THURSDAY, JANUARY 8, 1914.

LISTER AND HIS WORK.

Lord Lister: His Life and Work. By Dr. G. T. Wrench. Pp. 384. (London: T. Fisher Unwin, n.d.) Price 15*s.* net.

I APPROACHED Dr. Wrench's book with jealous suspicion. I was unfavourably impressed by his preface, the final paragraph of which contains the statement:—"Between Van Helmont and Lister nothing was added to the fundamental philosophy of disease." This over-coloration was an unpromising introduction to an account of the life and work of one of the greatest figures in medicine—Joseph Lister.

However, as I read I became more and more fascinated with the book. In addition to an unbounded enthusiasm for his task, the author has a detailed knowledge of the development of the antiseptic system, and understands that it was because Lister was a scientific investigator of the first order that he was privileged to make so great a contribution to the welfare of mankind. Further, Dr. Wrench's appreciation of the intellectual and moral greatness of Lister is so sincere that one forgives the occasional commission of some of the faults of journalism. The book is written throughout in an interesting and forcible style. Well-chosen anecdotes and extracts from Lister's addresses are interspersed, which recall the charm of his personality to those who knew him, and assist to present the beauty of his character to those who had not this privilege.

The preliminary chapters are devoted to a short account of Lister's childhood, student days, and the first portion of his professional career at Edinburgh. The importance of his early scientific investigations and their bearing upon the great work of his life is made clear. Then follows an account of the condition of the surgical wards of a hospital in pre-Listerian days. The picture is painted in lurid colours, but, as the generation which remembers this condition is disappearing, it is necessary to impress upon the reader the immense human importance of the problem which occupied the attention of Lister.

The rest of the book is a history of the development and final triumph of the antiseptic method in surgery. The antiseptic system was based on the germ theory of putrefaction, which had been finally established by Pasteur. Pasteur himself was fully alive to the possible application of the facts he had discovered in the interpretation of infectious diseases, and was anxious to put his ideas to the test. At that time, however, he had neither access to hospitals nor a laboratory where he could work at infectious diseases of animals. His opportunity soon arrived, and, in the same year (1866) that Lister was applying the germ theory to explain the occurrence of wound infection, Pasteur, at the request of the French Government, was occupied with an investigation into the causation of pébrine. This disease of silkworms he discovered to be caused by infection by a protozoan parasite, Nosema, which is transmitted from the moth through the egg to the next generation of worms.

From his first contact with hospital wards Lister had been impressed with the terrible evils of wound infection, and sorely perplexed as to its causation. What most surgeons took as a matter of course was to him, even as a student, a phenomenon urgently demanding explanation, and whilst house surgeon at University College Hospital he searched with his microscope for a possible fungus as causal agent.

In 1865 Lister read the papers of Pasteur dealing with the necessity of microbes for putrefaction, which appeared in the *Comptes rendus* of the Paris Academy of Sciences. The analogy between the happenings in a flask of broth exposed to the air and a festering wound was obvious to a mind so prepared; nevertheless hundreds of doctors must have read Pasteur's papers and failed to see that they had any significance for their art.

All this is well told in the chapter entitled "Perplexity and Enlightenment," and in two interesting chapters which follow, a description of the first attempts to put the principle into practice, and the striking success attained in one of the most insanitary hospitals in the kingdom is given.

Notwithstanding, antiseptic surgery was slow in making headway. Many surgeons failed to appreciate that antiseptic surgery was a system based on a principle, and seemed to think that they could neglect the principle and apply plenty of carbolic. As a consequence, they obtained results little, if at all, better than by their old methods.

The gradual spread of the gospel of "Listerism" until its final acceptance is dramatically told. In order to enhance the effect, the author has painted a sombre background representing the obstinate stupidity of many of the profession, and, to this end, has quoted from the speeches and writings of distinguished surgeons criticisms and opinions which it seems almost cruel to revive. This certainly produces the effect of contrast, but the lustre shed by the work of Lister is sufficient to render the artifice unnecessary.

The climax was reached at the International Medical Congress at Amsterdam in 1879, when Lister's appearance called forth the greatest ova-

tion ever witnessed at one of these assemblies. As the applause subsided, Prof. Donders, the president of the congress, stepped forth and said:—"Professor Lister, it is not only our admiration which we offer you; it is our gratitude, and that of the nations to which we belong."

The book concludes with an account of Lister's antiseptic technique, and the reasons on which it was based. This, in many respects admirable, is unnecessarily polemical. Like Dr. Wrench, I have no patience with those who would belittle the discoveries of Lister because it may be possible to attain the same end by a modification of his method; but the torrent of irony poured upon those surgeons who prefer to sterilise their dressings and tools by steam instead of by chemical means, or to adopt a number of precautions not found necessary by Lister, is, surely, uncalled for.

The elaborate equipment of the modern operating theatre is not, as many suppose, essential, but it is very convenient. The danger is that, by its obtrusive array of apparatus for sterilisation, the surgeon as well as the student may forget that it is impossible to sterilise the skin of the patient, so that it is, as Lister found, wiser to have a second line of defence in the form of an antiseptic dressing, which, although it may not destroy all the microbes in the area of operation, paralyses their activity until the wound has had time to close. C. J. MARTIN.

SPECIALISED CHEMICAL TEXT-BOOKS.

(1) *Gas Analysis.* By Prof. L. M. Dennis. Pp. xvi+434. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1913.) Price 9*s.* net.

(2) *The Chemistry of Rubber.* By B. D. Porritt. Pp. vii+96. (London: Gurney and Jackson, 1913.) Price 1*s.* 6*d.* net.

(3) *An Introduction to the Chemistry of Plant Products.* By Dr. Paul Haas and T. G. Hill. Pp. xii+401. (London: Longmans, Green and Co., 1913.) Price 7*s.* 6*d.* net.

(4) *Grundriss der Fermentmethoden. Ein Lehrbuch für Mediziner, Chemiker, und Botaniker.* By Prof. Julius Wohlgemuth. Pp. ix+355. (Berlin: J. Springer, 1913.) Price 10 marks.

(1) GAS analysis enters into almost every branch of chemical work, and there is therefore no need to emphasise the importance of a standard work on the subject. Prof. Dennis began his book as a second edition of the English translation of Hempel's famous "Methods of Gas Analysis," but the inclusion in it of the advances made during the last fourteen years has turned it into a new book. Procedures for the determination of most of the common gases are given in considerable detail, but the book is rightly devoted mainly to rapid methods of technical gas analysis, including the determination of heating power as well as of quantity. The opening sections, occupying about one-third of the book, treat in turn of the collection, storage, measurement, and other manipulation of gases. The various forms of apparatus devised for gas analysis are described, a variety of important practical details being included. After describing fully the methods of analysis of the various simple gases, chapters are devoted to the investigation of flue gas, illuminating gas, acetylene, and air. Although remarkably complete, the book is not exhaustive; for example, no reference is made to Bone and Wheeler's valuable apparatus, first described in 1908. Only one of the automatic carbon dioxide recorders is described, whereas there are others on the market equally if not more satisfactory. However, these are only minor blemishes on a work which is likely to be widely used.

(2) Mr. Porritt is to be complimented on having compressed within narrow limits a very complete and readable account of the chemistry of rubber. His book can scarcely fail to be of great value to all who master it, and it should be of considerable service to those directly interested in the industry. As a practical man, the author is fully alive to the complexities of the problem presented by rubber, and his account of the advanced chemistry of its structure is combined happily with the more practical details of its working.

The first chapter deals with the properties of crude rubber, directing attention to its constituents and such properties as tackiness and perishing, which require scientific investigation, so that they may be prevented in the future. A neat summary is given of the chemical constitution of rubber and of its synthetic imitations. Sections 3 and 4 describe the process of vulcanisation and the various theories which have been put forward to explain it. We read with interest that Hancock, the first to utilise the process in England about 1842, conducted experiments from which any kind of scientific method was conspicuously absent! He was nevertheless successful! Although Mr. Porritt's book assures us that this is not the method of procedure in 1913, we cannot help feeling that if, a few years ago when money was plentiful in the industry, the plantation companies had endowed properly scientific research on rubber, they would not now be complaining of the unsatisfactory price which their product realises as compared with the wild article. The subject of synthetic rubber is fully treated, though no optimistic opinion is expressed as to its com-

mercial success in the near future. The book ends with a bibliography giving 179 references to the original literature.

(3) The title of this work very accurately represents its contents; it is in no sense a text-book of plant chemistry, though it is intended for students of vegetable physiology. The plan adopted by the authors is to single out various groups of substances because they occur in plants, and to give some idea of their chemistry. Reference is usually made to the mode of occurrence of the particular compound, and occasionally to its biological significance or economic importance. From the point of view of the botanist, especially the junior student, the result is a valuable compilation of facts which were previously only to be found widely scattered. The authors are to be congratulated on the extent of their reading and the large amount of pertinent matter which they have introduced, much of which has not hitherto been found in text-books.

Viewed, however, from a somewhat higher standard of criticism, the book is disappointing. It lacks stimulus and feeling, both on the chemical and on the botanical side, and although informative it is not sufficiently critical to guide the user on just those questions where he needs information. If chemistry is to be of real aid to the biologist, he must realise its broader issues and acquire some chemical feeling. This it is impossible to gain from a book dealing with the reactions and properties of selected substances, and the introduction of such methods of teaching chemistry to biologists is to be deprecated on all grounds.

The writers are at their best in some of the more advanced sections, those dealing with the tannins and with plant pigments being admirably done. The other chapters are devoted to fats, carbohydrates, glucosides, nitrogen bases, colloids, proteins, and enzymes.

(4) Dr. Wohlgemuth in his preface claims to have collected together all the experimental methods which are of use for the study of enzymes, but we fear he will find it difficult to establish his claim. Indeed, the book is disappointingly superficial, the more so as there is a real need for it just at present. Many of the best and most generally used processes are entirely ignored, and there are far too many inaccuracies and loose statements. In particular, the author appears to have paid no attention at all to the very large bulk of English and American work on the subject, either in the original or in the excellent abstracts in the German journals which must have been available to him.

The carbohydrate enzymes are very incompletely treated, and the same applies to diastase. The estimation of this enzyme is so important for the brewing industry that it has been very thoroughly studied, and methods of great accuracy have been elaborated, for which we look in vain. Emulsin scarcely receives mention, in spite of its importance in plant physiology, and of the newer work on it we find not a trace. The information about urease is equally scanty. The author is more lengthy and presumably more at home on the pathological side of the subject, and he appears to cater specially for medical men who propose to make the detection of enzymes of advantage in diagnosis. It is desirable to emphasise the danger of this practice—the technique of enzyme identification is not easy, and insufficiently qualified workers are prone to obtain misleading results. Physiological chemical literature is already burdened with so much that is incorrect that no encouragement should be given to practices which are likely to lead to a continuance of the evil. E. F. A.

THE REGULATION OF NAVIGABLE RIVERS.

The Improvement of Rivers. By B. F. Thomas and D. A. Watt. In two volumes. Pp. xv + 749 + 76 plates. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1913.) Price 31*s.* 6*d.* net.

THIS is the second edition of a book published in New York in 1903. The authors are assistant engineers in the service of the United States, and have drawn to a considerable extent on their personal experience of works carried out in that country. The subjects dealt with are:—Chap. i., The characteristics of rivers; ii., Regulation of river channels; iii. and iv., Dredging and Snagging; v., Embankments and their protection; vi., Levees; vii., Storage reservoirs; viii., The improvements of the outfalls of rivers. The second part relates principally to the canalisation of rivers. Tidal rivers are not dealt with.

The text is accompanied by a great number of illustrations explanatory of the works described. These two volumes contain much useful information relating to the subject dealt with, and are well worth the study of engineers engaged in this class of work.

The authors direct attention to a fact that should be borne in mind by engineers engaged in river training, that experience has shown that although water is a fluid element without cohesion, influenced by the laws of gravitation, yet it cannot be made to flow in any desired direction unless the training works are carried out subject to rules

which experience has dictated. All flowing water moves under the guidance of natural laws which produce in their combinations complex results, which must be taken into consideration fully if favourable results are to be obtained from the regulation of river channels.

One subject dealt with at some length which deserves the careful attention of river engineers is the prevention of floods by regulating the flow of the water by means of natural or artificial reservoirs. It is not for want of example that this important subject has not received the attention that it deserves. So long ago as the time of the Pharaohs, the regulation of the Nile was effected by the construction of Lake Mœris. Advantage was taken of a large natural depression near the river, covering an area of 695 sq. miles. This was embanked, and a channel cut connecting the lake and the river. In times of extraordinary high Nile, an opening was cut in the embankment and the water from the river allowed to flow through the cut to the artificial lake; when the flood subsided the cut in the bank was made up again.

In America the great lakes form a practical object-lesson as to the use of storage reservoirs. These operate to preserve a balance between the cycles of wet and dry seasons, and so regulate the depth of the water in the rivers with which they are connected, to the advantage of navigation in dry seasons, and the prevention of floods when the rainfall is excessive.

The largest artificial reservoir that has been constructed in the United States is that at the head of the Mississippi. The country in the neighbourhood of the source of this river is interspersed with a great number of small lakes and depressions. About thirty years ago, following the Egyptian example, embankments were constructed to hold up the water over this area in wet seasons, and works carried out to enable this to flow out when the river could take it without causing floods. In Italy the lakes adjacent to the northern tributaries of the Po have in like manner been adapted to serve the same purpose. The flow of the Rhine in its upper part is also regulated by the lakes with which it is connected.

One of the most extensive modern artificial systems of regulation is to be found in Russia, at the head waters of the Volga and Msta rivers, where, by the embankment of a large tract of low swampy land, the flow of water in the Volga has been so regulated that the length of time over which navigation is practicable in dry seasons has been increased by three months.

The most recent example of river regulation in Europe has been carried out in Silesia, where, on an average, the river Oder overflowed its banks and flooded the country through which it flows once in eight years. The loss to the inhabitants caused by the last of these floods was estimated at half a million pounds. The scheme adopted has been to form a series of reservoirs by constructing embankments across the valley and holding up the water when the river is not able to carry off the rainfall.

OUR BOOKSHELF.

The Wonders of Wireless Telegraphy. By Prof. J. A. Fleming, F.R.S. Pp. xi+279. (London: S.P.C.K., 1913.) Price 3*s.* 6*d.* net.

DR. FLEMING'S reputation as inventor, experimenter, theorist, and expositor in the domain of wireless telegraphy is so high that any work by him upon this fascinating and difficult subject will be welcome. We already have learned to look to his advanced and mathematical works for guidance when seeking to understand the intricacies of spark or æthereal telegraphy. In the present book, however, Dr. Fleming has undertaken a task which in many ways is more difficult than writing an advanced treatise, for he has attempted, and his success is great, to unfold the nature of the operations on which this new art depends without the use of mathematical or very technical language. This book is to be considered as a continuation of, or addition to, "Waves and Ripples in Water, Air, and Æther," by the same author.

Without following the treatment of the several chapters, special reference may be made to the fifth chapter, which is of particular interest, as we there find the most recent views on long-distance transmission as not affected by the curvature of the earth, but susceptible to peculiarities of weather, and, above all, to the effect of the rising or setting sun. Another feature is the discussion of the methods of transmission by intermittent spark, continuously existing arc, and various mechanical methods of obtaining continuous waves or nearly so, and this it would appear might be read to advantage by some whose knowledge of electrodynamics is greater than their familiarity with the everyday difficulties met with in working commercially.

The chapter on the wireless telephone is also one which will appeal to every reader.

(1) *Who's Who,* 1914. Pp. xxx+2314. Price 15*s.* net.

(2) *Who's Who Year-Book for* 1914–15. Pp. vii+178. Price 1*s.* net.

(3) *The Englishwoman's Year-Book and Directory,* 1914. Edited by G. E. Mitton. Pp. xxxii+441. Price 2*s.* 6*d.* net.

(4) *The Writers' and Artists' Year-Book,* 1914. Edited by G. E. Mitton. Pp. x+157. (London: Adam and Charles Black.) Price 1*s.* net.

(1) THE best praise which can be given to the sixty-fifth issue of "Who's Who" is to say that it maintains the high standard of excellence of previous editions. We notice that it has increased in size by nearly a hundred pages, and that, as

usual, a prominent place is given to the biographies of eminent British and foreign men of science. We know of no more useful work of reference, or of one which is consulted more frequently.

(2) This supplement to "Who's Who" contains a remarkable miscellany of information as to the offices held by distinguished men and so on, arranged conveniently in tabular form to assist rapid reference.

(3) With the assistance of an honorary consultative committee of women workers eminent in their respective spheres of activity, the editor has compiled an indispensable compendium of information for all women who participate in public or social life. Parents desiring guidance as to careers for their daughters will find this volume very helpful.

