THURSDAY, JUNE 4, 1903.

INFINITE SERIES.

Théorie élémentaire des Séries. Par Maurice Godefroy: avec une Préface de L. Sauvage. Pp. viii + 268. (Paris: Gauthier-Villars, 1903.) Price 8 francs.

INFINITE series present themselves in mathematics in different contexts, serve different purposes, and admit of different interpretations. The simplest case is when, from a numerical sequence $(u_1, u_2, u_3, \ldots)$, we derive the series

$$u_1 + u_2 + u_3 + \ldots$$

which we may denote by Σu. It is assumed that there is a rule for calculating u_n when n is assigned; if we write s_n for $u_1 + u_2 + \ldots + u_n$, there exists a sequence $(s_1, s_2, s_3, \ldots)$ and we may, in fact, regard Σu as being, in a manner, a symbolical expression of this sequence. When we say that Σu is convergent and its sum is s, what is really meant is that the sequence (s_n) converges to the limit s.

To Cauchy and Abel is mainly due a strict theory of such arithmetical series. They showed that, whether its terms are real or complex numbers, a series of this sort may be divergent, indeterminate, or convergent; and that series which are absolutely convergent may be combined by processes which we may call addition, subtraction, multiplication, and division. There is one part of this theory which, even yet, is not always made so clear as it might be. Suppose that we have two sequences (u_n), (v_n) of such a character that every element u_p of the one occurs as an element v_q in the other, and conversely; that this is a (1, 1) correspondence, that is to say, that each element of one sequence is associated with one, and only one, of the other; and, finally, that when p is finite, q is also finite, and conversely. In this case we may call (v_n) a permutation of (u_n). When Σu_n is absolutely convergent, so is Σv_n, and the sums of these two series are the same; it is this property, really, that makes absolutely convergent series so easy to work with. Properly speaking, a series is distinct from its permutations; but in the case of an absolutely converging series this distinction may be ignored. It is a remarkable fact that a series and one of its permutations may both converge and have different sums. It is rather unfortunate that the phrase "changing the order of the terms in a series" is still used; it is certainly best to regard a series as defined, not merely by its terms, but by the order in which they are written.

After discussing this arithmetical theory, M. Godefroy proceeds to the next simplest case, when the terms of the series are functions of a variable x which is supposed to assume numerical values. Here the distinction between uniform and non-uniform convergence appears, a distinction first emphasised by Stokes and Seidel. In the sequence (s_n) derived from a convergent series of this kind, the index n for which s_n first differs from the sum of the series by less than an assigned quantity h is, in general, a function of x as well as of h; so that for particular values of x and their immediate neighbourhood n may be enormously large even for values of h which, though small, are not infinitesimal; accordingly the series is no longer available for practical calculation. At such places the convergence ceases to be uniform; the convergence is uniform wherever it is possible to assign, in terms of h but *not* of x, a value of n for which $|s_n - s| < h$.

Of course, the most important series of this class are power-series, and in his third chapter M. Godefroy deals with them at some length. On pp. 67–69 he gives Dirichlet's proof of Abel's fundamental theorem that when a power-series is convergent its value at the boundary of its circle of convergence is the limit of its value as x approaches the boundary. To learn to appreciate the necessity for proving this theorem is a good exercise for the mathematical student; it looks so obvious and is yet so far from being a truism.

The remaining three chapters are on the exponential function, the circular functions, and the gamma-function respectively. The noteworthy features are that $\sin x$, $\cos x$ are defined by power-series, that the transcendence of e is demonstrated, and that the properties of the gamma-function are deduced, after the manner of Gauss, from the product $\Pi(n,x)$. M. Godefroy points out that Weierstrass's formula

$$\frac{1}{\Gamma(x)} = xe^{Cx}\Pi\left(1+\frac{x}{n}\right)e^{-x/n}$$

was explicitly given in 1848 by F. W. Newman (*Camb. and Dubl. Math. Journ.*, vol. iii. p. 59).

The final chapter is the one which presents most novelty in the shape of actual results; thus, besides the series of Stirling, we have various interesting formulæ due to Prym, Hermite and others. But M. Godefroy's style and method will attract the reader's attention throughout; he combines simplicity with rigour, and is neither dry nor diffuse. His work is one which may be cordially recommended, especially to mathematical students; not the least of its merits is its excellent bibliography, which is just what a treatise of this sort should contain.

