. Pellew, The John Innes Horticultural Institution, Merton, S.W.19, and Prof. Punnett, Whittingehame Lodge, Cambridge, from either of whom further information may be obtained.

WE regret to see the announcement of the death at Naini Tal, in his sixty-first year, of Prof. A. W. Ward, professor of physics at the Canning College, Lucknow. From a short obituary notice in the *Times* we learn that Prof. Ward was educated at Liverpool College and Institute, and at St. John's College, Cambridge, where he held a scholarship, graduating in 1882. After lecturing at the Borough Road Training College and working in the Cavendish Laboratory, he went out to Southern India in 1885 as lecturer on physical science at the Kumbakonam College, but was soon invalided home. He returned to India in 1889 to take up his Lucknow appointment. He was a prominent figure in all matters connected with the University of Allahabad as a member both of the Senate and of the Syndicate, and was its representative on the United Provinces Legislature. Prof. Ward contributed a number of scientific papers to the Proceedings of the Royal Society and to the *Philosophical Magazine*.

IN the *South African Journal of Science* for 1918 (vol. xv., No. 6) the Rev. J. R. L. Kingon discusses "Cattle as a Factor in the Economic Development of South Africa." He considers the cattle question in relation to the Portuguese voyagers; the aborigines, including Bushmen, Hottentots, and Bantus; the Dutch; and the first British occupation, and shows that much of the history of the country is focused in its cattle. He leaves untold the story from the time of the second British occupation down to the present day, during which period the question has been of no less importance.

SELDOM has a more elaborate monograph descriptive of a group of people numbering fifty-seven souls been prepared than that issued as vol. xlii., part i., of the Journal of the College of Science, Imperial University of Tokyo (R. Torii, "Etudes Archéologiques et Ethnologiques: Les Ainou des Iles Kouriles"). The author remarks that in all the

many accounts of the Ainu, those of the Kurile Islands have been strangely neglected, but that they form an important factor in the study of this remarkable people. This claim is fully justified by the appearance of this elaborate account of them, dealing with their history, linguistics, sociology, customs, and superstitions. It is illustrated by thirty-eight pages of photographs and by numerous drawings in the text.

IN Norway, as elsewhere, the little Scrophulariaceous plant Euphrasia, best known to us as the common eyebright, is extraordinarily variable. The numerous forms that have been described, notably by R. v. Wettstein, may be due in part to local influences, differences of moisture, and the like, and appear to revert to the norm when withdrawn from the action of such influences. Other forms seem to be more permanent, and may be definite mutations provcked by differences of climate in different districts or changes of climate in past time, or by other physical changes in the environment. Such forms may be regarded as true species or sub-species. Yet other forms are probably hybrids between those last mentioned, and, though of apparently constant recurrence, would be susceptible to Mendelian analysis. Before such analysis is undertaken it is certainly helpful to have a very exact systematic survey of all the variations that occur in a state of nature; and this is the task that has been accomplished for the Norwegian species by Mr. E. Jørgensen, whose results have just been published in Bergens Museums Aarbok, 1916–17 (Naturvidenskabelig Raekke, 2 Hefte, 337 pp., 11 maps, 14 pls., 1919). The main text, which is in German, is also illustrated by enlarged diagrams of detail, and there is an English summary. The author recognises five species, with sub-species, forms, and sub-forms, all belonging to the sub-genus Eueuphrasia, Wettst., section Semicalcaratæ.

LIGHT has been thrown upon a very fascinating theme by the publication of Dr. Gilchrist's paper on "Luminosity and its Origin in a South African Earthworm" (Trans. Roy. Soc. S. Africa, vol. vii., part 3, 1919, pp. 203–12, pl. xxiv.). We have but one regret: the species of Chilota which displayed the phenomenon in so marked a degree is not identified. So long ago as 1900 no fewer than thirty species had been described. Chilota is nearly related to Photodrilus, Giard, and one species of this genus is now known as *Microscolex phosphoreus* on account of its luminous properties. Until each species known to be luminous has been definitely determined, we shall always have confusion. But in regard both to the information given and to the inferences or conclusions drawn therefrom, Dr. Gilchrist's paper is a decided advance on its predecessors. Fungi, bacteria, gregarines, and other lowly organisms have been regarded as agents in the production of luminosity, and the author not only states the case as it formerly stood, but also gives a very clear and instructive view of his own observations and findings. The fluid exuded was subjected to a variety of tests, and found to consist mostly of single cells heavily laden with inclusions of different kinds. "The luminosity is given out by the inclusions of small size, and these seem to be of a substance allied to fat, by the oxidation of which light is produced."

THE Weekly Bulletin of the Hawaiian Volcano Observatory records in vol. vii., No. 1, for January, 1919, the very considerable appearance of "smoke" that may arise from incandescent lava owing to copious evolution of sulphurous gases. The bulletin continues to give admirable photographs of successive stages of activity in Kilauea.

MR. THOMAS SHEPPARD, well known for his researches and historic studies in British stratigraphy, has given an interesting account of "Martin Simpson and his Geological Memoirs" in the Proceedings of the Yorkshire Geological Society (vol. ix., p. 298). Simpson was well known to visitors in the classic surroundings of Whitby, and published a summary of the contents of the Whitby Museum at the age of ninety-one, a year before his death in 1892.

IN *Naturen* for April–May, 1919 (forty-fourth year, Nos. 4–5), Hr. Olaf Holtedahl gives a distinctly original series of maps showing the relations of land and sea "i jordens oldtid" in the North Atlantic region. The "oldtid" dealt with ranges from Ordovician to Permian times, and the maps, and the evidence discussed, include the whole North Polar area and that down to Newfoundland and the British Isles. The maps, if enlarged, would make an excellent series of lecture-diagrams.

THE literature of that old and recurrent subject, the origin of flint, is added to by Mr. W. H. Twenhofel in a paper on chert in Kansas and Oklahoma (*Amer. Journ. Sci.*, vol. xlvii., p. 407, 1919). The author refers to W. A. Tarr's work (see NATURE, vol. ci., p. 174), but does not seem to have considered the formation of flint-zones by deposition of silica in waters moving at right angles to the stratification. He assigns, at any rate for the region dealt with, an early date in the history of the unconsolidated rock for the growth of flint from silica in solution in the sea.