(4) The sub-title of this book, "A Directory for Writers, Artists, and Photographers"—exactly describes its scope and intention, which are fulfilled successfully.

Papers of the British School at Rome. Vol. vi. Pp. xiv + 511 + xl plates. (London: Macmillan and Co., Ltd., 1913.) Price 42*s.* net

THE severely archæological part of this work consists of reports of excavations in Malta and Gozo made in 1908–11, and of a survey of the megalithic monuments of Sardinia. The investigation was confined to Neolithic monuments. Buildings usually ascribed to the Phœnicians are now assigned to the end of the Neolithic age, or to the very beginning of the "Eneolithic" period or the age of metals (p. 5). They were "in part sanctuaries, in part dwellings." No Neolithic burials were discovered in them, but typical Neolithic burials were found elsewhere under other conditions (pp. 7, 8, 12). Such evidence fully warrants the happy description "megalithic sanctuaries" (p. 35). "Connection of origin with the pottery of the Ægean there is apparently none; at any rate, it is so remote that we cannot trace it, and of direct Ægean influence," says Mr. Peet, "I can see no certain evidence whatsoever." The builders were evidently allied to the people who made "the rock-hewn graves of Sardinia, Spain, and perhaps Sicily" (p. 17).

But the "sanctuaries" of Malta are, according to the second report, "dolmenic tombs" in Sardinia. As no evidence of burial is produced, one is forced to think that the investigation in that quarter is in the "dolmenic tomb" period of research. It is all about the "cult of the dead," with the dead conspicuously absent. In the first report Dr. Ashby says: "I do not think that it is possible to accept the idea of Evans that these mounments 'served, in part at least, a sepulchral purpose.'" (p. 8).

Excellent plans disclose orientations which rank in well-known categories, and the linear measures dovetail into striking harmonies, but the "British School at Rome" seems to care little for such trifles. Nowhere one finds the suggestion that the "sanctuaries" were also observatories.

JOHN GRIFFITH.

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 Pressure of Radiation and Carnot's Principle.

As is well known, the pressure of radiation, predicted by Maxwell, and since experimentally confirmed by Lebedew and by Nichols and Hull, plays an important part in the theory of radiation developed by Boltzmann and W. Wien. The existence of the pressure according to electromagnetic theory is easily demonstrated,[1] but it does not appear to be generally remembered that it could have been deduced with some confidence from thermodynamical principles, even earlier than in the time of Maxwell. Such a deduction was, in fact, made by Bartoli in 1876, and constituted the foundation of Boltzmann's work.[2] Bartoli's method is quite sufficient for his purpose; but, mainly because it employs irreversible operations, it does not lend itself to further developments. It may therefore be of service to detail the elementary argument on the lines of Carnot, by which it appears that in the absence of a pressure of radiation it would be possible to raise heat from a lower to a higher temperature.

The imaginary apparatus is, as in Boltzmann's theory, a cylinder and piston formed of perfectly reflecting material, within which we may suppose the radiation to be confined. This radiation is always of the kind characterised as complete (or black), a requirement satisfied if we include also a very small black body with which the radiation is in equilibrium. If the operations are slow enough, the size of the black body may be reduced without limit, and then the whole energy at a given temperature is that of the radiation and proportional to the volume occupied. When we have occasion to introduce or abstract heat, the communication may be supposed in the first instance to be with the black body. The operations are of two kinds: (1) compression (or rarefaction) of the kind called *adiabatic*, that is, without communication of heat. If the volume increases, the temperature must fall, even though in the absence of pressure upon the piston no work is done, since the same energy of complete radiation now occupies a larger space. Similarly a rise of temperature accompanies adiabatic contraction. In the second kind of operation (2) the expansions and contractions are *isothermal*—that is, without change of temperature. In this case heat must pass, into the black body when the volume expands and out of it when the volume contracts, and at a given temperature the amount of heat which must pass is proportional to the change of volume.

The cycle of operations to be considered is the same as in Carnot's theory, the only difference being that here, in the absence of pressure, there is no question of external work. Begin by isothermal expansion at the lower temperature during which heat is taken in. Then compress adiabatically until a higher temperature is reached. Next continue the compression isothermally until the same amount of heat is given out as was taken in during the first expansion. Lastly, restore the original volume adiabatically. Since no heat has passed upon the whole in either direction, the final state is identical with the initial state, the tem-

[1] See, for example, J. J. Thomson, "Elements of Electricity and Magnetism" (Cambridge, 1895 § 241); Rayleigh, *Phil. Mag.* (xlv., p. 222, 1898); "Scientific Papers" (iv., p. 354).

[2] *Wied. Ann.*, vol. xxxii., pp. 31, 291, 1884. It is only through Boltzmann that I am acquainted with Bartoli's reasoning.

perature being recovered as well as the volume. The sole result of the cycle is that heat is raised from a lower to a higher temperature. Since this is assumed to be impossible, the supposition that the operations can be performed without external work is to be rejected—in other words, we must regard the radiation as exercising a pressure upon the moving piston. Carnot's principle and the absence of a pressure are incompatible.

For a further discussion it is, of course, desirable to employ the general formulation of Carnot's principle, as in a former paper.[3] If p be the pressure, θ the absolute temperature,

$$\theta\frac{dp}{d\theta}=M \quad . \quad . \quad . \quad . \quad . \quad . \quad (29),$$

where Mdv represents the heat that must be communicated, while the volume alters by dv and $d\theta=0$. In the application to radiation M cannot vanish, and therefore p cannot. In this case clearly

$$M=U+p \quad . \quad . \quad . \quad . \quad . \quad . \quad (30),$$

where U denotes the volume-density of the energy—a function of θ only. Hence—

$$\theta\frac{dp}{d\theta}=U+p \quad . \quad . \quad . \quad . \quad . \quad (31).$$

If we assume from electromagnetic theory that

$$p=\tfrac{1}{3}U \quad . \quad . \quad . \quad . \quad . \quad . \quad (32),$$

it follows at once that

$$U\propto\theta^4 \quad . \quad . \quad . \quad . \quad . \quad . \quad (33),$$

the well-known law of Stefan.

In (31) if p be known as a function of θ, U as a function of θ follows immediately. If, on the other hand, U be known, we have

$$d\left(\frac{p}{\theta}\right)=\frac{U}{\theta^2}d\theta,$$

and thence

$$\frac{p}{\theta}=\int_0^\theta\frac{U}{\theta^2}d\theta+C \quad . \quad . \quad . \quad . \quad . \quad (34).$$

RAYLEIGH.

"Atmospherics" in Wireless Telegraphy.

THE greatest difficulty in wireless telegraphy is due to atmospherics. I believe that every attempt to prevent these sudden shocks from entering the receiving apparatus in important stations has failed. Now Mr. S. G. Brown has wires stretched horizontally from his house to his stables in Kensington at about 40 ft. from the ground; he receives all the ordinary messages and time signals with practically no sign of atmospherics. Of course, lessening the height of high antennæ lessens the energy received, but it seems that the diminution of the blow is much greater than the diminution of ordinary signals. One of Brown's latest relays magnifies the currents in the receiving apparatus one hundred times, and he expected that the signals would be well received, in spite of the lowness of his wires, but he was surprised to find that the blow, the atmospheric, had almost altogether disappeared. In fact, there was no blow to magnify. I believe that the Salcombe Hill Observatory arrangement for receiving time signals is also free from atmospherics, its antennæ being quite low, and a Brown relay being used.

If the following explanation of this curious phenomenon is correct, it ought to be easy to destroy atmospherics however high the antennæ may be.

An antenna is affected by rays of all frequencies because its vibrations are damped by resistance, although it is, of course, most sensitive to rays of its own frequency. An atmospheric is of the nature of a sudden shock; it consists of rays of all frequencies, and particularly of rays of all sorts of very high frequencies. Suppose the frequency of the antenna to be anything from 50,000 to 300,000 per second; let us say 100,000. I take it that houses and trees are very imperfect antennæ the frequencies of which are probably much greater than 100,000 generally, although sometimes less. When rays are proceeding horizontally the æther in the neighbourhood of trees and houses is therefore greatly robbed of all energies which accompany waves of high frequency. In fact, all rays of frequencies corresponding to the frequencies of trees and houses are absorbed, and a low antenna of frequency 100,000 receives but little energy of other frequencies than its own, and therefore little of the "atmospheric" blow. If this explanation is correct, it is only necessary to surround a receiving antenna by numerous others of all sorts of high frequency. If I am right it is scarcely possible to receive atmospherics in the middle of a large city unless the ground is much higher than neighbouring ground, just as we know that an ordinary house in the middle of a city is never struck by lightning.

My explanation cannot be complete, for the man in charge of a coast station in the Mediterranean states that he has difficulty in receiving signals because disturbing atmospherics are so numerous, whereas ships in the neighbourhood, or even five miles away, are comparatively undisturbed in their signalling. Now these ships are far away from trees and houses.

Again, Mr. Brown tells me that although he receives no atmospherics from great distances, his signals are certainly disturbed by local thunderstorms. In fact, he can predict the coming of a thunderstorm when it is probably twenty miles away. My explanation may be defended by saying that the fronts of the Maxwell waves are not vertical in such cases. Again, I have been told that without altering the antenna at a receiving station, if we tune it to a lower frequency, there is more disturbance from atmospherics. It is possible that this is not generally true, but only true for certain stations, and, if so, my explanation may escape censure. JOHN PERRY.

December 30, 1913.

Columbium versus Niobium.

AT a meeting of the council of the International Association of Chemical Societies in Brussels, last September, a committee on inorganic nomenclature, among other recommendations, endorsed the name and symbol "niobium" and "Nb," for the element which was originally named columbium. As this recommendation is historically erroneous, a brief statement of the facts appears to be desirable.

In 1801 Hatchett, an English chemist, analysed a strange American mineral, and in it found a new metallic acid, the oxide of an element which he named columbium. A year later, Ekeberg, in Sweden, analysed a similar mineral from Finland, and discovered another element, which he called tantalum. Wollaston, in 1809, undertook a new investigation of these elements, and concluded that they were identical, a conclusion which, if it were true, would have involved the rejection of the later name, and the retention of the earlier columbium. The accepted rules of scientific nomenclature make this point clear.

For more than forty years after Hatchett's discovery both names were in current use; for although Wollaston's views were accepted by many chemists, there were others unconvinced. In 1844, however, Heinrich Rose, after an elaborate study of columbite and tantalite from many localities, announced the discovery of

[3] "On the Pressure of Vibrations," *Phil. Mag.*, iii., p. 338, 1902; "Scientific Papers," v., p. 47.

two new elements in them, niobium and pelopium. The latter supposed element was afterwards found to be non-existent, but the niobium was merely the old columbium under a new name. That name in some mysterious manner was substituted by the German chemists for the original appropriate name, and has been in general use in Europe ever since. In America the name columbium has been generally preferred, and was formally endorsed by the Chemical Section of the American Association for the Advancement of Science more than twenty years ago. In England, also, columbium is much used, as, for example, in Roscoe and Schorlemmer's "Treatise on Chemistry," Thorpe's "Dictionary of Applied Chemistry," and the new edition of the "Encyclopædia Britannica."

The foundation of Rose's error seems to have been an uncritical acceptance of Wollaston's views; for he speaks of all the minerals he studied as tantalite. He also, at least in his original memoir, claims that the atomic weight of niobium is greater than that of tantalum, and here he was obviously wrong.

In short, the name columbium has more than forty years' priority, and during that interval was accepted by many chemists, and was more or less in current use. To employ the name niobium is not only unhistorical, but it is also unfair to the original discoverer, meaningless, and without any justification whatever. Furthermore, it injures the splendid reputation of Rose, for it perpetuates and emphasises one of his few errors. The recommendation of the committee above-mentioned should not be accepted, for it is opposed to the established rules of priority.

F. W. CLARKE.

A New Etching Reagent for Steel.

WHAT I believe to be a novel and useful reagent for the etching of steel specimens for microscopic examination has recently been worked out in this laboratory by the writer, in conjunction with Mr. J. L. Haughton. A very brief account in this place is perhaps justified in view of the fact that the opportunity for publishing a full account of the work in the usual way will not occur for some months.

The etching reagent consists of an acid solution of ferric chloride, similar to that frequently used for etching copper alloys, but containing about 0·1 per cent. of cupric chloride and about half that quantity of stannic chloride. The copper in this solution is, of course, displaced by the iron of any steel specimen exposed to it, and the copper is deposited on the surface of the steel. We have, however, discovered that in ordinary carbon steels this action can be made to occur in such a way that a thin deposit of copper is slowly formed on the ferrite, while pearlite and cementite are only very slightly affected. Under the microscope the ferrite appears to be blackened, while the pearlite remains bright. The appearance of the etched specimens is thus the exact negative of that obtained by ordinary reagents, provided that the steel is very pure. We have found, however, that in commercial steels the ferrite is not darkened uniformly, but that a strongly banded structure is developed. Apparently the rate of deposition of copper is greater the purer the ferrite, one of the most important impurities in this regard being phosphorus. By a suitable use of the reagent, patterns are obtained which indicate the distribution of the phosphorus in a clear and striking manner, and it is thus possible to obtain in two minutes by the use of the new reagent results hitherto only obtainable by the process of "heat tinting."

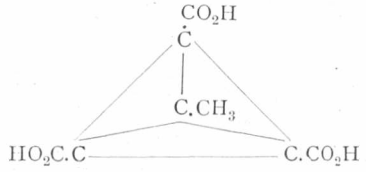
By the kindness of Dr. J. E. Stead, F.R.S., we have been enabled to compare the patterns obtained by heat-tinting on one of Dr. Stead's own specimens and those obtained by means of our reagent on the same surface after repolishing, and these patterns have proved identical. Beyond this, however, the new method of etching by the electro-chemical deposition of another metal promises to open up many possibilities in the study of the structure of metals, but these we have not yet had time to work out.

WALTER ROSENHAIN.

The National Physical Laboratory,
(Wernher Metallurgy Laboratory),
December 31, 1913.

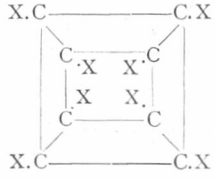
Dr. J. F. Thorpe's "Caged" Compound.

As Dr. J. F. Thorpe has apparently found difficulty in representing his newly discovered tricarboxylic acid by a formula in the plane of the paper (*vide* 'Proc. Chem. Soc., vol. xxvii., p. 347), may I suggest



as being as good as the one he suggested if not preferable to it.

A "caged" cube compound, C_8X_8, could similarly be advantageously represented by the projection formula :—

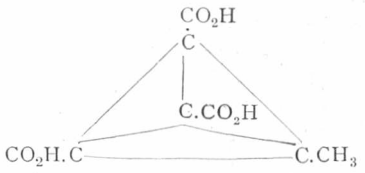


W. W. REED.

Technical Institute, Norwich,
December 16, 1913.

MR. REED is quite right, and doubtless the formula he suggests will have to be adopted for this and similar compounds when it is desired to express their structure graphically on the plane of the paper.

It is, however, evident, as Prof. Armstrong stated at the meeting of the Chemical Society, that a large number of organic compounds are very inadequately represented by the usual two dimensional formulæ, and that it will be necessary, in the near future, to reconsider our method of portraying the structure of these substances. The isolation of the compound under discussion, for which, on Prof. Armstrong's suggestion, the name methyl-tetrahedrene tricarboxylic acid has been adopted, merely serves to accentuate the limitations of our present method, for it is evident that the formula suggested by Mr. Reed does not represent the true relative positions of the carbon atoms in the molecule. For example, it is difficult to understand that the formula



represents the same compound as Mr. Reed's formula.

This is still more apparent in Mr. Reed's cube formula, in which it is difficult to realise that the eight carbon atoms are of equal value.

J. F. T.

Lucretius or Kapteyn?

NONNE vides etiam diversis nubila ventis diversas ire in partis inferna supernis? Qui minus illa queant per magnos ætheris orbis æstibus inter se diversis sidera ferri? *De Rerum Naturâ*, v., 646–9.

See you not too that clouds from contrary winds pass in contrary directions, the upper in a way contrary to the lower? Why may not yon stars just as well be borne on through their great orbits in ether by currents contrary one to the other?

Munro's Translation.

E. J. M.

Semi-absolute.

THE biologist, even the most mathematical, envies and admires the greater precision of statement and language that is possible for the physicist, and the physicist in his turn is apt to plume himself on the fact that his sciences, as compared with those of the biologist, are the exact sciences. Some biologists interested in precision of terminology have been wondering what the physicist may mean by the term "semi-absolute"—a term which will be found applied to volts in the title of a paper recently read before the Royal Society (NATURE, December 25, 1913, p. 495, column 1). On the face of it, semi-absoluteness is no more easy to conceive than is semi-infinity, and one is therefore tempted to regard the phrase akin to the "quite all right" of the modern young lady, the "quite a few" of the American, and other such degeneracies of modern speech. That view must, of course, be wrong, but an explanation would be comforting to more than one

ENQUIRER.