M. Godefroy does not explicitly introduce the complex variable, but it is easy to complete the chapter on power-series so as to make its results apply when x is complex. Thus we have, on the whole, a discussion, with illustrations, of numerical series, and of power-series which define functions of a variable within a circle of convergence.

Incidentally, we have examples of two other kinds of series. Stirling's formula is the classical example of a series which does not define a function, but which, while ultimately divergent, serves to calculate the numerical value of a function very exactly for any sufficiently large value of x. Such asymptotic series have been recently studied by Poincaré, Borel and others, and their properties are no longer a mystery.

Again, Lambert's series

$$\frac{x}{1-x} + \frac{x^2}{1-x^2} + \ldots + \frac{x^n}{1-x^n} + \ldots$$

is an example of a series which serves for enumeration. If each term is expanded in powers of x, and the result collected, we get $\Sigma\psi(n)x^n$, where $\psi(n)$ is the number of ways of solving $n = \delta\delta'$ with integral values of δ, δ', the order of δ, δ' being taken into account except when they are equal. Thus $\psi(n) = 2$ when n is prime, but not

otherwise. So long as $|x| < 1$, Lambert's series denes a function of x; calling this $f(x)$, a prime number p is distinguished by the fact that it makes

$$D_x^p \cdot (x) = 2p(p!)$$

when $x=0$. There are many remarkable instances of arithmetical truths derived by constructing an enumerative series (purely symbolical, in the first instance) and then investigating its properties as a function of x. Ultimately, of course, the results obtained must depend upon purely arithmetical considerations; but transcendental analysis supplies, in such cases, a kind of machine, by which, with slight effort, theorems are verified, or even suggested, although the proof of them by strictly arithmetical methods may be very difficult. Whether Lambert's series can be used in this way to simplify the problem of the frequency of primes still remains an open question. G. B. M.

A PLEA FOR INTERACTION.

Geist und Körper, Seele und Leib. Von Ludwig Busse. Pp. x+488. (Leipzig: Verlag der Dürr'schen Buchhandlung, 1903.) Price 8.50 marks.

IN this book the author aims at finally establishing a doctrine of "interaction." Previous expositions in less comprehensive form have already been criticised by eminent writers; to these objections the author now replies. The result is a veritable encyclopædia of views on this question; authors of all nationalities are here cited to defend themselves against criticisms which are throughout shrewd and relevant. In the mass of material the author's particular theory is apt to be obscured; a strictly methodical procedure has to some extent obviated this defect. After a refutation of materialism, adequate for its purpose as *entrée*, we come to the *pièce de résistance*, entitled "Parallelism or Interaction?" Here parallelism is discussed under the heads modality (is parallelism a metaphysical doctrine or merely a hypothesis?), quantity (must it be partial or complete?), and quality (materialistic, realistic-monistic, idealistic-monistic, and dualistic forms). From this catalogue there finally emerge as "valid forms" only the complete, the realistic-monistic, the idealistic-monistic, and the dualistic forms. The method of criticism employed is called by the author "immanent." Internal dissensions reduce the various doctrines to the vanishing point; those alone survive which do not contain in themselves any elements contradictory to parallelism. The crucial point comes when the idealistic-monistic form is discussed. The author holds an idealistic-spiritualistic doctrine, and is therefore concerned to show that this does not necessitate parallelism, that interaction is not only possible, but preferable. He relies mainly on the unity of consciousness, and the necessity of including activity as subjectively known in our view of the Whole. The arguments against "conservation of energy," "continuity," and naturalistic positions in general are then brought forward. The author is emphatically opposed to any compromises. Between mind and matter the break is absolute; activity without expenditure of energy, the extension downwards to the unconscious or to *quelque chose d'analogique*—in short, compromise of all kind is rejected. Philosophy must here take its stand upon experience, and claim that interaction alone does justice to the facts. The rejection of a preestablished harmony makes it necessary to assert that ultimately we must formulate any given series of events, not as one or as two homogeneous series, either physical (as *a b c . . .*) or psychical ($\alpha\ \beta\ \gamma\ .\ .$), but as a compound series of the form $a\ \beta\ c\ \delta$, &c. Similarly the rejection of any development of mind from lower elements is followed by the conclusion (after Lotze) that it supervenes on a certain development of "Zellengruppe." It follows that so far as interaction is concerned we must assert a dualism; the two systems which interact must be kept distinct; the ultimate unity is not to be found in their nature, but in the fact of their interaction; we have not to piece together the world, but to accept its living unity.