IN a paper recently received (Académie d'Agriculture de France, October 23, 1918) Prof. J. Mascart, the director of Lyons Observatory, has directed attention to the exceptional nature of the two winters 1916–17 and 1917–18 in that neighbourhood. Both produced cold spells of unusual severity, and the sequence of two such winters following one another appears to be almost unique. In the winter of 1916–17 the autumn might be said to be prolonged to January 15, after which, with two brief exceptions, temperature remained low until April 28, falling at times below −20° C. over extended regions. Thereafter the first fifteen days of May were very warm, so that the season of spring was entirely suppressed. The features of the following winter were very different; there was a cold spell from mid-October to mid-January, after which the weather became mild until the end of March, the break in January being of a very pronounced character. Thus the lowest temperature of the winter occurred on January 5, −17·1° C., and the mean temperature of that day was −11·2° C. On January 20 the mean was no less than +11·7° C., or 22·9° C. above that of January 5. This difference is greater than that between the mean coldest and the mean warmest days of the year. Attention is directed to the fact that the two winters were almost inverse, so that mean temperature from the two combined would have shown little of note. In considering the effect of such winters on fruit-trees and crops the difficulty of eliminating other factors is pointed out, and it is suggested that close collaboration between agriculturists and meteorologists is necessary to arrive at any conclusion of value.

A VALUABLE article on the mechanical extraction of coir is published in the *Philippine Journal of Science* (November, 1918); also one on the mechanical properties of Philippine coir and coir-cordage. The same issue also deals with steaming tests of Philippine coals.

THE annual report of the Board of Scientific Advice for India, just to hand, gives a very comprehensive summary of the work carried out by the different departments for the year 1917–18. The section reports deal with applied chemistry, astronomy, meteorology, terrestrial magnetism, geology, geodesy, botany, agricultural bacteriology, forestry, zoology, veterinary science, and medical research.

THE first number of *Science and Industry*, the official organ of the Commonwealth Institute of Science and Industry, is just to hand. The aim of the new journal is to serve as an authoritative medium for the expression of Australian scientific thought and aspirations. Contributions are welcomed at the same time from all independent scientific workers. The object of the new institute is the co-ordination of scientific research in the Commonwealth. At present there is a paucity of trained scientific workers and much overlapping. The inaugural number contains articles and notes of primary interest to Australian industries, *e.g.* the prickly pear pest, the obligation of science to pastoral industry, applications of veterinary research, the artesian water problem, sheep-fly investigations, etc.

THE Journal of the Royal Society of Arts for July 4 contains a paper on science and industry in Australia, which was read by Sir John McCall, whose death on June 27 is so deeply lamented. The paper sketches the development of agriculture in the Commonwealth, and sets forth the hopes for the future, especially in view of what is being done to promote scientific research and study. Australia contains vast mineral resources, particularly coal and iron, and the manufacture of iron and steel should be greatly facilitated by the excellent metallurgical coke derived from the coal of New South Wales and Queensland. Now that the steel industry is established in the continent, it is expected that wire and tinplate manufactures will be greatly stimulated. In regard to more scientific manufactures also, progress has been made during the war, and, with further development, they should be capable of production at much lower prices than those at which they can be obtained from Germany.

DR. R. E. SLADE, director of research of the British Photographic Research Association, has presented a report upon work in progress or contemplated. A wide programme of research has been drawn up and preliminary experiments have been made on a large number of subjects. The history of photographic science and industrial development shows that, since the publication in 1891 of the researches of Hurter and Driffield, practically no new methods of attacking the problems of photography have been introduced. Many workers have improved and worked out further details of the old-established methods, and very considerable advances have been made, but the time now seems ripe for entirely new methods of photographic research. The association is using all the means at its disposal to initiate such new methods, and is making progress in this direction. Some experiments have been made on gelatin, which, though not suitable for publication, will be of great use in future work. Progress has been made in investigations of photographic emulsions, and a communication on this subject will be circulated shortly. Success has been attained in staining wood black or grey right through. This black wood, which was made in Germany before the war, is used by manufacturers of cameras and optical instruments, and the grey wood for picture-frames and furniture. The process, for which an application for a patent has been filed, should be suitable for use on a large scale, and also be economical. Results of research, whether theoretical or experimental, which are of general interest, and not of immediate use for application to specific problems of the industry, are published at the first opportunity to increase knowledge in photographic science generally, and to induce other workers to devote their attention to theoretical photographic problems. The offices of the association are at Sicilian House, Southampton Row, London, W.C.1, and the secretary is Mr. A. C. Brookes.

A NEW volume by Mr. E. H. Chapman will shortly be added to the Cambridge Nature Study Series, published by the Cambridge University Press. The title is "The Study of the Weather," and the aim of the book is to provide not only a series of practical exercises on weather study, but also a simple introduction to the study of modern meteorology.

MR. CHARLES BAKER'S current list of second-hand scientific instruments is now available for distribution. The catalogue gives particulars of more than 1500 pieces of apparatus which can be examined at 244 High Holborn, London, W.C.1. Mr. Baker holds a large stock of materials for colour photography, and can undertake the immediate delivery of standard material. Every instrument included in the list is guaranteed, and customers can, in certain circumstances, have pieces of apparatus for three days on approval before actually purchasing.