THE MAKING OF MOUNTAINS.[1]

THE object of the very attractive volume before us, as stated by its author, is to supply geographers with such a knowledge of geological processes as is necessary for understanding the origin of the orographic features of the earth's surface. With this purpose in view, technical details are—so far as is possible—avoided, while disputed and doubtful topics are, as a rule, kept in the background; while by vivid and picturesque descriptions, aided by admirable photographic illustrations and diagrams, the reader is made acquainted with the chief types of mountain forms and the agencies by which they have been produced.

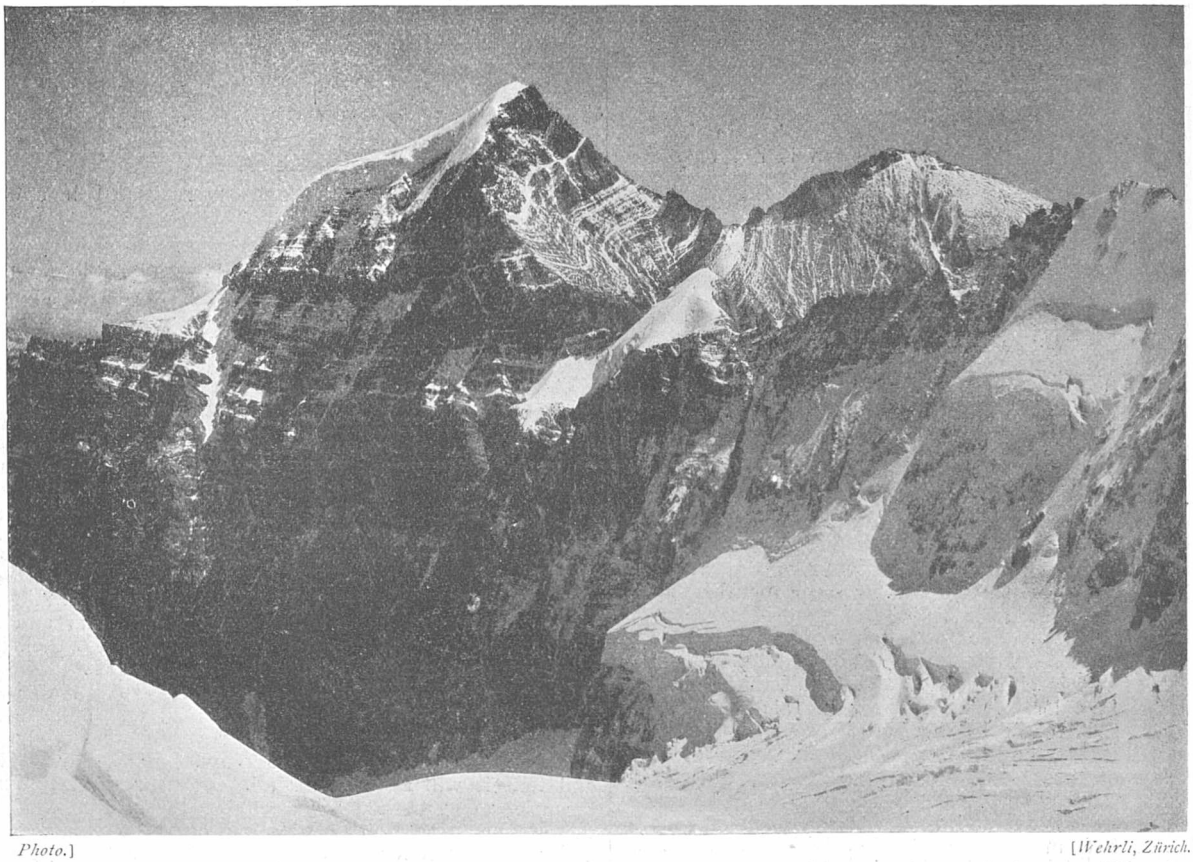


Photo.] [*Wehrli, Zürich.*

FIG. 1.—The Bifertenstock and Frisal, seen from the Firn plateau of the Tödi. Eocene and Mesozoic strata resting upon Gneiss. From "Mountains: their Origin, Growth, and Decay."

The great majority of the elevations of the land are classed as "original or tectonic," the building-up of these structures being due to many diverse agencies; only a small residue of the relief-forms are grouped as "subsequent or relict" mountains, being the result of operations that, by removing the surrounding materials, have left great upstanding masses behind.

First among the tectonic mountains are included those of volcanic origin, grouped by the author as "débris cones," which are made up of fragmental materials, usually of igneous origin but often accompanied by detritus from aqueous

[1] Mountains: their Origin, Growth, and Decay." By Prof. James Geikie, F.R.S. Pp. xix+311+lxxx plates. (Edinburgh: Oliver and Boyd, London: Gurney and Jackson, 1913.) Price 12*s.* 6*d.* net.

and metamorphic rocks; in the second place, we have "lava-cones" built up entirely by outwelling streams of liquid rock from a fissure; and, thirdly, "composite cones" built up by alternating ejections of fragmental materials and lavas. The varied slopes of cones, as determined by the nature of the fragmental materials or the degree of liquidity of the lavas, are well explained and illustrated. The very graceful forms assumed by some volcanoes—which is so conspicuously illustrated by the representation of the famous Japanese mountain Fujiyama—are explained by the author as being due to the larger ejected fragments accumulating nearest to the crater, but it may be in part also due to central subsidence. Such subsidence is admitted by the author to have taken place in the formation of some volcanic craters like that of the celebrated "Crater-lake" of Oregon. The results of denudation on volcanic cones is well illustrated. In describing the manner in which younger volcanic cones rise within old craters, the author unfortunately speaks of "cone-in-cone" structure, a term which has already been appropriated by geologists for a totally different phenomenon. As illustrating the vastness of the agencies by which volcanic mountains are built up, the author justly points out that the great cones of the Hawaiian Islands must be regarded as the grandest orographic feature on the globe, seeing that these cones rise from the ocean-floor to a height of 30,000 ft., while, so gentle are their slopes, they have diameters of more than 80 miles. At the other end of the scale, and as a supplement to the catalogue of volcanic mountains, geyser-cones and mud-volcanoes ("air volcanoes" of the author) are noticed.

In contrast to the elevations produced by the heaping up of materials brought from below the earth's surface we have "epigene types," formed by superficial detritus piled up either by glacial or æölian agencies. To the former class belong moraines of all kinds—sometimes forming hills more than 800 ft. in height—with the less conspicuous but more extended terrestrial features known as drumlins and eskers. As the result of wind-action, we have the sand dunes of sea-coasts and the far more extensive structures of the same kind characteristic of deserts.

In passing from the comparatively simple "mountains of accumulation" to the opposite class, to which he gives the name of "deformation mountains," our author approaches, as he himself admits, the most difficult part of his task. He commences by giving an outline of the history of the development of our knowledge of the subject, in which he justly lays stress on the important effect of Lyell's protest against the orographic theories of de Beaumont; and he goes on to indicate the value of the subsequent work

Photo.] [*Detroit Pub. Co.*

FIG. 2.—Mount Rainier (or Tacoma), Washington, U.S.A. An extinct composite volcano—snow capped and supporting glaciers. From "Mountains: their Origin, Growth, and Decay."

of the brothers Rogers in the Appalachian mountains of the United States. The great majority of the "deformation mountains" are shown to be undoubtedly "folded mountains," and, as may be expected in a work of this kind, the important light thrown upon mountain-origin by the study of the Scottish Highlands, as a mountain chain dissected by denudation, is admirably explained, though we miss any reference to the value of the labours of Nicol and Lapworth in this connection. The varieties of folding and the relations between folding and "thrusts" find full illustration; and the theoretical views of Heim, Steinmann, Suess, and other continental authors on the nature, extent, and results of the great complexities exhibited in the Alps, with their possible causes, are fairly stated though not fully discussed. The influence of jointing and weathering in producing the various types of alpine scenery rightly occupies a very important place in the work.

A second class of "dislocation mountains" includes curious types recognised in recent years by the geologists of the United States, with the "horsts" of German geologists. In all of these, extensive faulting—like that by which the mountains of Moab are left in relief by the great Dead-Sea fault—has been the chief agency concerned in their formation.

The mountains carved by denudation out of great igneous masses (the so-called "laccolites" and "batholites") constitute the author's third class of "deformation mountains," and are illustrated by the Henry mountains of North America and the Red Hills and Coolin Hills of Skye. It is here that we detect a little want of consistency in the classification adopted by the author. In describing his volcanic mountains he rightly refers not only to the denuded remains of small cones—commonly called "necks"—but to masses of lava, like the North Berwick Law, or of lava and tuffs like Largo Law, which are so conspicuous in the Scottish Lowlands as forming the denuded cones of great volcanoes. But the similar masses in Skye and the other islands of the Inner Hebrides do not differ from these in anything but their greater dimensions, and it seems scarcely justifiable to place them in a totally different class.

The final chapter of the book is devoted to the examples which the older geologists styled "mountains of circumdenudation," but which the author designates "subsequent or relict" mountains, of which we have such striking British examples in the great stacks of Torridon sandstone in western Sutherland and Ross.

Not less instructive than the text of this excellent work is the selection of eighty photographic plates which illustrate it. One-half of these is taken from the admirable series prepared by the Geological Survey of Scotland, and they show how rich our country is of examples of mountain structure; the other half consists of pictures supplied by photographers of Switzerland and the United States.

J. W. J.

ZONAL STRUCTURE IN PLANTS AND ANIMALS.[1]

WHEN a drop of strong silver nitrate is placed on a thin layer of 5–10 per cent. gelatine containing about 0·1 per cent. of potassium bichromate, remarkable phenomena are observed. The gelatine under the drop is coloured red-brown by the abundant precipitation of silver chromate. The nitrate spreads gradually by diffusion into the gelatine, the rusty brown area of precipitation enlarges, it forms at its periphery a dull whitish seam, and further outwards in the gelatine a system of numerous concentric rings is developed, spreading like rings on the surface of a quiet pool. These are the well-known Liesegang's rings or zones, and the central idea of Prof. Küster's investigation is that these throw light on zoned structure in cells and tissues. He has made numerous experiments with the diffusion zones formed in colloidal media *in vitro*, and he seeks to utilise the phenomena observed in the interpretation of organic structures—such as cross-striping in leaves, annular and other markings in cells and vessels, the layers in starch-grains, the markings on diatoms, the lines on butterflies' wings, on shells, on feathers, on porcupines' quills, and what not.

Ostwald's explanation of Liesegang's rings is not unanimously accepted, but no one doubts that the phenomenon will be cleared up in terms of laws of diffusion, concentration, precipitation, and the like. Prof. Küster does not go into that; his object is to make zoned structure in organisms more intelligible by bringing it into line with Liesegang's rings. He is aware of the risks of arguing from the conditions of inorganic processes to those of organic processes, of mistaking similarity for sameness—and he quotes the wise advice that Roux has given in connection with this kind of argument.

Prof. Küster admits that his suggestion is only at the stage of hypothesis, for we do not know much about the active substances the diffusion of which in cells may induce zoned structure. We cannot isolate them and experiment with them. On the other hand, Prof. Küster points out that organisms are largely built up of colloid material, and that his experiments *in vitro* were with colloidal material, that artificially induced modifications of Liesegang's rings find their parallel in organic structure, and that the zoned structure occurs in the most diverse kinds of plants. His experiments show that "rhythmic structure may arise without any rhythmic influence from the outer world, and that even simple diffusion processes can give rise to rhythmic structures." Is it not probable that analogous occurrences take place in the formation of zoned organic structure? It may be said that in living creatures the rhythms are characteristically dynamic, but our author replies to this by referring to Bredig's "pulsating

[1] "Ueber Zonenbildung in kolloidalen Medien." By Prof. Ernst Küster. Pp. 111+53 figs. (Jena: Gustav Fischer, 1913.) Price 4 marks.

systems," and the like, which may point a finger from a distance to the pulsating life of the cell.

Prof. Küster has opened up an exceedingly interesting line of inquiry, and he states his case in cautious and undogmatic manner. It appears to us that at this stage he would not have weakened his position by leaving out the reference to such complicated "structural rhythms" as the striping of vertebrate animals.

SHACKLETON'S TRANSANTARCTIC EXPEDITION, 1914.

THOUGH Sir Ernest Shackleton has adopted plans for an antarctic expedition that were formulated and published by me even before his return from his last expedition, and details of which have appeared since that time in various scientific journals, and in the public Press,[1] my view has always been that one explorer should not stand in the way of another, but as soon as one has secured money—a task more arduous than carrying out any plan whatever in the field—he should carry out whatever plan he pleases, and should receive, if he desires, any assistance that the other may be able to give. Therefore I welcome Sir Ernest Shackleton entering what has for a century mainly been, so to speak, the Scottish sphere of influence in the antarctic regions.

It is a curious fact that those who have done the most strenuous work on antarctic land have been seamen, while landsmen have been left to carry out the most strenuous work in antarctic seas, and it is, perhaps, for this reason that Sir Ernest Shackleton concentrates his attention again mainly on the land, whereas, as I have already pointed out,[2] it is a study of "antarctic seas that is at present most urgent, including an exploration and definition of the southern borders of those seas," that is to say, the coastline of the antarctic continent. This part of the programme cannot be efficiently carried out in the time that Sir Ernest Shackleton proposes to allow himself, either for necessary preparation or for his expedition. Hurry is unfavourable to detailed scientific research.

But no one is better fitted than Shackleton to carry out to a successful issue the transcontinental journey, as is shown by the brilliant way in which he conducted his south polar expedition in 1907–1909. Shackleton is a trained seaman and a capable business man, appreciative of the work that scientific people carry out under his leadership. Abundant testimony to this fact has been given by his former colleagues, especially Dr. D. Mawson, Prof. Edgeworth David, and Mr. James Murray. It is certain, therefore, that he will give his scientific staff every opportunity of carrying out important scientific research.

Granted that his ship is able to reach Coats Land or Luitpold Land—and this is entirely dependent on whether it is a good or bad ice year in the Weddell Sea—the expedition should endeavour to unite and chart in more detail Coats Land and Luitpold Land. It should endeavour to map out the coast line between Coats Land and Enderby Land, between Coats Land and Luitpold Land, and between Luitpold Land and New South Greenland. The investigation of New South Greenland is in itself one of the most interesting and difficult problems of Weddell Sea. Detailed soundings should be taken, especially to the south and west of those of the *Scotia* and *Deutschland*, so that, if new coastlines are not actually discovered, their presence and general outline may be indicated. This can be arrived at with a wonderful degree of accuracy. It is of great interest to obtain considerable quantities of bottom deposits, especially macroscopic specimens, along with indications of the distribution and drift of icebergs which have been the means of carrying them to the place where they have been deposited. The important discovery of Archæocyathinæ at a depth of 1775 fathoms in lat. 62° 10′ S., long. 41° 20′ W. is a lucid example of the value of this type of research, for it most certainly indicates that the Cambrian rocks found by Shackleton in the vicinity of the Beardmore Glacier stretch across Antarctica towards the shores of the Weddell Sea, and possibly form part of that mountain system seen by Morrell in about lat. 69° S.[3]

But will Shackleton be able to spend time to carry on these researches when the main object is to cross the antarctic continent? On her outward voyage the ship will be full to the gunwale with stores and equipment, and every effort must be made to find a suitable landing place along a practically unknown coast, to build a house, and set up the base camp for the tremendous task of crossing Antarctica, and this along a coast that Ross failed to reach because of heavy ice in 1843, that the *Scotia* failed to reach in 1903, where the *Scotia*, in 1904, was heaved right out of the water, and left stranded on the top of the ice, her keel being 4ft. above water-level, and where the *Deutschland*, in 1912, was beset and driven northward helplessly during the whole winter.

These are difficulties that may be met with again in the Weddell Sea, difficulties which have never been experienced by any ship in the Ross Sea, where no one has ever failed to reach the Ross Barrier. It is therefore to be hoped that Shackleton will not meet with such conditions, but will find a favourable season such as Weddell and Morrell found in 1823.

Once landed at or in the vicinity of Coats Land —more likely to the east than to the west— Shackleton starts his main objective. A meteorological station here will be of immense importance, and should be cooperative with those of the Argentine Republic in Scotia Bay and South Georgia. Detailed discussion of the meteoro-

[1] *Scottish Geographical Magazine*, vol. xxiv., No. 4, April, 1908; vol. xxvi., No. 4, April, 1910. NATURE, March 24, 1910, p. 101; and October 27, 1910, p. 551. "Polar Exploration," by W. S. Bruce, chap. x., pp. 252, 253. (Williams and Norgate, 1911.)