Clearly such a theory claims attention more for the consequences to which it looks than for the advantages it attains. So far we must regard the Weltanschauung of the closing section as much more than a "dessert." Here there appears an "All-Geist," and with it new possibilities; unfortunately the binder omitted some pages here, and criticism must therefore turn upon him rather than upon the author. As an exposition of how experience may be treated in the interests of a Weltanschauung, we have here an admirable discussion. Much of it is common property among writers on the philosophy of psychology. But refutation has before now proved a two-edged sword, and on the crucial points, the subjects of activity and of development, the author seems to glide from proof to assertion. The idealistic treatment of the two factors said to interact presumably forms the ground of a final unity; the question "how" is more easily solved *ambulando* than *cogitando*. It seems to require more than the author's theory of Thing-monads and Soul-monads—more even than the binder can have omitted. G. S. B.

THE NEW ENCYCLOPÆDIA.

Encyclopaedia Britannica. Vol. xxxi. New volumes. Vol. vii. Mos—Pre. (London: A. and C. Black; and the *Times* Office, 1902.)

THE prominence given to scientific subjects in the seventh of the new volumes of what has long been regarded as our national encyclopædia serves in a measure to indicate how large a part the work of men of science has taken in the increase of knowledge during the last quarter of a century. Among articles of prominent importance in this volume, so far as the student of science is concerned, are those dealing with palæobotany, pathology, and physiology, though there are many other articles of a less exhaustive kind dealing with problems of great scientific interest. Technological questions receive due attention, and are represented, among others, by essays on navies, ordnance, paper manufacture, petroleum, photography, and elec-

tric, hydraulic, and pneumatic power transmission. Students of geography and history are provided with an abundance of material, including the latest statistics referring to the chief countries of the world the names of which fall alphabetically between Natal and Portugal, besides an elaborate account of the polar regions, and an able review of the present state of our knowledge of oceanography. Mathematicians will find the article on "Number" both interesting and original, and readers who prefer biographical studies will meet with appreciative estimates of the lives of such celebrities as Owen, Paget, and Pasteur, to name only three.

But no mere mention of a few of the contents can serve more than to give a vague idea of the variety of valuable material brought together in this volume, and the space available makes it possible to refer only to a few of the chief contributions.

The prefatory essay of this volume—and it must be remembered that these essays are a distinguishing characteristic of this new edition—is by Mr. Frederick Greenwood, and deals with the influence of commerce on international conflict. In this scholarly presentation of an important problem, Mr. Greenwood shows how the growth of commerce has given rise in recent times to dreams of the extinction of war. He goes on to explain, however, how war became later to be regarded as a trade weapon and an instrument for the provision of new markets; and as the discoveries of men of science have placed resources for the destruction of men at the disposal of the armies of the world so terrible in their efficiency that, to ensure any chance of success in a war between great Powers, each of them must have armies so large and so expensively equipped as to lead to a growing likelihood of war becoming so dreadful and so costly that it would not be endured. Yet notwithstanding the horror and brevity of modern battles, humanity still seems able to bear the excess, and militarism flourishes.

Of another factor influencing the industrial competition of the nations Mr. Greenwood takes no notice, and that is the increased attention being paid by the leading nations to the higher education of their manufacturers and merchants. The combined efforts of armies and nations are not enough to secure commercial supremacy. A nation must, in addition, provide a sufficient number of institutions of higher education to secure opportunities for its citizens to become conversant with modern scientific knowledge, able to apply the principles of science to modern industrial problems, and to extend the bounds of science into the unknown. The volume itself does not, we find, ignore the importance of higher technical education, for in addition to articles with a less direct bearing on the subject, an essay on polytechnics by Sir Joshua Fitch is included. The subject does not appear to have been allotted the amount of space its importance merited, and the consequence is that metropolitan polytechnics are alone described. It is a pity that the opportunity could not have been taken to familiarise British readers with the complete and lavish provision of institutions abroad corresponding to these polytechnics. The comparison to which such an article must have given rise would have shown England's lamentable deficiency and the low position she must be assigned when the sacrifices made by the leading peoples for the establishment of institutions of the higher learning are passed in review.

