THURSDAY, MAY 30, 1912.

THE PRACTICAL AND SCIENTIFIC METALLURGY OF STEEL.

The Metallurgy of Steel. By F. W. Harbord and J. W. Hall. Fourth edition, enlarged and revised. Volume i., Metallurgy. By F. W. Harbord. Pp. xvi + 522 + xxix. Volume ii., Mechanical Treatment. By J. W. Hall. Pp. xviii + 523–933 + xxix. (London: Charles Griffin and Co., Ltd., 1911.) Price 36*s.* net, two volumes.

IT is not surprising that the fourth edition of this valuable and painstaking work should be called for. It is without doubt the best compilation of its kind in metallurgical literature.

In reviewing the fourth edition the critic should, as a matter of fairness, make the preliminary admission that an absence of up-to-dateness is not necessarily due to lack of knowledge on the part of the authors, but possibly to revision rules imposed upon them by the publishers. The plan adopted by the authors of dividing their bulky work into two volumes will be fully appreciated by readers as a much more convenient arrangement.

Mr. Harbord in volume i. deals in his introduction with the definition of steel in perhaps rather unnecessary detail. There is, in the reviewer's opinion, only one true and comprehensive definition of steel, and that is quite brief, namely, "Steel is an alloy of iron and carbon with other elements, which is capable of being hot-worked from commercial ingots or castings into merchant sizes." Mr. Harbord states on p. 3 that "metal containing over 2·3 per cent. carbon may reasonably be classified as cast-iron." Therefore, according to Mr. Harbord, Sheffield crucible cast-steel wortle plates, costing 6d. per lb., are cast-iron. Mr. Harbord is evidently not aware that under specially favourable conditions crucible steel ingots containing nearly 3 per cent. of carbon have been forged, and cast-iron will not forge. Mr. Harbord's treatment of the Bessemer process as to matter, diagrams, and tables is as a whole admirable, but his appreciation of the vital part played by Mushet in this process is rather inadequate. As a matter of justice, the method should be called the Bessemer-Mushet process. Bessemer's blown metal was commercially worthless, and it was brought into the region of practical metallurgy only by what Mr. Harbord calls the "suggested addition" of manganese in Mushet's patent. In the useful article on ingot moulds there is on plate ii. an unfortunate misprint; the drawing is headed "the Thomas Turner patent system of cutting small ingots," instead of "*casting* small ingots."

The practice and chemistry of the crucible process are, as a whole, dealt with in an excellent manner, but the statement that in coke melting the absorption of sulphur is "generally very slight" will be news to Sheffield crucible steel-makers too good to be true. With the best coke now obtainable the average increase is from, say, 0·01 to 0·02 per cent., whilst with impure coke steel is occasionally discarded because it has absorbed up to 0·04 per cent. sulphur. Gas crucible melting, in spite of Mr. Harbord's commendation, has not made very much headway. It has certainly many good points, but the fact remains that the highest qualities of steel are still melted by the Huntsman process.

The electric melting of steel is naturally most ably handled by Mr. Harbord, but in the reviewer's opinion his statement that electrically refined steel is equal to the best crucible steel is contradicted by the ruling market prices, which are based on practical experience. The figure 765 units per ton of steel made in the arc furnace will not appeal to those who, like the reviewer, have personally investigated this matter, and have found 1200 units to be nearer the mark when starting with cold and common scrap. Repairs and renewals are put down at 3*s.* 6*d.* to 5*s.* 6*d.* per ton. This is the cost of electrode waste alone.

In dealing with the thermal phenomena of recalescence and absorption, there is an unhappy slip on p. 353, where Prof. le Chatelier is saddled with the statement that the point A_{r_2} is accompanied by "a slight absorption of heat." The word "absorption" should, of course, read "evolution." The theories of the rival Carbonist and Allotropic schools are fairly stated by Mr. Harbord, but he is obviously unaware that in the discussion on a paper by Sir Robert Hadfield and Prof. Hopkinson on "The Magnetic Properties of Steel," Mr. Osmond withdrew the B iron theory of hardening (Journal of Institution of Electrical Engineers, April, 1911, No. 206, p. 293).

The micrographic section cannot be deemed up-to-date. It is stated that "martensite" is a series of interlacing crystalline fibres, the real composition of which is unknown. It would seem that the composition of an imaginary constituent must necessarily remain unknown. Hardenite, the true constituent of hardened steel, discovered by Sorby and named by Howe, is not mentioned. The constituent "sorbite" is somewhat unkindly disinterred from its grave. Mr. Harbord has evidently not seen the recent work of Dr. Benedicks at Upsala University, which has fully confirmed

the observations made years ago at Sheffield University that sorbite is merely pearlite containing its Fe_3C in a fine state of division. Mr. Harbord has also ignored the researches recently published by the Iron and Steel Institute, where the so-called troostite yielded practically the whole of its carbon as carbide.

Turning to vol. ii., for which Mr. Hall is responsible, this naturally deals with metallurgy from an engineer's point of view, and so treats it in an able manner. But in connection with coal-fired reheating furnaces Mr. Hall is disturbed at what he considers their wastefulness in the loss of fuel as smoke. As a metallurgist the reviewer, speaking from personal research data, would reassure Mr. Hall on this point. The use of smoke in reheating fine steel is an art, and without smoke there would be no fine steel. Mr. Hall deals with hammers, rolling mills, and presses, illustrating his text with many excellent figures. He also describes the fluid compression of steel, wire-drawing, and tube-making. This second volume thus forms a valuable engineering supplement to the metallurgical matter dealt with by Mr. Harbord in vol. i.

These books should be on the shelf of everyone interested in steel metallurgy, and the steel world is much indebted to the authors for their able and laborious work. It is, however, certain that owing to the rapid progress of scientific research the portions of vol. i. dealing with the physical chemistry of steel will for a further edition require drastic revision, or even rewriting, to render them of practical value to the student.

J. O. ARNOLD.

EXPERIMENTAL PSYCHOLOGY.

A Text-book of Experimental Psychology, with Laboratory Exercises. By Dr. C. S. Myers. Second edition. Part i., Text-book. Pp. xiv+344. Part ii., Laboratory Exercises. Pp. iv+107. (Cambridge: University Press, 1911.) Price, two vols., 10*s.* 6*d.* net.

THE first edition of Dr. C. S. Myers's book was reviewed in the pages of this journal three years ago. The present edition is issued by a different publisher, viz., by the Cambridge University Press in the place of Mr. Edward Arnold, and the laboratory exercises now appear in a separate volume. The revision of the work has been very thorough, and in many parts important and extensive additions have been made. Certain psychological results appearing in Dr. Henry Head's "Croonian Lectures" of last year have been incorporated in the text, and a most important concluding chapter on the experimental investigation of thought and volition has been added.

The publication of the first edition marked an epoch in the history of the teaching of psychology. The edition just issued is probably the most complete text-book of experimental psychology in this or any other language. Every page is loaded with trustworthy statements of verified fact, yet the argumentation is so well ordered and the style so concise and clear that the book can be read with ease and pleasure. A bibliography of all the important monographs and articles upon the subject under discussion is appended to each chapter; in the text conflicting views are carefully weighed and balanced one against another, and no conclusions are stated without sound justifications of this kind.

The wide scope of the book may be indicated by an enumeration of the headings of the various chapters. These are:—"The Standpoint of Experimental Psychology," "Cutaneous and Visceral Sensations," "Auditory Sensations" (two chapters), "Labyrinthine and Motor Sensations," "Visual Sensations" (two chapters), "Gustatory and Olfactory Sensations," "Specific Energy of Sensations," "Statistical Methods," "Reaction Times," "Memory" (two chapters), "Muscular and Mental Work," "The Psychophysical Methods," "Muscular Effort," "Local Signature," "Sensibility and Sensory Acuity," "Experiences of Identity and Difference," "Binocular Experience," "Binaural Experience," "Visual Perception of Size and Direction," "Time and Rhythm," "Feeling," "Attention," "Thought and Volition."

Addition chapters on the experimental investigation of the psychology of young children and animals would have made the treatment of representative topics more complete, but the author is probably well advised in leaving these rather outlying subjects to books specially devoted to their treatment.

A standard text-book is notoriously difficult to review, and in a case like the present, where the book stands alone, this difficulty is especially great. There are one or two slips, however, that may be pointed out. At the end of the chapter on "Statistical Methods," on p. 124, in the mediate term showing the reduction of the ordinary product-moment formula to the corresponding rank-formula for the correlation coefficient, the term $\Sigma(xy)$ is not identical with the term $\Sigma(xy)$ of the product-moment formula, and should have been written $\Sigma(ab)$, where a and b are corresponding ranks in the two series correlated. In this chapter, too, mention might usefully have been made of the conception of

"partial" correlation, which promises to be so important in the analysis of correlation results. In the discussion of the psycho-physical method of constant stimuli, it is unfortunate that a reference is still made to a method for doing without Gauss's formula in which the mean of a frequency-distribution is "corrected" or "adjusted." It has been known for some years that the mean of a frequency-distribution needs no adjustment. One must hasten to add, however, that the text of this chapter on the psycho-physical methods is exceptionally clear and sound, and is undoubtedly the best elementary account we have of a rather difficult part of psychology.

A JOURNEY TO CANADIAN BARRENS.

The Arctic Prairies: a Canoe Journey of 2000 Miles in Search of the Caribou; being the Account of a Voyage to the Region north of Aylmer Lake. By Ernest Thompson Seton. Pp. xvi+415. (London: Constable and Co., Ltd., 1912.) Price 12*s.* 6*d.* net.

IT need scarcely be said that Mr. E. Thompson Seton's book makes wholesome and exhilarating reading, instinct throughout with its author's sympathy and enthusiasm for wild life. The æsthetic embroidery, while enjoyably present, is kept subordinate to the sincerity and accuracy required of the true naturalist. A six months' canoe-journey was made by the author in the open season of 1907 down the Athabaska River and through the forested country of its lake and river continuations to Lakes Clinton-Colden and Aylmer of the Barren Lands, in lat. N. 64°, a distance, there and back, of some 2000 miles or so; and this is the record of it.

Geographically, the journey was not of high consequence, though Mr. Seton was able to make some additions and corrections to the previous maps, particularly in respect to Lake Aylmer. Nor is there any startling incident of travel to relate, for the adventures and misadventures were just those of every voyageur into the northern wilderness; indeed, the author's capability is best shown by the relative ease with which his task was accomplished. Neither is this a hunter's book; the sportsman-reader will be fretted with the same sense of wasted opportunity that was expressed by Mr. Seton's Indian and half-breed companions, who found it unaccountable that a man should follow the chase so laboriously for the thin satisfaction of seeing animals. Because of these unusual features—and of the author's ever-artistic touch—the narrative is more entertaining than most of its type.

In a highly interesting chapter on the ebb and flow of animal life, the author discusses a series of graphs which he has compiled from the records of the Hudson Bay Company for the years 1821 to 1908, showing the number of pelts of fifteen different fur-animals that have been dealt with annually during this long period. From these statistics certain deductions are drawn, notably that "the high points for each species are with fair regularity ten years apart" (p. 109). In another chapter Mr. Seton deals categorically with the interdependence of the rabbit (*Lepus americanus*) and the lynx, stating that the former increases rapidly to a maximum in spite of its many voracious enemies, and is then suddenly thinned out nearly to vanishing point by epidemic diseases known collectively as "plague," with secondary consequences almost equally disastrous to the lynx population.

Most commendable is the author's ingenious way of treating a recurrent subject that would make "painful and dreary reading" if oft repeated. He asks the reader to allow him, once and for all, a chapter on that terror of the northern wilds, the mosquito; and later allusions to it take the form of a simple "see chap. ix." The idea might profitably be extended by the introduction of standing references of this kind for use in travel-literature in general.

Some vigorous drawings, as well as photographs, of animal life are reproduced as plates, and the book is further illustrated by 125 sketches in the text, which have the live touch that no photograph can convey.

The appendices include full lists (with notes) of the mammals, birds, and plants that were collected or seen; a short list of insects; a "buffalo summary," from which it appears that more of these animals survive in the wild state than had been supposed; and a (reprinted) plea for the introduction of the yak as a range-beast for the north-west.

ELEMENTARY PRACTICAL PHYSICS.

A Laboratory Note-book of Physics. By S. A. McDowall. Part i., pp. viii+166. Part ii., pp. viii+126. (London: J. M. Dent and Sons, Ltd., n.d.) Price 2*s.* 6*d.* net each part.

THOSE who have to deal with large classes in practical physics know how difficult it is for the demonstrator to set and maintain the class going without some aid in the form of printed instructions, such as note-books or separate slips relating to each experiment. This plan is, how-

ever, looked upon with suspicion by many owing to the obvious danger that the work degenerates into mere mechanical operations, without any intelligent appreciation on the part of the pupil of what he is doing, and of the physical principles underlying the experiment. This danger seems to be almost entirely avoided in the volume before us.

At Winchester College, as the author explains in the preface,

"Each student is given a printed slip describing the experiment to be performed and containing questions designed to test whether the experiment had been understood. These slips were then pasted into a note-book, and full supplementary descriptions, with diagrams, graphs, and answers to the questions, are entered by the student as well as the actual experimental results."

The present note-book is a development of this system, the underlying plan being that when the experiments have been worked through, the student should have a text-book of elementary practical physics, largely written by himself, to which he can refer when preparing for any definite examination. The experiments are briefly described on the left-hand pages, the right-hand pages being blank, to receive descriptions, by the student, of important experimental details and calculations. Sketches and diagrams are to be drawn in the blank spaces on the left-hand page. Volume i. contains the simpler experiments on measurement, hydrostatics, heat, light, magnetism, electrostatics and current electricity; while in the second volume are to be found more advanced experiments on the same subjects. This volume includes in addition some experiments on surface tension. It is greatly to be regretted that experiments on dynamics, statics, and sound are omitted entirely. The experiments are numerous and well chosen, and (except for the omissions mentioned) cover the whole range of elementary physics. There is no doubt that a student who had worked through these two volumes, and had filled in the supplementary descriptions and diagrams, would be very well equipped for a higher course.

One of the most valuable features of the book is the large number of short questions ("Why?" "Why not?" "How?" "What do you notice?" "Why ether rather than water?" "Why use the high-resistance coil?" and so on) which are found in brackets among the printed directions. The student is required to answer these questions when writing up an experiment. He is thus encouraged all along to think things out for himself. This feature will be a valuable corrective against the experiments being performed mechanically.

The book contains a few blank pages for additional experiments, and is well supplied with graph paper.

We heartily commend this book to the notice of those who have to deal with large classes in elementary practical physics. G. O.

LOGARITHMIC TABLES.

Tables of Logarithms and Anti-logarithms to Five Places. By E. Erskine Scott. Students' edition. Pp. 383. (London: C. and E. Layton, n.d.) Price 5*s.* net.

Table of Logarithms and Anti-logarithms (Four Figures), 1 to 10,000. Arranged by Major-Gen. J. C. Hannyngton. Pp. iv+41. (London: C. and E. Layton, n.d.). Price 1*s.* 6*d.* net.

Four Place Tables of Logarithms and Trigonometric Functions. Unabridged edition. Compiled by Prof. E. V. Huntington. Pp. 33. (Cambridge, Mass., U.S.A.: the Harvard Co-operative Society; London: E. and F. N. Spon, Ltd., n.d.) Price 3*s.* net (60 cents).

THE old French saying,

> Dans la gendarmerie
> Quand un gendarme rit
> Tous les gendarmes rient
> Dans la gendarmerie,

applies with considerable force to writers of mathematical text-books. For some time past the market has been inundated by a flood of books of logarithmic tables. In these circumstances it is impossible for a reviewer to say that any single book of the collection supplies a long-felt want, and all that can be done is to give as precise a description as possible of the contents and arrangement of the different tables so that a reader can select that one which most closely meets his actual requirements.

Now Hannyngton's and Erskine Scott's tables are exactly similar in character, and only differ in the fact that Hannyngton's are four-figure and Erskine Scott's are five-figure tables. Both books contain logarithms and anti-logarithms, and nothing else, and in each case *all* numbers are tabulated separately so that the use of interpolation is obviated, every logarithm or anti-logarithm being entered separately. This, of course, makes the tables ten times as long, and provides compensating advantages in the matter of convenience. Those whose work is facilitated by this arrangement, and is limited to the use of logarithms, will appreciate the efforts that have been made to supply what they prefer. In Erskine Scott's book the anti-logarithms are printed on green paper.

Huntington's four-figure tables, on the other

hand, cover a wider ground, including conversion of degrees into minutes and seconds, squares and cubes and corresponding roots, reciprocals, circumferences and areas of circles, natural functions, logarithms, logarithmic sines, cosines, tangents, cotangents, logarithms of radians, exponential and natural logarithms, radian tables, and constants. Each table occupies two pages only, but "special tables" are given for those parts of the logarithmic and trigonometric scales where the differences are large. The book is well suited for use in the laboratory or examination-room. The author wisely does not follow the usual fashion of introducing unnecessary and superfluous tables of anti-logarithms as well as logarithms. The edges of the pages are cut after the fashion of a "Where is it?" thus facilitating reference. In the trigonometrical logarithms, negative characteristics are used, the functions being thus referred to an arc of unit radius instead of radius 10^{10}, as in the earlier tables.