[2] "Polar Exploration," by W. S. Bruce, p. 247.

[3] Morrell's Voyages, 1822–31, Capt. Benjamin Morrell, 1832, chap. p. 69.

logical programme with Mr. R. C. Mossman is strongly advised. Magnetic work of the usual kind at the base station and, so far as possible, on the cross journey will fall in with other work that has been done; in both these departments of science it would be specially profitable to have other expeditions in the field synchronously. Local zoological and botanical work will also be of great interest. But, undoubtedly, solving some of the many great topographical and geological problems is the leading work to be done both in the vicinity of the base station and in the interior.

According to evidence at present at our disposal, Shackleton, if he penetrates southward from Coats Land, will gradually rise without much interruption over completely and heavily ice-clad land—over inland ice, in fact—until he reaches the South Pole, an ice-field that continues until it reaches the Beardmore Glacier and Axel Heiberg Glaciers. It would be a great triumph if, after Shackleton reached the South Pole, he could strike a new route, say, to the west of the mountains of South Victoria Land; but if this sacrifices the life or even limbs of the party, it is not worth attempting. Another expedition can carry out that work in time to come from the Pacific side. The intrinsic value of the expedition is to seek and find out what lies between Coats Land and the South Pole.

The route will probably be to the east of the antarctic continuation of the Andes, but possibly Shackleton may have to cross another range—the continuation of the South Victoria Land Mountains—but all is new, and all depends upon whether previous conceptions have been based on sufficient facts. It is expeditions such as Shackleton's that we require as the only way of obtaining data for the solution of many theories founded on too few facts. We therefore wish him all possible success, and trust that he will receive all the support he requires. The 50,000*l.* provided by a generous friend is an absolute minimum; 70,000*l.* is nearer the figure, and may we also trust that even another 10,000*l.* will be forthcoming to enable the gallant leader to have the scientific results of the expedition described in detail; for an expedition of this kind is not completely successful unless the technical results of the work are published. WILLIAM S. BRUCE.

DR. WEIR MITCHELL.

DR. SILAS WEIR MITCHELL died at Philadelphia on January 4, and in him has passed away one of the most remarkable men of America. At different times in his life he took a place in the very first rank of experimental physiologists, of practical physicians, and of novelists.

Dr. Weir Mitchell was born at Philadelphia, February 15, 1829, and was educated at the University of Pennsylvania and the Jefferson Medical College. He began researches on various physiological subjects in 1852, and in 1860 he published his researches "On the Venom of the Rattle Snake," a work which, even at this day, remains a perfect model of what an investigation into the physiological action of a poison ought to be, and is of itself sufficient to establish his claim to a front rank amongst American physiologists, past or present.

During the American Civil War Dr. Weir Mitchell had charge of a hospital in which cases of injury to nerves by gunshot wounds were specially treated. In 1872 he published a book on the effect of such injuries. After the war was over his patients were scattered over many parts of the United States, and he was thus enabled to make some very extraordinary observations upon the effect of weather upon disease. He was struck by the fact that one day, for example, he would get a batch of letters from California, a day or two afterwards from Denver, and a day or two later from Chicago, in which the patients complained of pains in their old wounds. These coincidences led him to inquire into the cause of the pain, and on communicating with the meteorological office he found that a wave of rain and a wave of pain were passing simultaneously over the American continent from west to east at the same rate. The "rain area" and the "pain area" were concentric, but the pain area was much larger than the rain area. The radius of the rain area from the storm centre was 550 to 600 miles, while the radius of the pain area was 150 miles greater than this. As a consequence of this, patients in the rain area felt pains, and, seeing the rain, concluded that their pains were due to change of weather. Those in the pain area felt pains, but saw no rain, and could not understand why they were suffering, although the real cause of their pain was the climatic disturbance. He afterwards extended his observations to the effect of weather on chorea and infantile paralysis. The curve of cases of infantile paralysis closely corresponded with the curve of temperature, but no such relationship could be noticed in the case of chorea either with temperature, height of barometer, or relative humidity. But a very close relationship indeed could be observed between the number of attacks of chorea and the number of storm centres within a radius of 400 or even 750 miles of Philadelphia.

Dr. Weir Mitchell's attention having been thus directed to diseases of the nervous system, he was led to give special attention to the treatment of nervous diseases in women, and more especially to hysteria and neurasthenia. In the treatment of these diseases he effected a complete revolution, introducing the system of seclusion, rest, massage, and feeding, which is now known as the Weir Mitchell treatment. It has been extraordinarily effectual in very many cases which would have otherwise proved hopeless, and establishes his claim to rank as one of the greatest practical physicians of his time.

From the published catalogue of his works it appears that he did not begin to write novels or poems until 1880, when he published "Three Tales of the Older Philadelphia," and in 1882 he

published some poems. From that time onward he continued to write poems and novels. The most successful of these was "Hugh Wynne," a novel which dealt with life and manners in Philadelphia at the time of the Revolution. This novel showed an intimate knowledge of the history of the time, and of the people who took part in the great national movement. The figures he described were no mere puppets, but seem to be living and breathing men and women, and the work was of such high literary excellence that it at once placed him in the foremost rank of American novelists. Of very few men can it be said that as a young man he took a first place amongst the physiologists, as a middle-aged man amongst the physicians, and as an elderly man amongst the novelists of his country. His extraordinary mental power was combined with an almost equally extraordinary bodily activity, so that until about a year before his death he would think nothing of a walk of ten miles.

As a host he was most cordial and genial; as a friend he was most kind, trusty, and true; and his great information, broad views, and power of expression made a conversation with him a pleasure, and a stay in his house a delight to be remembered for the rest of life. He seemed to possess in a very marked degree the power of saying and doing the right thing at the right moment. His loss leaves the world the poorer, and will be a personal sorrow to everyone who has ever known him.

Little more than a week ago I received a Christmas card from him headed, "The Star of Bethlehem," containing four verses of poetry printed, but signed in his own handwriting, and I think probably his own composition. In view of his death so soon afterwards, the last verse seems almost prophetic, and it gives such an insight into his feelings, character, and hopes that I think perhaps I may be allowed to quote it:—

"Still in our heaven of memory keep
Remembrance of the gifts He gave;
The guiding life, the star of love,
To glow for us beyond the grave."

LAUDER BRUNTON.

NOTES.

THE chief distinction of interest to the scientific world in the list of New Year Honours is the appointment of Sir Archibald Geikie, K.C.B., F.R.S., to the Order of Merit, in recognition of the eminent services which he has rendered to the nation and to the world at large in the science of geology. Mr. James Bryce, O.M., F.R.S., who retired recently from the post of British Ambassador at Washington, is created a viscount. Sir Christopher Nixon, Bart., professor of medicine in University College, Dublin, has been made a Privy Councillor in Ireland. Sir Rickman J. Godlee, Bart., president of the Royal College of Surgeons, has been made a Knight Commander of the Royal Victorian Order, and Sir William J. Collins has received a like honour. Among the forty new knights are Prof. E. Rutherford, F.R.S., Langworthy professor of physics, University of Manchester; Mr. R. Blair, education officer of the London County Council since 1904; Prof. H. B. Allen, professor of pathology, University of Melbourne; and Surgeon-General A. T. Sloggett, director, Medical Services in India. Major A. Cooper-Key, Chief Inspector of Explosives, Home Office, has been appointed a Companion of the Bath (C.B.); Dr. A. Theiler, director of veterinary research, Department of Agriculture, Union of South Africa, has been promoted to be Knight Commander of the Order of Saint Michael and Saint George (K.C.M.G.); and the new Companions (C.M.G.) of the same Order include Mr. A. G. Bell, Inspector of Mines, Trinidad; and Prof. J. Shand, professor of natural philosophy, University of Otago, New Zealand. Major J. D. E. Holmes, Imperial bacteriologist in charge of the veterinary laboratory at Muktesar, has been made a Companion of the Order of the Indian Empire (C.I.E.).

MR. W. POPPLEWELL BLOXAM, whose death we announced with regret last week, contributed to the Chemical Society many papers which testify to his work for the advancement of science. In the early 'nineties of last century he devoted his energies to the task of unravelling the mysteries surrounding the alkali polysulphides and their oxidation changes; no doubt his attention was turned in this direction by Debus, under whom he started his professional career. Having filled a position as *locum tenens* professor of chemistry at Presidency College, Madras, Bloxam was retained in India by the Government of Bengal to investigate the question of improving the cultivation and manufacture of indigo, and from 1902–5 much work was carried on at the Dalsingh Serai Research Station, culminating in a report in conjunction with H. M. Leak and R. S. Finlow, now cited as authoritative. The underlying chemical investigations are to be found in the Transactions of the Chemical Society. A further Government grant enabled Mr. Bloxam on his return to this country to continue his researches at Leeds, whence there emanated several papers for the Chemical Society, in conjunction with Prof. A. G. Perkin and others, on the constitution of indirubin, the analysis of indigo, and the like. Another subject which came under Mr. Bloxam's notice was the complexity of the proteids of blood, and in the Proceedings of the Physiological Society is to be found a paper dealing with the constitution of these compounds as they occur in horse serum. As a whole Mr. Bloxam's work was sound, and his death at a comparatively early age deprives us of a genuine enthusiast in the cause of chemical research.

DR. HUGO MIEHE, associate professor of botany in the University of Leipzig, has succeeded the late Prof. H. Potonié as editor of the *Naturwissenschaftlichen Wochenschrift*, published by Mr. Gustav Fischer, Jena.

DR. R. WORMELL, instructor in mathematics at the Royal Naval College, Greenwich, in 1873, headmaster of the Central Foundation School, London, from 1874 to 1900, and the author of several valuable works on scientific and educational subjects, died on January 6, at seventy-four years of age.

MR. C. B. ROBINSON, an American botanist, who was holding a temporary appointment under the Philippine Government, is reported to have been killed by natives of Amboyna Island, where he was engaged on a study of the local flora. He was forty-one years of age, and had been connected for some time with the New York Botanical Gardens.

A MEETING of members of the Wireless Society of London will be held at the Institution of Electrical Engineers on January 21, when an address, illustrated by experiments, will be given by the president, Mr. A. A. Campbell Swinton. By the courtesy of Le Commandant Ferrio, a vice-president of the society, the radio-telegraphic station of the Eiffel Tower, Paris, will send a special wireless message to the society during the meeting, and arrangements are being made to render the message audible to all present.

PROF. A. GARBASSO informs us that Mr. A. Lo Surdo, assistant professor in the R. Istituto di Studi Superiori, Florence, has succeeded in observing the Zeeman effect in an electric field announced by Prof. Stark in NATURE of December 4, 1913 (p. 401). Mr. Lo Surdo has observed that the effect is present in all vacuum tubes, but in a very short space immediately in front of the kathode. A photograph sent by Prof. Garbasso shows the line $H\gamma$ resolved into five components, but it is unsuitable for satisfactory reproduction. Two papers upon the subject have been presented to the R. Accademia dei Lincei, and will be published in the *Rendiconti* of the academy.

IN spite of appeals from several distinguished Americans, the Bill giving San Francisco extensive water supply and power rights in the Hetch-Hetchy Valley has passed both Houses of Congress, and becomes law by the signature of the President. One effect of the new Act will be to remove from the use and enjoyment of the general public the valley of the Tuolumne River in the north-western part of the Yosemite National Park. It is estimated that the provision prohibiting any refuse of men or animals from being deposited within 300 ft. of running water or of lakes tributary to the Tuolumne River above Hetch-Hetchy will exclude the public from one-half of the park. The Tuolumne Cañon, in particular, is described as containing some of the finest scenery in America, excelled only, if at all, by the Grand Cañon of the Colorado in Arizona.

THE eighty-second annual meeting of the British Medical Association is to be held next July at Aberdeen. The president-elect, who succeeds Dr. W. A. Hollis, of Brighton, is Sir Alexander Ogston, of Aberdeen. The annual representative meeting will begin on Friday, July 24; the president's address will be delivered on July 28, and the sections will meet on the three days following. The address in medicine is to be delivered by Dr. Archibald E. Garrod, and the popular lecture by Prof. J. Arthur Thomson. The sections of the council of the association with their presidents are:—Anatomy and Physiology, Prof. Robert W. Reid; Dermatology and Syphilology, Dr. Alfred Eddowes; Diseases of Children, including Orthopedics, Dr. John Thomson; Electro-Therapeutics and Radiology, Dr. Samuel Sloan; Gynæcology and Obstetrics, Dr. Francis W. N. Haultain; Laryngology, Rhinology, and Otology, Dr. Harry L. Lack; Medical Sociology, Dr. John Gordon; Medicine, Dr. F. J. Smith; Naval and Military Medicine and Surgery, Deputy-Surgeon-General M. Craig; Neurology and Psychological Medicine, Dr. F. W. Mott; Ophthalmology, Dr. C. H. Usher; Pathology and Bacteriology, Dr. W. S. Lazarus-Barlow; Pharmacology, Therapeutics, and Dietetics, Prof. J. T. Cash; State Medicine and Medical Jurisprudence, Prof. Matthew Hay; Surgery, Mr. John S. Riddell; Tropical Medicine, Prof. W. J. R. Simpson.

THE reports for the fifty-two weeks ended December 27, issued by the Meteorological Office, show that the mean temperature for 1913 was in excess of the average over the whole of the British Isles; the greatest excess was in the midland counties and the east of England, where it amounted for the whole year to nearly 2°. The rainfall was in agreement with the average in the south-east of England, and was in excess in Ireland and in the south-west of England; in all other districts there was a deficiency. The greatest deficiency of rain was 5·37 in. in the west of Scotland, and in the east of Scotland it was 4·53 in. In the English districts the greatest deficiency was 3·32 in. in the north-eastern district, and in the east of England the deficiency was 2·58 in. The rainy days were generally deficient in the eastern section of the kingdom and in excess in the western section. The duration of bright sunshine was below the average over the whole of the British Isles. The Greenwich observations give 51·5° as the mean temperature for the year, which is 1·5° in excess of the average. April, July, and August were the only months with a deficiency of temperature, the defect for the several months being respectively 0·4°, 3·8°, and 1·1°. The highest monthly mean was 61·8° in August. In July the highest temperature was 76°, and there was only one day with the temperature above the average, whilst the duration of bright sunshine was only ninety-five hours, which is ninety-one hours less than the average. There were in all only thirty-three nights with frost. The rainfall for the year was 22·00 in., which is 2·13 in. less than the average. The wettest month was October, with 3·58 in., the driest June, with 0·61 in. Rain fell on 169 days during the year, and January, March, and April each had twenty days with rain. The aggregate sunshine for the year was 1329 hours, which is twenty-two hours fewer than the average.

IN the sixth part of "Visvakarma," edited by Mr. Ananda K. Coomaraswamy, a number of interesting photographs of examples of Indian sculpture are reproduced. Perhaps the finest specimens are the elephants, a favourite study of the native artist, from Mamallapuram, on the western coast, and a remarkable bronze figure of the monkey god, Hanumán, from Ceylon, and of a mongoose from Nipal. This cheap and well-illustrated periodical furnishes valuable material for the study of Oriental sculpture.

IT is a good sign of the interest now felt among Anglo-Indian officials in local beliefs and folklore,

that the *Dacca Review* has been founded for the publication of information on these subjects from eastern Bengal. Mr. H. E. Stapleton, in vol. iii., No. 5, of the review, gives an interesting account of Ghazi Sahib, the patron saint of boatmen, the first Musalman invader of Sylhet. Round this worthy a mass of curious legend has collected, which deserves the attention of students of folklore and peasant religions.

IN the December issue of *Man* Prof. G. Elliot Smith revives the question of the origin of the dolmen. According to his theory, it is a degraded form of the Egyptian *mastaba*, or stone sepulchre. It is, he believes, "altogether inconceivable that the more or less crude, though none the less obvious, imitations of the essential parts of the fully-developed *mastaba*, which are seen in the Sardinian 'Giants' Tombs,' the *allées couvertes* of France and elsewhere, the widespread 'holed dolmens,' and all the multitude of 'vestigial structures,' to use a biological analogy, represented in the protean forms of the Algerian and Tunisian dolmens, could have been invented independently of the Egyptian constructions." At the two last meetings of the British Association, this view failed to command the acceptance of authorities like Profs. Boyd Dawkins and Flinders Petrie. The present exposition, though interesting and suggestive, does not deal with the more obvious objections which have been from time to time advanced in opposition to it.