BIO-CHEMISTRY.

The Chemical Changes and Products Resulting from Fermentations. By R. H. Aders Plimmer. Pp. vi+184. (London: Longmans and Co., 1903.) Price 6*s*. net.

THE number of chemists who are interested in biological problems is now gradually on the increase, whilst, on the other hand, the biologist realises the importance of a further investigation of the chemical changes concomitant with life. In these circumstances, the book of Dr. Aders Plimmer cannot fail to be particularly welcome, and the perusal of this admirable *résumé* of the work in the borderland between biology and chemistry will indicate to the reader how much has been done and how much still remains to be done in this most difficult field of research.

Under his treatment of polysaccharides the author gives a succinct account of the chemistry of starch, and then proceeds to discuss the changes undergone by monosaccharides and glucosides. In this connection due prominence is given to the recent important observations of Croft Hill, Emmerling and E. Fischer and E. F. Armstrong on reversible ferment action. In the chapter on changes in esters reference is made to the work on lipase, where Kastle concludes that ferments do not act on substances which can be electrolytically dissociated. It should be noted, however, that Slimmer has subsequently pointed out that this view cannot be maintained, since glucovanillic acid and other electrolytes are attacked by emulsin. Other chapters include changes in urea and uric acid, blood, albumins, and changes occurring as a result of oxidation and reduction. Nitrification and denitrification are also considered, and the volume is completed by an account of the changes occurring as the result of putrefaction.

It is pointed out in connection with lactic acid production by microorganisms that the usual product is the inactive acid, but that one of the pure optically active forms may sometimes be obtained. In this latter case the author is apparently of the view that the inactive acid is first of all formed and then converted into the one active form by the selective action of the organism. Experimental evidence, however, seems to show that, if the action were of this nature, the resulting product would not be the pure active acid but rather a mixture of inactive and active acids. Frankland's resolution of *i*-glyceric acid, where the one active constituent is attacked by *Bacillus ethaceticus* and the other apparently remains untouched, is altogether exceptional. In those cases, however, where the lactic acid obtained is optically active, but is mixed with some of the inactive form (as in Harden's experiments on the action of *Bacillus coli communis* on *d*-glucose, &c.), the possibility of the intermediate

formation and subsequent partial resolution of inactive acid may be maintained. In the discussion of Harden's results (p. 69), it is not clear why the lactic acid formed should be optically active at all; from the description given it appears that the asymmetry of the molecule must disappear altogether.

Dr. Plimmer points out that many of the changes caused by living organisms may possibly be due to enzyme action. In addition to his experiments with zymase, Buchner has lately submitted further experimental evidence in favour of this conception, since, conjointly with Meisenheimer, he has proved that from *Bacillus acidificans longissimus* an enzyme may be prepared which converts cane sugar into lactic acid. The same investigators have also shown that the conversion of ethyl alcohol into acetic acid may be accomplished by an enzyme which they obtained from vinegar bacteria.

Buchner's work on zymase surely merits more than the few lines which the author devotes to it, especially since space is found for an account of many discoveries which are of much less fundamental importance. Reference might also have been made to Bredig's experiments on inorganic ferments. Further, one cannot help regretting that a brief account of Emil Fischer's work on the decomposition products of albuminoids is not incorporated in the volume. Those are, however, minor objections. British workers in different sciences will appreciate Dr. Plimmer's account of biochemistry. A. McK.

OUR BOOK SHELF.

Metallurgical Laboratory Notes. By Henry M. Howe, Professor of Metallurgy in Columbia University. Pp. xiv+140. (Boston: The Boston Testing Laboratories, 1902.)