## *OUR ASTRONOMICAL COLUMN.*

A WORLD SURVEY.—The Paris Bureau des Longitudes is proposing to make use of wireless telegraphy to determine the geodetic position of certain points on the earth's surface which shall be considered fundamental, and may be used as reference points for future geodesy. Triangulations have been made and arcs of longitude measured in different regions of the world which have been co-ordinated, but it is possible that the attachment of these may be improved. The closing error in the longitude of the sphere, or the amount by which the sum of the arcs circumscribing the earth differs from 24 hours, is about a fifth of a second of time. The details of the plan at present suggested are that Paris, Shanghai, and a third point in the neighbourhood of San Francisco shall be taken as primary points. The latitude of each is to be determined, possibly with the prism astrolabe, and the difference of longitude between each consecutive pair measured. It is suggested that the clocks at Paris and Shanghai may be compared by means of signals from the radio-telegraphic station at Lyons, those at Shanghai and San Francisco by signals from Honolulu, whilst signals from Annapolis would serve for the comparison of the clocks at San Francisco and Paris. This is the main feature of the scheme, to which subsidiary details will be added. It is proposed, for instance, that the position of a point in New Zealand, the antipodes of France, shall be determined, and naturally it is hoped that Greenwich will take part in the operations and form one of the points of reference.

SOLAR PHYSICS AT CAMBRIDGE.—The sixth annual report of Prof. Newall, the director of the Solar Physics Observatory at Cambridge, which relates to the year ending March 31 last, shows that the staff is returning after war service, and that one member only is absent, Capt. W. E. Rolston, who is with the Army in Cologne. The staple work of the institution is divided under three heads:—(A) Stellar work, which at present consists mainly of the classification of stellar spectra, and the arrangement of these in sequence in relation to the intensities of characteristic lines. (B) Solar work, the observational

part of this being done by the spectroheliograph, with which photographs of the sun's disc are taken in calcium light, and pictures of this kind were obtained on 111 days in the period under review. Similar spectroheliograms are received from Kodaikanal, and these records are studied at Cambridge for evidence of systematic distribution of flocculi. The third heading (C) is Meteorological Physics, which is represented by the work of Mr. C. T. R. Wilson on lightning discharges and the variations of potential of the electric field in thunderstorms.

THE SPECTRUM OF NOVA AQUILÆ.—Besides the work recorded in the preceding note, investigations have been made of the spectra of Novæ. Photographs of the spectrum of Nova Aquilæ (1918) were obtained very soon after the appearance of the star, and it is concluded from examination of these early photographs that the outburst was accompanied by changes in the spectrum which, if indicating motion in the line of sight, involve two or more pulses moving with exceedingly high velocity. A study previously made of the spectrum of Nova Geminorum (1912) showed that the narrow lines in the spectrum of that star resembled those of α Cygni. The complex absorption lines exhibited in the spectrum of Nova Aquilæ have been deciphered as being effects characteristic of α Cygni, but duplicated by two large displacements which agree with those of the simultaneously duplicated absorption lines of hydrogen.

## THE BRITISH ASSOCIATION.

### PROVISIONAL PROGRAMMES OF SECTIONS.

THE programme of sectional arrangements for the meeting of the British Association at Bournemouth on September 9–13 is well advanced, and many interesting subjects, both in connection with scientific work during the war and otherwise, will come up for discussion. Among these the following are provisionally entered:—The Mathematical and Physical Section will discuss the origin of spectra and thermionic tubes, and will receive reports or papers on the recent solar eclipse observations, on wireless telegraphy during the first three years of the war, and on wave-motion. A visit to the neighbouring Holton Heath cordite factory, with appropriate papers, has been arranged by the Chemistry and Engineering Sections. The Geological Section will concern itself specially with local geology, and will discuss jointly with the Anthropological Section the age of local antiquities. The Section of Zoology, among many other papers, provisionally announces afternoon lectures on grain pests and the storage of wheat, lice and their relation to disease, and the geographical distribution of fresh-water fishes. The Geographical Section purposes to discuss the geographical aspects of devolution, and, among other subjects, to receive papers on air photography, long-distance air routes, the geography of Imperial defence, the colonisation of Africa, and various frontier questions, if circumstances permit; it also hopes for a paper on geography from Sir Henry Wilson. The Economics Section announces a number of distinguished speakers on a national alliance of employers and employed, price-fixing (with special reference to Australian experience), transport, the gold standard, finance and taxation, the replacement of men by women in industry, and other subjects. The Engineering Section will pay special attention to aviation in various aspects. The Anthropological Section will receive a number of papers on the eastern Mediterranean region, on early prehistoric archæology, the ethnology of the Russian borders, cults, the migration of culture, etc. The Physiological Section will discuss jointly with that of Economics the influence of the six-hour day on industrial efficiency and fatigue. The Botanical Section will join the Zoological in receiving papers on the origin, evolution, and transmission of biological characters, with the Agricultural for the discussion of forestry problems, and with the Educational for that of the teaching of biology. The programme of the Educational Section includes the discussion of the free-place system, the teaching of English, the method and substance of science teaching, training in citizenship, continuation schools, private schools, museums, fundamental principles in education, and (jointly with the Economics Section) business in relation to education. The Agricultural Section, among various other topics, will receive a group of papers on war-time food production in Great Britain. Fuller details, with particulars as to membership of the association, may be obtained from the offices at Burlington House, W.1, or from the local secretaries, Municipal Buildings, Bournemouth.

## CANCER RESEARCH.

THE annual general meeting of the Imperial Cancer Research Fund was held at the Examination Hall, Queen Square, Bloomsbury, on July 23, his Grace the Duke of Bedford, K.G., in the chair.

Sir William Church, Bart., proposed the adoption of the report, and gave a summary of the work of the fund during the war, both on cancer and on other subjects. The effect of withdrawing a large number of young males for military service was to alter the age-constitution of the civil population, producing an apparent great increase in the crude male death-rate from cancer. The female rate was unaffected, and the apparent rise for males disappeared when the necessary correction was made. The method of autologous transplantation had been used to separate tumour-like proliferations of lymphoid tissue from the true malignant new growths of mice. The former never grew on grafting into the affected animal itself, even when recurrence and dissemination occurred. Autologous grafts of true new growths were practically always successful, whether recurrence took place or not. Experiments were carried out on the relation of the water-content of tumours to their rate of growth. In harmony with the findings for normal tissues in animals and plants, the tumours showed a close relationship in this respect, the more rapidly growing tumours having the higher percentage of water. The water-content of tumours could be artificially reduced by exposure to isotonic calcium chloride solution *in vitro*, and such material on inoculation exhibited diminished powers of growth, from which recovery was slow but complete.