OUR BOOKSHELF.

Complete Yield Tables for British Woodlands and the Finance of British Forestry. By P. Trentham Maw. Pp. xii+108. (London: Crosby Lockwood and Son, 1912.) Price 7*s.* 6*d.* net.

SIR W. SCHLICH has stated that the most urgent need of British forestry is the collection of statistics by means of which the financial results of the industry can be estimated. These statistics are usually embodied in so-called yield tables, which give for an acre covered with a certain species of tree, and treated in the best manner, the volume of timber, number of trees, their average height and diameter, &c., corresponding to different ages. As the productivity of timber varies with the nature of the soil, a number of qualities of soil must be admitted. Usually three are sufficient—good, medium, and bad soils—and, corresponding to these, three different tables for each species are made. The tables are constructed from a graphic analysis of the data obtained by measuring a large number of sample plots of the given species on all classes of soil and of all ages.

Yield tables are either general, applicable to a whole country, or local, restricted to a small district where climatic conditions are uniform. It is usually admitted that general tables are not trustworthy, and we cannot, therefore, use with safety the German yield tables.

The present volume is an attempt to furnish the necessary yield tables for British practice. His tables, meant to be applicable to all Britain, can only be approximative. They have been constructed by a method which Mr. Maw claims to be new, and explains as follows: "The growth of timber is characterised by certain girth indices and density factors, both of which are interdependent, and which are dependent also on the height growth; and if these and the height growth at different ages are taken into account, the preparation of yield tables is a comparatively easy matter, and results can be obtained which are approximately correct for all practical purposes."

This theoretical method requires to be tested by comparison of actual woods with Mr. Maw's figures. It is also to be noted that his ideal woods are more heavily thinned from the beginning than the ideal woods of most German tables. This is financially sound if the quality of the timber is not thereby affected; but herein lies great danger. Mr. Maw's tables are ingenious and original, and deserve consideration at the hands of practical foresters.

Forme, Puissance et Stabilité des Poissons. By Prof. Frédéric Houssay. (Collection de Morphologie Dynamique. Directeur: Prof. F. Houssay. IV.) Pp. 372. (Paris: A. Hermann et Fils, 1912.) Price 12.50 francs.

THE question of the best form which a body should have so that its resistance shall be a minimum is one which will always attract the scientific mind, and one is naturally inclined to think that in fishes the form that has survived is best for propulsion in water. Prof. Houssay in this new work gives a very complete account of the experiments which he has been making during the last few years on the resistance of fish-shaped forms, partly from this point of view. Curves of power of various forms with and without elastic fins have been obtained by towing them from their leading end. The marked effect of the fins upon the stability and relative resistance to the motion of the forms has been investigated very exhaustively, and some interesting results have been obtained.

By a very ingenious method the author has succeeded in tracing out the stream lines of several fishes, and a very good beginning has been made with the experimental investigation of the power which various fishes are capable of exerting. The author has successfully examined the case of fishes kept almost stationary, and it is hoped that the further experiments which it is proposed to undertake will include some with the fishes moving at different speeds relative to the water.

Quite a large part of the work is devoted to the question of the means of propulsion which the fish possesses, and in particular seeks to differentiate between the action of the main body of the fish, its tail and the fins, and the part which the necessity of these actions has played in giving the fish its form. G. S. B.

Heat and Steam. By Engineer-Lieut. S. G. Wheeler, R.N. Pp. vii+224. (London: Edward Arnold, 1911.) Price 4*s.* 6*d.* net.

THE original design of the author of this book was to provide material covering the more theoretical parts of the subject required by naval cadets up to the time of their leaving the training cruisers. While this object has been kept in view, sufficient additional matter has been included to render the book useful to other classes

of students. The method of treatment of the thermodynamic principles is good, and will be readily comprehended by any reader who has but slight knowledge of higher mathematics.

The earlier chapters deal with heat, temperature, energy, the first law of thermodynamics, and the formation and expansion of steam. These lead to very useful chapters on the theory of reciprocating engines and on their thermal performances in practice. Sufficient is included on valve gears and indicator diagrams to enable the student to understand the ordinary gears and to detect any defects in practical working. A considerable section of the book is devoted to the steam turbine, and this portion is excellent, both as regards the treatment of the laws of expansion in nozzles, and also the explanations given of the action of the more common types of turbines. Some notes on propulsion, coal consumption, internal combustion engines, and refrigerators are also given.

As the book is rather a collection of expanded notes than a comprehensive text-book, the author has wisely omitted any elaborate descriptive drawings. Such drawings as appear give all the information required to enable the principles discussed in the text to be understood readily. Within its scope the book can be recommended as supplying a useful supplement to lecture courses dealing with the subject.

Gardens in their Seasons: a Nature Book for Boys and Girls. By C. von Wyss. Pp. 64. Illustrated. (London: A. and C. Black, 1912.) Price 1*s.* 6*d.*

Wonders of Plant Life. By S. Leonard Bastin. Pp. x+136. Illustrated. (London: Cassell and Co., Ltd., 1912.) Price 3*s.* 6*d.* net.

THE first of these books can be depended upon to arouse in children a love for both the plants and animals of the garden. It is for the most part well and simply written, and with the exception of the last one in the book, the illustrations are charming. One cannot altogether concur with the statement that the crocus lays eggs, nor is the author accurate in his remark that "none of us know" how food is constructed in green leaves. The statement on p. 64 that the thick skins of the holly leaves "keep in the warmth of the body, and frost cannot penetrate," is not only untrue, but very misleading even to children.

The second volume cannot fail to interest the young botanical student, but it is unfortunate that the author has not confined his attention entirely to the popular side of the subject. As soon as he enters the domain of scientific botany, especially physiological, he is obviously out of his depth, as can be verified by reference to many of his statements in the chapter on "The Feelings of Plants," and to his account of the reproduction of the fern on p. 66. Many of the illustrations are very good, and that of the Yucca in flower, facing p. 38, is excellent. As in so many books of this kind, "fertilisation" is used where pollination is meant.

LETTERS TO THE EDITOR.

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

The Ammonia Flame.

WITH reference to Mr. Egerton's interesting letter in NATURE of May 16, my colleague, Prof. Fowler, reminds me that he photographed the spectrum of the ammonia flame at the time that we were investigating the spectrum of the active nitrogen glow. Although the general colour of the flame is not unlike that of the nitrogen glow, he found nothing really in common between their spectra in the visual region. Re-examination of the negatives confirms this conclusion. I fear, therefore, that we cannot connect the ammonia flame with active nitrogen, interesting though such a connection would be.

Observations on the ammonia-flame spectrum are not new; an account of what has been done in this direction will be found in Kayser's "Handbuch der Spectroscopie," vol. v., p. 835.

I take this opportunity of referring to another flame phenomenon which is connected with the afterglow of electric discharge. E. Becquerel (*La Lumière*, vol. i., p. 196) remarks (and I have verified) that a colour may be observed at the tip of the oxy-hydrogen flame identical with the greenish-yellow of the afterglow in air. The latter, as I have shown (Proc. Roy. Soc., A, vol. lxxxvi., p. 57, 1911), is characteristic of nitrogen peroxide, and may be imitated by passing nitric oxide or peroxide into a Bunsen flame. The colour of the tip of the oxy-hydrogen flame is no doubt due to the presence of nitrogen peroxide, which is formed by oxidation of atmospheric nitrogen at the high temperature, and is stimulated to luminosity in just the same way as nitrogen peroxide artificially introduced.

There is nothing new in the oxidation of nitrogen attendant on the combustion of oxygen and hydrogen in its presence—indeed, the effect has been recognised as a source of error in gas analysis. At the time when Lord Rayleigh was working out the method of isolating argon by oxidation of atmospheric nitrogen, he was able, I remember, to detect the presence of nitrogen peroxide by its smell on entering an ordinary room lighted by incandescent gas lamps. R. J. STRUTT.

Imperial College of Science and Technology, May 22.

The Free-living Marine Nematodes.

I HAVE recently paid a short visit of a few days to the Port Erin Marine Biological Station in order to gain some idea of the free-living marine nematodes and their distribution. The subject is one that has not received much attention in this country since the publication in 1866, in the Transactions of the Linnean Society, vol. xxv., of Bastian's monograph of the Anguillulidæ.

The nature of the food is one of the most obscure points in connection with this much neglected group, but I have been able to determine what it is in at least one of the marine species. Owing to pressure of work on the terrestrial nematodes, more extended investigation of the marine forms is at present impossible, and must be left until some future date. Therefore I have thought it better merely to report the matter now, and to publish my observations later on when they have been considerably amplified.

Nematodes were found to be plentiful in localities rich in detritus, such as the fine shingle among the rocks and boulders in the Laminaria zone and among the small filamentous seaweeds in the rock-pools. But they were almost equally abundant (though some of the genera were different) in shore-sand, in which there was scarcely any detritus.

Nematodes were not observed to be plentiful in actively decaying animal and vegetable matter. Two were seen feeding within the almost completely emptied skin of a decaying Tubificid worm. There were, however, quantities of small flagellates present, and it may have been these, and not the worm, that the nematodes were devouring.

Nematodes occurred in quantity in situations where diatoms were plentiful, as among small red and green seaweeds growing in the rock-pools and attached to boulders just exposed at low tide. Several individuals, which appeared to belong to the genus Oncholaimus, were seen to contain diatoms, all of the same genus Fragilaria, both in the œsophagus, down which they were passing, and in the intestine, where they were congregated. The diatoms found inside the nematodes were all of the elongated, pennate type, that is, of such a shape as would allow them to pass readily down the œsophagus. These diatom-consuming nematodes were found among tufts of *Corallina officinalis* in the rock-pools and in bunches of small filamentous seaweeds, such as Polysiphonia, which were growing epiphytically on *Fucus vesiculosus* and *Ascophyllum nodosum*. The same genus, and apparently the same species, of nematode, however, was plentiful in shore-sand where diatoms were found to be relatively scarce. Bastian in his monograph records the similar occurrence of diatoms in nematodes. He says (p. 84):—"In individuals of the genera Cyatholaimus and Spilophora I have frequently seen the intestine filled with large Diatomaceæ, whilst in species of other genera I have occasionally made out a few cells of algæ."

In Leuckart's *Festschrift*, 1892, Dr. de Man described a new species of nematode forming wart-like galls on the "stems" of *Ascophyllum nodosum*, the knotted wrack. It is closely related to the notorious *Tylenchus devastatrix*, and was named by him *T. fucicola*. This was the first discovery of galls formed by a parasitic nematode on seaweeds. The galls themselves were described by Miss E. S. Barton in the Phycological Memoirs of the British Museum, part i., 1892. The material on which they were found was collected at Stonehaven, Kincardineshire, on the east coast of Scotland, and at Seamill, W. Kilbride, Ayrshire, on the west. I kept a careful look-out for these galls at Port Erin, but, being unfamiliar with their appearance, was only fortunate enough to find one, though probably they are really plentiful. The galls and the nematodes present inside them corresponded to the descriptions given by Miss Barton and Dr. de Man, and are without doubt the same.

No relation was discovered between the position or vertical movements of nematodes in the shore-sand and the presence or absence of daylight, though it is possible that some sort of relation exists.

GILBERT E. JOHNSON.
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May 20.

Lobsters in the Ægean.

IN NATURE of March 7 (p. 9) "W. T. C." quotes from Prof. Herrick the statement that the common lobster is not found in the Mediterranean east of the Adriatic; and, if perhaps this statement be not made so categorically elsewhere, I can at least find no mention of the lobster's occurrence in the Ægean in the works of Forbes, Heller, Carus, or other authoritative writers. The point is interesting, as the writer points out, because the lobster was well known to Aristotle; and so I have sought further information from my friend Prof. N. Apostolides, of Athens. Prof. Apostolides tells me that the lobster does occur in the Ægean, but comparatively rarely. On the islands of Syros and Sciathos there is a great fishery of *Palinurus vulgaris*, the crawfish or "Langouste," in modern Greek ἀστακός, and with it the market of Athens is abundantly supplied. Together with it, but only in the proportion of one in a thousand, the common lobster, *Homarus vulgaris*, modern Greek καραβίδα, also occurs; in the Sea of Marmora, however, the latter species is more abundant.

It would be highly interesting to know something more about the distribution of the two species in other parts of the Ægean, and to verify further, for instance, Aristotle's statement (*H.A.*, V., 17, 459 *b*) that lobsters are found in the Hellespont and on the coast of Thasos, and crawfish in the neighbourhood of Sigeum and Mount Athos. It would be especially interesting to know something of their relative abundance at Mitylene, where (as I believe) Aristotle did much or most of his zoological work; but this is only one of the multitude of points interesting to the student of Aristotle that might be cleared up by exploration of that particular neighbourhood.

It will be seen that the names of the two species in modern Greek do not agree with Aristotle; for it is abundantly clear that (*e.g.* in *H.A.*, IV., 2, 526 *a*, 12) Aristotle describes the common lobster under the name of ἀστακός, and that his κάραβος is *Palinurus locusta*. In this identification of the Aristotelian names the chief commentators, Cuvier, Schneider, Young, Aubert and Wimmer, are all at one: and so there would seem to have been an exchange of the two names, one with another, for which transference we cannot at present account.

May 21. D'ARCY W. THOMPSON.

Birds' Nests.

BEING occupied at present in an endeavour to ascertain the method of transmission of the trypanosomes and other blood parasites occurring in common British birds, such as the chaffinch, I very much desire to obtain nests, with the view of searching them for fleas; the nests which I want especially are those of the house-sparrow and the chaffinch, in both of which occurs the particular flea (*Ceratophyllus fringillae*) that I require. May I ask any of your readers who may be interested in the subject if they can procure for me nests of either of the above-mentioned birds? I shall be greatly obliged if any nests will be sent to me at the Lister Institute of Preventive Medicine, Chelsea Gardens, London, S.W. Nests should be well and closely wrapped up in paper, as soon as possible after being obtained, in order to prevent the possible escape of any fleas which may be present. Of course, any out-of-pocket expenses, &c., will be gladly refunded. H. M. WOODCOCK.

The Lister Institute, May 27.

June Meteor-showers.

THE following meteor-showers become due during the month of June:—

Epoch June 4, 10h. 30m. (G.M.T.), approximately twenty-fourth order of magnitude. Principal maximum, June 4, 9h. 10m.; secondary maxima, June 3, 7h. 5m. and 14h. 10m.

Epoch June 7, 6h. 30m., approximately eighth order of magnitude. Principal maximum, June 6, 7h. 30m.; secondary maximum, June 7, 0h. 30m.

Epoch June 10, 18h. 30m., approximately fourteenth

order of magnitude. Principal maxima, June 7, 21h. 35m., and June 9, 18h. 15m.; secondary maximum, June 9, 7h. 20m.

Epoch June 13, 6h. 30m., twenty-eighth order of magnitude. Principal maximum, June 11, 1h. 5m.; secondary maximum, June 10, 22h.

Epoch June 12, 6h. 30m., eighth order of magnitude. Principal maximum, June 12, 9h. 55m.; secondary maximum, June 13, 16h. 45m.

Epoch June 13, 7h. 30m., twenty-eighth order of magnitude. Principal maximum, June 14, 22h. 10m.; secondary maximum, June 13, 11h. 40m.

Epoch June 16, 2h. 30m., twenty-second order of magnitude. Principal maximum, June 15, 21h. 10m.; secondary maximum, June 14, 10h. 45m.

Epoch June 18, 1h., approximately second order of magnitude. Principal maxima, June 15, 16h. 10m., and June 17, 12h. 55m.; secondary maximum, June 17, 5h. 10m.

Epoch June 18, 4h., fourteenth order of magnitude. Principal maximum, June 17, 22h.; secondary maximum, June 16, 18h. 50m.

Epoch June 26, 19h., eighth order of magnitude. Principal maxima, June 24, 15h. 50m., and June 25, 14h. 45m.; secondary maximum, June 25, 4h. 30m.

Epoch June 27, 12h. 30m., thirteenth order of magnitude. Principal maximum, June 26, 13h.; secondary maximum, June 27, 11h. 20m.

Epoch June 26, 19h., ninth order of magnitude. Principal maxima, June 27, 1h. 5m., and June 28, 21h. 45m.; secondary maximum, June 28, 10h. 20m.

During the first week in June there is not much meteoric activity, the first important maximum of the month occurring on June 7, 21h. 35m. Another interesting maximum, but not so large, is that of June 11, 1h. 5m. Of the two principal maxima of the epoch of June 18, 1h., that due on June 15, 16h. 10m., is the more noteworthy, and this remark is also specially applicable to the maximum of June 28, 21h. 45m.

JOHN R. HENRY.

May 27.

Solar Halos on May 17.

READERS of NATURE may like to hear of a curious set of halos seen at Goudhurst on May 17 at 6.45 p.m.

The first thing noted was an object high over the setting sun, just like a moustache brushed into a fierce upward curve. This had a metallic lustre like burnished brass, and marked the contact between two coloured circles, the top one, of which only about one-sixteenth was visible, showing two colours, silvery blue on the concave and rusty buff on the convex. The lower halo was complete down to the horizon, and showed all the colours, while from the sun itself a long slender cone rose about half-way up to the moustache, and had exactly the same colour and lustre.