MR. ROBERT MOND, who founded the Infants' Hospital, Vincent Square, S.W., in an interview reported in *The Times* of December 29, expresses a very decided opinion that infants should be fed on fresh, raw milk. He states that children thrive far better on untreated milk, that there is little risk of tuberculous infection therefrom, and that children fed on sterilised or pasteurised milk, are weak and ill-nourished and predisposed to tuberculosis. Mr. Mond has an experimental farm at Sevenoaks, at which full records and memoranda are kept, which are at the disposal of any farmer or dairyman who desires to consult them.

DR. G. MCMULLAN and Prof. K. Pearson describe, in the October (1913) issue of *Biometrika*, a pedigree of split-foot or "lobster-claw." The pedigree extends over four generations, and includes more than a hundred individuals. The deformity is always transmitted only by the affected, but appears in considerably more than half the members of affected families; for example, in the three largest families there are eight affected and none normal, six affected and four normal, five affected and four normal. The extent of the abnormality varies greatly in different cases, as is shown in the photographs with which the paper is illustrated.

EHRLICH'S well-known method of *intra vitam* staining by means of methylene-blue is proving itself extraordinarily fruitful in investigations of the nervous system of the lower animals. Adolf Gerwerzhagen has recently applied this method to the study of the nervous system of the Polyzoa, or, as some authorities prefer to call them, Bryozoa (*Zeitschrift für wissenschaftliche Zoologie*, Bd. cvii., p. 309). Students of zoology have hitherto had to content themselves with very scanty information on this subject, and will doubtless be surprised at the complexity of the nervous system now for the first time demonstrated. It appears that, in addition to the cerebral ganglion and the main nerves supplying the lophophore, &c., there is a rich network of nerve fibres and ganglion cells, not only in the body-wall of individual zooids, but extending throughout the whole colony, while the lophophore and tentacles are provided with an elaborate system of nerve fibres and sense cells, and there is also a so-called "sympathetic" system ramifying over the alimentary canal. The present communication deals with the nervous system of the well-known fresh-water form, *Cristatella mucedo*, and the remarkable coordinated creeping movements of the entire colony are rendered intelligible by the discovery of the common colonial nervous system.

IN vol. lxiv. of *Vidensk fra den naturk. Foren* Mr. H. Blegvad describes, under the name of *Leptocephalus hjorti*, the smallest leptocephalid, or eel-larva, at present known. The specimen, which was taken by the writer in the Atlantic during a voyage to the Danish West Indies in 1910–11, measures only 19·8 mm. in total length. The next smallest example taken had a length of 21·5 mm.

IN an article published in the December issue of the Museums' Journal, Mr. C. Hallett, the official guide at the British Museum, alludes to some of the difficulties connected with the work of guide-demonstrators in museums. One curious point is that, in Mr. Hallett's opinion, the majority of the visitors to the museum are drawn from the classes least fitted to appreciate its contents. Among those who form the guide-led parties, there may be a few with some knowledge of the objects under review, while there will generally be many with a little knowledge, which they desire to increase. The bane of such parties are those who are not only utterly destitute of knowledge, but have no desire to acquire any. Noise and overcrowding form other difficulties, but the gravest question to be faced is the extent (if any) to which a guide-conducted party ought to take precedence over other visitors to a museum.

THE 1914 issue of the "Live Stock Journal Almanack" fully sustains the high reputation of that publication as a trustworthy and up-to-date guide to all important matters connected with British horses, cattle, sheep, &c., during the previous year. Special interest attaches to an article by Col. Ricardo on the horse-problem, particularly in respect to Army remounts; and although there may be a shortage in horses suitable for this particular kind of work, it is satisfactory to learn from other articles that the trade in shire and other working horses was never better. In connection with cattle, reference may be made to an article on "free-martins," by Mr. C. J. Davies, in which a common misunderstanding is corrected. A "free-martin" is generally stated to be an infertile female twin calf, the fellow of which is a male; but, according to Messrs. Geddes and Thompson, such an infertile calf is really a hermaphrodite male, the

fellow twin of which is a normal male. The true nature of the free-martin is revealed by its possessing the essential internal generative organs of the bull, although these are accompanied by the external accessory organs of a female, while a rudimentary vagina and uterus are also present. From the article on sheep we regret to learn that the number of head in Great Britain continues to show a serious decrease.

THREE papers on osmotic pressures in plants, by Prof. H. H. Dixon and Mr. W. R. G. Atkins, have recently appeared in the Proceedings of the Royal Dublin Society, vol. xiii. (1913). The authors show that the sap pressed from living, untreated tissues does not give a true estimate of the concentration of that in the vacuoles of the cells before the application of pressure, that in order to extract the sap from the cells without altering the concentration it is necessary to render the protoplasmic membranes permeable, and that this can best be effected by the application of liquid air. This discovery makes it necessary to revise all freezing-point and electrical conductivity determinations where expressed sap has been employed, and the authors find that their new measurements, making use of sap pressed immediately after thawing from tissues frozen solid in liquid air, give much higher osmotic pressures than had been obtained previously. An important point established is that the actual osmotic pressures in the cells are much greater than the requirements of the well-known cohesion theory of the ascent of sap in trees demand.

THE potentialities of the British egg and poultry trade are indicated in an article, by Mr. Edward Brown, in the Journal of the Agricultural Organisation Society, vol. vii., Nos. 3 and 4, 1913. Since the visit of the first egg and poultry demonstration train, three years ago, to three of the counties in South Wales the value of the local output has been increased, according to a conservative estimate, to the amount of 25,000*l.* to 30,000*l.* per annum. During April and May of last spring a similar train made a twelve days' tour in six counties in North Wales, and was visited by more than 19,000 persons. This will suffice to indicate the great interest evinced by the general public in the question, and such work, educational in itself, followed by cooperation and organisation in the marketing of produce, cannot fail to be of great value. It is, however, highly desirable that the continuation of this work should be ensured, and that adequate official support should be given instead of its being dependent on private generosity.

WE have received from the United States Geological Survey three bulletins, namely No. 522, "Portland Cement Materials and Industry in the United States," by Edwin C. Sekel; No. 527, "Ore Deposits of the Helena Mining Region, Montana," by Adolph Knapf; and No. 529, "The Enrichment of Sulphide Ores," by William Harvey Emmons. The first- and last-named of these are necessarily of more general interest than a description of a specific district can be, and whilst the first will particularly interest cement makers and engineers in general, the latter appeals most strongly to the economic geologist, and student of ore deposition. Although the bulletin upon Portland cement is intended primarily for Americans who are either "owners of lands on which marl, limestone, or clay deposits are found," or "cement manufacturers or those who desire to become such," the information conveyed will be found of great use to cement manufacturers and users all the world over, giving as it does an excellent sketch of the nature of cements and the principles of cement manufacture. As regards the bulletin by Mr. Emmons, it recapitulates in a very clear and readable form the present state of knowledge concerning the phenomena of secondary enrichment of ore deposits, paying particular attention to the chemistry of the changes involved in this enrichment; it deserves the careful attention of all mining engineers who have to deal with ore deposits liable to be affected by the phenomena here discussed.

MR. R. C. MOSSMAN has contributed to *Symons's Meteorological Magazine* for December the sixth of his interesting articles on southern hemisphere seasonal correlations. (1) Argentine Republic and Chile: The departure from the normal of the thirty-six years, 1876–1911, at certain stations show that the winter variations of temperature are generally in harmony with each other from May to August. A comparison of South American winter temperature variations with conditions in other regions yielded (with one exception) negative results. (2) Auckland, N.Z., and Alice Springs, Australia: On comparing the mean temperature at Auckland for the second quarter of the year with the values at Alice Springs for the last quarter, it was found that from 1892 to 1906 the former was an index of the latter. (3) Sydney, N.S.W., and San Francisco: From 1864 to 1889 a well-marked relation was apparent between the mean temperature at Sydney from May to August and the rainfall at San Francisco for October to April following. (4) South Orkneys and Kimberley: For the years 1903–11 the August and September temperature at the former has been a direct index of the temperature at the latter during the three months following. The temperature at the South Orkneys in August and September is largely dependent on the ice conditions of the surrounding ocean. The paper is accompanied with explanatory tables and diagrams.

MR. P. E. B. JOURDAIN'S "The Principle of Least Action" (Open Court Publishing Company, 1*s.* 6*d.*) is a reprint of three essays published in *The Monist* (1912–13). The first of these is mainly historical, and gives an abundance of quotations and references; the second deals with extensions of the theory, and alternative ways of considering the problem—in particular an outline of O. Hölder's important theory; the third paper is a critical summary. Altogether we have an interesting and impartial view of the subject, expressed in as simple a form as the nature of the topic seems to admit.

IN a pamphlet called "Principles of a New Theory of the Series," Mr. F. Tavani has given an interesting and apparently novel view of the subject. It has at any rate the advantage of making one comparatively simple test cover a large number of important cases.

We can scarcely expect more from it than this; for the test of convergence of a given series is ultimately whether s_n has a limit, s_n being the sum of the first n terms, and there is no reason to suppose that we can find, in all cases, another and more manageable way of expressing the condition of convergence. Mr. Tavani gives several important references, and has had the advantage of criticisms by Prof. M. J. M. Hill and Mr. G. H. Hardy.

RECENT low-temperature research has led to results which it is difficult to reconcile with the belief that at the absolute zero of temperature the energy of the atoms and molecules of bodies vanishes. The change of the specific heat of hydrogen at very low temperatures has been shown by Prof. Einstein and Dr. Stern to be consistent with the energy of the molecules being finite at the absolute zero. Prof. Onnes and Dr. Keesom come to the same conclusion with regard to the translatory energy, and Dr. Keesom has shown that some of the difficulties of the theory of free electrons in metals are removed by the assumption of finite energy at the absolute zero. According to a recent communication from the physical laboratory of the University of Leyden, Dr. Oosterhuis finds it necessary to assume a finite energy of rotation of the molecules at the absolute zero in order to correlate his observations of the magnetic susceptibilities of a number of paramagnetic substances at very low temperatures. By this means the deviations from Curie's law of constancy of the product of susceptibility and absolute temperature are explained.

IN a paper in the *Atti R. Accad. Lincei* (vol. xxii., ii., p. 390) Mr. C. Acqua shows that nuclear degeneration is produced in plant cells by traces of uranium salts. If, for example, wheat plants are grown in very dilute solutions of uranyl nitrate (1 in 10,000), the rootlets soon cease to develop, and this is accompanied by the production of a yellow colour in the nuclei of the cells of the meristem, which at the same time no longer stain in the usual manner with hæmotoxylin. The action of the uranium brings about destruction of the chromatin, and the cessation of nuclear activity. The cause of this is not yet ascertained, but it is suggested that it may be the formation of organo-metallic compounds or the radio-activity of the uranium itself.

THE Chemical Society's Journal contains an important contribution, by Messrs. Pickard and Kenyon, to the study of optical rotatory power in homologous series. Of the series of secondary alchohols from $C_2H_5.CHOH.CH_3$ to $C_2H_5.CHOH.C_{15}H_{31}$, one is necessarily inactive, but all the others with one exception have been prepared and isolated in an optically active form. The molecular rotatory powers in this remarkable series of compounds increase fairly regularly when once the inactive diethyl carbinol $C_2H_5.CHOH.C_2H_5$ has been passed, but somewhat excessive optical activity appears in the fifth and tenth members of the series. There might be some tendency to ascribe this small excess of rotatory power to experimental error, but for the fact that when the alcohols are merely dissolved in benzene or in ethyl alcohol the curve of increasing rotatory power loses all pretence of uniformity, and develops a series of remarkable humps, which culminate at the alcohols, $C_2H_5.CHOH.C_5H_{11}$, $C_2H_5.CHOH.C_{10}H_{21}$, and perhaps $C_2H_5.CHOH.C_{15}H_{31}$. This curious behaviour is attributed to the fact that the "growing chain" of carbon atoms probably assumes a spiral form, each loop of the spiral containing *five* carbon atoms. Some indication of the same qualities has been detected in *solutions* of the methyl-carbinols, $CH_3.CHOH.R$, but the isopropyl-carbinols, $(CH_3)_2CH.CHOH.R$, behave in a perfectly regular manner, both in the homogeneous state and in solution.

WE learn from *The Engineer* for January 2 that the French Minister of Public Works has requested the railway companies to submit proposals for equipping the cabs of express locomotives with audible signals as soon as possible. The Minister also points out the terrible consequences resulting from the employment of gas for lighting the coaches whenever a train is smashed in collision. He therefore orders the railway companies to hasten the substitution of electrical for gas lighting on fast trains, and he further states that he will henceforth refuse permission to the companies to purchase rolling stock equipped for gas lighting. It may be noted that British railway companies are giving attention to the automatic control of trains. Some are trying mechanical means of placing fog-signals on the line when the semaphore is at danger; others, like the Great Western and the North-Eastern, have cab signals already in use, and some are testing electrical apparatus. Many people hold that it is better to leave full responsibility with the driver, and not transfer it to a mechanism which may fail. Public opinion will, however, probably force automatic control on British railway companies.

LECTURERS in colleges and teachers in schools will welcome the publication of the second part of Messrs. Newton and Co.'s catalogue of lantern slides. The volume, which is effectively bound in cloth, runs to nearly six hundred pages, and gives full particulars of the immense variety of slides which this firm is able to supply to illustrate lectures and lessons in science, nature-study, geography, history, the various industries, and other subjects. The increase in this department of their business has led Messrs. Newton and Co. to open their New Lantern Slide Gallery at 37 King Street, Covent Garden, W.C. It is worthy of note that many of the sets of slides catalogued have been compiled by such educational authorities as the Visual Instruction Committee of the Colonial Office, the Committee of London Teachers of Geography, and so on, and purchasers have the assurance that the slides are particularly suitable for educational purposes. The number of slides dealing with scientific subjects is very large, and many of them represent important pieces of research. As typical may be mentioned those from photographs of flying bullets by Prof. C. V. Boys, of sound waves by Prof. R. W. Wood, of ripples by Dr. J. H. Vincent, and of astronomical work in the Solar Physics Observatory.

OUR ASTRONOMICAL COLUMN.

TUTTLE'S NEBULA, N.G.C. 6643.—In this column for September 25 last attention was directed to M. Borrelly's observation of Hind's nebula indicating its variable nature. M. Borrelly has recently been making observations on the nebula of Tuttle, N.G.C. 6643, at the Marseilles Observatory, and has communicated the results to the *Comptes rendus* for December 22, 1913 (vol. clvii., No. 25, p. 1377). He brings together all the observations made since its discovery in 1859, and the evidence is distinctly in favour of its variability. In very recent years, *i.e.* in 1909, its light appeared to diminish considerably. From 1910 to 1912 it was feeble, but still to be seen in the comet-seeker (mag. 11). On July 10, 1913, M. Borrelly says it was scarcely visible in the instrument; on August 26 it was at the limit of visibility, while on August 27 it was practically invisible (mag. 11·5). From the observations M. Borrelly concludes that changes have taken place.

BRIGHT HYDROGEN LINES IN STELLAR SPECTRA AND P CYGNI.—Mr. Paul W. Merril communicates two papers to the Lick Observatory Bulletin, No. 246. The first is the description of a series of spectrograms of stars the spectra of which contain bright hydrogen lines, and is a continuation of the work described in the previous bulletin, No. 162 (1913). The spectra are confined to the Hα region, and were obtained with the 36-in. refractor and a one-prism spectrograph previously described. The stars here dealt with belong to classes B and A, but stars of class Oe5 were photographed to test their relation to class B. In the last-mentioned case, although only a few stars were photographed, the evidence was negative, out of nine stars none of them indicated bright hydrogen lines. The second paper is on the spectrum of P Cygni between λ4340 and λ4650, taken with the three-prism spectrograph. Twelve photographs are discussed, having been taken between August, 1907, and September, 1913. Tables are given showing the determined displacements for numerous lines of H, He, O, N, and Si, from each of the photographs. Attention is directed to the resemblance between the hydrogen lines of P Cygni, and those of an ordinary Nova. It is stated that the measurements given in the tables show good agreement with those of Frost.

MEASUREMENT OF SMALL DISPLACEMENTS OF SPECTRUM LINES.—Bulletin No. 32 of the Kodaikanal Observatory contains an important communication by Mr. J. Evershed on a new method of measuring small displacements of spectrum lines. The main idea of the method consists in placing a positive copy of the plate to be measured reversed, and almost in contact with the negative, film to film, and moving one with reference to the other, so that the positive images are made to coincide successively with the negative images of the corresponding lines. No spider thread is used, and the accuracy of the adjustment for coincidence depends on the sensitiveness of the eye in estimating the change from the bright and dark contiguous images of a line, to the perfectly uniform density which results when the positive image exactly coincides with the negative, and the positive copy has the same gradation of tone as the negative. Mr. Evershed describes and illustrates the method and machine employed, and points out its advantages and disadvantages. He also gives two examples of measures made in the ordinary way and by the new method to show the relative accuracy obtained; these represent two series of solar rotation plates. The results indicate that the probable error is about halved in the positive on negative measures as compared with the ordinary measures, and the gain in accuracy is about the same whatever way the probable errors are estimated.