The work on war problems mentioned in the report dealt, first, with the heat-regulating mechanism of the body, especially the *rôle* played by the thyroid-adrenal apparatus, and its derangements in disease accompanied by fever or hypothermia. A second paper was devoted to the pathology of gas gangrene. It could be shown that a specific local injury of the tissues permitted the development of the anaerobic bacteria of gas gangrene and tetanus. Substances present in cultivated soil, particularly ionisable calcium salts, were able to produce the necessary lesion which breaks down the otherwise efficient natural defences against these micro-organisms. These two papers, and another on the fate of grafted cartilage, will shortly be published in the Sixth Scientific Report of the fund.

## THE METALLOGRAPHY OF IRON AND IRON-CARBON ALLOYS.

AT the May meeting of the Iron and Steel Institute two papers of decided scientific importance were presented. In one of these Prof. G. Cesarò, of Liège University, a distinguished Belgian man of science, has endeavoured by careful mathematical analysis to ascertain the course of the curve joining the points at which molten iron-carbon alloys commence to solidify, if the abscissæ are taken either as $x$, the number of atoms of carbon contained in a unit of the alloy, composed of a hundred atoms, or as $y$, the number of molecules of cementite $Fe_3C$ contained in a unit of the alloy composed of a hundred molecules, and assuming an iron molecule to contain two atoms. The author has used for his data the experimental results obtained by Carpenter and Keeling fifteen years ago, which are generally accepted as valid for the liquidus of the series. He comes to the conclusion that whether Raoult's law of the depression of the freezing point or the more general law expressed by the Le Chatelier-Schroeder formula

$$lz = \frac{Q}{2}\left(\frac{1}{T_0} - \frac{1}{T}\right),$$

where T is the absolute temperature and $z$ is the number of molecules in the solvent contained in a unit of the alloy forming a single molecule, be adopted, the calculated figures agree decidedly better with the experimental results on the iron-cementite than the iron-carbon hypothesis. Further, the results which agree best are obtained on the assumption of a rectilinear variation afforded by the $Fe_3C$–$Fe_2$ hypothesis.

In the second paper Prof. Honda, of the Tohoku Imperial University, Sendai, Japan, returns to a consideration of the allotropic forms of iron. It is now generally agreed that pure iron undergoes two transformations between the freezing point and the ordinary temperature, which are allotropic. The first of these is the $A_4$ transformation, and takes place at 1394° C., about 130° below the freezing point. It is completed in a few minutes. The second is the $A_3$ transformation, and occurs at about 900° C. This transformation, although not so rapid as the previous one, can be completed in a very narrow temperature interval, provided the heating and cooling are sufficiently slow. In a recent experiment by Ishiwara, where the complete transformation required about three hours, the difference between the $Ac_3$ and $Ar_3$ points did not exceed 5° C.

The $A_2$ change is of a different nature. It does not take place at a definite temperature or within a small range, but begins at the ordinary temperature, its rate becoming greater as the temperature is increased, until it is completed at 785° C. The various physical properties, such as heat absorption or evolution, intensity of magnetisation, electrical resistance, thermal conductivity, etc., vary similarly with one another, the values changing slowly at lower temperatures, and the change becoming faster as the temperatures approach 785° C. When thermal equilibrium is established the change in any one of the properties does not increase by a prolonged heating. The properties are definite functions of the temperatures. It is this distinction, according to the author, which constitutes the essential difference between allotropic and non-allotropic changes. According to him, therefore, an allotropic change is the transformation of a substance from one phase to another which proceeds at a definite temperature if sufficient time be allowed for the transformation.

The $A_2$ critical point, as determined thermally, is usually taken as 768° C. This is the temperature at which the rate of heat evolution or absorption is at the maximum on cooling and heating respectively. This figure is somewhat lower than 785° C., which is the value proposed by Honda, and is the temperature at which the $A_2$ transformation begins on cooling and terminates on heating.

In the case of carbon steels, in addition to the above, there are two other transformations, $A_1$ and $A_0$. The former is a change of phase, while the latter is a change in cementite of a similar nature to $A_2$. Accordingly, whereas $A_4$, $A_3$, and $A_1$ are phase changes, the $A_2$ and $A_0$ transformations extend from the critical to the lowest temperature. Every stage of these changes is a definite function of the temperature, and, from the point of view of the molecular theory of magnetism, they may be regarded as processes in which the molecules acquire rotational energy about their magnetic axes.

H. C. H. CARPENTER.

## SEX, REPRODUCTION, AND HEREDITY IN PIGEONS AND FOWLS.

DR. OSCAR RIDDLE has previously brought forward evidence to show that male pigeons arise from eggs (yolks) of less *storage* metabolism, which implies small size and higher (oxidising) metabolism, and that females arise from eggs (yolks) of greater *storage* metabolism, which implies large size and lower (oxidising) metabolism. He has now (*Journ. Exper. Zoology*, vol. xxvi., 1918, pp. 227–54) studied two cases of female "identical twins," and seeks to show that the ova (yolks) which produced both of them were extraordinarily and abnormally large.

Of course, the yolk of an egg cannot be directly weighed on a balance and then put back to see what it will develop into; Dr. Riddle's evidence is necessarily indirect. The eggs when laid were very large compared with all the other eggs produced by the particular parents (totals of 116 and 134 eggs). Double-yolked eggs in doves are practically restricted in their production to hybrids from wider crosses, or to birds showing striking reproductive abnormalities, or to both of these, and would not be expected to appear in the series in which the two cases of "identical twins" were found.

It is suggested that the blastoderm-borders will be abnormally raised in extraordinarily large eggs, and abnormally lowered in extraordinarily small ones, and that this might lead, for physical reasons, to the establishment of two independent foci of development. If male "identical twins" were found developing from a very small egg, it would be an interesting corroboration of the author's theory. Meanwhile, he thinks that the available data point to the conclusion that each pair of female "identical twins" arose from a single ovum of high storage metabolism.