Both halos were enveloped in a huge outer one, of which the top was visible for a few seconds only, and that while the others were very dim. There was thus no chance of seeing the relation of it to the top inner circle.

A rough attempt to measure the radius of the big halo with the hand and outstretched thumb seemed to make it subtend about 44°, and the inner one by a still rougher method about 23°; perhaps someone will be able to tell me whether anything near these angles is possible.

To the eye the outer circle seemed just double the inner one, but the top of it, during the brief time that it was visible, seemed to narrow almost to a pointed arch.

W. P. HASKETT-SMITH.

United University Club, Pall Mall, May 24.

A Mineral from Copper Ore.

A FEW weeks ago I received a quantity of copper ores from Atacama, Chile, and on examining them was struck by the peculiar appearance of one specimen. The ground mass consisted of a kind of quartz conglomerate, containing some fissures, which were filled with a loose aggregate of minute clear and bright-green crystals. These crystals, of about one-sixteenth of an inch in length, are very thin, and belong to the monoclinic system. Some are double pyramids, others more columnar, with base, but the majority are absolutely distorted, owing to their growth being impeded by others of their kind.

This mineral seemed to be natro chalcite,

$$Na_2SO_4Cu_4(OH)_2(SO_4)_22H_2O,$$

but even on heating the crystals for more than an hour up to 170° C. no loss of water occurred. On examining the crystals we found that they contained only 32 per cent. of copper, but 48 per cent. of SO_4, instead of, as in natro chalcite, 39 per cent. Cu and 43 per cent. SO_4.

The formula for the mineral would therefore be:

$$CuSO_4Cu(OH)_2Na_2SO_4,$$

viz.

$$Cu\begin{matrix}<OH\\ <SO_4Na_2SO_4.\end{matrix}$$
$$Cu<OH$$

The crystals are insoluble in cold water, but get broken and partly dissolved in boiling water.

They are easily soluble in acids or liquid ammonia.

P. WALTHER.

44 Sanderson Road, Jesmond, Newcastle-on-Tyne, May 15.

Clouds and Shadows.

GIVEN a background of fine stratus, blue-black shadows are often thrown upon it, particularly by the setting sun from mountain peaks or the summits of masses of cumulus. On this coast such shadows attain a great length; there may be four or five ray-like shadows diverging from the sunset glow to the zenith, becoming broader as they rise. This seems quite simple, the shadows being cast by the reflected light of the glowing clouds in the west, not by the sun itself, of course; but what to me needs explanation is the reappearance of the rays in the east. Opposite the sunset is a broad band of lilac-pink extending for 30° or so towards the zenith, and upon this the dark bands reappear, converging and narrowing upon a point opposite the sunset. In some cases one can almost trace the shadow bands the whole way from the west over the zenith to their eastern focus. The appearance is very striking, but I have seen no description of it.

CYRIL CROSSLAND.

Sudan Government, Red Sea Province, Office of the Marine Biologist, Dongonab, May 5.

THE ASIATIC SOCIETY OF BENGAL.

ALL societies which attempt, as the Asiatic Society of Bengal professes to do, to cover the whole field of scientific knowledge are at present exposed to obvious danger. In the first place, the growth of specialism, with societies and journals devoted to single branches of learning, tends to attract important contributions to periodicals which provide for the wants of the botanist, chemist, or geologist. The Bengal

Society, founded by that enthusiastic scholar, Sir W. Jones, in 1784, naturally complains that its scientific work is hampered in this way.

The managers of an Oriental society are, again, confronted by the difficulty that the best scientific workers are usually hard-worked officials, and that continuity of effort is impeded by the constant changes in the staff due to deaths, transfers, invaliding, and furloughs. It is, of course, true that at present the lack of trained workers tends to limit its activity; but, as in the case of the Celtic movement in Ireland, nationalist aspirations are beginning to attract increased attention to the science, art, antiquities, and literature of India, and a body of men of science is being gradually created which is prepared to devote itself to unremunerative investigation. The larger attendance of educated Bengalis at the meetings of the society is a welcome indication of progress.

At the present time an opportunity is being offered to the British and native residents of Calcutta of asserting their claim that their city should be regarded as a centre of scientific life, even if the seat of the Executive Government be removed to Delhi. The society's buildings, erected in 1807, at present, owing to the ravages of time and especially to the great earthquake of 1897, no longer provide safe accommodation for its meetings, library, and other collections. With the aid of a liberal grant from the Government of India—that of Bengal has strangely refused to cooperate—a scheme for the erection of new buildings is under consideration. We trust that the liberality of the citizens of Calcutta will provide for the erection of a more worthy edifice than that at present contemplated.

Meanwhile, under the control of a capable council, it exhibits a record of which any society may be proud—an increase of membership from 357 to 508 in the period 1905–1910. This result is largely due to the establishment of a branch medical society, devoted to the study of Oriental disease and to the examination of the material which Indian hospitals provide with such liberality for the use of the physiologist and the anatomist. This is a most effective means of keeping the physician and surgeon, isolated in a country station, in touch with recent scientific progress.

Another promising sphere of the work of the society is the examination of the extension of Buddhist and Hindu art and beliefs across the Himalaya into Tibet. This is a fitting commemoration of that devoted pioneer in this branch of learning, Csoma de Koros, a member of the society. For the prosecution of these studies the society has lately acquired a copy of the great Tibetan cyclopædia, the Tangyur.

The set of the recent issues of the society's Proceedings and monographs now before us illustrate the wide scope of its operations in the study of the natural sciences, ethnology, archæology, and philology. We may congratulate it on its present state of efficiency, which offers a promise of successful exploration of the various fields of science which India and its borderlands present in such abundance and interest.

THE MINERAL PROSPECTS IN THE ANGLO-EGYPTIAN SUDAN.[1]

THE Anglo-Egyptian occupation of the Sudan led to the hope that the ancient mines might again be worked successfully. The geological structure of the country was known to be not unpropitious, for though a large proportion is covered by barren sheets of Nubian Sandstone, there are vast areas of metamorphic rocks invaded by igneous intrusions. The country was known to have yielded much gold to ancient miners, and some is still found and exported from the adjacent parts of Abyssinia. Large concessions have been granted to British syndicates and carefully prospected. Many of these areas were taken up owing to the remains on them of ancient workings. The results of the prospecting expeditions have, however, been most disappointing; gold is found to be widely distributed in small quantities, but, so far, has not been found in quantities that will pay to mine under modern conditions. There is only one gold mine working in the Sudan, and its yield to December, 1910, was only 45,308*l*. Lead and copper ores are known to exist; iron is abundant, and there are salt deposits which will be of local value. Coal occurs in Abyssinia, and poor lignite in the Sudan. There seems, however, no immediate prospect of the Sudan becoming an important mining country, owing to the expense of access and the scarcity of water and fuel.

Mr. S. C. Dunn, the director of the Geological Survey of the Anglo-Egyptian Sudan, has not, therefore, a hopeful story to tell as the result of the past ten years' operations. He has wisely issued as a bulletin a statement of the historic evidence as to the mineral resources of the country, and a collection of the chief reports by the recent prospectors. He regards eighty-five old workings as certainly due either to the ancient Egyptians or to Arabs before the tenth century A.D., though none of these have proved to be capable of being worked at a profit under modern conditions. The antiquity of Sudanese mining is shown by a regulation assigned to the time of Menes in the thirty-eighth century B.C., by which the bimetallists of that period fixed the price of silver as two and a half times that of gold, and it was not until 2000 B.C. that the rise in the price of gold rendered the two metals of equal value.

The bulletin also contains a translation of some passages from Russegger's "Reisen," which refer to his discoveries and reports as to the occurrence of gold in the eastern Sudan made during his expedition from 1835–1841.

Russegger found abundant traces of gold and gold mining, and described the district around Beni Shangul on the western side of the Blue Nile as a "veritable Eldorado," but it has not proved so to the London and Sudan Development Syndicate, though the natives still wash gold from the gulleys between the rains and the harvest. Mr.

[1] "Notes on the Mineral Deposits of the Anglo-Egyptian Sudan." By Stanley C. Dunn. Pp. 70+2 maps. Published by the Sudan Government. (Khartoum: The Sudan Press; Edinburgh: Oliver and Boyd, 1911.) Price P.T. 7½, or 1*s*. 6*d*. (The Anglo-Egyptian Sudan Geological Survey, Bulletin No. 1.)

Dunn dismisses Russegger's views as based on "extravagant optimism."

The bulletin includes the reports of fourteen syndicates; but of these companies thirteen have allowed their concessions to lapse, and the only mine at work is that of Om Nabardi.

The prospecting has no doubt been superficial and hurried, and it is possible that mining may yet prove profitable in some of the goldfields; but the evidence is not sufficiently promising to tempt private enterprise to spend more money in prospecting. A geological survey of the country is now the best chance of ultimate success, for it should indicate the best sites for more detailed research, and the prospects are sufficient to justify the expenditure by the Government. The collected reports will be very useful, but might have been accompanied by some editorial notes, for though the preface contains the warning that the director is not responsible for the statements quoted, the bulletin gives currency to many which are certainly erroneous. Thus one report states that the district described contains "nearly every class of volcanic rocks," yet it mentions none in the detailed account, and apparently no volcanic rock is present in that area. The repetition of such statements without warning in the official bulletins of a geological survey is apt to lead to subsequent mistakes. J. W. G.

JEFFERSON PHYSICAL LABORATORY.[1]

THE previous volumes of the series of publications from the Jefferson Physical Laboratory, which have been published annually, have contained a reprint of the original publications contributed during the year by the staff and students of the Jefferson Physical Laboratory, Harvard University. The volume before us differs somewhat in scope and intention from its predecessors, for it is dedicated to Prof. John Trowbridge on the occasion of his retirement from the directorship of the laboratory. An excellent photograph of Prof. Trowbridge is given in the frontispiece, and the following dedication is included:—"To John Trowbridge, who projected a great physical laboratory for Harvard University and found the means to build and equip it, who by his foresight, invention, and care has kept this laboratory among the foremost in opportunities for scientific achievement, and by his magnanimity has made it a place proverbial for good feeling, this volume is gratefully and affectionately dedicated by those who have profited by his labours and enjoyed his friendship."

The volume, which is twice or thrice as bulky as the previous numbers, contains the reprint of twenty-six papers contributed by past and present students of the Jefferson Physical Laboratory. Most of the papers have been published in other journals before the appearance of the present volume. Among the contributors are Prof. Kennelly and Mr. Alexanderson, who give an account of some experiments on the physiological tolerance of alternating-current strengths for frequencies up to 100,000 cycles per second; Prof. B. O. Peirce, with several papers on magnetism; Prof. Lyman, on the spectra of some gases in the Schumann region; Prof. Duane, on the heat generated by radio-active substances; and Prof. Richards and J. H. Mathews, on a method for determining heat of evaporation as applied to water. The last paper in the volume is a short one by Prof. Sabine, and gives an account of some interesting experiments on the relative sense of loudness of sounds of different pitch shown by different observers.

It will be seen that the contents of the volume are very varied in character, covering the greater part of the domain of physics. The list of the distinguished contributors to this volume and the character of the papers contained in it afford a striking illustration of the great influence of the physical laboratory of Harvard University on the development of physical science in America. Not only has the laboratory been responsible for the training of a number of men of science who have gained great distinction, but it has always taken a leading place in the promotion of scientific research and in its original contributions to physics.

E. R.

[1] "Contributions from the Jefferson Physical Laboratory and from Colleagues and former Students, dedicated to Prof. John Trowbridge, S.D., for the Year 1910." Vol. viii. (Cambridge, Mass., U.S.A., n.d.)

NOTES.

THE Court of Inquiry into the loss of the *Titanic* was on May 22 occupied with a consideration of the warnings as to ice received by wireless telegraphy by the vessel before the disaster. From the evidence as reported in the Press, it would appear that during the course of the *Titanic's* voyage six vessels communicated definite information as to the position of ice. Five of the warnings, it is reported, were received on the day of the wreck—the last some two hours before the collision with the iceberg. As to whether all the messages were communicated to the captain and officers there would seem to be doubt, and, in view of the death of the chief telegraphic operator, this may never be known. The court will, however, report on such matters. The only bright point in this sorrowful subject relates to the services rendered by science through wireless telegraphy. By it were the warnings given, and when these were disregarded, with terrible consequences, the call for help which went vibrating through the æther brought rescue to the survivors in the boats. No patrol system could have given more particulars of the positions of the ice than is contained in the advices communicated by various vessels, and no method which may be devised of detecting ice at a distance can prevent disaster if its predictions have to be neglected on account of the exigencies of rapid transit. After everything has been done by science to avoid calamity, there is still need for care and foresight in making full use of the warnings offered.

AMONG the recommendations of the American Committee of Inquiry into the circumstances of the *Titanic* disaster are that there should always be some-

body on duty at the wireless telegraphy apparatus, that there should be legislation against interference by amateur operators, and that all ships carrying more than a hundred passengers should have two searchlights. In connection with the last recommendation a paper by Dr. Henry Wilde, F.R.S., on searchlights for the mercantile marine, of which a summary appears among our reports of societies (p. 338) is of particular interest. Dr. Wilde states in his paper certain causes which have retarded the progress of the use of searchlights on merchant ships, and are largely responsible for the deplorable event which is now engaging the attention and sympathy of the civilised world. The great value of searchlights for navigation, as well as for other purposes, at sea, was reported to the Lords Commissioners of the Admiralty by Admiral Sir Beauchamp Seymour in 1876. The Admiralty later claimed the right, from the exigencies of the public service, to use Dr. Wilde's inventions without making any compensation, and to prevent the adoption of the searchlight in ships other than those of the Royal Navy. There are many circumstances in which searchlights are useful apart from the navigation of ice-fields and the avoidance of icebergs, as instanced in the detection of derelicts and the rendering of assistance to other vessels in a disabled or sinking condition. Referring to the loss of the *Titanic*, Dr. Wilde remarks, "It has been repeatedly stated in evidence that at the time of the collision and for some hours afterwards, the atmosphere was perfectly clear, so much so that the stars were seen brightly on the horizon. If, therefore, the *Titanic* had been equipped with an efficient searchlight, an iceberg would have shone out by reflection at a distance of several miles (visible to all persons on deck) and collision therewith would have been easily avoided. The ultimate responsibility, therefore, of a calamity which the world now deplores rests upon the naval authorities at Whitehall through their blind policy of excluding searchlights from the mercantile marine."

IN the list of those who are now known to have perished in the *Titanic* disaster, we regret to note the name of Mr. Henry Forbes Julian, a well-known member of the Institute of Mining and Metallurgy. Mr. Julian was a pupil of Sir Henry Roscoe, and began his career as a consulting engineer for the mining of precious metals in South Africa. In 1904, with Mr. Edgar Smart, he published a treatise on "Cyaniding Gold and Silver Ores," which has passed through three editions. He was an unassuming student of several branches of science, and for many years regularly attended the meetings of the British Association. In 1902 he married the youngest daughter of the late Mr. William Pengelly, F.R.S., and also became an active member of the Devonshire Association and the Torquay Natural History Society. With Mrs. Julian he travelled extensively, and a large circle of friends mourns his sad loss.

THE KING has conferred the honour of knighthood on Mr. Harry James Veitch, who has taken a leading part in connection with the recent International Horticultural Exhibition, and has been a pioneer in many departments of horticulture, notably in the hybridisation of plants, and in the collection of rare specimens from many parts of the world.

AN extra meeting of the Chemical Society will be held at Burlington House on Wednesday, June 26, at 8.30 p.m., when Sir William Tilden, F.R.S., will deliver the memorial lecture in honour of the late Prof. Stanislao Cannizzaro.

THE Peabody Museum, Yale University, is hoping to benefit by an expedition which will visit Texas and Nebraska this summer in search of fossil remains of prehistoric horses. The museum at present contains parts, but parts only, of twenty-six such horses. A look-out will also be kept for remains of the great imperial mammoth. The expedition will be led by Prof. R. S. Lull, assisted by Mr. F. W. Darby.

THROUGH the liberality of a friend, the Smithsonian Institution has just been able to participate in a zoological expedition to the Altai Mountain region of the Siberia-Mongolian border, Central Asia. Mr. N. Hollister, assistant curator, Division of Mammals, U.S. National Museum, represents the institution, and will make a general collection of the birds and mammals. At present the party expects to remain in the field for four months hunting and collecting, returning to the United States about the beginning of October.

THE Government Bill to deal with the subject of the feeble-minded, to which reference was made in a note in our last issue (vol. lxxxix., p. 300), has formed the subject of discussion at the meetings of several associations during the past week. The Medico-Psychological Association resolved unanimously that the authority which will have to administer the new Feeble-minded Persons Control Act should be constituted at once in anticipation of any amalgamation such as is contemplated by section 62, and that such body, in the first instance, should consist of the Commissioners in Lunacy. The general committee of the London Teachers' Association passed a number of resolutions on the subject. Among other matters, this committee urges that any measure for the education, care, and training of mentally defective children should be made compulsory; that all educable mentally defective children should be registered; that the present system of special instruction for mentally defective children in day special schools should be continued; and that all children, still certifiable as mentally defective on leaving schools or institutions, should automatically be subject to the control of the commissioners.