ASTRONOMICAL ANNUALS AND STAR CHARTS.—The annual "Companion to The Observatory" has nearly become standardised in form, and the present issue will be found as useful as ever. The favourable and accessible total eclipse of the sun on August 20–21 next calls for extra information, and this has been given in the form of the sun's altitude, azimuth, and parallactic angle for the more accessible part of the line of totality in addition to the usual data. For the fiftieth year the handy astronomical and meteorological annual, edited by M. Camille Flammarion, makes its appearance, and the great amount of interesting matter contained within its covers is as complete and useful as in previous issues. Space does not allow one to enter into any detail regarding the wide range of the information here brought together, but astronomical readers are sufficiently acquainted with previous volumes to know the utility of the information displayed. As is usual, a number of excellent illustrations and figures accompany the text. Mrs. H. Periam Hawkins's "Star Almanac for 1914" and "Revolving Star Map" will be found very useful to astronomers generally. The former consists of a large sheet to be hung up on a wall, and contains much useful matter relative to the apparent stellar movements, meteor showers, planets, &c. The latter is a well-constructed planisphere for stars seen from the northern hemisphere, and has a movable declination scale.

PRIZE SUBJECTS PROPOSED BY THE PARIS ACADEMY OF SCIENCES FOR 1915.

Geometry.—Francœur prize (1000 francs), for discoveries or works useful to the progress of pure or applied mathematics; Bordin prize (3000 francs), to make notable progress in the study of curves with constant torsion; to determine, if possible, which of these curves are algebraic, at least those which are unicursal.

Mechanics.—A Montyon prize (700 francs), for the invention or improvement of instruments useful to the progress of agriculture, the mechanical arts or science; Poncelet prize (2000 francs), for work on applied mathematics; Boileau prize (1300 francs), for researches on the motion of fluids contributing to the progress of hydraulics.

Navigation.—The extraordinary prize of 6000 francs for work leading to increased efficiency of the French naval forces; Plumey prize (4000 francs), for improvements in steam engines or any other invention contributing to the progress of steam navigation.

Astronomy.—Pierre Guzman prize (100,000 francs), to anyone finding a means of communication with another planet other than Mars. Failing the above, the accumulated interest of five years will be awarded for an important astronomical discovery. Lalande prize (540 francs), for memoir or work useful to the progress of astronomy; Valz prize (460 francs), to the author of the most interesting astronomical observation during the year; G. de Pontécoulant prize (700 francs), for researches in celestial mechanics.

Geography.—Tchihatchef prize (3000 francs), as recompense or encouragement to naturalists of any nationality distinguished in the exploration of the lesser-known parts of Asia; Gay prize (1500 francs), for a study of the distribution of plants in Indo-China.

Physics.—Hébert prize (1000 francs), for a treatise or discovery in connection with the practical use of electricity; Hughes prize (2500 francs), for discoveries or works contributing to the progress of physics; Henri de Parville prize (1500 francs), for original work

in physics; Gaston Planté prize (3000 francs), for the French author of an important discovery, invention, or work in the field of electricity.

Chemistry.—Jecker prize (10,000 francs), for work conducing to the progress of organic chemistry; Cahours prize (3000 francs), for the encouragement of young chemists; Montyon prize (unhealthy trades; one prize, 2500 francs, a mention of 1500 francs), for the discovery of a means of rendering an art or trade less unhealthy; Houzeau prize (700 francs), for a young chemist.

Mineralogy and Geology.—Delesse prize (1400 francs), for work in geology, or, failing that, in mineralogy; Joseph Labbé prize (1000 francs), for geological researches contributing to the development of the mineral wealth of France, its colonies, and protectorates.

Botany.—Desmazières prize (1600 francs), for the best publication during the year on Cryptogams; Montagne prize (1500 francs), for work on the anatomy, physiology, development, or description of the lower Cryptogams; de Coincy prize (900 francs), for a work on phanerogams; Thore prize (200 francs), for work on the cellular cryptogams of Europe; Jean de Rufz de Lavison prize (500 francs), for work on plant physiology.

Anatomy and Zoology.—Savigny prize (1500 francs), for the assistance of young travelling zoologists, not receiving Government assistance, who work on the invertebrates of Egypt and Syria; Cuvier prize (1500 francs), for work in zoological palæontology, comparative anatomy, or zoology; da Gama Machado prize (1200 francs), for memoirs on the coloured parts of the tegumentary system of animals.

Medicine and Surgery.—Montyon prize (2500 francs, mentions of 1500 francs), for discoveries or inventions in medicine and surgery; Barbier prize (2000 francs), for a discovery in botany in relation to medicine, or in the sciences of surgery, medicine, or pharmacy; Bréant prize (100,000 francs), for a specific cure for Asiatic cholera; Godard prize (1000 francs), for the best memoir on the anatomy, physiology, and pathology of the genito-urinary organs; Baron Lorrey prize (750 francs), for a work treating of military hygiene, medicine, or surgery; Bellion prize (1400 francs), for medical discoveries; Mège prize (10,000 francs); Argut prize (1200 francs), for the discovery of a remedy for a disease at present not capable of treatment; Chaussier prize (10,000 francs), for the best book or memoir published during the last four years on legal or practical medicine; Dusgate prize (2500 francs), for a work on the signs of death and the means of preventing premature burial.

Physiology.—Montyon prize (750 francs), for work in experimental physiology; Philipeaux prize (900 francs), for experimental physiology; Lallemand prize (1800 francs), for work relating to the nervous system; Pourat prize (1000 francs), for a memoir on the relations between the combined sugar of the blood and the albuminoid materials.

Statistics.—Montyon prize (1000 francs, and two mentions of 500 francs), for works dealing with statistical questions.

History of Science.—Binoux prize (2000 francs).

General Prizes.—Arago medal; Lavoisier medal, for work in chemistry; Berthelot medal, to persons taking prizes in chemistry or physics; Henri Becquerel prize (3000 francs); Gegner prize (3800 francs); Lannelongue prize (2000 francs); Gustave Roux prize (1000 francs), Tremont prize (1100 francs); Wilde prize (4000 francs), for a work or discovery in astronomy, physics, chemistry, mineralogy, geology, or experimental mechanics; Lonchampt prize (4000 francs); Saintour prize (3000 francs), for work in mathematics; Henri de Parville prize (2500 francs); Victor Raulin prize (1500 francs), for facilitating the publication of works relating to geology and palæontology; Vaillant prize (4000 francs), for the discovery of a photographic plate free from grain, and as sensitive as the gelatino-bromide in current use; Fanny Emden prize (3000 francs), for work dealing with hypnotism and suggestion; Grand prize of the physical sciences (300 francs), for the study of a French colony from the point of view of its geology, mineralogy, and its physical geography; Leconte prize (50,000 francs), for new and important discoveries in mathematics, physics, chemistry, natural history, and medical science; Petit d'Ormoy prize (10,000 francs), for work in pure or applied mathematics or in natural science; Pierson-Perrin prize (5000 francs), for a discovery in the field of mechanics or physics.

THE ASSOCIATION OF ECONOMIC BIOLOGISTS.

THE twelfth annual Congress of the Association of Economic Biologists, held at the Liverpool School of Tropical Medicine, last week, marked off a distinct era in the progress and development of economic biology in the United Kingdom.

Founded in November, 1904, with a membership of twenty-four, it seemed doubtful for a time whether what Prof. Fred V. Theobald aptly christened "Mr. Collinge's healthy infant," would weather the storms of its early days. At that time economic biology was looked askance at in all our universities, and regarded as something ultra-scientific, and could only be said to be taught and studied in any detail at the South-Eastern Agricultural College, Wye.

Even at a later date professors of biology were interested only in the morphological or systematical aspects of biology, and dreaded the intrusion of applied biology. Happily these views have all passed away, and the association may very rightly claim to have had a large share in bringing about a more reasonable and truly scientific spirit.

Meeting first in the University of Birmingham, the association has held meetings in the Universities of Liverpool, Cambridge, London, Edinburgh, Oxford, Manchester, and Dublin. From each of these centres of learning it has gathered strength, leaving behind some record of the really valuable work which its members have been engaged upon, and indirectly tending to gain the sympathies of those who originally regarded the organisation from an entirely mistaken point of view. Gradually biologists in this country were beginning to realise that, as stated by Prof. Miall, "a practical purpose is, in my opinion, not a hindrance but a powerful motive to the acquisition of scientific knowledge. If not too narrowly prosecuted, the practical purpose may be a means of distinguishing knowledge, which is really useful from knowledge which is merely curious."

Since 1904 departments of economic biology have been founded in nearly all our universities, which has meant an increase in the number of workers, and has made the association still more necessary for such investigators to possess an organisation wherein they could "discuss new discoveries, exchange experiences, carefully consider the best methods of work, give opportunity to individual workers of announcing proposed investigations, so as to bring out suggestions and prevent unnecessary duplication of work, and to suggest, when possible, certain lines of investigation upon subjects of general interest."

The outstanding feature of the Liverpool meeting was the decision of the council to increase the number of meetings to four per annum, three of which will be held in London, and one in the provinces; coupled

with this it was gratifying to note the large number of new members, particularly so of those working in connection with the Board of Agriculture and Fisheries, and in the newly established university departments.

It is hoped that with the increase in the number of meetings there will be a still further increase in the membership, and that the association will take its position amongst the numerous other learned societies, thoroughly representative of all branches of applied biology.

To a very much larger extent than hitherto, the association will in the future play no unimportant part in defining the scope of economic studies in biology, and having now definitely taken up its headquarters in London, it will be more in touch with Governmental departments. Representative as its membership is of the universities of the country, and not a few of our Colonial departments, the possibilities that lie before it are endless, and should exercise a very profound influence upon the future of economic biology in this country, tending to raise its status to the level it occupies in other countries, and to become still more beneficial to the people of this country and its great Colonial Empire. W. E. C.

FATIGUE AND EDUCATIONAL WORK.

THE London County Council's annual Conference of Teachers, held last week, yielded some notable pronouncements. On the opening day, January 1, Canon Masterman laid stress upon the training in morals and in imagination which pupils gain when history is properly taught. History provides an education in sympathy not only with our forefathers, but with "the brotherhood that binds the brave of all the earth." The true historian always cares supremely for the truth; the critical faculty of the pupil must be carefully trained. To the great deed they must offer their admiration, their gratitude if they could, and, if not, then their silence. The historian differs from the antiquary in his constant thought of the present; the boy who rides in imagination with the knight to the *Parliamentum* at Westminster will have a clearer idea of the responsibility of citizenship. The pageantry of history is sacramental; it has an inward and spiritual import, and, unless the teacher feel something of the spiritual significance of history, he had better teach algebra or mechanics all his life.

On the second day, Mr. W. H. Winch gave the results which had attended a few experiments he had made in testing the fatigue of adolescents who were in attendance at evening continuation schools. He pointed out that his experiments in connection with the fatigue of day-school pupils had yielded no satisfactory result, while he had found distinct evidence of fatigue in adolescents who continued their education in the evenings. His experiments indicate that, in the cases he examined, adolescent students suffered a loss of ability as the period of instruction drew to a close. He instanced six sets of experiments, and in the only case which did not show the results of fatigue subsequent inquiry showed that 75 per cent. of the students were not occupied during the daytime. From such evidence he concluded that evening continuation schools were not places of serious continued education for adolescents; they were a waste of educational appliances. The chairman, Dr. W. McDougall, Wilde reader in mental philosophy, thought these conclusions somewhat premature, as it did not follow that work which caused a measurable amount of fatigue was work which should, therefore, not have been undertaken.

Mr. T. H. Pear described an experiment in connection with the fatigue which ensues from loss of sleep in which it was demonstrated that the fatigue persisted long after the subject was of opinion that the effects of the lack of sleep had disappeared. He suggested that, on account of fatigue, the teacher who energetically changed from a strenuous lesson on one subject to a lesson of equal strain on another subject lost efficiency; the early lesson caused fatigue, and should have been followed by a period for recuperation.

The conference closed with a description of six educational experiments; it was announced, as evidence of the wide latitude for experiment allowed in the elementary schools, that no fewer than sixty descriptions of such experiments had been offered for the consideration of the conference.

ENGINEERING AT THE BRITISH ASSOCIATION.

THE Engineering Section of the British Association met under the presidency of Prof. Gisbert Kapp, who took for the subject of his address the electrification of railways. The address, which was printed in full in NATURE of October 9 (p. 184), was followed by an interim report of the committee on gaseous explosions, which very briefly chronicled the work accomplished during the year, and described the steps which are being taken to carry on further research work at the Imperial College of Science. One of the notes presented to this committee was also read by the authors, Profs. Petavel and Asakawa, and described some experiments on the effect upon gas-engine efficiency of varying compression ratio. In these experiments the brake-horse-power increased in the same proportion as the theoretical air efficiency, but the mechanical efficiency decreased as the compression ratio increased.

The concluding paper of the first meeting was read by Prof. Burstall on solid, liquid, and gaseous fuel, in which he discussed the various advantages obtained from each kind of fuel, and outlined a scheme for utilising, to the best advantage, a large daily supply of coal at the pit mouth by the production of coke, fuel gas, sulphate of ammonia, and various by-products of the tar obtained from the retorts.

The first paper on the Friday morning dealt with the application of the internal-combustion engine to railway locomotion, and described a bogie-coach of 60 ft. in length propelled by two six-cylinder Daimler engines through the medium of gears affording six-speed ratios. Recent trials demonstrate the feasibility of maintaining a high speed over long distances at a reasonable cost, and the author, Mr. F. W. Lanchester, advocated the running of such vehicles on main lines at frequent intervals as much more economical and satisfactory than a service of long trains at considerable intervals. In the paper which followed, Dr. Hele-Shaw described a new type of hydraulic weighing-machine of the piston type, in which packings are dispensed with, while friction and leakage are practically eliminated by ingenious mechanical devices.

The propulsion of barges on canals by aërial propellers was described by Mr. L. B. Desbleds, and although the possible efficiency of this system of propulsion was shown to be very small, the author considered there was a limited field for its application in cases where submerged propellers could not be employed.

Mr. Lanchester directed attention to the various factors which cause instability in aëroplanes, and with the aid of models demonstrated the important features

which are necessary to consider in the design of a stable aëroplane, especially as regards the tail-plane.

The cost of electric cooking was discussed by Prof. Morris, with reference to the result of one year's working in a flat within the London area. A paper by Mr. A. E. Bawtree on bank-note engraving was illustrated by a number of photographs describing various methods in general use for the prevention of forgery. The author showed examples of a new system of a geometrical character, which cannot be imitated by repetition work, or by mechanical devices such as the pantagraph. The system which was not described was stated to allow the incorporation of a design which could only be made visible by a special screen. The concluding paper at this meeting was read by Mr. C. H. Lander on the frictional loss in steam pipes, and described experiments which agree with a dimensional formula due to Osborne Reynolds.

A joint meeting of Sections A and G took place on the Monday morning to discuss the report of the committee, appointed last year, to consider certain of the more complex stress distributions in engineering materials. The principal results of modern investigations on combined stress were discussed by Mr. W. A. Scoble, while alternating stress was similarly dealt with by Messrs. Mason, Rogers, and Eden, and a special report on the resistance of tubes to collapse was contributed by Mr. G. Cook. The discussion upon the report was opened by Prof. Perry, the chairman of the committee, who urged the importance of coming to a definite agreement as to the criterion of failure in a material subjected to stress. The discussion on the various sections was continued by Mr. Stoney and other engineers, and covered a wide range of subjects connected with the experimental investigation of stress distribution in engineering materials.

A Section A paper by Prof. Coker was, for the convenience of the meeting, read immediately after the termination of the joint discussion; it described the construction of polariscopes for examining the stress distribution in large models of engineering structures built up of transparent materials. A second paper by the same author described the preliminary results of an investigation upon the stress distribution in rings subjected to internal or external pressure, with apparatus which leaves every part of the ring free for measurement except the surface exposed to fluid pressure.

A paper contributed by Mr. T. Reid, described some experiments on the flow of solids based on the well-known experiments of Tresca. Lead cylinders divided in halves by a diametral plane are grooved to receive tin wires, which latter serve to map out the flow produced when pressure is applied to the cylinders. The experimental results appear to show that a very slow flow is stable, and that above a certain limit there is a condition resembling turbulence in a fluid.

A paper by Mr. A. Robertson described experiments on the strength of free-ended struts, in which Euler's formula is shown to hold good down to the length for which the stress given by this law is equal to the stress at yield, and, below this limit collapse occurs, when the load per square inch is equal to the yield stress. A concluding paper by Mr. A. T. Walmisley described the properties of non-ferrous metals which are of importance in structural engineering.