In healthy doves and pigeons the right testis is larger than the left in a very high percentage of cases, yet in the female it is the left ovary that persists. The left testis more nearly approaches the ovary than does the right. In disease, particularly in tuberculosis, the testes undergo extreme atrophy, but more in the right than in the left; the ovary does not seem to suffer reduction in size. The right testis of the very young birds (from embryos to squabs a few weeks old) is normally longer than the left. The single (persistent) left ovary of young female squabs is twice, or more than twice, as long as is either testis in males of similar age (three to seven weeks). Now Dr. Riddle finds (*Anat. Record*, vol. xiv., 1918, pp. 283–334) that in hybrids the normal size relations of the two testes are often disturbed, sometimes reversed, approximating to the female condition. The number

of such reversed cases increases as the width of the cross. The excess of males from such crosses is also known to increase similarly, *e.g.* when the crosses are between members of different genera. The theory suggested is that "sex has been controlled in these forms, and that a male which is forced to arise from a female-producing egg may show in the relative size of its gonads an approximation to the relative size of the gonads of a female."

In an investigation (*Journ. Biol. Chem.*, vol. xxxiv., 1918, pp. 161–70) of the correlation between fat content in the blood of fowls and the total egg records, Dr. Riddle and Mr. J. Arthur Harris find a progressive change; it is positive for birds in a laying condition, sinks to zero after the cessation of laying, and finally takes a high negative value in birds which have long ceased to lay. At the end of the first laying year birds which have laid larger numbers of eggs and are still laying have a higher percentage of fat in their blood than laying birds which have made a poor record for the year. But birds which have laid a large number of eggs and exhausted their fertility have a smaller percentage of fat in their blood than non-laying birds which have poor egg records. Thus the correlation changes from a positive to a negative relationship. This conclusion involves a serious criticism of that reached by Warner and Edmond (*Journ. Biol. Chem.*, vol. xxxi., 1917, p. 281).

Dr. Riddle and Mr. Carl E. Anderson (*Amer. Journ. Physiol.*, vol. xlvii., 1918, pp. 92–102) gave ring-doves small doses of quinine sulphate, and found a marked reduction in the yolk size and total size of the eggs. It is well known that quinine reduces the destruction of nitrogenous components of the tissues, and probably checks the secretory activity of the oviduct, the product (albumen) of which is entirely of a protein nature. Furthermore, the presence of quinine in the yolk of the eggs probably checks the characteristic transformation of the nitrogenous compounds; the eggs are poor in yolk for some weeks after the dosage is discontinued.

From an egg produced by a pigeon under the weakening influence of "reproductive overwork" there was hatched in 1914 a female bird which might be called an ataxic mutation. Dr. Riddle describes the bird (Proc. Soc. Exper. Biol. and Med., vol. xv., 1917, pp. 56–58), which showed when young a marked lack of power over the voluntary movements of the head and body. The affected female was bred to two different males, and the derangement was seen through four generations descended from either. Of 175 young ones reared to the age at which the disorder might be exhibited, 119 were classed as normal and 46 as affected. With some irregularities the character appears like a Mendelian recessive

In an interesting study of the brains of the "ataxic" pigeons (*Amer. Journ. Physiology*, vol. xlvii., 1918, pp. 124–36), Miss Mathilda L. Koch and Dr. Riddle report that, as compared with normal birds of the same parentage, there are increased values for moisture, protein, and extracted sulphur, and decreased values for lipoids, phosphatides, and cholesterol. The results of the analyses are interpreted as suggesting a chemical under-differentiation or immaturity of the disordered brains.

Dr. Riddle and Mr. Victor K. La Mer report (*Amer. Journ. Physiol.*, vol. xlvii., 1918, pp. 103–23) a remarkable fact which must be considered in connection with theories of colour-inheritance, namely, the post-mortem formation of melanin in the pigmentless retinas and choroids of embryo white ring-doves of 3–12 days of development. Killing the tissues in $HgCl_2$ does not prevent the production of the pigment, but the presence of free oxygen is necessary.

## INDUSTRIAL LIGHTING.

IN his lecture at the British Scientific Products Exhibition on July 28, Mr. L. Gaster traced the growth of interest in industrial lighting, which had now come to be regarded as essential to the health of the workers, to the avoidance of accidents, and to efficient work. The extension of night-work during the war and the great demands made on British factories had rendered good artificial lighting specially important; and various factors likely to operate in the future, such as the fuller use of the "three-shift" system and the development of the manufacture of accurately made standardised and interchangeable parts, also tended in the same direction. Another important consideration at present was the saving in fuel that might be brought about by the general use of more scientific and efficient methods of lighting, whereby the consumption of gas or electricity necessary to produce a given illumination on the work could be reduced. The case for adequate industrial lighting, both from the economic and humanitarian points of view, was very strong. There was no doubt that both the output and the quality of work suffered if the illumination was defective. Cases were on record in which the output had increased by 8–27 per cent., and even more, when the illumination was improved. In general, the cost of lighting formed only a small proportion (often less than 1 per cent.) of the wages bill, so that even a small gain in output more than compensated for the expenditure on good lighting.

Mr. Gaster also gave an instructive account of the steps taken by various Governments in Europe to promote better industrial lighting in the years immediately preceding the war. The French Government had nominated a Committee to inquire into the subject, and the Belgian Government had also been asked to do so. In these cases action had been inevitably delayed by the war, but the Departmental Committee on Lighting in Factories and Workshops, appointed by the British Government in 1913, had persevered with its labours, and issued a most instructive and valuable interim report in 1915. In this matter Great Britain might justly claim to have taken the lead in comparison with other nations. During the war, however, the United States, profiting by European experience, had been very active, and there were now five States which actually possessed codes of industrial lighting in force. Experience had shown that managers of factories were quite willing to adopt the recommendations in these codes, their chief desire being to receive assistance and guidance in bringing their illumination up to date. To the worker likewise good illumination was of direct personal benefit. Mr. Gaster expressed the hope that definite reference to adequate industrial illumination would be introduced into the British Factory Act in the near future. It was also desirable that industrial lighting should be included amongst the conditions of work to receive international treatment, so that there might be interchange of experience and uniformity of action in the chief countries of the world.