DR. H. BAYER publishes a lecture (Jena: Fischer, 50 pp.) on "Vererbung und Rassenhygiene," addressed especially to the medical profession. It is intended as a sketch on quite general lines of the principles underlying eugenics. The work of Galton, Pearson, and Johannsen is described and compared, after which follows a discussion of Weismannism. Although the inheritance of somatic acquirements is rejected, considerable importance is ascribed to the action of environment on the germ-cells. A clear

account of Mendel's laws is illustrated by coloured diagrams. Proceeding to the consideration of eugenics in particular, the author maintains that at the present time the chief task of the eugenist is the collection of accurate family histories, more especially the results of consanguineous marriage. The possibilities in this direction are illustrated by good genealogical charts of the Habsburg dynasty, showing the occurrence of the famous lip and the remarkable amount of consanguineous marriage. In conclusion, the author gives a tabular summary of types of inheritance. With regard to the practical aspect, he considers that the science of eugenics is still in a very elementary stage; its task is rather investigation than drastic action, for which our knowledge is not yet ripe.

THE Research Department of the Royal Geographical Society brought its worthy career to a close on Thursday, May 23, with a valedictory address by the chairman, Prof. J. L. Myres. It is not to be supposed that the society's efforts at encouraging research in geographical subjects have been tried and found wanting; rather they have been attended with such success that it is in future intended to add to their efficacy by making the afternoon meetings at which research subjects have hitherto been discussed no longer departmental meetings, but meetings of the society as a whole. Prof. Myres pointed out in his address some of the important branches of study that have come under the purview of the department—branches which fully justify a wider view being taken of them. They include new methods of surveying, problems of geomorphology (especially those affecting rivers and coasts), of hydrography and of climatology, various regional and synthetical studies and investigations from the point of view of distribution, physical changes within historic times, and the exploration or investigation of particular territories with special regard to conditions affecting their settlement and economic development. The list is nearly, if not quite, as comprehensive as the term "geography" itself.

ON May 6 the Aëro Club of Washington held a field day in commemoration of the anniversary of Dr. S. P. Langley's first successful flight with his model steam "aërodrome" on May 6, 1896, when the practicability of mechanical flight was demonstrated. The successful model was a steam-driven, double-propeller tandem biplane, having a total sustaining surface, without the tail, of 68 square feet, and a total flying weight of 26 lb. Its engine was rated at about one horse-power. In the initial flight the machine remained in the air for one minute and thirty seconds, and traversed a distance of about 3000 ft., a little more than half a mile. It landed safely in the Potomac River, as had been planned, was taken out, immediately put on the track, and relaunched. In the second flight a repetition of the former success followed. In a subsequent report on the subject Dr. Langley said:—"A flying machine, so long a type for ridicule, has really flown; it has demonstrated its practicability in the only satisfactory way—by actually flying, and by doing this again and again under conditions which leave no doubt." Later experiments with a man-carrying machine were terminated by two trials in 1903, which were discouraging after the labour and effort put upon the machine itself and the auxiliary apparatus. The aëroplane was precipitated into the water before it was fairly launched into the air, due to a slight defect in the launching apparatus. Dr. Langley admitted no failure in his machine, which all students of modern aviation agree was correctly built, and undoubtedly would have flown if it had been properly launched. Not realising that the launching was an accident and not a failure, and not understanding that the proceedings were in the nature of a Government secret, the Press and the public ridiculed Dr. Langley and his machine, and the War Department decided not to renew the grant for further experiments.

THROUGH arrangements made with the Metropolitan Museum of New York, the Smithsonian Institution and the U.S. National Museum have been investigating the physical characteristics of the natives of the Kharga Oasis, in the Libyan Desert, lying about 130 miles west from Luxor. Dr. Ales Hrdlicka, curator of physical anthropology, U.S. National Museum, spent some fifteen weeks in the field carrying out the work, and the results of his studies have just been issued by the Smithsonian Institution under the title "The Natives of the Kharga Oasis, Egypt." Owing to their isolation, the natives of the oasis may be regarded as representing the old inhabitants of the region, who probably settled there about 2000 B.C. In selecting individuals for examination and measurement, Dr. Hrdlicka chose only those showing normal development, who were apparently free from negro admixture. The total population of the oasis is about 10,000, including some Bedouins, but out of this number Dr. Hrdlicka found only 150 individuals available for study. The type of the Kharga natives is radically distinct from that of the negro. It appears to be fundamentally the same as that of the non-negroid Egyptians of the Nile Valley, and is a composite of closely related north-eastern African and south-western Asiatic, or "Hamitic" and "Semitic," ethnic elements, and is to be classed as part of the southern extension of the Mediterranean subdivision of the white race.

MR. R. TORII publishes in vol. xxxii. of the Journal of the College of Science, Imperial University of Tokyo, the second part of an elaborate anthropological monograph on the aborigines of Formosa. The present instalment is confined to the Yami tribe of Kotosho or Botel Tobago Island. They are a small race, averaging only 5 ft. 2 in. in height, and seem to be formed of two distinct types, one with the small nose and non-protruding lips of the Malay, the other with projecting eyebrows, deeply sunk orbits, short noses, and large nostrils, with the large mouth and thick lips of the pure Papuan, but having lost his special feature—the frizzled hair. The monograph is furnished with an elaborate series of measurements and a number of good photographs of this little-known race.

IN the May issue of *Man* Mr. J. P. Johnson describes a series of native kraals with elaborate stone-wall enclosures in the Masibi Bantu Reservation on the Magalakwin River, in the north Transvaal, which are interesting in connection with the problems of the origin of the Zimbabwe and similar ruins. These kraals contain an inner and an outer enclosure, the former being used to stable the cattle at night, as a place of assembly, and to protect the grain-pits excavated beneath its floor. A curious feature of the enclosure is a tapering pole decorated with alternate coloured bands, and carved at the top in the shape of the head of a hornless ox. Mr. Johnson, owing to his ignorance of the language, could only ascertain that they were in some way connected with initiation rites. On the analogy of similar village poles in India and elsewhere, they seem to represent the embodied "luck" of the community. Thus they become easily anthropomorphised, and pass into some form of idol worship.

WE are indebted to the author, Mr. G. Weber, for a copy of an article from the *Sitzber. k. Akad. Wiss. Wien*, vol. cxxi., on the movements of the circumoral cilia in the heterotrichous infusorians, such as Stentor and its relatives. After reviewing previous theories, the author describes, with diagrams, his own views on the nature of these highly complex movements.

BY the Smithsonian Institution we have been favoured with a communication relating to a recent zoological exploring and collecting expedition in the neighbourhood of the Panama Canal. Large collections of fishes have been secured, which it is believed will be of great interest and importance in the future as indicating the present condition of the fish-fauna of the district. At present there appear to be more or less well-defined faunas severally restricted to the Atlantic and Pacific slopes and the two coasts of the Panama area, but when the canal is completed these faunas must become mixed. Many salt-water fishes, for example, will readily ascend fresh-water streams, and some will in this manner probably make their way to the Gatun Lake.

ACCORDING to a richly illustrated article by Dr. W. Leche, published in the "Zool. Jahrbüch" for 1912, the skull of the tropical American howling monkeys (Mycetes) undergoes a kind of retrograde post-embryonic development, in consequence of which it assumes a form assimilating to that characteristic of the lower mammals, such as Carnivora, rather than the type distinctive of the Primates in general. The embryonic skull, on the other hand, is essentially of the Primate type. The degeneration displays itself in the lengthening of the facial region, so that the skull gradually passes from a brachycephalic to a meso-, or even dolicho-, cephalic type, most of the cephalic indices thereby becoming much lower than in any other anthropoids, while the hemispheres extend to a smaller degree over the cerebellum in the adult than in the young. Observations are also recorded with regard to a correlation between the degree of development of a sagittal crest and of the jaws in the Primates. It is added that Pithecanthropus cannot, as often supposed, be merely a gigantic gibbon, as a gibbon of such stature devoid of a sagittal crest could not have existed.

THE Ctenophora, or comb-jellies, form one of the most remarkable and interesting groups of the pelagic cœlenterates, and are well known for their wonderful beauty and delicacy. For twenty years Mr. A. G. Mayer, now director of the department of marine biology of the Carnegie Institution of Washington, has been engaged upon the study of this group as it occurs on the Atlantic coast of North America. Publication No. 162 of the Carnegie Institution contains the results of this investigation, and will be welcomed by all students of marine zoology. The group is a small one, and only twenty-one species have been recorded from the area in question. Four of these are new to science, while six are Mediterranean species. The work, which is very beautifully illustrated, comprises a general account of the anatomy and detailed descriptions of the species, together with notes on the physiology and embryology. One would scarcely suppose that these transparent gelatinous organisms could be a source of danger to the existence of such highly organised animals as fishes, but it appears that in the cold northern waters they occur in vast swarms and constitute a serious menace to the cod fisheries by devouring the pelagic eggs and young fish.

PROF. H. SPEMANN (*Zool. Jahrb.*, Bd. xxxii., Heft 1) describes experimental studies on the development of the eye in embryos of the edible frog. He cut out a portion of the medullary plate, and replaced it, but with the anterior and posterior ends reversed. The wounds healed, and the piece proceeded to develop as if it were in its normal position. By arranging that the anterior cut passed through the anlage of each eye, it was found possible to produce tadpoles with four eyes—two in the normal position and two further back, either in front of or behind the auditory organ. If the lens-forming cells were replaced by epidermis transplanted from any other part of the head, or from the body, the optic vesicle was unable to evoke the formation of a lens from these "foreign" cells. The author transplanted, in embryos of the mountain toad, *Bombinator pachypus*, a small fragment of the eye, together with the overlying lens-forming epidermis, to a more posterior position, and found that the lens formed was well developed, although the retinal fragment was very small and deformed. The formation of the lens could scarcely be due, in this case, to any mechanical stimulation which such a small eye-fragment could exert, but was possibly due to some specific chemical stimulus proceeding from the fragment.

PROF. C. CORRENS, who shares with de Vries and Tschermak the honour of having "rediscovered" Mendel's laws in the year 1900, and who has since contributed so materially to the science of genetics, has just published under the title "Die neuen Vererbungsgesetze" (Berlin: Gebrüder Borntraeger, price 2 marks) a useful and readable account of the more recent discoveries in this field. The book is

expanded from a semi-popular lecture, and it gains materially in interest from the fact that the author largely describes his own work, including some results published for the first time.

MR. R. S. ADAMSON, of Cambridge University, has published an interesting and detailed ecological study of a small woodland area at Gamlingay, near Cambridge. The distribution of the vegetation itself is correlated with observations on climate, composition and water-content of the soil, evaporation, light intensity, and other factors of the habitat. The wood is situated on Boulder Clay, above Gault and Lower Greensand. The clay gives rise to two very distinct types of soil—a heavy calcareous clay and a non-calcareous loam. The vegetation of these soils is quite different, the calcareous soil supporting an oak-and-ash association, and the loam a pure oak association, each with its own characteristic plant-societies. Six plates accompany the paper, which appears in the Journal of the Linnean Society, vol. xl. (January).

IN the *Jahres-Berichte und Mitteilungen des Oberrheinischen geologischen Vereines* for 1912, Heft ii. (1.50 marks), various writers combine to furnish a geological guide to the interesting district between Bâle and Laufenburg on the Rhine. The occasion for these papers was the meeting of the society in April at Rheinfelden, one of those beautiful old-world centres from which much of Switzerland and of the Black Forest may be visited. South of Bâle, again, lie picturesque ravines and ridges in the Juras, where the strata are happily fossiliferous. At Laufenburg, of which many travellers to Constanz catch some glimpse from the railway, the floor of ancient gneiss comes to the surface from beneath Permian and Triassic strata, and the Rhine forms picturesque rapids across the obstacle. Those in search of a field of study where a variety of rocks and a variety of physiographic features are conveniently combined, and where even the villages retain a mediæval character, may well turn, under such guidance, towards the Upper Rhine.

AMONG the various contributions of interest and importance to the first volume of the "Records of the Survey of India, 1909–10" (Calcutta, 1912), there is one from the pen of the Surveyor-General himself, Colonel S. G. Burrard, which, though occupying barely a single page, foreshadows the establishment of a branch of the work which will be of peculiar value to physical geographers. "It is intended in future," he says, "to maintain a record of all changes that may be noticed to have occurred or to be now occurring in the form and features of the land-surface." The beginning of the new topographical survey offered the opportunity for this. Instructions have been issued which indicate, by way of example, various directions in which changes may be looked for. Thus it is known that the sands of the Rajputana desert are advancing north-eastward under the influence of prevalent winds; it is desired to specify with precision how far they have done so, and whether there is a compensating retreat along the opposite fringe of the desert. The advance of the sand is known to have changed the course of Punjab rivers; it is desired to ascertain whether it is still doing so. The changes in river-courses generally, in the low plains, are to be observed with particular reference to the question whether their movement is always in a particular direction or not. The growth of deltas and the effects of irrigation works upon it, coastal changes, and the desiccation of formerly cultivated lands, are other important points to be noticed.

AN interesting paper discussing the results of a careful survey of the Girdle Stanes—a standing stone circle in Eskdale, Dumfriesshire—is published by Mr. G. R. Goldsbrough in part iii., vol. iv., of the Proceedings of the University of Durham Philosophical Society. Working on the orientation theory as enunciated by Sir Norman Lockyer, Mr. Goldsbrough finds convincing evidence that the foundation of the Girdle Stanes had an astronomical basis. A feature of the sight-lines is that two natural landmarks are employed, as at the Keswick Circle, according to Dr. Morrow, and this at first sight would appear to be rather a difficult condition to fulfil; but correspondence with Mr. Goldsbrough elucidates the demonstration that at the Girdle Stanes it was quite a simple matter to place the circle so that these two existent features might serve as azimuth marks. Mr. Goldsbrough finds evidence that the sunrise of the first and second quarter days of the May-year was marked, and that clock stars and warning stars were probably used at the Girdle Stanes about 1300 B.C.

THE volcanic eruptions in the Philippine Islands have been attended with serious loss of life on two occasions, one of Mayon in 1814, the other of Taal in 1911. In order to determine whether this loss might have been averted or lessened, the Rev. M. Saderra Masò, assistant-director of the U.S. Weather Bureau, has examined the phenomena preceding the eruptions (twenty in number) of these volcanoes during the last two centuries. He finds that both the explosive eruptions of Taal and the lava eruptions of Mayon have invariably increased from a mild beginning, indicated by earthquakes or subterranean noises, to a maximum intensity which followed generally after a few days, and but rarely a few hours later, thus allowing sufficient time for most persons to escape. An interesting result of the inquiry is that the earthquakes which have nearly always accompanied and followed the great eruptions of Taal cannot be ascribed to vibrations caused by the violent escape of the ejecta, but are due to movements of the fault on which the volcano is situated. This is shown by the persistence of the tremors after the volcano has returned to its normal state and by the migration of the seismic foci to the north-north-east and south-south-west of the volcano.

THE possibilities of an industrial development in the Highlands, from the utilisation of the water-powers, is foreshadowed in a paper read by Mr. A. Newlands, assistant engineer of the Highland Railway, before the Inverness Scientific Society, and now obtainable in pamphlet form from Messrs. Carruthers and Sons, *Courier* Office, Inverness. Nothing has

served so much in recent years to direct attention to the water-power of the Highlands as the installation of such works as those at Foyers and Kinlochleven, the former developing 7000 horse-power and the latter 30,000 horse-power. Many smaller installations are scattered over the north and west of Scotland, and Mr. Newlands discusses how the development of this natural resource can be effected throughout the area. He suggests that this potential power ought to be looked upon as a national asset, and that the appointment of a Royal Commission to examine and report is desirable. Scotland is estimated to possess a million horse-power from water, and even if the figures be put at one-half that amount, this, Mr. Newlands says, would represent an amount of power on a ten-hour working day basis throughout the year equal to that obtained from 3½ million tons of coal, which is about one-twelfth of the total quantity raised in Scotland for 1911, and of this quantity only a small proportion is converted into power.

THE seventh part, forming part ii. of the supplement, has reached us of "Bibliotheca Chemico-Mathematica: Catalogue of important Works, many old and rare, on Mathematics, Astronomy, Physics, Chemistry, and Kindred Subjects," issued by Messrs. Henry Sotheran and Co., of Strand and Piccadilly, London. Another useful catalogue is that published by Messrs. Dulau and Co., Ltd., of Soho Square, London, giving particulars of some 1703 works on entomology offered for sale by this firm.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR JUNE:

June 2. 16h. 0m. Mercury in conjunction with Saturn (Mercury 0° 28′ N.).
3. 20h. 36m. Uranus in conjunction with the Moon (Uranus 4° 31′ N.).
8. 19h. 0m. Mars at greatest distance from the Sun.
11. 16h. 54m. Mercury in conjunction with Venus (Mercury 0° 26′ N.).
13. 1h. 1m. Saturn in conjunction with the Moon (Saturn 5° 15′ S.).
14. 9h 4m. Venus in conjunction with the Moon (Venus 4° 29′ S.).
„ 13h. 40m. Mercury in conjunction with the Moon (Mercury 3° 48′ S.).
16. 14h. 44m. Neptune in conjunction with the Moon. (Neptune 5° 38′ S.).
17. 0h. 0m. Mercury in superior conjunction with the Sun.
„ 22h. 54m. Mars in conjunction with the Moon (Mars 3° 29′ S.).
21. 7h. 17m. Sun enters Sign of Cancer. Solstice.
26. 15h. 59m. Jupiter in conjunction with the Moon (Jupiter 4° 37′ N.).
29. 18h. 53m. Mercury in conjunction with Neptune (Mercury 2° 27′ N.).