THE time has passed when practical teaching in metallurgy was a synonym for little more than a course of exercises in assaying. No one recognised this sooner and more fully than Prof. Howe, and his students now devote much of their time in the laboratory to carrying out experiments illustrating the principles which underlie the various processes of the treatment of ores and metals in works. This little volume contains a description of ninety-one such experiments of both educational and instructive value, and constitutes the first attempt to embody the new methods in book form. The author expresses in the preface his feeling that the series of experiments now published is incomplete and shows a lack of balance, and probably many metallurgists will find themselves constrained to agree with him. Those teachers who are convinced that ore treatment is still by far the most important branch of the subject may object to a system in which the majority of the experiments are directed to the study of the treatment and properties of metals. Even the methods will not command universal approval in this country, where students are encouraged to learn to overcome the difficulties occasioned by the use of indifferent implements on the grounds that they will be better fitted by such training to deal with the more serious difficulties unavoidably encountered in the industries. The smoothing away of obstacles, and the reduction to a minimum of the practice in manipulation, have been characterised as "spoonmeat methods." It must be admitted, however, that these views are likely to be held most firmly by the professors who are least adequately supplied with laboratory equipment. Prof. Howe considers that in proportion as less time is devoted to details of manipulation, more leisure is available to the student for "the unwelcome task of thinking," than which nothing could be more important. Perhaps it might be argued that practice in manipulation would make the best laboratory workers, and that practice in thinking would assist in turning out the best general managers. The book is extremely welcome, and breaks ground that must soon be assiduously cultivated. It will be carefully studied by all who have the improvement in the training of metallurgists at heart. T. K. R.

Nature Studies in Australia. By W. Gillies and R. Hall. Pp. v+299. (Melbourne and London: Whitcombe and Tombs, Ltd., n.d.) Price 2*s*.

THE recognition of the importance of "nature-study," if we are to know anything really worth knowing about animals and plants, in Australia is a satisfactory sign of the times, and an indication that throughout the world the old-fashioned ways of teaching are to be abolished, and also that the days of mere section-cutting and skin-describing are numbered. The greater part of the present little volume is devoted to birds (mammals being left out), of the life-histories of which Mr. R. Hall has for many years been an enthusiastic student, and we must congratulate both authors on the mass of interesting information they have concentrated into such a small space with regard to a number of characteristic Australian species. The majority of the numerous illustrations are the results of the authors' own cameras, and, although necessarily on a small scale, they are, for the most part, excellent examples of bird-photography. One great advantage possessed by the authors is that their subject has a freshness which cannot be claimed for descriptions of British bird-life, and this gives a charm to their work which stay-at-home writers must find it difficult to equal. We must confess, however, to a feeling of dissatisfaction at the use of names like "lunulated honey-eaters" for certain of the species, which are certainly not examples of "nature-teaching," and we are by no means sure that we quite like the "pupil and teacher" style on which the work is planned—it savours a little too much of "Sandford and Merton."

One fact appears of more than usual interest. It is commonly stated in ornithological works that every species of migratory bird breeds in the most northern portion of its range. According, however, to the authors, at least one Australian bird—the double-banded or sand dotterel—goes south to breed, travelling to the south of New Zealand, "that is to say, as far towards Antarctica as it can now get."

Space, we regret to say, prevents our going deeper into the contents of the work before us, the latter portion of which is devoted to the lower vertebrates and invertebrates. We can, however, safely recommend it to the best attention of teachers of nature-study, if only for the fact that a book written on the spot is worth a dozen compilations made elsewhere. The price renders it within the reach of all. R. L.

Considerazioni agrarie sul Piano di Capitanata. By Dr. Nestore Petrilli. Pp. 87. (Naples, 1902.)

THIS work consists of a monograph upon the agricultural conditions which prevail in the great plain of the Capitanata, constituting the northern part of Apulia. Such monographs, which are regularly produced upon the Continent, and provide great assist-

ance to the statesman wishing to get a sound idea of the state of an industry subject to such local variations as agriculture, seem to have dropped out of favour in this country; to parallel them we must go back fifty years to the prize reports on the farming of the various counties which used to be a feature of the earlier numbers of the *Journal* of the Royal Agricultural Society.

The Tavoliere di Capitanata is a dry flat plain with an annual rainfall of only eighteen inches, and a mean temperature of more than 60° F.; the prevailing calcareous subsoil results in there being but little surface water, while the few rivers descending from the Apennines are torrential in their nature, and in consequence have formed a considerable area of marsh. The agriculture of the district is of a primitive character, much of it is pastoral, this being one of the sheep-producing districts of Italy; the cultivated land is farmed on a kind of four-course rotation of hard wheat (macaroni wheat), wheat, oats and fallow, and on the poorer land an even simpler rotation of wheat or oats and fallow alternately is practised. A certain acreage is also occupied by vines and olives.