## THE ROYAL SOCIETY OF CANADA.

THE sessions of the Royal Society of Canada were held as usual in Ottawa on May 19–22, and were of more than ordinary interest. There was an unusually large attendance of fellows from the various provinces, from British Columbia in the west to Nova Scotia in the east, and the presidential chair was occupied by the Hon. Rodolphe Lemieux, M.P., the distinguished French-Canadian statesman and jurist. Many fellows present had just returned from Europe,

their professional duties having ended with the conclusion of the war.

The Canadian Royal Society combines the features of the French Academy and the British Association, in accordance with the views of the founder, the late Duke of Argyll, who, as Marquess of Lorne, and occupying the office of Governor-General at the time (1882), originated the society. It includes French and English Literary and Historical Sections (Sections I. and II.) and three scientific sections, Chemistry and Physics (Section III.), Geology and Mineralogy (Section IV.), and the Biological Sciences (Section V.), and its fellows, about 150 in number, are able to assemble in session not more frequently than once a year, owing to the vast distances necessary to be travelled to reach the capital of the Dominion.

The serious duties of the meetings were relieved by many social functions, the principal one being the garden-party at Government House, given by their Excellencies the Duke and Duchess of Devonshire, on the afternoon of May 20. There was also a largely attended public luncheon, in honour of the society, on the following day.

As many as 131 communications were presented to the various sections, and of these 51 were chemical, physical, and mathematical, and 32 were botanical and zoological, but owing to the absence of the presidents of Sections I. and V. the usual opening addresses were omitted. In Section II. Principal Maurice Hutton, Toronto, gave a masterly disquisition entitled "Humour and Satire," with ancient and modern illustrations from Aristophanes to Jane Austen, Dickens, and H. G. Wells; and in Section III. Prof. L. V. King, Montreal, spoke on "Outstanding Problems of Modern Physics," and Prof. L. W. Bailey, University of New Brunswick, the Nestor of Canadian geology, addressed Section IV. on "Acadian Palæography." The president of the society (Mr. Lemieux) delivered an eloquent and remarkable address in French at the first evening session (on May 20) entitled "Le Canada, la Guerre et Demain." The second evening address took the form of a memorial lecture, viz. the "Sir John Murray Memorial Address," and the council invited one of the Dominion's most eminent biologists and the leading authority on the resources of Canada's seas, Prof. E. E. Prince, Commissioner of Fisheries, Ottawa, to deliver it. The annual popular evening address is always one of the attractive features of Royal Society week in the capital, and, as the generosity of an anonymous Scottish donor had provided for this special lecture, it proved to be a very notable event.

Prof. Prince appropriately chose as his subject "Life in the Ocean: A Review of Recent Deep-sea Researches," a subject which formed the late Sir John Murray's life-work. The spacious ballroom of the Château Laurier was packed by a crowded audience, and moving pictures of fish-life under the waves and of whales and whaling, and exquisite coloured projection views of marine vertebrate and invertebrate life, added greatly to the interest. Prof. Prince referred to the fact that Sir John Murray was a Canadian, born in Ontario in 1841, and at the time of his tragic death in Edinburgh was honorary vice-president of the Canadian Royal Society. He spoke of his own personal friendship, dating from student days at St. Andrews, when Sir John Murray occasionally visited the ancient university. After detailing the main features of the world's oceanic areas, their extent, profound depths, currents, salinities, etc., the lecturer emphasised the existence of unsuspected minute organic forms, enormous in amount, in the ocean's depths, and of organic detritus there, ultramicroscopic in its character. As the late Prof. Minchin declared, this invisible organic matter was of supreme moment in maintaining life in the sea. Dr. W. B. Carpenter fifty years ago had styled sea-water "minute broth."

The enormously abundant diatoms, infusorians, copepods, and the like could not suffice, it is generally admitted, for the nutrition of the incalculable hordes of mid-water and deep-sea creatures in the sea. A familiar sponge (Suberites), one ounce in weight, required 22 milligrams of carbon, to provide which nearly one and a half billions of such a diatom as Skeletonema, or more than seven billions of Thalassiosira, would be required to be ingested daily. A small copepod such as Calocalanus must capture and digest daily 9,750,000,000 Thalassiosira every twenty-four hours; and an oyster 5 in. long consumed, it has been calculated, one-twelfth of a cubic inch of solid food daily, and would need to filter eight or nine gallons of water, or nearly two thousand times its own bulk, to obtain that amount of nutriment. Dr. Kishinouye has stated that the Japanese sardine would require to wander nine miles through the sea to secure the ¾ gram of food constituting its daily diet; for 1 gram of diatoms, foraminifera, copepods, etc., usually occurs in 1000 litres of the water where the schools of fish feed.

Is there not some unsuspected source of abundant nutriment available in the sea? In addition to the plankton, with all its infinitely varied and copious life, Lohmann has signalised the nannoplankton, which passes through the finest tow-nets, and can be secured only by centrifuging small quantities of sea-water; but there remains the "Demerson," that extremely plenteous floating organic matter, invisible, disintegrating, probably largely moribund, derived from the sinking clouds of planktonic forms which "rain down," as Prof. Moseley expressed it, from the upper waters to the depths below. The "Demerson" finally settles on the floor of the sea as a thin colloidal stratum, as Bessels found in Arctic waters, and Hornell describes in Indian waters off the Malabar coast. Though the "Demerson" recalls the discredited Bathybius of Huxley, yet marine biologists are being compelled to recognise it as the great source of nutriment for innumerable Benthonic forms at all depths, from the coast to the abysmal zones in the oceans of the world.

At the close of the address President Lemieux, in thanking Prof. Prince for it, said that the science of the deep sea demonstrated how much stranger truth is even than fiction, and that Prof. Prince's long services in connection with the valuable biological stations of Canada, his wide experiences as a fishery expert in Canada, as well as in Irish, Scottish, New Zealand, and Australian waters, entitled him to speak with authority on fisheries and life in the sea generally.