THE REPORTED DISCOVERY OF A COMET.—No news of the reported discovery of a comet has come through the usual channels, and no further observations of such a body are reported. A bifurcated nebula, excessively long and irregular, is shown near the given position in the New General Catalogue.

THE SPECTRUM OF NOVA GEMINORUM NO. 2.—Although numerous papers have already been published dealing with the spectrum of Nova Geminorum No. 2, it is obvious that the nature and reason of its remarkably complex changes have yet to be explained, and probably the fuller discussion will controvert some of the conclusions already arrived at, as it must, for they disagree *inter se*.

One debated question, the true nature of the very earliest spectrum recorded, is of primary importance. Some observers say it was not like the F5-type spectrum (Procyonian type), a purely absorption spectrum, while Prof. Pickering believes that it was. In this he is supported by Mr. J. A. Parkhurst, who, writing in *Popular Astronomy*, No. 4, vol. xx., of the spectra secured at the Yerkes Observatory, states that the one photographed on March 13 was a dark-line spectrum of the F5 type in which the solar G group shows faintly just to the left of Hγ, but in which there was a slight tendency towards fluting in the continuous spectrum, not seen in the typical stars. The spectrum extended further into the ultra-violet than that of θ Geminorum, a Sirian star, thus indicating radiation at a much higher temperature than the average F5 star.

Mr. Parkhurst says that he believes this to be the first case in which the entire change from an absorption to an emission spectrum has been followed at this stage in the evolution of a new star, but Harvard reported a somewhat similar transition in the case of Nova Persei.

A telegram from the Kiel Centralstelle informs us that on a spectrogram taken at Bonn Observatory "dark lines [due to] uranium radium emanation" have been found by Dr. Küstner. The telegram was sent from Kiel late on May 28, but it is not stated on what date the spectrogram was secured.

THE MAY AQUARIDS AND HALLEY'S COMET.—From a discussion of the observations of the Aquarid meteor shower, made by the Bureau Central Météorique in 1910 and 1911, Herr Cuno Hoffmeister deduces parabolic elements of the meteor stream and compares them with the elements of the path of Halley's comet. The chief difference is in the longitude of the node, and when this is eliminated the approximate elements resulting show no difference which cannot readily be explained by the probable errors of observation of a meteor radiant. He concludes that there can be little doubt of the intimate relationship of the meteor stream and the comet (*Astronomische Nachrichten*, No. 4573).

THE MEASUREMENT OF CELESTIAL DISTANCES.—The current number of *Scientia* (vol. xi., No. 3) contains a very interesting paper by Mr. Hinks dealing with the measurement of celestial distances. Mr. Hinks reviews the enormous labours of the Eros campaign which enabled him to deduce so satisfactory a value ($8{\cdot}806'' \pm 0{\cdot}002''$) for the solar parallax, and pays a just tribute to the French institutions which, by their unselfish labours and expenditure, enabled the work to be completed.

He outlines the scheme for determining stellar distances more accurately and promptly, and points out the almost insuperable difficulties which at present appear to debar absolutely the direct measurement of many of them. The base line provided by the earth's orbit is so small, relatively, that only one star is known to have an annual parallax of 1″, and not more than twenty stars are known to have a parallax greater than 0·2″. The completion of the Astrographic Catalogue is a work of primary importance if future generations of cosmogonists are to attack this great problem under more favourable conditions than yet obtain.

THE ROYAL INTERNATIONAL HORTICULTURAL EXHIBITION.

THE Royal International Horticultural Exhibition which has just been held in the grounds of the Royal Hospital, Chelsea, possessed considerable scientific and educational interest. In the first place, a whole tent was devoted to scientific exhibits contributed by Prof. Bateson, Prof. Keeble, Prof. Balfour, the director of the Rothamsted Experimental Station, the Board of Agriculture and Fisheries, the Wye Agricultural College, Messrs. James Veitch and Sons, Mr. Backhouse, of the Innes Horticultural Station, Mr. William Cuthbertson, and others, whilst a most excellent exhibit of specimens of injurious insects, contributed by Mr. Georges Truffaut, of Versailles, was staged in the tent specially reserved for French exhibits.

Then there were two conferences held under the presidency of the Rt. Hon. A. H. Dyke Acland, one on Thursday, May 23, on horticultural education, and another on the following day on the subject of legislation in connection with insect pests. At the education conference the papers included one from Prof. L. H. Bailey, Cornell University, U.S.A., on horticultural education in America; Herr K. Weinhausen, Berlin, on horticultural education in Germany; Mr. W. Hales, on the education of a gardener; and Prof. A. Buyssens, of the School of Horticulture, Vilvorde, Belgium, on horticultural education in Belgium.

At Friday's conference Prof. Ritzema Bos, Holland, contributed a paper on the value of importation regulations as a means of preventing the introduction of plant pests from abroad; A. G. L. Rogers (Board of Agriculture), on the aim of legislation in Great Britain; H. Maxwell Lefroy, imperial entomologist for India, on legislation in connection with insect pests; H. J. Gussow, botanist to the Canadian Government, on legislation in connection with fungus diseases; and A. W. Sutton, Reading, on import dues and regulations.

Both conferences were fairly well attended, and the second one particularly appeared to excite much interest. The committee intend to get all the information possible on both subjects, and their report, together with the papers contributed to the conferences and the discussion, will be printed in the official report.

The exhibition will also be famous for the notable speech delivered by the Rt. Hon. Walter Runciman, President of the Board of Agriculture, at the jurors' luncheon. Mr. Runciman spoke very sympathetically respecting the proposed national diploma for gardeners, and though not pledging the Government to any particular line of action, he said that "whatever is best in the interests of horticulture in the allotting, organising, and examining for diplomas shall receive full assistance from the department over which I preside." Mr. Runciman then proceeded to make an even more notable announcement, namely, that he had created a horticultural branch of the Board of Agriculture, the interests of which will be devoted exclusively to horticulture, and near the head of that branch it was proposed to appoint one of the best entomologists the country can furnish.

AN EARLY CRETACEOUS FLORA.[1]

THE coastal plain of Maryland, a region forming part of the Atlantic slope which extends from the crest of the Alleghanies to the sea, consists of Mesozoic and Tertiary strata deposited in orderly sequence since the dawn of the Cretaceous epoch. It is with the estuarine and fluviatile beds of the Lower Cretaceous, or Potomac, group that this important volume is primarily concerned. With the exception of a few Reptilia and Mollusca, described respectively by Mr. R. S. Lull and Mr. W. Bullock Clark, the life of the period is represented by a rich flora, which has been entrusted to Mr. E. W. Berry. As stated in the preface, "The necessity of some sort of systematic treatment of the maze of described forms in the literature of the Potomac which would enable the geologist or botanist to obtain some idea of the flora has long been felt." This want is satisfactorily met by the publication of the reports included in the fourth volume of a series dealing with the stratigraphy and palæontology of Maryland.

The determination of fragmentary fossil plants affords ample scope not only for the imagination, but also for differences of opinion. Some of Mr. Berry's conclusions are open to criticism; but this is of minor importance, and reluctance to agree with a few of his determinations does not necessarily imply ability to do better. He has treated the subject from a broad point of view, and the result is a monograph of permanent value. The introductory section, by W. B. Clark, A. B. Bibbins, and E. W. Berry, includes a concise account of the Potomac group, with a bibliography and historical review, followed by a general discussion on the stratigraphical and palæontological features of the beds. In the two lower subdivisions of the Potomac group (the Patuxent and Arundel), ferns, cycads, and conifers are abundant, but the genera Rogersia, Proteæphyllum, and Ficophyllum are wisely distrusted by Mr. Berry as records of flowering plants. In the uppermost, or Patapsco, formation Angiosperms are abundant.

In a letter to Hooker in 1879 Darwin wrote:—"The rapid development as far as we can judge of all the higher plants within recent geological times is an abominable mystery." It is because this mystery is still unsolved that any additions to our knowledge of floras in which the earliest examples of flowering plants occur is particularly welcome. Mr. Berry expresses the opinion that the evolution of the Angiosperms was accomplished, if not inaugurated, in the Lower Cretaceous period. There can, however, be very little doubt that the angiospermous type had been evolved some time before the close of the preceding Jurassic epoch, though it was not until the later phase of the Cretaceous period that the remarkable success of the new type became apparent. Unfortunately, the Potomac Angiosperms are represented almost entirely by impressions of leaves, fossils which it is so easy to name but in many cases almost impossible to identify with confidence.

The concise summary by Mr. Berry of the literature on the Lower Cretaceous floras of the world is a welcome contribution both to geologists and to the student of ancient phytogeography. The descriptions by the same author of the Maryland plants, accompanied by good illustrations and some useful maps, mark a considerable advance on the less critical accounts of the Potomac flora previously published. Several new genera are instituted, though it is questionable whether they all rest on a satisfactory foundation. Some fronds of a "pseudo-dichotomous" habit are referred to Knowltonella, a genus assigned with hesitation to the Matonineæ on unconvincing evidence. The genus Dicksoniopsis is founded on pieces of fern fronds which afford no satisfactory indication of close relationship to Dicksonia rather than to other members of the Cyatheaceæ, and might well be included in the old genus Coniopteris. Similarly the generic name Dryopteris suggests an affinity to Dryopteris, which is not established.

In coining new names implying near relationship

[1] "Maryland Geological Survey.—Lower Cretaceous." Pp. 622+xcvii plates. (Baltimore: Johns Hopkins Press 1911.)

to recent genera, authors run considerable risk of misleading students who fail to appreciate the slender grounds on which such supposed affinity rests.

The volume issued by the Johns Hopkins Press is the best account of the Potomac flora so far produced, and the careful work of Mr. Berry, who is responsible for the greater share of the monograph, is deserving of warm praise. A. C. SEWARD.

THE LUMINOUS ORGANS OF CERTAIN INSECTS.

IN *The Canadian Entomologist* (1911, p. 399), Mr. F. A. Macdermott describes a number of interesting observations which afford strong confirmation of the view that the photogenic function in the Photinini is primarily a secondary sexual character; in at least four species in two of the genera, Lecontea and Photinus, the photogenic function serves undoubtedly as a mating adaptation. Direct observation showed that the female of, for example, *Photinus pyralis* responded by an answering flash to the flash of the flying male, which then dropped down, flashed again, and after her second answer alighted a few inches away from her, crawled towards her, flashing at intervals—to each of which flashes she responded—and finally located her.

It is interesting that in many cases it was possible to deceive the females in an open field by igniting a safety match and swinging it in an arc, so as to imitate the dipping flight and flash of the male *pyralis*. In each instance the flash of light from the match was answered within two to five seconds by the flashes of females of *pyralis* in the surrounding grass and weeds. By the use of a very small electric lamp it was found quite as easy to deceive the male *pyralis*. When a male flashed within about 2 or 3 ft. of the lamp, the circuit was closed two or three seconds afterwards by means of a push-button, so as to imitate as nearly as possible the intensity and time of flash of the female.

No definite instance was observed of a flying male mistaking the flash of a creeping male for that of a female and dropping to it. Observation on a single female of *pyralis* showed that she would not respond to the flash of a female *Photuris pennsylvanica*, Deg., made to flash above her, nor to a male of *Photinus consanguineus*, Lec., although the same female readily responded to a match. In the case of *consanguineus*, the female would answer a double flash of the lamp while some 20 or 30 ft. away, but on close approach seemed to recognise the difference and ceased to respond. *Scintillans* female also responds to the flash of the male *consanguineus* flying above her, but the latter appears to pay no attention to her.

In a second paper, in the Journal of the American Chemical Society (vol. xxxiii., p. 1791), Mr. McDermott deals with the chemical nature of the photogenic material, and shows that if the luminous organs of Photinus be dried *in vacuo* with a residual atmosphere of hydrogen, the tissue will retain its photogenic power and exhibit it when moistened eighteen months after preparation. If the dried tissue be moistened with 3 per cent. hydrogen peroxide a brighter light is produced than if water alone is used and the hydrogen peroxide is actively decomposed. If air is admitted to the sealed tubes containing the dried organs they rapidly lose their photogenic activity. When a living lampyrid was dropped into a test-tube immersed in liquid air it flashed rapidly for a few seconds, then fell back into the tube frozen stiff; meanwhile, the photogenic organ began to shine brilliantly, but the brilliancy rapidly diminished, the diminution being accompanied by a change in the colour of the light, which became reddish. The light finally disappeared, or very nearly so, but on warming to the room temperature it reappeared The insect was dead, but the tissue continued to glow for some time.

The probable chemical nature of the photogenic substance is discussed, and although there is very little real evidence as to its nature, the hypothesis is put forward that it is probably an albuminous lipoid (phosphatide) which fairly readily undergoes oxidation.

NATIONAL TEACHING OF SCIENCE SUBJECTS.

IN consequence of the issue by the Board of Education of Circular No. 776, which abolished examinations in the biological sciences, without providing any alternative scheme, the Physiological Society recently sent to the Board a memorandum directing attention to this action as a step gravely affecting national education in science. It was pointed out by the society that the cessation of the examinations in question, by withdrawing central guidance and inspiration, rendered it probable that unprofitable, inaccurate, and trivial courses of lessons would be given, and that in many cases it will lead to the abandonment of instruction in biological subjects in small centres. Moreover, it was insisted upon that development of the national teaching of science subjects, including biological subjects, necessitated an inquiry into the reorganisation of education in physics and chemistry.

With regard to the training of teachers, the memorandum dealt with the indispensable necessity of physics and chemistry as preliminary to physiology and with this science in turn as necessary for the rational understanding of hygiene, a subject which is already a part of the teacher's training, although no adequate provision for training in the necessary fundamental preliminary sciences is made.

Further, attention was directed to the fact that no teacher can possess a correct appreciation of psychology, or its application to national health and education, unless its study has been founded on a basis of physiology.

The Physiological Society, therefore, suggested to the Board of Education the desirability of suspending the operation of Circular No. 776 in order that reconsideration of its effects may be made by the Board, and especially directed attention to the necessity of reform in the scientific education of teachers and of the continuation of (reformed) examination in biological subjects (especially in physiology and hygiene) until a better method of ensuring adequate training in these sciences is established.

In forwarding this memorandum, the society requested that a deputation of its members should be received by the Board of Education. Accordingly, the President of the Board agreed to receive such a deputation on May 16. This deputation consisted of Sir Victor Horsley, Prof. Sherrington, Dr. Edkins, Prof. Starling, Dr. Waller, Dr. Myers, and Prof. Bayliss (hon. sec. of the society), and was introduced by Dr. Addison, M.P.

Sir Victor Horsley spoke chiefly on the absolute necessity of physics and chemistry as preliminary to hygiene. The training colleges were not teaching science in this way, but were beginning with biological nature-study. The training in science should be given to all teachers, and by them in turn to their pupils in the elementary schools.

Prof. Sherrington, who has had much experience

in the training of teachers, pointed out the impossibility of such students learning hygiene and applying it intelligently unless it was absolutely and strictly based on physiology, and that physiology could not be taught unless students had a preliminary knowledge of physics and chemistry.

Dr. Edkins insisted on the uselessness of teaching hygiene as a collection of health maxims, on the necessity that the teacher should know something of the material, bodily and mental, upon which he had to work, and that no teacher could do justice to the subject of hygiene or to the children taught if his or her qualification were simply rule-of-thumb knowledge and not genuine training in physical science.

Dr. Myers advocated the close coordination of the teaching of psychology and of the physiology of the nervous system and sense organs. Psychology should be included in every scheme of training college approved by the Board, and all psychology taught must have a basis of physiology.

The President of the Board of Education referred to the fact that the teaching of hygiene is universal in schools. He pointed out that the subjects taught in the training colleges were English language, literature and composition, history and geography, elementary mathematics, elementary science, the theory of music, principles of teaching, reading and repetition, drawing, needlework for women, singing and physical training, and that it would be very difficult to force other subjects upon these training colleges without sacrificing some of the subjects which the Board believed were more essential than the higher scientific subjects which the deputation desired to have taught. In conclusion, he informed the deputation that the Board thought that it ought to allow the effect of the Circular to be further realised before any step was taken in connection with it. The Board was not therefore prepared to suspend its operation.

AMERICAN BULLETINS ON AGRICULTURAL SUBJECTS.