On the Tuesday morning the first paper on an engineering theory of the gyroscope was read by Mr. J. W. Gordon, who pointed out that when a gyroscope is precessing freely it is absorbing power, while in forced precession it is transmitting. By the application of suitable constraining devices many important practical instruments can be constructed, of small size, for the steering of ships, the prevention of rolling and pitching of aëroplanes, and the like. A short note by Prof. Wilson on tests of metals and alloys, directed especial attention to the increased brittleness and rise of electrical resistance of duralumin on prolonged exposure to the atmosphere.

Papers dealing with various matters connected with wireless telegraphy were also read by Prof. Howe, who described the nature of the electromagnetic waves employed in radio-telegraphy, and the mode of their propagation. Dr. Eccles discussed atmospheric refraction and absorption as affecting transmission, and Prof. Marchant, the effect of atmospheric conditions on the strength of signals received at Liverpool from Paris and other wireless stations of great power. The final paper on Tuesday morning was read by Mr. W. R. Cooper, and described some practical suggestions for shortening the tests of temperature rise in electrical machines under working loads.

As in previous years, a meeting on the Wednesday was necessary for the consideration of several important papers, and a programme on civil engineering subjects was followed with much interest by a large audience. Dr. Vaughan Cornish described the landslides in the Culebra Cutting of the Panama Canal, especially those in which subsidence of the banks has caused numerous upheavals of the canal bottom.

A paper on the reconstruction of the station at Snow Hill, Birmingham, was read by Messrs. Gleadow and Shackle, in which the structural steel work was very fully described. The effect of harbour projections was discussed by Mr E. R. Matthews, and he advocated the use of piers inclined at such an angle to the shore that moving sand and shingle tends to sweep past the end of the pier and settle on the lee side. The transport and settlement of sand in water was also described, with many experimental illustrations, by Dr. J. S. Owens. An apparatus was also exhibited for exploring sand bars and river beds. It consisted of two concentric tubes closed above and open below, and provided with stop-cocks so that water under pressure can be forced through the inner tube to sink the apparatus in the sand or other material. When the desired level is reached a stop-cock communicating with the annular space is opened to allow a return passage for the water under pressure, and this carries with it a sample of the material at the base of the apparatus, and delivers it at the outlet.

These interesting experiments concluded a very successful programme of the Engineering Section at the Birmingham Meeting.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BRISTOL.—The degree of D.Sc. in engineering will be conferred on Mr. Charles F. Smith, who has submitted to the University records of his research work and publications in connection with electrical engineering.

LONDON.—The degree of doctor of science in chemistry has been conferred upon Mr. F. G. Pope, an external student, of East London College. In addition to a thesis entitled, "The Fluorine Group," Mr. Pope submitted a list of printed contributions to the advancement of science, published independently or conjointly.

The degree of doctor of science in geology has been conferred upon Mr. E. H. Pascoe, external student, of University College. Mr. Pascoe presented a published thesis entitled, "The Oil Fields of Burma," together with some further contributions to the advancement of of science, published independently.

The following lectures to advanced students of the University, and to others interested in the subjects

dealt with, are to be given. Admission is free, without ticket:—Eight lectures on recent studies on the phenomena of soil fertility, Royal College of Science, Dr. E. J. Russell, on Wednesdays, beginning on January 28. Five lectures on the Devonian flora, University College, Dr. D. H. Scott, F.R.S., on Wednesdays, beginning on May 6. Two lectures on plant pigments, University College, probably on May 4 and 5, Dr. R. Willstätter, professor of chemistry in the University of Berlin. Two lectures on "La catalyse, et mes divers travaux sur la catalyse," King's College, probably on May 14 and 15, Prof. Paul Sabatier, of the University of Toulouse. Four lectures on the theory of wave-motion, with special reference to earthquake waves, the University, Dr. Horace Lamb, F.R.S., on Fridays, February 20, 27, March 6 and 13 Nine lectures on the theory of heat in relation to atmospheric changes, the Meteorological Office, South Kensington, Dr. W. N. Shaw, F.R.S., on Fridays, beginning on January 23. The fortnightly meetings at the Meteorological Office for discussion of important contributions to meteorology, chiefly in Colonial or foreign journals, will be resumed on Monday, January 19, and will be continued on alternate Mondays until March 30. Four advanced lectures in physics will be given during the third term by M. Jean Perrin, professor of physical chemistry at the Sorbonne. Further particulars will be published at a later date. Four lectures on carbohydrate fermentation, King's College, Dr. A. Harden, F.R.S., on Mondays, January 26, February 2, 9, and 16. Eight lectures on physiological effects of anæsthetics and narcotics, Guy's Hospital, Dr. M. S. Pembrey and J. H. Ryffel, on Thursdays, January 22, 29, February 5, 12, 19, 26, March 5 and 12. Twelve lectures on the Protozoa parasitic in man, the Lister Institute, Prof. E. A. Minchin, F.R.S., on Tuesdays and Fridays during the second term, beginning on Tuesday, January 27. Eight or nine University lectures on anaphylaxis, King's College, department of bacteriology, Dr. L. Rajchman, on Thursdays, beginning on January 15. Three lectures on the place of instinct in evolution," Prof. C. Lloyd Morgan, F.R.S., have been arranged for the second term. During the third term a course of three lectures on the morphology of the cranial muscles in vertebrates will be given by Prof. F. H. Edgeworth. A course of lectures on the Assouan Dam will be given by Mr. J. S. Wilson, on Wednesdays during March.

A lecture, open to the public, on the æther of space, will be given by Sir Oliver Lodge, F.R.S., at Bedford College, on Tuesday January 27. Other free lectures at the college are:—January 22, "Minerals Used as Gem Stones," Dr. C. A. Raisin; February 5, "The Optical Characters of Minerals," Dr. A. Hutchinson; February 19, "Corundum and Spinel," H. H. Thomas; January 19, "Geology of the British Isles," Dr. C. A. Raisin.

Mr. H. J. Crawford, formerly principal clerk for higher education under the Glamorgan County Council, has been appointed secretary to the Appointments Board of the University of London in succession to Dr. A. D. Denning.

MR. J. C. JOHNSON has been appointed to the chair of general biology, botany, and zoology at Auckland University College, in succession to Prof. A. P. W. Thomas, who recently resigned.

BY the will of the late Miss Emily M. Easton, who died a few days ago, a legacy of 10,000*l.* is bequeathed to the Durham College of Medicine, Newcastle, and one of 5000*l.* to Armstrong College.

THERE is much interesting reading in the December issue of the *Reading University College Review*. The principal of the college, Mr. W. M. Childs, contributes an obituary notice of the late Mr. George W. Palmer, to whose munificent generosity the college owes much of its success. The college lecturer in geology writes on the charm of palæontology, and the college lecturer in education and master of method on an outdoor school. The leading article deals with the University library, and has already been referred to in these columns.

THE general meeting of the Association of Public School Science Masters will be held at the Imperial College of Science and Technology, South Kensington, on Tuesday and Wednesday, January 13 and 14. The president, Prof. H. B. Baker, F.R.S., will deliver an address, and the following papers will be read and discussed:—"Agricultural Experiments in Public Schools," H. O. Hale; "Present Conditions of Science Teaching in Public Schools," E. H. Tripp, G. H. Martin, and J. R. Eccles; "The Place of Acoustics in a School Course of Physics," D. Rintoul; and "The Relative Value of Physics, Chemistry, and Biology," H. A. Wootton.

THE sixth annual dinner of old students of the Royal College of Science, London, will be held at the Criterion Restaurant, Piccadilly Circus, W., on Saturday, January 31, 1914. The president of the Old Students Association (Dr. A. E. H. Tutton, F.R.S.) will preside, and the guests will include Mrs. Ayrton, Prof. W. Bateson, F.R.S., Sir John Rose Bradford, K.C.M.G., F.R.S., Dr. H. Frank Heath, C.B., Dr. W. P. Herringham, Sir Alfred Keogh, K.C.B., Sir William Ramsay, K.C.B., F.R.S., and Sir Amherst Selby-Bigge, K.C.B. Tickets may be obtained on application to the secretary of the association, 3 Selwood Place, S.W.

AN international kinematograph exhibition and conference will take place in the Zoo Buildings, Glasgow, on February 17–26, 1914, and will be opened by the Lord Provost. Special films will be shown dealing with natural history, medicine, industries, travel, geography, and an entirely new series will deal with a complete survey of the British Isles. Conferences will be held dealing with secular and religious education, emigration, and business. In connection with the education conferences an advisory committee has been formed consisting of prominent Scottish educationists and representatives of school boards and educational associations. All communications and inquiries should be addressed to Mr. H. D. Cotton, 140 West George Street, Glasgow.

THE prime necessity that adolescents should be encouraged to continue their education beyond the stage represented by the primary school was abundantly illustrated at the great public meeting of employers inaugurated by the London County Council, and held on January 5, at the Mansion House. Very many firms had expressed their support of the proposal that employers should aid the council in obtaining the best results from the reorganised system of evening institutes established this year in London, and many prominent business men supported the principal speakers, Mr. J. A. Pease, President of the Board of Education, and Lord Salisbury, by their presence on the platform. There was no lack of evidence that the old scheme of evening schools was inefficient, since but 25 per cent. of the possible students enrolled, and 33 per cent. of the actual students attended badly; and it was demonstrated that wherever employers had given facilities for their young people to acquire additional knowledge under a scheme which allowed the students time for study

in working hours without loss of wages, there had been keenness and improved efficiency among the staff. Mr. Pease pointed out that the problem was of national importance, and that while there might be immediate loss to the employers there would be ultimate gain not only for the employers and the employees, but for the nation at large. He suggested that no employment was beneficial that did not allow reasonable time off for continued education, and charged the business community with the responsibility of a national duty to effect some improvement, which he was sure the London County Council would facilitate.

THE annual report of President Butler on the work of Columbia University, New York, for the year ending June 30, 1913, has now been published. We find that during the year the sum of 123,600*l.* was given to the University to establish permanent funds or to add to existing resources; 67,500*l.* to purchase land or to erect and equip buildings, and 93,300*l.* to be expended for specific purposes, making a total of 284,400*l.*; and yet President Butler says "it is still necessary to repeat words that were used eleven years ago: 'Columbia University as now organised and equipped, may be likened to a giant in bonds. Strength, power, zeal for service, are all at hand, but the bonds of insufficient funds hold them in on every side.'" The unparalleled growth and expansion of the University have far more than kept pace with the new resources that have been provided. The enrolment of students as compared with that for the year 1911–12 shows an increase of 1016, the net total of regular students in every subject reaching 9379. If to the regular students be added those receiving extension teaching and those studying in evening technical classes, the grand total receiving instruction is 13,120. The teaching staff in 1913 numbered 847, as compared with 781 in 1912. President Butler, commenting on these very large numbers, says:—We should deplore growth in numbers unless it were accompanied by a steady increase in the quality of the students. The fact that a rigid examination is insisted upon for admission . . . and that all credentials offered by those who seek advanced standing or who wish to enter the graduate and professional schools are subjected to the closest scrutiny, and the further fact that no student is allowed to shirk his work and to remain long upon the rolls of the University, are an indication of the spirit with which the several faculties, administrative boards, and administrative officers view their responsibilities."

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, December 17, 1913.—Dr. Aubrey Strahan, F.R.S., president, in the chair.—C. **Dawson** and Dr. A. Smith **Woodward,** with an appendix by Prof. G. Elliot **Smith**: Supplementary note on the discovery of a Palæolithic human skull and mandible at Piltdown (Sussex). The gravel at Piltdown (Sussex) below the surface-soil is divided into three distinct beds. The first, or uppermost, contains subangular flints and "eoliths," and one palæolith was discovered there *in situ*. The second is a very dark bed, composed of ironstone and subangular flints. All the fossils so far found in the pit have been discovered in, or traced to, this bed, with the exception of the remains of deer. A cast of a Chalk fossil, *Echinocorys vulgaris*, from the zone of *Micraster cor-testudinarium*, occurred as a pebble. The third bed was recognised only in 1913, and consists of reconstructed material from the underlying Wealden rock (Hastings Series). It is only about 8 in. thick, and contains very big flints (8 to 15 in. long) which have been little rolled, and are not striated. They are saturated with iron, and have undergone considerable chemical change. They differ very markedly in appearance from the smaller flints in the upper strata. No implements, "eoliths," or fossil bones have been met with in this bed. The floor of the gravel, where the remains of Eoanthropus were discovered, has been carefully exposed, and many irregularities and depressions have been found to exist. In some of these depressions small patches of the dark overlying bed remained, and new specimens were discovered. The method adopted in excavation is described. The finds made in 1913 are few but important, and include the nasal bones, and a canine tooth of Eoanthropus discovered by Father P. Teilhard de Chardin; also a fragment of a molar of Stegodon and another of Rhinoceros; an incisor and broken ramus of Beaver (*Castor fiber*); a worked flint from the dark bed; and a Palæolithic implement from the débris in the pit. It will be noted that the remains are those of a land fauna only. The further occurrence of bedded flint-bearing gravels in the vicinity of the pit is noted. The authors' former conclusions, as to the Pliocene forms having been derived, are maintained. A further study of the cranium of Eoanthropus shows that the occipital and right parietal bones need slight readjustment in the reconstruction, but the result does not alter essentially any of the conclusions already published. The nasal bones, now described, are typically human, but relatively small and broad, resembling those of some of the existing Melanesian and African races.—In a note appended to the paper Prof. Elliot **Smith** points out that the presence of the anterior extremity of the sagittal suture, which hitherto had escaped attention, had enabled him to identify a ridge upon the cranial aspect of the frontal bone as the metopic crest, and thus to determine beyond all question the true median plane. It is 21 mm. from the point of the large fragment (in the frontal region). The backward prolongation of the frontal median crest cuts the parietal fragment precisely along the line determined by Dr. Smith Woodward on other grounds.

Institution of Mining and Metallurgy, December 18.—Mr. Bedford McNeill, president, in the chair.—C. O. **Bannister** and G. **Patchin**: Cupellation experiments: a simple method for the detection of the platinum metals in cupellation beads. Following up previous investigations, the authors presented in this paper, and by means of a series of fine lantern slides, illustrations of the method they submit for the detection of platinum and its kindred metals in cupellation beads composed of gold and/or silver. The method consists in transferring the beads, after cooling, and without any squeezing, hammering, or brushing, direct from the cupel on to a plasticine mount attached to a microscopic slide, and examining it with a low-power objective, with vertical illumination preferably. This method possesses the marked advantage that no preparation of the bead by polishing, etching, &c., is necessary before examination, the only precaution advisable being the prevention of undue spitting. The results of the authors' investigations and experiments with gold and silver beads containing varying quantities of platinum, iridium, rhodium, ruthenium, and palladium were to show that, by a simple microscopic examination it is possible to detect platinum in cupellation beads when present below 1·6 per cent.; that is to say, when present below the amount necessary to cause crystallisation visible to the naked eye; the presence of iridium in small quantities may be detected in silver beads; that rhodium and ruthenium

may also be detected by visual examination; that palladium, whilst producing a structure similar to that caused by the presence of platinum, yields evidence of its presence by the coloration of the parting acid. No specific indications were obtained of the presence of osmium, but the presence of osmiridium was shown to give results closely approximating to those obtained from the presence of iridium alone.—G. Maitland **Edwards**: Notes on mines of the Ottoman Empire. In this paper the author gives a brief review of the mineral resources of Asia Minor, dealing respectively with coal, iron, chrome and emery, lead, zinc, silver, nickel, gold, mercury, borax, magnesia, phosphates, guano, salt, petroleum, and other deposits. He also furnishes a brief review of the laws governing mining enterprise in the empire, and of the economic and transportation facilities.

Linnean Society, December 18.—Prof. E. B. Poulton, F.R.S., president, in the chair.—J. **Parkin**: The evolution of the inflorescence. The author stated that the evolution of all types of inflorescences is to be traced from the solitary terminal flower; and he indicated the order of development.—C. E. **Salmon**: *Hypericum desetangsii*, Lamotte, in Britain. In 1893 the late Mr. T. Hilton, of Brighton, collected what he considered to be *H. dubium*, Leers, in the vicinity of Lewes. Some years after, the specimen came into the author's hands and was seen not to be the usual plant so named. Various causes prevented him from visiting the locality at the proper season until the present year, when good examples were examined on the spot and afterwards more minutely at home. It appears that the Lewes plant must be placed under the species published by Lamotte (in Bull. Soc. Bot. Fr., vol. xxi., p. 121) in 1874, as *H. desetangsii*, and further elaborated, in the same journal, by Bonnet in 1878. It may be roughly distinguished from *H. perforatum*—of which it has the golden yellow flowers—by its four-angled stem; from *H. tetrapterum* by the colour and size of its flowers, and from *H. quadrangulum* (*H. dubium*) by its dotted leaves and narrower sepals. These are main distinctions; finer ones exist.