The author, after a preliminary discussion of the meteorological conditions, geology, &c., of the district, proceeds to describe the system of management which prevails, and sets out in detail the cost of the various operations, rates of wages, and gross returns as regards sheep, wheat and vines. As a means of improving the condition of agriculture he lays stress on the introduction of forage crops, such as temporary pastures, sainfoin and lucerne, instead of the present primitive and exhausting alternation of cereals and fallow.

The Stellar Heavens. By Ellard Gore. Pp. xxxii + 128. (London: Chatto and Windus, 1903.) Price 2*s.* net.

THE author has brought together in a small compass a list of the more prominent objects in the heavens for the use of possessors of small telescopes. The list is accompanied also by brief historical and introductory information applicable to each class of object treated. There are five chapters in all, and these are devoted to the following subjects:—Stars, double, multiple and binary stars, variable stars, star-clusters and nebulæ, and the stellar universe. In the first of these a brief account, among other topics, is given of the classifications of stellar spectra, but unfortunately the reader is not told that Vogel's classification is based on the assumption that all stars are decreasing in temperature, while a natural and more recent classification, dividing the stars into groups in which they are increasing or decreasing their temperature, is altogether omitted.

The paragraph devoted to the explanation of temporary or new stars is needlessly brief considering the number of views expressed on this important subject. On the other hand, an excellent account is given of the methods of observing the brighter variable stars which are in the reach of amateurs, and it is hoped that this interesting branch of astronomy, one specially suitable for those who have only opera glasses at their service, will be taken up more generally.

The volume will, however, be a very useful help for directing the observer's attention to the various more conspicuous objects in the sky, and although it does not pretend to take the place of that well-known friend of amateurs, namely, Webb's "Celestial Objects for Common Telescopes," it will prove a serviceable guide. The only erratum found was the misspelling of the name of Klinkerfues on p. 23, although the name is indexed correctly.

Departmental Notes on Insects that Affect Forestry. By E. P Stebbing, F.L.S., F.E.S., Forest Entomologist under the Government of India. No. 2. Pp. vii+151–334; plates vii–xix. (Calcutta, 1903.)

THE importance of economic entomology is now fully recognised by the Indian Government, and the publication before us is devoted chiefly to Scolytidæ and other beetles injurious to the bark and leaves of trees, and to their parasites; a few moths and scale-insects are also noticed. Each species occupies several pages, and is fully dealt with under various headings, the most important being description, life-history, relations to the forest, points in the life-history requiring further observation (an extremely important matter), protection and remedies, localities, parasites, fungi, &c. Several species are referred to under their generic names only, but this will not render their identification a matter of any great difficulty. The illustrations are fairly good, and many of them are devoted to galleries of Scolytidæ and to different portions of trees attacked by insects. The illustrations of the Coccid, *Monophlebus Stebbingi*, Green, on plate 14 are very interesting. We are sorry that Mr. Stebbing has overlooked the necessity for adding the author's name to every described species mentioned; it is done in some cases, but is frequently omitted, and many of the species described have "M.S." appended to their names. We presume that these are names published for the first time by Mr. Stebbing himself, in which case he should either have added his own name or else "n. sp."

We are glad to notice the increase of well-illustrated publications on economic entomology, for their value is considerable, both from a practical and from a scientific point of view.

Analytical Chemistry. By F. P. Treadwell, Ph.D. Translated from the second German Edition by W. T. Hall, S.B. Pp. xi+466. (New York: Wiley and Sons; London: Chapman and Hall, Ltd., 1903.) Price 3 dollars.

THE text-book is compiled from lectures delivered by the author at the Polytechnic Institute at Zurich. The matter is, as one might expect, very largely explanatory of the various reactions, that is to say, it is a book to be studied rather outside than in the laboratory. From this point of view it doubtless serves a useful purpose, for every reaction is clearly described and illustrated by an appropriate equation.