THE results of the investigations carried out at the American experiment stations are issued as bulletins, and are sent out broadcast to all who are interested. Perhaps none of the institutions is more prolific than the Bureau of Entomology of the United States Department of Agriculture. In bulletin 97, part iv., Dudley Moulton describes the Californian peach borer (*Sanninoidea opalescens*, Hy. Edw.), which has been a constant menace to fruit-growers in certain districts. The adult moths fly from June to October, but are present in maximum numbers during July and August. The eggs are placed immediately after emerging, and after about two weeks the newly hatched larvæ enter the tree. The protective wash, a mixture of lime and tar oil, must therefore be applied before the middle of June. Carbon disulphide is used to a certain extent as an insecticide, but it has obvious disadvantages in that it is very volatile and combustible. Attempts have from time to time been made to replace it by a less dangerous liquid, and in bulletin 96 Messrs. Chittenden and Popenoe discuss the relative advantages of carbon tetrachloride and carbon disulphide as insecticides. It appears that the tetrachloride is less efficient and far more expensive, so that the problem is not as yet solved.

Bulletin No. 11 of the Michigan Agricultural College Experiment Station contains some experiments by D. G. Shafer, designed to ascertain how contact insecticides kill, a contact insecticide being one that works by enveloping the body in contradistinction to those that must be eaten to become effective. It appears that most of the vapours in use diffuse quickly into the insect tissues, and apparently reduce the oxygen absorption. If this conclusion is substantiated it will put the preparation of insecticides on a more scientific basis than has hitherto been possible.

Further observations on a bacterial disease of the pear, known as Hold-over blight, are reported by W. G. Sackett, of the Colorado Agricultural College. It appears that the prevalence of the disease in the arid western climate has been underestimated, and that careful watch will be necessary to prevent further spreading.

The special climatic conditions of New Mexico—rainfall from six inches per annum upwards and a warm climate—necessitate a corresponding degree of specialisation at the agricultural experiment station there. Bulletin No. 78 describes the cacti that occur most commonly, and the uses to which some of them may be put; it is considered that they might be used to a greater extent than they are as stock food. Both spiny and spineless forms have been tried with some measure of success, but the Opuntia are by far the most important for this purpose, because of their abundance. The Cylindropuntias come next, but they multiply too slowly to be of much value. The advantage of the cactus is, of course, its ability to utilise a scanty and irregular water supply; its disadvantages are that it contains a good deal of saline matter to which animals do not readily become habituated. Methods are suggested by which the live stock can be trained to take more cactus than they do, so as to increase the output of food material from each farm.

NOTEWORTHY WEATHER RECORDS.

AN interesting article on "The High Temperature of the Twelve Months May, 1911, to April, 1912," is published in *Symons's Meteorological Magazine* for May. Dr. Mill points out that for the first time in the Camden Square (N.W. London) record there has been a run of twelve consecutive months in each of which the mean temperature has been above the average of fifty years. In 1911 the month of April was the only one below the average. The mean temperature for the twelve months above quoted was 53·1°, or 3·1° above the average. The nearest approach to this figure for any twelve successive months in the past fifty-four years was 52·8° for the period March, 1868, to February, 1869. The most severe frosts of last winter occurred in the first week of February, but the unusual warmth of the latter part of the month raised the mean temperature 3·6° above the average. March was also very remarkable for its warmth, both the mean temperature, 46·5°, and the mean shade minimum, 40·5°, being the highest on record for March. There were no frosts in the screen.

The same periodical also contains an article on the rainfall of April last. In our issues of May 2 and 9 it was stated that, so far as Greenwich is concerned, so small a monthly amount as 0·02 in. had not occurred in the last 100 years. Referring to the rainfall over the whole of England, Dr. Mill states:—"We may say with confidence that no previous April since the establishment of the British Rainfall Organisation has been so dry." An interesting map which accompanies the article shows that it was an exceptionally wet month in the west of Scotland, while, on the contrary, the east of Scotland had, for the most part, less than an inch of rain. In Ireland the rainfall was little under the average for the month. The map shows very clearly another instance of the frequent divergence of rainfall at opposite parts of the British Isles.

THE GAUMONT SPEAKING KINEMATOGRAPH FILMS.[1]

JOHANNES MÜLLER, one of the greatest physiologists of last century, when considering the time factor in nervous processes, was so impressed with the inherent difficulties of the question, that he said, "We shall probably never attain the power of measuring the velocity of nervous action, for we have no opportunity of comparing its propagation through immense space as we have in the case of light." As is often the case, when the forecast is darkest light is near. As it has in the case of determining the velocity of a nervous impulse by Helmholtz, so it has in the synchronisation of the kinematograph and phonograph. The question of synchronisation of a camera and a talking machine is a problem that attracted the attention of Edison himself from the time of his invention of the kinetoscope, an instrument, however, in which only one person at a time could see the moving picture.

It is not enough to have a perfect synchronism between the phonograph and the kinematograph—between the talking machine and the camera. The vocal sounds of one or more speakers must be registered at a distance of several yards from the phonograph. To do this without altering the purity and intensity of the sounds emitted is no easy problem.

Obviously the phonograph and kinematograph must be placed in the same electrical circuit. Experience has shown that the phonograph must control the action of both instruments. In July, 1901, the Gaumont Company obtained the first patent for such an arrangement.

The problem is how to obtain *at the same time* records from a kinematograph and from a phonograph, gramophone, or talking machine, and, having obtained these, how can they be reproduced and presented *simultaneously*, the one record to the eye and the other to the ear, so that a large audience—even six thousand in number—shall be able to see and hear that all marches in unison and produces an illusion so complete as almost to represent real life.

In the ordinary speaking and moving pictures which have been presented hitherto, the actor or singer has just to speak or sing into a phonograph placed close to his mouth, whereby a record is obtained. This is reproduced on an appropriate machine, and when he hears the sounds he makes as best he can the appropriate sounds, movements, and gestures while the kinematograph records. There is no question of *simultaneous recording and reproduction* of the double record. Consequently, the result is not satisfactory. By means of the combination of a camera, a talking machine, and a megaphone, the combination being termed by M. Gaumont the chronophone, large scenes as well as the effects of a full chorus are obtained at one and the same operation.

At first sight it might seem as if the problem of producing *simultaneously* combined pictorial and audible records was a comparatively simple one. It is, however, far from being so. We may lay down the following conditions:—

(1) Absolute synchronism between the phonograph and the kinematograph both in recording and reproducing the result.

(2) Registration of sound by the phonograph at a sufficient distance at the same time as the registration of the pictures on the moving film, without the phonograph being in the field of the kinematograph.

(3) The amplification of the sound so that a large audience can hear the sound and observe the exact correlation between the movements of the speakers, or actors, or singers, and the audible sounds as regards pitch, loudness, and quality of the vocal or other sounds.

It has been calculated that in a record on an ordinary 12-in. disc of a gramophone the length of its sinusoidal sound line or spiral groove—counting 100 grooves to the inch from the centre to the circumference of the disc—is about 240 yards, or 720 ft. If, however, the ripples made by the vibrating stylus as the disc revolves under it at the rate of 32 in. per second be added, it brings up the total length of the sound line—in the reproduction of a sound record lasting from three to four minutes—to, it may be, 500 yards, or 1500 ft. The disc makes about 76 revolutions per minute, or an average rate of each revolution in 0·8 second.

In order to produce what M. Gaumont has called "filmparlants," or speaking kinematograph films, two motors of identical pattern actuated from the same source, and of approximately the same power, are used for driving the phonograph and the kinematograph. A rheostat introduced into the circuit enables the operator to vary at will the velocity of the motors, even when they are in action.

Experience has shown that the best results are obtained by first setting in action the dynamos and the phonograph. The kinematograph is not engaged until a given moment. This can be arranged by placing a clutch between the kinematograph and its motor. The automatic engagement apparatus is controlled by a lever connected with the armature of an electromagnet, which is actuated at a given moment which corresponds with a definitely determined position of the needle in one of the grooves of the disc of the phonograph, which is of the gramophone type.

If, however, by any chance there is a discord, however small, even a fraction of a second, between the emission of the sound by the talking machine and the movement of the lips of the speaker, there is a special arrangement, called the "differential," by means of which any want of accord between the phonograph and camera can be immediately rectified. The differential gearing, which is placed on the shaft between the kinematograph and its motor, and is actuated by means of a special small motor, is provided with a reversing commutator which enables the operator to control the speed of the kinematograph, either hastening or slowing its movements. The speed of the phonograph remains constant, so that all correction in speed, in order to synchronise the two machines, is done by accelerating or retarding the speed of projection by means of the kinematograph. By means of the differential any accidental displacement of the phonograph needle during the projection can instantly be rectified.

In order that the operator may be in close proximity to the phonograph, and to enable him to make sure that everything works well and to regulate the apparatus, he has before him a rectangular box called "Chef d'Orchestre," but which is practically a "control board," fitted with a voltmeter which acts as a speed indicator, a frequency meter which gives exactly the angular velocity at each instant of the phonograph, a starting gear with a series of resistances, whereby the phonograph is set in motion, and a two-way commutator in connection with the differential motor.

The following coloured speaking films, amongst others, were demonstrated by means of the "chronophone" by way of showing its applicability to the reproduction of all kinds of vocal sounds:—(1) A Gallic cock placed on a pedestal, where he crows right lustily, so that the whole audience could hear the

[1] Abstract of a discourse delivered at the Royal Institution on Friday, May 10, by Prof. William Stirling.

loud-sounding efforts of Chanticleer, and observe the characteristic movements that accompany his vocalisation. (2) A den of lions with their trainer. The growling of the animals, the dull thud of the iron bar on the floor of the cage, are reproduced with startling realism. (3) The reproduction of speech and accompanying gestures by a person who is seen speaking through a telephone. (4) A musician playing on a banjo, exhibiting the movements of the fingers over the strings, and the fidelity with which musical sounds elicited by the vibrations of strings can be reproduced. (5) A festive gathering of Frenchmen, one of whom gives the toast of "The King," and the company unite in singing "God Save the King." (6) A sailor reproduces in stentorian tones Kipling's "Ballad of the Clampherdown."

THE AMERICAN PHILOSOPHICAL SOCIETY.

THE annual general meeting of the American Philosophical Society was held in Philadelphia on April 18–21 inclusive, when numerous papers embodying the results of original investigations were presented.

The evening of April 18 was devoted to a celebration of the centenary of the introduction of gas as an illuminant, under the auspices of the American Philosophical Society, the Franklin Institute, the American Chemical Society, and the American Gas Institute. Dr. William W. Keen, the president, was in the chair, and a paper on by-products in gas manufacture was read by Prof. C. E. Munroe, of George Washington University, Washington.

The total number of papers read and discussed at the various sessions was very large, and it is possible here to refer only to a few of wide interest or importance. In a paper entitled "Illustrations of Remarkable Cambrian Fossils from British Columbia," Dr. Charles D. Walcott, secretary of the Smithsonian Institution, described a remarkable and ancient fauna that he found in connection with geological explorations in the higher Rocky Mountains of British Columbia. From a camp at 7000 ft. elevation, he climbed a thousand feet to a ledge of rocks where the ancient Cambrian fossils are so perfectly preserved that the internal anatomy of many of the forms may now be reproduced by photography. The bay in which the mud was deposited which now forms the rocks containing the fossils was connected with the open ocean, and at the spot where the fossils were found the waters must have swarmed with the invertebrate life of the time. No fishes or other vertebrates were found to have existed at this ancient epoch. The marine worms are so perfectly preserved that they show not only the exterior form, but the interior intestine and the long proboscis which the worms thrust out through the mouth to secure food and to aid in drawing themselves through the mud. The crabs show the intestinal canal, liver, and a beautiful series of legs, gills, and claws connected with the appendages about the mouth. Specimens of Medusæ, or jelly-fish, are beautifully preserved, even to the details of the thread-like swimming muscles.

During the evening of April 19 Prof. R. W. Wood, of Johns Hopkins University, delivered a lecture before the society and guests at the College of Physicians on "The Study of Nature by Invisible Light, with especial Reference to Astronomy and Physics." The following morning an executive session was held in the hall of the society, at which candidates for membership were balloted for, when the following foreign men of science were elected members:—Dr. George F. J. A. Auwers, of Berlin; Dr. Wilhelm Ostwald, of Leipzig; and Prof. Magnus G. Retzius, of Stockholm.

Afterwards Dr. Frank W. Clarke, of the U.S. Geological Survey, contributed a paper on some geochemical statistics. He first treated of the average composition of the igneous rocks, and then compared them with the rocks of sedimentary origin. From the amount of soda lost by the decomposition of the igneous rocks, and the amounts retained by the sedimentaries or transferred to the ocean, he showed that about 78,000,000 cubic miles of the primitive crust of the earth had been decomposed, forming a mass of rock consisting of about 80 per cent. shales, 15 per cent. sandstones, and 5 per cent. limestones. He next compared the rate at which river waters transport dissolved salts to the ocean, with the composition of the ocean itself, and from these data computed the probable age of the earth since the continents assumed their present form at something near 83,000,000 years. The saline matter of the ocean alone amounts to about 5,000,000 cubic miles, or enough to cover the entire surface of the United States with a solid mass a mile and three-quarters thick. The rate at which sediments are being deposited in the ocean was also determined, and found to be about 0·000027 of an inch annually.

Prof. H. C. Jones, of Johns Hopkins University, read a communication on absorption spectra and the solvate theory of solution. A large number of lines of evidence have been brought to light, he said, in the laboratory of Johns Hopkins University all pointing to the conclusion that a dissolved substance combines with more or less of the solvent in which it dissolves; about 7000 solutions have now been studied with respect to their power to absorb light. It has been found that a given coloured compound dissolved in different colourless solvents absorbs light very differently in the different solvents. This is interpreted as being due to a combination of the different solvents with the dissolved substance, forming the different compounds which absorb light differently. The bearing of this work on the nature of solution is important. Matter in the pure homogeneous condition does not enter into chemical reaction. It becomes active chemically only when dissolved. Chemistry, biology, and geology owe their existence to matter in the dissolved state, and any light thrown on the nature of solution is of importance for the natural sciences in general. The theory of solution hitherto held has been found to be insufficient. In dealing with solutions we must always take into account the part of the solvent combined with the dissolved substance.

In a paper on the thermal relations of solutions, Prof. W. F. Magie, of Princeton University, pointed out that the heat capacity of electrolytes dissolved in water is related to the temperature change of the heat of dilution. Experiments to demonstrate this were described, and it was pointed out that the heat of dilution is a difference between two quantities of heat, one evolved in an amount proportional to the absolute temperature, the other, absorbed in an amount independent of the temperature. One of these quantities is proportional to the dissociation which occurs on dilution, and measures the energy lost by the solute as its ions combine with water. The other involves as a part of its value the heat absorbed by the dissociation. The special significance of these relations lies in the strong support which they give to the theory that the molecules and ions of a salt in solution are associated or combined with the molecules of water.

The results of an important research on an exact

measurement of temperature up to 1750° C. were presented by Dr. A. L. Day, director of the Geophysical Laboratory of the Carnegie Institution. The range through which temperatures can now be determined in terms of the fundamental definition (the expansion of gas under constant volume or pressure) has now reached nearly to the absolute zero downward, and to 1550° C. upward. The present investigation is concerned with the higher temperatures lying between 300° and 1550°. The accuracy attained in the present investigation within this region is about 0·2° in the vicinity of 300° and 2° at 1550°. For the purpose of establishing temperatures of reference in this region for general use, the following constants have been determined :—

Cadmium (melting point)	..	...	320·8°±0·1°
Zinc (melting point)	...		419·3°±0·1°
Sulphur (boiling point)	..	...	444·5°±0·1°
Antimony (melting point)		...	629·8°±0·2°
Silver	,,	...	960·0°±0·7°
Gold	,,	...	1062·4 ±0·8°
Copper	,,	...	1082·6°±0·8°
Li_2SiO_3	,,	...	1201·0°±1·0°
Nickel	,,	...	1452·3°±2·0°
Palladium	,,	...	1549·2°±2·0°
Platinum	,,	...	1752·0°±5·0°

New magnetic charts of the Indian Ocean (illustrated) were described by Dr. L. A. Bauer. The charts embody the results of magnetic observations made during the summer and fall of 1911 on board the non-magnetic yacht *Carnegie*. The necessity of the new charts arose from the exceptionally large errors found in the magnetic charts at present in use by mariners. Thus, for example, the errors in the charted compass directions for two of the most recent charts approximate respectively 4° and 6°, though one of the charts was issued as recently as 1910. With the exception of a few values found by the vessel used in the Pacific Ocean work, namely, the *Galilee*, these are the largest errors thus far revealed. In the portions of the Atlantic Ocean covered by the *Carnegie*, the compass chart errors have generally been below 2°, though running at times up to 2½°. The chart errors in the compass directions are usually found to be systematic, that is, in the same direction for large stretches, and are to be ascribed largely to erroneous secular changes allowed for in attempting to bring previously observed values up to date. The errors in the other magnetic elements, while of less importance to the mariner, are of consequence to theoretical investigations regarding the earth's magnetism. In the magnetic dip the errors on the present cruise have amounted at times to 4°, and in the horizontal intensity to about one-twentieth part.