MANCHESTER.

Literary and Philosophical Society, December 2.—Prof. F. E. Weiss, vice-president, in the chair.—Prof. E. **Rutherford**: The structure of the atom. The author two years ago described a new type of atom—the "nucleus" atom—supposed to consist of a central nucleus, probably charged positively, of very minute dimensions, in which practically all the mass of the atom was concentrated. This was surrounded by a distribution of negative electrons sufficient to make the atom electrically neutral. This type was devised to explain the fact that the swift α particles in traversing matter are occasionally deflected through more than a right angle as the result of a single encounter with another atom. It was deduced that the number of electrons and consequently the charge on the nucleus was numerically equal to about half the atomic weight. Experiments since carried out by Geiger and Marsden have shown that the large angle scattering of α particles is in very close agreement with this assumption of the atom's constitution, and they showed, in particular, that the variation of the number of α particles scattered through different angles by different elements agreed closely with the theory over a range in number of nearly one million times. The deflection of the α particle is due to its passage close to the intense field of the nucleus. In his experiments with hydrogen, Mr. Marsden has found definite evidence that some of the hydrogen atoms actually acquire such a great velocity by their encounters with α particles that they are able to travel through hydrogen at least three times the distance of the α particle itself through the same gas. On the nucleus theory it is supposed that the hydrogen atom contains one positive charge and the helium two. The author discussed the dimensions of the bodies in question, and the probable distance apart of the nucleii at the moment of repulsion. It was pointed out that the chemical and physical properties of the atom are ultimately determined by the charge on the nucleus, which should consequently be a more fundamental constant than the atomic weight. The latter will depend on the inner structure of the nucleus, and may not be proportional to the charge on the nucleus.

December 16.—Mr. F. Nicholson, president, in the chair.—R. L. **Taylor**: The action of bleaching agents on various natural colouring matters. In estimating the bleaching power of the ordinary bleaching agents the kind of colouring matter has to be taken into consideration. Colouring matters such as indigo and turkey-red are quickly and completely bleached by chlorine or hypochlorous acid. In ordinary unbleached linen, cotton, and jute, there appear to be two quite different kinds of colouring matter, one rapidly bleached by chlorine and hypochlorous acid, while the other is quite unaffected by these bleaching agents, but is bleached by a solution of a hypochlorite containing little, if any, free alkali. A considerable amount of the colouring matter in linen and jute is not affected by chlorine or hypochlorous acid, but in cotton the proportion unbleached by these agents is very small indeed. However, cotton is not completely bleached by either bleaching agent even after prolonged exposure to one of them.

PARIS.

Academy of Sciences, December 29, 1913.—M. P. Appell in the chair.—Paul **Sabatier** and M. **Murat**: Contributions to the study of benzhydrol: the preparation of symmetrical tetraphenylethane. The reaction between benzaldehyde and phenylmagnesium bromide gives a very poor yield of benzhydrol, under 3 per cent., diphenylmethane and symmetrical tetraphenylmethane being produced by secondary reactions. The interaction of hydrogen and tetraphenylmethane in presence of reduced nickel at 230° C. gives diphenylmethane and di*cyclo*hexylmethane.—M. de **Grossouvre** was elected a correspondant for the section of mineralogy in the place of M. Depéret, elected non-resident member.—Ernest **Esclangon**: Observations of the Delavan comet made with the large equatorial of the Bordeaux Observatory. Data given for December 22 and 23.—F. **Ollive**: The solar system.—Luc **Picart**: The calculation of a circular orbit with the aid of a single photographic observation.—A. **Demoulin**: The resolution of a problem of the integral calculus.—Léon **Lichtenstein**: Integration of the equation $\Delta_2 u = k\epsilon^u$ on a closed surface.—Georges **Giraud**: A group of birational transformations.—Alfred **Rosenblatt**: The invariants of algebraical varieties in three dimensions.—Jules **Drach**: The integrals common to several problems of mechanics.—A. **Cotton**, H. **Mouton**, and P. **Drapier**: The influence of the size of the particles on the electro-optical and magneto-optical properties of a mixed liquid. The conclusions arrived at theoretically by Pockels are shown to be confirmed by experiment.—Jean **Pougnet**, Emile **Segol**, and Joseph **Segol**: The variation of the electromotive force of a Weston cell under the influence of ultra-violet light. Light of short wave-length causes a progressive lowering of the E.M.F. of a Weston cell. Removed from the radiation, the cell slowly returns to its original E.M.F. The change observed was 0·007 volt.—A. **Recoura**: Chromium fluosilicate and

its transformations.—F. **Bourion** and A. **Sénéchal**: The estimation of chromium by oxidation in alkaline solution. The results are exact with chromium alone or in presence of iron. The determinations are inexact in presence of nickel, cobalt, and manganese.—Paul **Gaubert**: The modifications of form of crystals of some substances artificially coloured during their growth.—G. **Friedel**: The crystalline symmetries shown by the diffraction of the Röntgen rays.—L. **Blaringhem**: The hereditary transmission of rust in the hollyhock.—M. **Sauvageau**: Fucus of the Straits of Gibraltar.—J. **Vallot** and Raoul **Bayeux**: Experiments made at Mont Blanc, in 1913, on spontaneous muscular activity at very high altitudes. The daily work done by a squirrel at the summit of Mont Blanc was reduced to one-seventh of the daily work done at Chamonix.—M. **Piettre** and A. **Vila**: The study of the plasmas after sugar dialysis.—Louis **Roule**: The influence exerted by the reproductive function on the migrations of salmon in spring and summer. There is a definite relation between the ascent of rivers by salmon and the condition of their reproductive organs.—A. **Trillat**: The influence of surface tension of liquids on the removal of micro-organisms by an air current. If air is bubbled through a liquid containing micro-organisms in suspension, the latter may be carried on with the air current if the droplets of liquid produced are sufficiently small, and the size of the drops is governed by the surface tension of the liquid.—L. **Mengaud**: The lower Aptian marl of the province of Santander.—G. J. **Painvin**: New contribution to the geology of the region of high plateaux situated to the north and north-west of Bou-Denib.—René **Fourtau**: The echinitic fauna of the raised shores of the Red Sea.—G. **Vâlsan**: Remarks on the terraces of the eastern Roumanian plain.

NEW SOUTH WALES.

Linnean Society, November 26, 1913.—Mr. W. S. Dun, president, in the chair.—W. N. **Benson**: The geology and petrology of the Great Serpentine Belt of New South Wales. Part iii., Petrology. A detailed account of the rocks collected over the whole area described in parts i.–ii. The material is classified under (A) igneous rocks, twelve divisions; and (B) sedimentary rocks: (*a*) clastic rocks of the Eastern Series, the Tamworth Series, cherts and breccias; (*b*) the limestone; (*c*) Baldwin Agglomerates; (*d*) Barraba, Burindi, and Rocky Creek Series; (*e*) Permo-Carboniferous sandstone.—F. H. **Taylor**: A revision of the Culicidæ in the Macleay Museum.—Dr. R. **Greig-Smith**: Contributions to our knowledge of soil fertility. Nos. vii.–xi. (vii.) When soils are heated or treated with volatile disinfectants, the bacterial development depends upon the amount of fatty matter present. Field soils show little difference, while a garden soil produced about ten times more bacteria, when treated with chloroform, than when heated at 65°. (viii.) The demonstration of toxins in soils depends upon obtaining a soil in which the toxins preponderate over the nutrients, and in using an appropriate dilution in making the extracts. Equal parts of soil and water generally yield the most toxic extract. (ix.) Rain removes toxin from soil, but the toxicity returns with dry weather. Similarly, a soil originally toxic, becomes non-toxic when extracted with water, and the toxicity reappears upon incubation in the moist condition. (x.) When nitrogenous, organic matter is saturated with wax or vaseline, and subsequently treated with chloroform, it does not decay any quicker on account of the treatment. (xi.) Naphthalene induces an increase in the number of bacteria in soils.—Dr. J. M **Petrie**: Note on the occurrence of strychnicine. The native strychnine-tree, *Strychnos psilosperma*, contains the alkaloid strychnicine, which was discovered, in 1902, in the leaves of the Nux-vomica. Its properties differ from those of strychnine or brucine.—R. J. **Tillyard**: A study of the Odonata of Tasmania, in relation to the Bassian Isthmus. Though the dragonflies of Tasmania are fairly well known, the number of species is small, particularly on rivers; still waters support a more abundant fauna. A comparison made with the dragonfly fauna of southern Victoria gives the following results. Of the forms that breed exclusively in running water, about 22 per cent. of the Victorian fauna are found to have reached Tasmania. Of the forms that breed in still water about 80 per cent. have reached Tasmania. The 20 per cent. that failed to do so, all belong to the most recent genera, which have come into Australia from the north. The reason suggested for the discrepancy is that, throughout a long period, the connection between the island and S. Victoria was of such a nature that few permanently running water-courses were formed.

BOOKS RECEIVED.

Lowson's Text-Book of Botany. Indian edition. Adapted by M. Willis, with a preface by Dr. J. C. Willis. Pp. xii+602. (London: W. B. Clive.) 6*s*. 6*d*.

Annuaire Astronomique et Météorologique pour 1914. By C. Flammarion. Pp. 427. (Paris: E. Flammarion.) 1.50 francs.

Conseil Permanent International pour l'Exploration de la Mer. Rapports et Procès-Verbaux des Réunions. Vol. xix. Procès-Verbaux. Juillet 1912–Juillet 1913. Pp. vii+142. (Copenhague: A. F. Host et Fils.)

La Face de la Terre (Das Antlitz der Erde). By Prof. E. Suess. Translated by E. de Margerie. Tome iii. (3e Partie.) Pp. x+957–1360. (Paris: A. Colin.) 12 francs.

Canada. Department of Mines. Mines Branch. The Production of Copper, Gold, Lead, Nickel, Silver, Zinc, and other Metals in Canada during the Calendar Year 1912. By C. T. Cartwright. Pp. 86. (Ottawa: Government Printing Bureau.)

Summary Report of the Mines Branch of the Department of Mines for the Calendar Year Ending December 31, 1912. Pp. ix+174+xvi plates. (Ottawa.) 15 cents.

Records of the Survey of India. Vol. iii., 1911–12. Prepared under the direction of Col. S. G. Burrard. Pp. ii+176+12 maps. (Calcutta: Superintendent, Government Printing, India.) 6*s*.

Smithsonian Institution: Bureau of American Ethnology. Bulletin 83. Chippewa Music, ii. By F. Densmore. Pp. xxi+341+45 plates. (Washington: Government Printing Office.)

Traité Raisonné de la Pisciculture et des Pêches. By Prof. L. Roule. Pp. viii+734. (Paris: J. B. Baillière et Fils.)

The A.B.C. Guide to Astronomy. By Mrs. H. P. Hawkins. Third edition. Pp. 124. (London: Simpkin and Co., Ltd.; Bedford: Beds. Times Publishing Co., Ltd.) 1*s*. 6*d*. net.

The Revolving Star Map with Movable Declination Scale. By Mrs. H. P. Hawkins. (London: Simpkin and Co., Ltd.; Bedford: Beds. Times Publishing Co., Ltd.) 1*s*. net.

The Star Almanac for 1914. By Mrs. H. P. Hawkins. (London: Simpkin and Co., Ltd.; Bedford: Beds. Times Publishing Co., Ltd.) 6*d*. net.

Experience Teaches. By I. Trinda. Pp. xiv+194. (London: Simpkin and Co., Ltd.) Limp leather, 4*s*. net; cloth, 2*s*. 6*d*. net.

Department of Commerce and Labor Bureau of the Census. Thirteenth Census of the United States taken in the Year 1910. Statistics. 52 parts. (Washington: Government Printing Office.)

New Zealand. Dominion Museum. Bulletin No. 4. The Stone Implements of the Maori. By E. Best. Pp. 410+li plates. (Wellington: J. Mackay.)

Ministry of Finance, Egypt. Survey Department. The Value of Gravity at Eight Stations in Egypt and the Sudan. By P. A. Curry. Pp. 65+v plates. (Cairo: Government Press.) P.T.10.

Essays and Studies Presented to William Ridgeway on his Sixtieth Birthday, August 6, 1913. Edited by Dr. E. C. Quiggin. Pp. xxv+656+plates. (Cambridge University Press.) 25*s.* net.

Celluloid Dangers with Some Suggestions. By D. W. Wood. Pp. 36+plates. (London: British Fire Prevention Committee.) 2*s.* 6*d.*

Catalogue of Lantern Slides. Part ii. Pp. xx+351–918. (London: Newton and Co.)

Catalogue of the Noctuidæ in the collection of the British Museum. By Sir G. F. Hampson, Bart. Pp. xiv+609; plates ccxxii–ccxxxix. (London: British Museum (Natural History); Longmans and Co.)

The Animal Kingdom. By Dr. Zwanziger. Translated by G. K. Gude. Pp. vi+92. (London: S.P.C.K.) 8*s.* 6*d.* net.

Meteorological Office. The Observer's Handbook. Annual Edition, 1913. Pp. xxiv+157+plates. (London: H.M.S.O.; Wyman and Sons, Ltd.) 3*s.*

Die Riviera. By A. Voigt. Pp. vi+466+vi plates. (Berlin: W. Junk.) 7 marks.

Sound. By Dr. J. W. Capstick. Pp. vi+296. (Cambridge University Press.) 4*s.* 6*d.*

Cambridge County Geographies:—Northumberland. By S. R. Haselhurst. Pp. xi+181+2 maps. Merionethshire. By A. Morris. Pp. ix+166+2 maps. (Cambridge University Press.) Each 1*s.* 6*d.*

Handbuch der Arbeitsmethoden in der anorganischen Chemie. Edited by Dr. A. Stähler. Dritter Band. Allgemeiner Teil. Erste Hälfte. Pp. x+692. (Leipzig: Veit and Co.) 22 marks.

International Congress of Americanists. Proceedings of the Eighteenth Session. London, 1912. Parts 1 and 2. Pp. lxxxviii+570+plates. (London: Harrison and Sons.) 2 guineas net.

Travaux et Mémoires du Bureau International des Poids et Mesures. Tome xv. (Paris: Gauthier-Villars.)

DIARY OF SOCIETIES.

THURSDAY, JANUARY 8.

CONCRETE INSTITUTE, at 7.30.—Factory Construction: P. M. Fraser.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—British Practice in the Construction of High-tension Overhead Transmission Lines: B. Welbourn.

FRIDAY, JANUARY 9.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Hydrogen and the Primary Constituents of Nebulæ: J. W. Nicholson.—The Short-period Variable XZ Cygni: C. Martin and H. C. Plummer.—A New Algol Type Variable Star in Pegasus: A. Stanley Williams.—*Probable Papers:* The Number of Stars of Each Photographic Magnitude down to 17·0 m. in Different Galactic Latitudes: S. Chapman and P. J. Melotte.—The Proper Motions of the Brighter Stars within 17° of the Pole, considered in relation to their Spectral Type: H. S. Jones.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Application of Power Railway Signalling in Great Britain: C. I. Routh.

MONDAY, JANUARY 12.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Evolution of the Federal Capital, Australia—Canberra: G. Taylor.

TUESDAY, JANUARY 13.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Superheating Steam in Locomotives: H. Fowler.

THURSDAY, JANUARY 15.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Some Scientific Results of Captain Scott's Antarctic Expedition: G. Taylor.

ROYAL SOCIETY OF ARTS, at 4.30.—Indian Museums: A Centenary Retrospect: Col. T. H. Hendley, C.I.E.

INSTITUTION OF MINING AND METALLURGY, at 8.

LINNEAN SOCIETY, at 8.—Lantern Slides Illustrating the Fauna and Flora of the Interior of Vancouver, from her last journey: Mrs. Henshaw.—Some Observations on the Tentacles of *Blennius gattorugine:* H. A. Baylis.—(1) Some Recent Additions to the British Flora; (2) A Note on Article 45 of the Vienna Code; (3) The Abridgment of Miller's "Gardener's Dictionary" of 1754, and Hill's "British Herbal" of 1756: G. C. Druce.

ILLUMINATING ENGINEERING SOCIETY, at 8.—Discussion on Mr. C. J. Waldram's Paper: Some Problems in Daylight Illumination, with Special Reference to School Planning."

FRIDAY, JANUARY 16.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Commercial Tests of Internal Combustion Engines: W. A. Tookey.

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

Advertisements and business letters to be addressed to the Publishers.

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