One may doubt sometimes the expediency of simplifying all analytical operations on paper in this way, but, provided practical experience is added as a corrective, the value of an equation as a general guide to a reaction can do no harm.

The book is written in a thoroughly scientific spirit—not a common characteristic of books on this subject—and the author is conversant with the modern theory of analytical chemistry, to which reference is frequently made.

Seeing that prominence is given to minerals in which the different elements occur, one misses the refinements of blowpipe analysis which Plattner and Richter did so much to develop. Possibly this might have made the volume too bulky. As it is, the information seems accurate and complete. There are plenty of tables of separation, and there is a section at the end devoted to the rarer elements. The book is printed on good paper in clear type, and is bound in a substantial cover. Altogether the external appearance, for a work on qualitative analysis, produces a very favourable impression. The translator has done his work well. Whether this justifies the prominence given to his name on the back can scarcely be decided by the reviewer. J. B. C.

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.*]

Coleridge's Theory of Life.

THE old subject of the nature of the vital force or vitality having lately been under discussion, allow me to remind some of your readers that Coleridge did not hesitate to enforce his opinion that it came into the domain of the scientific inquirer, and appertained to the other forces in nature. I cannot express an opinion on his theories of the nature of life, but his holding them in any tangible form has had great weight with some persons, in consequence of his being an orthodox Christian, belonging to what is called the religious world, yet he considered that the nature of life was open to investigation like any other natural phenomenon.

I may be allowed to quote a few passages for the information of those who are not familiar with his essay on the "Theory of Life." Coleridge's idea was that physical life is a process or mode of operation, as we recognise under such names as magnetism chemical affinity, for these, he says, by their own properties affect all the results observed in life. "Life supposes a universal principle in nature with a limiting power in every particular animal, constantly acting to individualize and as it were *figure* the former. Thus then life is not a thing—a subsistent hypostasis—but an act and process." "To account for Life is one thing, to explain Life another. To a reflecting mind indeed, the very fact that the powers peculiar to life in living animals *include* cohesion, elasticity, &c. (or, in the words of a late publication) 'that living matter exhibits these physical properties' would demonstrate that in the truth of things, they are homogeneous and that both the classes are but degrees and different dignities of one and the same tendency. Unless therefore a thing can exhibit properties which do not belong to it, the very admission that living matter exhibits *physical* properties, includes the further admission that those physical or dead properties are themselves vital in essence, really *distinct* but in appearance only *different*; or in absolute contrast with each other." "If I were asked for what purpose we should generalise the idea of Life thus broadly, I should not hesitate to reply that were there no other use there would be some advantage in merely destroying an arbitrary assumption in natural philosophy and in reminding the physiologists that they could not hear the life of metals asserted with a more contemptuous surprise than they themselves incur from the vulgar when they speak of the life in mould or mucor. But this is not the case. This wider view fills up the arbitrary chasm between physics and physiology and justifies us in using the former as means of insight into the latter."

The author then proceeds to discuss his argument through the lowest creatures in animal life until he reaches man.

"The arborescent forms on a frosty morning to be seen on a window or pavement must have *some* relation to the more perfect forms developed in the vegetable world." He then alludes to the different classes of animals, and says, "as the individuals run into each other so do the different genera. They likewise pass into each other so indistinguishably that the whole order forms a very network. Man forms the apex of the living pyramid. He has the whole world in counterpoint to him but he contains an entire world within himself."

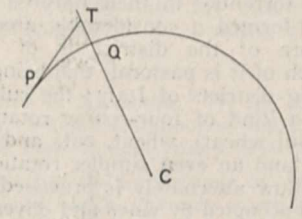
It is clear, therefore, that Coleridge (and others may do the same), whilst holding strictly to the belief in a spiritual existence, yet regarded vitality from quite a different point of view, resulting, indeed, from a combination of forces as we see in other phenomena of nature. SAMUEL WILKS.

Psychophysical Interaction.

SIR OLIVER LODGE says (p. 53) that he would "interfere with the course of nature," regarded as a mechanically determinate problem, even by lifting a log. Why so? The course of nature is exactly what happens, is it not? It is the business of scientific men to find out the course of nature, and the various connections which give it coherence and consistency and determinancy. This has been largely done, even in vital processes: and in the obscurer regions of psychics it seems probable that the course would be determinate if we knew all the circumstances. In any case we have nothing else but the course of nature to go by, in the determination of its laws, and that psychic phenomena are natural phenomena is, it seems to me, the only rational view to take. OLIVER HEAVISIDE.