During the afternoon of April 20 Prof. W. W. Campbell, of Lick Observatory, University of California, contributed a paper on radial velocity to a symposium on stellar spectroscopy. All observed stellar motions, he said, contain components due to the motions of the observer. The first step in studies of stellar motions is to determine the elements of the solar motion and to eliminate its effects from the observed motions of the stars, thus leaving the motions with reference to the stellar system. The direction of the solar motion has long been fairly well known : the solar system is approaching a point 10° or 15° south-west of Vega. The speed determined from 1200 radial velocities is 19½ kilometres (12 miles) per second. The velocities of the stars are functions of their spectral classes, *i.e.* of their effective ages. The young stars are travelling slowly—12 kilometres per second on the average; the middle-aged stars more rapidly—28± km. per second; and the old stars the most rapidly—34± km. per second. Our sun, as a middle-aged star, is travelling with a speed of 19½ km. per second—far below the average of its class. We do not know why stars increase their speeds as they grow older. Among the brighter and nearer stars, those resembling our sun in effective age predominate, and they partake somewhat of the solar motion. Neglecting these brighter middle-aged stars, the remaining stars form a fairly homogeneous mixture of stars of all ages. Radial velocity data increase our estimate of the scale of the universe about 50 per cent. above proper motion estimates. There is the utmost need for cooperation amongst astronomers in observing the radial velocities of stars between the fifth and seventh magnitudes.

The relations between the spectra and other characteristics of the stars formed the subject of a paper by Prof. H. N. Russell. Among the stars the distances of which can be measured with some approach to accuracy, and the real brightness of which can thus be determined, there exists, with few exceptions, a very marked relation between the actual brightness and the class of spectrum. Stars resembling Sirius in their spectra are, on the average, about fifty times as bright as the sun, those like Procyon about five times as bright as the sun, those with spectra like the sun's are nearly equal to the sun in brightness; while the orange stars average only one-sixth as bright, and red stars are usually less than one-fiftieth, as bright as the sun. There exist, however, many stars of great brightness, of all spectral types, which are almost so remote that their distances cannot be accurately measured. From the best available data, these stars appear to be, on the average, from 100 to 250 times as bright as the sun, without much difference between the different spectral types. Among the stars redder than the sun, these two groups, of different brightness, are widely separated; but among the whiter stars they run together, and become identical for the whitest stars, which average more than 250 times as bright as the sun. From a study of double stars, it is found that the stars of the brighter class do not greatly exceed those of the fainter class in mass, and hence that they are either much less dense or much brighter per unit of surface, or both. An arrangement of all these groups of stars in order of increasing density would begin with the bright red stars of the type of Antares, run up the series of stars of great brightness to those of spectrum B, and then down the series of fainter stars, past those like the sun, to the faintest and reddest stars. It seems probable that this arrangement represents the evolutionary history of a star, which at first becomes heated more and more by its own contraction, and, finally, as it becomes too dense to admit of further shrinkage, cools off like a solid body.

An important feature of the annual dinner in connection with the meeting was the presentation to Mr. C. H. Burr, of Philadelphia, of the Henry M. Phillips prize of 400*l.* to the author of the essay on "The Treaty-making Power of the United States and the Methods of its Enforcement as affecting the Police Powers of the States."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—In commemoration of the opening of the new buildings in 1909 by his late Majesty King Edward VII., the pro-vice-chancellor (Alderman F. C. Clayton) has presented to the University a statue of that monarch. The statue, which is the work of Mr. Alfred Drury, stands in the entrance hall of the main block. It is of white marble, and represents his Majesty in Garter dress, holding the sceptre in his

right hand and the orb in his left. The attitude is one of remarkable dignity, and the general effect is a happy one. On the base of the statue is the following inscription:—"His Majesty King Edward VII., accompanied by Queen Alexandra, opened these buildings on July 7th, 1909, and concluded his address thus: 'To you, the students, I say that the honour and dignity of this University are largely in your hands, and I look to you to initiate and hand down worthy traditions to your successors.'" It is understood that the unveiling ceremony is to be performed on June 27 by Mrs. Joseph Chamberlain, wife of the Chancellor of the University.

CAMBRIDGE.—The Research Hospital, which was opened on Friday last, May 24, stands about a mile south of the railway bridge at Cambridge on a site one acre in area. The object of the hospital is an intensive study of one disease at a time. In an ordinary hospital a patient comes in, undergoes certain treatment, gets better or is found incapable of improvement, and is sent out to make room for a further specimen of our suffering humanity. This will not be the case at the Cambridge Research Hospital. The study there is not so much the alleviation of one specific case of disease as the attempt to discover the causation of certain obscure diseases, and to experiment not only on their cure, but on their prevention. It may be put shortly by saying that, instead of one physician attending a large number of hospital cases of varying nature, at the Cambridge Research Hospital the best medical talent available from every side will be concentrated on three or four patients all suffering from one definite disease. At present the disease under investigation is rheumatoid arthritis, and experiments as to the cause of this terrible malady have been for some years carried on at Cambridge, at first in lodgings, and then in a small villa rented for the purpose. Owing to the energy of Mr. T. S. P. Strangeways, Huddersfield lecturer in special pathology in the University, and to the support he has received from Mr. R. C. Brown, of Preston, these patients are now transferred into a fine and commodious hospital.

The Public Orator spoke as follows in presenting Mr. R. C. Brown for the degree of Master of Arts *honoris causa* on May 23:—"Medicum modestum, medicum munificum, qui tot alios tam diu salvere iussit, ipsum hodie iubemus salvere. Lancastrensium in comitatu medio, in oppido suo natali, Salutis templo amplificando, et in melius mutando, quantum temporis, quantum pecuniae dedicavit! Ibi pauperum tabernis quantam lucem, quantam salubritatem, quot vitae melioris commoda intulit! Arti musicae deditus, convalescentibus ars illa quantum prosit, quam sollerter indicavit; quod nemini vestrum mirum sit, novimus enim ipsum Apollinem non modo Aesculapii patrem, sed etiam Musarum omnium, atque adeo artis musicae, fuisse patronum. Idem eos, qui inter nosmet ipsos in certos quosdam morbos curiosius inquirunt, liberalitate maxima adiuvit; instrumentis subtilissimis ornavit; militiae denique huius tironibus stipendia quotannis distribuenda curavit. Vir igitur in artem medicam tam munificus, artium magister hodie honoris causa merito nominatur. Idem domicilium novum his studiis benefactorum complurium liberalitate dedicatum die crastino auspiciis optimis inaugurabit. Duco ad vos medicum insignem, virum et medicinae in studium et in Academiam nostram munificum, Robertum Carolum Brown."

The Extension of the School of Agriculture Syndicate reports that the Lords Commissioners of the Treasury have approved of a grant not exceeding 14,500*l.* from the Development Fund for the building and equipment of an extension of the School of Agriculture, chiefly for the accommodation of research institutes in plant breeding and animal nutrition. Of this sum it is proposed to expend about 3000*l.* on fittings and equipment, and about 11,500*l.* on the actual building.

The Board of Agricultural Studies, in consultation with the president of the Royal Agricultural Society, has appointed Mr. C. R. Fay to be the Gilbey lecturer on the history and economics of agriculture.

DUBLIN.—The Chancellor of the University of Dublin (the Rt. Hon. Viscount Iveagh), having learned that the Department of Geology and Mineralogy was in need of endowment for the prosecution of research and for equipment, has presented the authorities of Trinity College with the sum of 10,000*l.*, to be invested, and the proceeds to be applied in part to the payment of a research assistant and in part to the purchase of apparatus, &c., required for the school and for investigation. It will be remembered that in response to the appeal of a science schools committee and of the former chancellor, the late Earl of Rosse, Lord Iveagh has already given nearly 25,000*l.* for the construction of laboratories for experimental physics and for botanical science, the fund required for the upkeep of these departments being contributed by graduates and friends of the University. The movement of reform initiated by the Science Schools Committee was for various reasons arrested shortly after the claims of the School of Geology and Mineralogy were put forward by the committee. This department, therefore, failed to derive any appreciable benefit from the movement, a result which was particularly unfortunate, as it was specially active in carrying out and promoting research. The serious financial restrictions which hampered its work have now been removed by the generous gift of Viscount Iveagh.

MR. M. POWER, lecturer in mathematics in University College, Dublin, has been appointed professor of mathematics in University College, Galway.

PROF. D'ARCY W. THOMPSON, C.B., professor of natural history in the University College, Dundee, has been appointed Herbert Spencer lecturer at the University of Oxford for 1912.

THE Vice-Chancellor of the University of London (Sir William Collins) will present the prizes to the students of the London (Royal Free Hospital) School of Medicine for Women on Friday, June 7, at 4 p.m. Mrs. Garrett Anderson, president of the school, will be in the chair.

PROF. F. G. DONNAN, Muspratt professor of physical chemistry in the University of Liverpool, has decided to decline the chair of chemistry at University College, London, in succession to Sir William Ramsay, K.C.B., for which he was nominated recently, and to remain in Liverpool.

THE Board of Agriculture and Fisheries will award twelve research scholarships in agricultural science in October next if so many suitable candidates present themselves. These scholarships have been established in order to train promising students under suitable supervision, with the view of their contributing to the development of agriculture, either by carrying out independent research, or by acting in an advisory capacity to agriculturists. They will be granted only to students who show distinct promise of capacity for advanced study and research in some one of the sciences bearing on agriculture. The scholarships will be of the annual value of 150*l.*, and will be tenable for three years, provided that satisfactory reports are made at the end of each year as

to the conduct and capacity of the holder by the authority under whose supervision the scholar is placed by the Board. The scholar will be required, as a general rule, to spend some part of the three years at an approved Continental laboratory or university. An applicant for a scholarship must be (*a*) a graduate of a university, or (*b*) the holder of a diploma of a university or college of university rank. He must be nominated by a professor or lecturer of a university or college of university rank. Nominations must be received not later than June 17.

THE sixth annual report, that for 1911, of the Apprenticeship and Skilled Employment Association shows that with the advent of the juvenile advisory committees—now established under the Board of Trade in connection with every labour exchange in London—there has still been scope for the work of a voluntary society in the organised effort to improve the industrial conditions of young people. During the year a working scheme of cooperation has been devised between the association and the official juvenile advisory committees. The Board of Trade has shown its recognition of the work done by the association by nominating many of the members of its affiliated committees to serve on the local juvenile advisory committees. The functions of the association are of a twofold character: through its local committees it places children as they leave school in situations where an adequate industrial training may be secured, and the central office serves as a co-ordinating body, collecting industrial information and acting as a clearing-house in the matter of vacancies. The friendly relations that have always existed between the London County Council and the association have been maintained. As in the past two years, the central office has, at the request of the Council, continued to place laboratory monitors in work as they leave the Council's service. The finances of the association are not in the satisfactory condition the excellence of its work merits, and an appeal is made in the report for further assistance. Donations may be sent to the honorary treasurer at the office of the association, 36 Denison House, Vauxhall Bridge Road, London, S.W.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, May 10.—Prof. A. Schuster, F.R.S., president, in the chair.—Dr. J. A. **Harker** and Dr. G. W. C. **Kaye**: The generation of electricity by carbon at high temperatures. The experiments described owe their origin to some contamination phenomena which were encountered when tubes of refractory rare earths were baked in carbon-tube resistance furnaces at temperatures from 1500° C. upwards. It was found that the tubes often had their outer surfaces carbonised to an appreciable depth, while the inner surfaces, though freely exposed, were much less attacked. The blackening was presumably caused by particles shot from the carbon walls of the furnace with velocity high enough to penetrate the refractory material after crossing a few millimetres of air at atmospheric pressure. The preliminary experiments on the nature of these particles were carried out by the use of two insulated exploring electrodes of carbon inserted into an alternating-current furnace. They were connected externally to a battery of cells, and the potential-current curves were determined for the electrode gap in the furnace at a number of temperatures. No appreciable current could be detected at temperatures below about 1400° C., but as the temperature rose it was found that quite small E.M.F.'s gave rise to steady currents of relatively enormous magnitude. For example, with 8 volts, currents up to 10 amperes have been obtained at a temperature of about 2500° C. The relation between current and temperature was found to be of an exponential character.—S. **Butterworth**: A method of measuring small inductances. The author shows how Anderson's method may be modified so that, while still retaining the usual standards of capacity, very small inductances may be measured. As in Anderson's method, balance is attained by a simple resistance adjustment. The conditions of maximum sensibility are indicated, and experimental results are quoted in which an inductance of 20 microhenries is compared with a capacity of 0·1 mfd. The method may also be employed to compare a very low capacity with the usual mica standards of capacity.—H. A. **Colwell** and Dr. S. **Russ**: The conversion of starch into dextrin by X-rays. When solutions of starch are irradiated for several hours by X-rays of moderate penetrating power, the opacity and viscosity of the solutions are markedly diminished. These physical changes are attended by chemical changes; there is a partial conversion of the starch into soluble starch and dextrin. A quantitative estimation of the amount of dextrin formed after the starch solution had been irradiated for eight and a half hours showed that it corresponded to about 5 per cent. of the amount of starch initially present. When solutions of dextrin were subjected to a similar exposure of X-rays, no conversion of this substance into glucose was obtained.

Institution of Mining and Metallurgy, May 16.—Mr. Edward Hooper, president, in the chair.—J. B. **Tyrrell**: The law of the paystreak in placer deposits. This paper embodied the results of a study of the placer deposits of the Klondike district with the view of determining the laws which govern the deposition of placers and the formation of the run of coarse gold usually found in the bottom of the larger valleys. The author believed that the laws or principles he enunciated with reference to the Klondike have a general application to the concentration of heavy metals or minerals in alluvial deposits. He then proceeded to describe the various stages of development which the existing valleys have undergone with the view of showing the probable course of events which have resulted in the present position of the "pay-streak."—F. Percy **Rolfe**: Illogical precision in mine reports. The author of this paper directed attention to the prevalent custom of expressing large tonnages to the extreme accuracy of a single ton, and of reporting mine assays to excessive minuteness, and he aimed at showing that such practice is inconsistent, since the same or a greater actual degree of accuracy can be attained by simpler "round figures." He gave examples in illustration of his contention to show what varying results may be obtained according to the "personal equation" of the mine engineer or assayer. For example, a reserve of ore was separately estimated by two experts, each estimate being expressed to the accuracy of one in a million, while the two varied to the extent of one in ten, the difference being considerably more than 100,000 tons. Similarly, in mine assays, values are given at times to a single penny, when assay results taken from different parts of the face show wide variations from which an average value can only with difficulty be deduced to the limits of accuracy of a shilling unit. —Leon **Perret**: Gold and platinum alluvial deposits in Russia. This was an exhaustive review of the growth and present position of gold and platinum alluvial mining in Russia, and contained a number of interesting details in relation to the special conditions necessitated by climatic and other peculiarities.

The distinctive features of Russian mining are the predominance of hand labour and a simplicity of equipment to admit of local repairs, and while more perfect methods based on mechanical principles are now under consideration, engineers are desirous, before throwing out methods which have stood the test of time, of making certain that the more modern practice will be suited to the capacity of the labour available to operate it.—E. C. **Hugon**: A plant for the enrichment of pyritic blende concentrates. This is a description of a new plant recently erected at the Pierrefitte Mines, Hautes Pyrénées, France, in order to cope with the increasingly pyritic character of the ore encountered in a portion of the property hitherto untouched. The process adopted consisted of magnetic separation preceded by a preliminary roast, which resulted, among other features, in presenting the advantages of a higher grade of concentrate, higher recoveries, a saving in carriage, and other economies.

British Psychological Society, May 18.—Prof. J. Sully in the chair.—J. C. **Flügel**: Illusions of reversible perspective and fluctuations of attention.—W. H. **Winch**: Spontaneous drawings of young children, with typical examples.

Royal Meteorological Society, May 22.—Dr. H. N. Dickson, president, in the chair.—C. J. P. **Cave**: The severe thunderstorm of March 11 in the east of Hampshire and the west of Sussex. The storm was not of the line-squall type, but was of the type of summer thunderstorms with very little movement, and, besides being severe, the storm appeared to be very local. As the result of information supplied by 132 observers, Mr. Cave has been able thoroughly to investigate the storm. Actual thunderstorms appear to have occurred in five patches, viz:—(1) a small patch near Alresford; (2) an area stretching from Privett in Hampshire nearly to Fernhurst in Sussex, with its centre near Liss; (3) an area north-east of Haslemere; (4) a small patch north of Chilgrove; and (5) a patch near West Grinstead. Heavy rain occurred, especially in the Liss storm; nearly an inch and a half fell at Durford Farm, between Rogate and Petersfield, and at Borden wood, north of Chithurst. Hail also occurred at several places. One of the peculiarities of the storm was the intense darkness that occurred near the centre, which was accompanied by black rain. The author believes this to be due to soot from London. He is also of opinion that the cause of the storm was the flowing of a cold current under a warmer one, as is the case with line-squalls.—E. S. **Bruce**: The automatic release of self-recording instruments from *ballons-sondes*. When a balloon is sent up with a meteorograph attached, it is doubtful whether these will be recovered, for they may not be seen at all, or they may fall into the sea. In order to diminish the chance of the recording instruments being lost, Mr. Bruce has devised a simple apparatus called the "meteoparachute," which brings down the meteorograph from the balloon at any moment the observer chooses to fix before he sends the balloon up.

MANCHESTER.