At the closing business meeting of the society on the afternoon of May 22 the election of officers for 1919–20 took place, and it was announced that Dr. R. F. Ruttan, the distinguished professor of chemistry in McGill University, Montreal, had been chosen as the new president of the Royal Society.

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

GLASGOW.—His Majesty the King has been pleased to appoint Dr. George Gerald Henderson, F.R.S., to the Regius chair of chemistry in the University of Glasgow. Prof. Henderson has held the chair of chemistry in the Royal Technical College, Glasgow, which is affiliated to the University, since 1892. He was formerly lecturer and demonstrator in chemistry at the University and at the Queen Margaret College

for Women incorporated with it. He was a few years ago president of the Society of Chemical Industry, and is a vice-president of the Chemical Society. The Regius chair, resigned by the late Prof. John Ferguson in 1915, has since then remained vacant owing to the war.

The following appointments to new chairs have been made by the University Court:—*Gardiner Chair of Bacteriology:* Dr. C. H. Browning, director of the Bland-Sutton Institute of Pathology at the Middlesex Hospital, and professor of bacteriology in the University of London. *Gardiner Chair of Organic Chemistry:* Dr. T. S. Patterson, Waltonian lecturer, and lecturer in organic chemistry in the University of Glasgow. *Gardiner Chair of Physiological Chemistry:* Dr. E. P. Cathcart, professor of physiology, London Hospital Medical School. These three important new chairs owe their foundation to the munificent endowment of Mr. William Guthrie Gardiner and Mr. Frederick Crombie Gardiner, shipowners, Glasgow. The sum of 20,000*l.* was provided for each chair—60,000*l.* in all. The benefaction contributes greatly to the equipment of the University for dealing with important scientific studies. The subjects of the chairs are among those in which some of the most remarkable modern developments have taken place. It is provided that the professor of bacteriology shall apply himself to the promotion of instruction and research in relation to bacteriology as bearing on disease, and that the holders of the other chairs shall apply themselves to the promotion of instruction and research in their different subjects.

LONDON.—Sir William H. Beveridge has been appointed Director of the London School of Economics.

Mr. T. L. Wren has been appointed to the University readership in geometry tenable at University College. In the session 1913–14 Mr. Wren was assistant lecturer in mathematics at Bedford College, and was then for two years lecturer at St. John's College, Cambridge.

A scheme was approved for the establishment at University College of a school of librarianship from funds provided by the generosity of the Carnegie trustees. The school will be administered by a committee consisting of representatives of University College and of the Library Association. Dr. E. A. Baker has been appointed director.

Lloyd's Register of Shipping has presented 10,000*l.* to the fund which is being raised to establish a degree in commerce at the University. The trustees of Sir Ernest Cassel have promised 150,000*l.* if a similar sum is subscribed before October. It is estimated that a sum of 500,000*l.* will be required to make suitable provision for the subject in the University.

The title of emeritus professor has been conferred upon the following:—Prof. Sir George Thane, who has resigned the chair of anatomy at University College, which he has held since 1877 (with the title of University professor since 1907); Prof. F. M. Simpson, who has resigned the chair of architecture at University College, which he has held since 1903 (with the title of University professor since 1907); and Prof. A. K. Huntington, who has resigned the chair of metallurgy at King's College, which he has held since 1879 (with the title of University professor since 1912).

The Senate has resolved to institute a University chair of botany tenable at Bedford College.

The following doctorates have been conferred by the Senate:—*D.Sc. in Biochemistry:* Mr. S. S. Zilva, an internal student, of the Lister Institute of Preventive Medicine, for a thesis entitled "The Influence of Deficient Nutrition on the Production of Agglutinins, Complement and Amboceptor." *D.Sc. in Physiology:* Mr. E. W. H. Cruickshank, an internal student, of University College, for a thesis entitled (1) "The Production and Utilisation of Glycogen in Normal and Diabetic Animals," and (2) "The Digestion and Absorption of Protein and Fat in Normal and Depancreatised Animals." *D.Sc. (Economics):* Mr. E. W. Shanahan, an internal student, of the London School of Economics, for a thesis entitled "The Production and the Consumption of Animal Foodstuffs, with Special Reference to the British Empire." *D.Sc. in Botany:* Mr. James Small, an external student, for a thesis entitled "The Origin and Development of the Compositæ," together with subsidiary contributions.

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LT.-COL. SIR THEODORE MORISON has been appointed Principal of Armstrong College, Newcastle-upon-Tyne, in succession to Sir Henry Hadow.

PROF. W. M. GARDNER, head of the chemistry and dyeing department of Bradford Technical College since 1895, and principal of the college since 1906, is retiring on account of ill-health.

THE trustees of the Beit Fellowships for Scientific Research, which were founded and endowed in 1913 by Mr. Otto Beit in order to promote the advancement of science by means of research, have recently elected Mr. Jonas Arthur Hey to a fellowship. Mr. Hey was educated at the Keighley Trade and Grammar School, 1907–14, and has been a student at the Imperial College of Science and Technology since, except for the period of his war service. He will carry out his research at the Imperial College.