Literary and Philosophical Society, May 7.—Prof. F. E. Weiss, president, in the chair.—Dr. Henry **Wilde**, F.R.S.: Search-lights for the mercantile marine. One of the author's early applications of the dynamo-electric machine was the projection of a beam of electric light to illuminate distant objects for naval and military purposes. In 1873 his inventions were sufficiently developed to enable him to submit them to the Admiralty, as a protection against torpedoes, when, after lengthened trials at Spithead (1874–5) by a joint War Office and Admiralty committee, they were definitely adopted, and a number of first-class battleships were equipped with search-lights. When attempts were made later to establish the search-light on merchant ships the Admiralty intervened and claimed the exclusive right to use the light, on the alleged ground that its brilliancy interfered with the navigation of other ships. The result is that at the present day none of the Atlantic liners are equipped with search-lights. The lesson to be derived from the lamentable loss of the *Titanic*, and of the *Oceana* in March last, is that all ships of the mercantile marine above a specified tonnage should be equipped with one or more search-lights as now in permanent use in the Royal Navy.—F. **Jones**: The volatility of sulphur and its action on water. The volatility of sulphur in a current of steam has long been known. The author has volatilised sulphur at 100° C., but in absence of water. Crystals are slowly formed of two kinds. The bulk consists of aggregations of octahedral crystals elongated so as to appear needle-shaped, and there is a much smaller amount resembling β-sulphur crystals, but differing from them in remaining permanently transparent. These crystals are very pure, and were used to show that sulphur is volatile even at ordinary temperatures, since when it was sealed up in a tube with silver foil placed a few inches above it the latter became slowly blackened. The action of sulphur on water has been examined by many chemists with somewhat contradictory results, which the author thinks are partly due to the action of the water on the glass vessels used. By boiling sulphur with water in platinum and fused silican flasks, he finds that sulphuretted hydrogen is always evolved while thiosulphuric acid is present in the contents of the flask.—T. G. B. **Osborn**: A note on a submerged forest at Llanaber, Barmouth.—Miss Mary A. **Johnstone**: Notes on a specimen of *Calamites varians*, var. *insignis* (Weiss).—T. A. **Coward**: The smelt in Rostherne Mere. The author referred to the permanent presence of the anadromous smelt in fresh water in Rostherne Mere. He mentioned the date at which it was first recorded, 1740, and differed from the opinion expressed that it was originally introduced artificially. During the last twenty years, or perhaps more, the smelt has, so far as he knew, only been observed three times in Rostherne.

PARIS.

Academy of Sciences, May 13.—M. Lippmann in the chair.—M. **Lecornu**: The flexure of a beam supported at one end.—**Prince Albert of Monaco**: The first campaign of *Hirondelle II.*, and the twenty-fourth campaign of the complete series.—C. **Guichard**: Surfaces such that the osculating spheres to the lines of curvature of a series are tangential to a fixed sphere.—M. Schwendener was elected a foreign associate in succession to the late Lord Lister.—J. J. **Landerer**: The eclipse of the sun of April 17, 1912. The value adopted by the author for the lunar semi-diameter, 15′ 31·62″, in the calculation of the last two total eclipses in Spain was shown by the observations of the eclipse of April 17 to be very close to the exact value.—Jules **Baillaud**: The variation of the relative intensities of the various radiations of the solar spectrum during the eclipse of April 17.—F. **Croze** and G. **Demetresco**: Photographs of the prominences and of the inner corona obtained at the Observatory of Paris during the eclipse of April 17. Full details are given of the results from three photographs.—A. de La Baume **Pluvinel** and F. **Baldet**: The spectrum of Brooks's comet, 1911*c*. Twenty-two good photographs of the spectrum of this comet

spread over an interval of two months have been obtained. The wave-lengths were determined with higher accuracy than in previous work with the same instruments, owing to additional precautions taken in the photography of the comparison spectra. The changes in the spectrum observed during the two months are discussed in detail.—Patrick **Browne**: Some singular cases of Volterra's equation.—E. **Barré**: The surfaces described by an indeformable helix which remains constantly an asymptotic to the surface which it describes.—Alphonse **Berget**: A total immersion areometer without capillary correction. A glass bulb is held completely under the surface of the liquid the density of which is required by means of a flat invar spring, and the rise or fall of the bulb measured by means of a cathetometer. The instrument is calibrated with solutions of known density, and will give the density with an accuracy of about one-millionth. It has been chiefly designed for determining the density of samples of sea water.—Jean **Effront**: The action of hydrogen peroxide upon lactic acid and glucose. Lactic acid is transformed quantitatively by hydrogen peroxide into acetic and carbonic acids. Glucose gives alcohol, aldehyde, formic acid, and acetic acid.—J. **Giraud**: The eruptive rocks in the south of Madagascar.—V. **Vermorel** and E. **Dantony**: Surface tension and the moistening power of insecticides and fungicides. A means of conferring moistening power on cupric or insecticide solutions.—G. **Arnaud** and E. **Foëx**: The oidium of the oak, *Microsphaera quercina*. A discussion as to the correct classification of this fungus.—P. **Gérard**: The influence of the food on the amount of sodium and potassium in a dog.—Mlle. **Robert**: The method of fixing calcium by *Aspergillus niger*. Calcium is fixed by the mycelium of the mould in the form of calcium oxalate.—M. **Neveu-Lemaire**: Congenital bronchial strongylosis in the sheep.—Mieczyslaw **Oxner**: New experiments on the nature of the memory in *Coris julis*, carried out by the method of substitution.—Georges **Negre**: Discovery of phosphate sands in the department of Yonne.—Ernest **Esclangon**: New researches on the value of the earth's acceleration in the south-west of France.

May 20.—M. Lippmann in the chair.—H. **Deslandres**: Relations between temporary stars and the sun. A simple explanation of temporary stars. The author's view of a temporary star is that it consists of a single body, already cooled with a solid crust relatively thin. A break in this crust, with the sudden eruption of incandescent gases under high pressure, is sufficient to explain most of the observed spectroscopic phenomena. A similar phenomenon, on a much smaller scale, has been previously noted by the author in the solar faculæ. The final transformation into a nebula remains unexplained.—M. **de Forcrand**: Some physical properties of cyclohexanol. A kilogram of the phenol was prepared by the catalytic method and carefully purified from traces of water, first by fractional crystallisations and afterwards by repeated treatments with anhydrous sodium sulphate. The pure substance boils at 160·9°, and melts at 22·45° C. The density and solubility in water were also determined.—A. **Perot**: The green line of the corona. The line was very large, unsymmetrical, and degraded towards the red. The mean wave-length was 5303·7 A.—MM. **Durand, Levesque,** and **Viviez**: Observation of the solar eclipse of April 17, 1912.—René **Garnier**: The limits of the substitutions of the group of a linear equation of the second order.—G. **Bouligand**: The small movements of the surface of a liquid in the field of a central attractive force as a function of the distance.—Gaston Leinekugel **Le Cocq**: A remarkable property of teledynamic cables.—Jean **Villey**: Volta's phenomenon and the theory of Nernst.—L. **Dunoyer**: An apparatus for the rapid distillation of mercury in a vacuum. The mercury is heated electrically in a barometer forming an inverted **U**-tube. When the level of the undistilled mercury falls to a determined point the heating resistance is automatically cut out.—G. **Sagnac**: The direct measurement of the differences of phase in an interferometer with inverse pencils. Application to the optical study of transparent silver deposits.—H. **Buisson** and Ch. **Fabry**: The temperature of sources of light. The width of the lines of the spectrum is used as a measure of the temperature of the vapour. From these considerations the temperature of the vapour in a Cooper-Hewitt lamp with a small current is about 1200° C., or even a lower value. An electric arc in a vacuum between iron electrodes gives from the width of the lines a temperature of 2400° C.—Camille **Matignon**: The preparation and heat of formation of magnesium nitride. The nitride was prepared in a pure state by the action of ammonia, purified by liquefaction, upon heated magnesium powder. The material was utilised for the determination of the heat of solution of the magnesium nitride in dilute sulphuric acid, from which the heat of formation is calculated as 119·7 calories.—Œchsner **de Coninck**: A mode of formation of acrolein. This aldehyde is formed in the dry distillation of sodium formate.—P. **Lemoult**: The question of the hexahydro-derivative of malachite green: an example of two different leuco bases giving the same colouring matter.—Marcel **Guerbet**: The condensation of the primary alcoholates of sodium with the secondary alcohols.—Ch. **Mauguin**: The internal agitation of liquid crystals.—Marcel **Baudouin**: Osteo-arthritis in the polished stone age. A study of human bones found in the Neolithic remains of Vendrest show that these present lesions characteristic of the disease now known as osteo-arthritis.—Maurice **Arthus**: Anaphylaxy and immunity. Experiments on the rabbit with snake poison show that the states of anaphylaxy and immunity can co-exist in the same animal.—Jousset **de Bellesme**: The functions of pigment. A discussion of the relations between reproductive activity and the formation of pigment.—N. A. **Barbieri**: The non-existence in the retina of the chemical principles of the optic nerve.—J. M. **Albahary**: The metabolism of oxalic acid and the oxalates in the economy.—H. **Labbé** and G. **Vitry**: The non-dialysable urinary substances eliminated during the diabetic condition.—Em. **Bourquelot** and M. **Bridel**: A synthetic action of emulsin.—Pierre **Kennel**: The adipolymphoid bodies in the Batrachians. There is a seasonal development of these bodies in frogs, passing through a minimum about April.—L. **Falcoz**: The classification of the burrowing mammals.—Paul **de Beauchamp**: The evolution of *Rhytidocystis Henneguyi*.—Pierre **Bonnet**: The Mesozoic of the gorge of the Araxe, near Djoulfa.

BOOKS RECEIVED.

Spectroscopy. By Prof. E. C. C. Baly. New edition. Pp. xiv+687. (London: Longmans and Co.) 12*s.* 6*d.*

Prodromus Floræ Britannicæ. By F. N. Williams. Part ix. Pp. 477–532. (Brentford: C. Stutter.) 2*s.* 9*d.*

Lehrbuch der Thermochemie und Thermodynamik. By Prof. O. Sackur. Pp. viii+340. (Berlin: J. Springer.) 12 marks.

The Montessori Method. Scientific Pedagogy as Applied to Child Education in "The Children's Houses," with Additions and Revisions by the

Author. By M. Montessori. Translated by A. E. George. Pp. xlii+377. (London: W. Heinemann.) 7s. 6d. net.

Forty-third Annual Report of the American Museum of Natural History, for the Year 1911. Pp. 173. (New York: American Museum of Natural History.)

The Evolution of Educational Theory. By Prof. J. Adams. Pp. vii+410. (London: Macmillan and Co., Ltd.) 10s. net.

Rambles in the Pyrenees and the Adjacent Districts, Gascony, Pays de Foix, and Roussillon. By F. H. Jackson. Pp. xii+419. (London: J. Murray.) 21s. net.

Geometry for Schools. By W. G. Borchardt and Rev. A. D. Perrott. Vols. i.-iv. Pp. xiv+325+xiv. (London: G. Bell and Sons, Ltd.) 3s. 6d.

The Calculus for Beginners. By W. M. Baker. Pp. viii+166. (London: G. Bell and Sons, Ltd.) 3s.

Handbuch der Anatomie des Menschen: Die Muskeln des Stammes. By Prof. P. Eisler. Pp. xii+705. (Jena: G. Fischer.) 38 marks.

Omens and Superstitions of Southern India. By E. Thurston. Pp. 320. (London: T. Fisher Unwin.) 12s. 6d. net.

Preventable Cancer: a Statistical Research. By R. Russell. Pp. vi+168. (London: Longmans and Co.) 4s. 6d. net.

The Young Nietzsche. By Frau Förster-Nietzsche. Translated by A. M. Ludovici. Pp. x+399. (London: W. Heinemann.) 15s. net.

Man and the Universe. By Sir Oliver Lodge. Cheap edition. Pp. 284. (London: Methuen and Co., Ltd.) 1s. net.

Schutzfermente des tierischen Organismus. By E. Abderhalden. Pp. xii+110. (Berlin: J. Springer.) 3.20 marks

Barker on Heating: The Theory and Practice of Heating and Ventilation. By A. H. Barker. Pp. xvi+640+lxxvi. (London: The Carton Press.) 25s. net.

The Dictionary of Photography. By E. J. Wall. Edited by F. J. Mortimer. Ninth edition. Pp. iv+738. (London: Hazell, Watson and Viney, Ltd.) 7s. 6d. net

Studies in Bird Migration. By W. Eagle Clarke. Two vols. Vol. i., pp. xvi+323; vol. ii., pp. vii+346. (London: Gurney and Jackson; Edinburgh: Oliver and Boyd.) 18s. net.

The Energy System of Matter: a Deduction from Terrestrial Energy Phenomena. By J. Weir. Pp. ix+200. (London: Longmans and Co.) 6s. net.

Fungoid Diseases of Agricultural Plants. By Dr. J. Eriksson. Translated by A. Molander. Pp. xv+208. (London: Baillière, Tindall and Cox.) 7s. 6d. net.

DIARY OF SOCIETIES.

THURSDAY, MAY 30.

ROYAL INSTITUTION, at 3.—X-Rays and Matter: Prof. C. G. Barkla.

FRIDAY, MAY 31.

ROYAL INSTITUTION, at 9.—Icebergs and their Location in Navigation: Prof. H. T. Barnes.

PHYSICAL SOCIETY, at 5.—The Calibration of Wave-meters for Radio-telegraphy: Prof. G. W. O. Howe.—On the Use of Heaviside's Resistance Operators in Air-core Transformer Theory: Dr. W. H. Eccles.—The Movements of Semi-oily Liquids on a Water-surface: C. R. Darling.—Experiments on Surface Leakage in Alternating Electric Fields: G. L. Addenbrooke.

SATURDAY, JUNE 1.

ROYAL INSTITUTION, at 3.—The Development of Meteorological Science: Willis L. Moore.

MONDAY, JUNE 3.

ARISTOTELIAN SOCIETY, at 8.—Significance and Validity in Logic: W. E. Tanner.

VICTORIA INSTITUTE, at 4.30.—The Influence of Babylonian Conceptions on Jewish Thought: The Ven. Archdeacon Beresford Potter.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Nature of the Process of Oxidation (with demonstrations): H. E. Armstrong, F.R.S., and R. T. Colgate.—Some Present Day Aspects of the Match Industry: E. G. Clayton.

INSTITUTE OF ACTUARIES, at 5.

TUESDAY, JUNE 4.

ROYAL INSTITUTION, at 3.—The Formation of the Alphabet: Prof. W. M. Flinders Petrie.

RÖNTGEN SOCIETY, at 8.15.

ZOOLOGICAL SOCIETY, at 8.30.—The Preservation of the English Fauna: E. G. B. Meade-Waldo.—The North Rhodesian Giraffe: R. Lydekker.—On the Hydrocoralline Genus Errina: Prof. S. J. Hickson.—Contributions to the Anatomy and Systematic Arrangement of the Cestoidea. VI. On an Asexual Tapeworm from the Rodent *Fiber zibethicus*, showing a New Form of Asexual Propagation, and on the supposed Sexual Form: Dr. F. E. Beddard.—Polychæta from the Pacific Coast of North America. Part I. Serpulidæ, with a Revised Table of Classification of the Genus Spirorbis: Helen L. M. Pixell.—On some New Fossil Reptiles from the Permian and Triassic Beds of South Africa: Dr. R. Broom.

WEDNESDAY, JUNE 5.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Composition of Milk: H. D. Richmond.—On the Application of Adsorption to the Detection and Separation of certain Dyes: A. C. Chapman and A. Siebold.—The Estimation of Dirt in Milk: W. F. Lowe.—A New Method for the Detection and Estimation of Small Quantities of Nitrous Acid: E. H. Miller.—A Further Note on the Use of Methylene Blue as an Indicator in Iodimetric Titrations: F. S. Sinnatt.—The Estimation of Nitric and Nitrous Acids in Acetic Acid Solution. The Stability of Nitric Acid in Acetic Acid Solution: Dr. K. J. P. Orton.

GEOLOGICAL SOCIETY, at 8.—The Further Evidence of Borings as to the Range of the South-Eastern Coalfield and of the Palæozoic Floor, and as to the Thickness of the Overlying Strata: Prof. W. Boyd Dawkins.—Shelly Clay dredged from the Dogger Bank: J. W. Stather.

ENTOMOLOGICAL SOCIETY, at 8.—Studies in the Blattidæ, XII.: R. Shelford.—*Lycaena* (Agriades) *alexius*, Frr., a "Good" Species: Dr. T. A. Chapman.

THURSDAY, JUNE 6.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: The Process of Excitation in Nerve and Muscle: Keith Lucas.

INSTITUTION OF MINING ENGINEERS, at 11 a.m.—Address by President: W. E. Garforth.—Why Leave Shaft-pillars? W. H. and B. H. Pickering.—Safety-devices in Connection with Electrical Machinery and Appliances for Coal-mines: D. Bowen and W. E. French.—A Rope-driven Coal-cutter: W. L. Spence.

ROYAL INSTITUTION, at 3.—On X-Rays and Matter: Prof. C. G. Barkla.

FRIDAY, JUNE 7.

ROYAL INSTITUTION, at 9.—Lord Lister: Sir William Macewen.

SATURDAY, JUNE 8.

ROYAL INSTITUTION, at 3.—The Weather and the Utilities of Forecasts: Willis L. Moore.

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