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## *SOCIETIES AND ACADEMIES.*

### PARIS.

**Academy of Sciences,** July 7.—M. Léon Guignard in the chair.—C. **Richet**, P. **Brodin**, and F. **Saint-Girons**: The immunising action of sodium chloride against anaphylactic injection. The second injection of plasma, which normally causes a violent anaphylactic shock, can be rendered also innocuous by dilution with nine times its volume of an isotonic (0·8 per cent.) solution of common salt. The sodium chloride cannot be replaced by glycose. The plasma injected was from the horse, and dogs were used in the experiments, but the authors regard the immunising action of the salt as general, and not limited to these special cases.—A. **Blondel**: Some properties of the bipolar diagram of synchronised alternators on a network at constant potential.—V. **Grignard** and Ed. **Urbain**: The preparation of phosgene by means of carbon tetrachloride and oleum or ordinary sulphuric acid. The best yield of phosgene in this reaction is obtained with oleum containing 45 per cent. of $SO_3$, and $SO_2HCl$ is left as the residual product. If the presence of some HCl in the phosgene is without objection, ordinary sulphuric acid may with advantage be substituted for the oleum, using infusorial earth as catalyst.—M. Emanuele Paterno was elected a correspondant for the section of chemistry in succession to M. G. Charpy, elected member of the division of the applications of science to industry.—V. **Karpen**: The cause of the adherence of the concrete to the iron in armoured concrete constructions.—MM. **Auclair** and **Boyer-Guillon**: An accelerograph.—J. **Ubach**: Observations of the annular eclipse of December 2, 1918, made at Buenos Aires.—F. **Diénert** and F. **Wandenbulcke**: The action of sodium thiosulphate upon hypochlorites. When a potable water has been treated with hypochlorite, it is

necessary to know the exact amount of sodium thiosulphate to be added to destroy the free chlorine. The course of the reaction is variable, depending on the presence or absence of free carbon dioxide in the water, and a direct laboratory experiment must be made in each case.—M. **Lespieau**: Cryoscopy in acetylene tetrabromide. This substance, when pure, melts at +0·13° C., and has a high cryoscopic constant, 217.—M. **Picon**: The preparation of some true substituted acetylenes by means of the monosodium derivative of acetylene. A description of the preparation of heptine, decine, and octodecine.—Ch. **Mauguin** and L. J. **Simon**: The action of concentrated sulphuric acid upon carbon tetrachloride.—S. **Posternak**: The constitution of the reserve phospho-organic principle of green plants.—A. **Krempf**: A primitive and essential stage, so far unrecognised, in the development of the Anthozoa.—A. **Rochon-Duvigneaud**: The double retinal fovea in birds of prey flying by day.

VICTORIA.

**Royal Society**, May 8.—Mr. J. A. Kershaw, president, in the chair.—R. H. **Walcott**: Origin of the volcanic tuff of Pejark Marsh, Victoria. The following results, giving further evidence of the formation *in situ* of the bedded volcanic tuffs, were obtained during excavations at this locality to find further data as to man's antiquity in Victoria. This evidence consists of the continuous thinning out of the beds away from the probable points of eruption, the cross-bedding present, and the gas cavities in the upper part not due to decomposition of vegetable remains; also in its being precisely like other tuffs which were undoubtedly formed in the same way both in physical and in mineralogical aspects.—F. **Chapman**: New or little-known Victorian fossils in the National Museum. Part xxiv.: A fossil tortoise in ironstone from Carapook, near Casterton. This is a replacement of the greater part of the body cavity of a tortoise, in which the vertebral column is well-marked. The sutures of the costal plates and the impression of the bones of the pelvic girdle are visible. The ventral surface shows the impress of the bones of the plastron. This cast is referred to Emydura, and with some reserve to the species *E. macquariae*, the Murray mud-tortoise. Pleistocene fossils of this species from Australia already exist in the British Museum (Natural History), London, as single bones. A curious point in physiography is suggested by the present occurrence: since the living Murray mud-tortoise is now found only in rivers flowing north into the Murray, the rivers of the Carapook district, which now flow into the Glenelg, probably had a northerly trend in the Pleistocene. This is also supported by local physiographic evidence.

## *BOOKS RECEIVED.*

A Synoptical List of the Accipitres (Diurnal Birds of Prey). Part i.: Sarcorhamphus to Accipiter. Pp. 38. (London: John Wheldon and Co., 1919.) 4*s*.

A Student's Book on Soils and Manures. By Dr. E. J. Russell. Second edition, revised and enlarged. (Cambridge Farm Institute Series.) Pp. xii+240. (Cambridge: At the University Press, 1919.) 6*s*. 6*d*. net.

Union of South Africa: Province of the Cape of Good Hope. Marine Biological Report, No. iv., for the period ending June 30, 1918. Pp. v+182+ii. (Cape Town: Cape Times, Ltd., 1918.)

Planetary Rotation Periods and Group Ratios: Two Essays on the Relations between the Planets in Diurnal Rotation and in Mass. By F. A. Black. Pp. xii+115. (Edinburgh and London: Gall and Inglis, n.d.) 3*s*. 6*d*.

Shell Shock and its Lessons. By Prof. G. Elliot Smith and T. H. Pear. New impression. Pp. xv+135. (Manchester: At the University Press; London: Longmans, Green, and Co., 1919.) 1*s*. 6*d*. net.

Scientific Signalling and Safety. By Prof. John Joly. Pp. 36+1 plate. (London: Taylor and Francis, 1919.) 1*s*. 6*d*. net.

The Statesman's Year-Book: Statistical and Historical Annual of the States of the World for the Year 1919. Edited by Sir John Scott Keltie and Dr. M. Epstein. Fifty-sixth annual publication. Revised after official returns. Pp. lii+1476. (London: Macmillan and Co., Ltd., 1919.) 18*s*. net.

Volumetric Analysis for Students of Pharmaceutical and General Chemistry. By Charles H. Hampshire. Second edition. Pp. 127. (London: J. and A. Churchill, 1919.) 5*s*. net.

Lectures on Sex and Heredity delivered in Glasgow, 1917–18. By F. O. Bower, J. Graham Kerr, and W. E. Agar. Pp. vi+119. (London: Macmillan and Co., Ltd., 1919.) 5*s*. net.

Insect Artisans and their Work. By Edward Step. (Hutchinson's Nature Library.) Pp. x+318. (London: Hutchinson and Co., 1919.) 7*s*. 6*d*. net.

The Seashore: Its Inhabitants and How to Know Them. By Forster Robson. Pp. 111. (London: Holden and Hardingham, Ltd., n.d.) 1*s*. 6*d*. net.

Coal Mines and Nationalisation. By Dr. Arthur Shadwell. Reprinted from the *Times*. Pp. 32. (London: Longmans, Green, and Co., 1919.) 1*s*.

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