May 21.

MAY I contribute a pictorial illustration to the controversy raised by Sir Oliver Lodge?



P Q, part of a circular path described by a body of mass m round a fixed centre C, under the influence of a constant centripetal force of magnitude F. Whether this is supplied by a string with a tension F or by an attraction which will be constant if the path is circular does not seem to matter in the least.

Now let P T be the tangential distance which would be traversed in a time t if the centripetal force were absent.

When that force is introduced, P will come to Q instead of to T, and the work done by the force consists of pulling the mass from T to Q in the time t. The energy required to do this is $F \times T\,Q$, and the same amount is required and absorbed in each successive interval of t. This result is not affected by calling F a guiding force, which it is. If instead of a body describing a circle we had dealt with a body at rest in the position T, the energy required to bring it to Q would be exactly the same.

If Newton had had to express himself (modern fashion) in terms of energy, can we imagine him dealing with the problem except in some such way as my drawing indicates?

Athenæum. G. W. HEMMING.

ATMOSPHERIC ELECTRICITY.

UNTIL within the last two or three years, the advances made in our knowledge of atmospheric electricity were mainly due to the investigation of the electric field of the earth. An interesting summary of the facts brought to light by such investigations will be found in a paper by Exner in "Terrestrial Magnetism and Atmospheric Electricity" (vols. v., p. 167, and vi., p. 1).

Except at or near places where rain (or other form of precipitate) is falling, there is in the free atmosphere an electric field tending to drive positive electricity downwards; the earth's surface is thus in fine weather regions negatively charged. The strength of the electric field and the magnitude of the charge per square centimetre on level ground at a distance from trees or buildings may be found by observing the potential at a measured height. According to Exner, the normal (fine weather) potential gradient in European latitudes varies from about 80 volts per metre in summer to 400 or 500 volts per metre in winter.

It has now been established by means of balloon observations that the intensity of the electric field in fine weather begins to diminish when a comparatively small altitude is reached, and at a height of 5000 metres has only a small fraction of the intensity at the earth's surface. This shows that the lower layers of the atmosphere possess a positive electrification very nearly equivalent to the negative charge on the ground.

For the study of the variations of the electric field at a given place a large mass of material is furnished by the electrograph curves obtained at various observatories. There is a well-marked annual variation in the intensity of the electric field; the maximum occurs in winter and the minimum in summer, the midwinter values being five or six times as high as those of midsummer. The daily variation is less regular, and its character depends on the place of observation and on the season of the year. Three types are recognisable according to Exner. Most commonly there are maxima about 8 a.m. and 8 p.m., with night and noon minima between them. There may, secondly, as on the Eiffel Tower [1] and in winter at many low level stations also, be a minimum in the early morning hours, and a flattened maximum over the day hours. Finally, as in Ceylon and on the Indian Ocean, there may be no daily variation.

A great advance was made in 1899 by Elster and Geitel. They proved, in agreement with previous experiments of Linss, that an electrified body exposed in the open air loses its charge comparatively rapidly by leakage through the air; the leakage is more rapid the clearer and more free from dust the air may be. They showed that the phenomena were entirely in agreement with the supposition that the atmosphere contains positively and negatively charged ions free to move under the action of the electric field. An interesting account of the application of our knowledge of gaseous ions to the explanation of many of the phenomena of atmospheric electricity has been given by Geitel.[2]

Charged conductors exposed in the open air are found to lose 1 or 2 per cent. of their charge or more per minute; the leakage from negatively charged bodies is often somewhat greater than that from positively charged bodies; this difference is especially great on mountain peaks, where a negative charge may be neutralised many times as fast as a positive one, indicating an excess of positive ions. Ebert [3] found in balloon ascents an increased rate of neutralisation in the upper atmosphere as on mountain peaks, but without any marked difference between positive and negative leaks. Many observers, especially in Germany, have lately been carrying out measurements of this "Elektricitätszerstreuung."

There have, however, been very few absolute measurements from which the number of ions present per c.c. in the open air could be determined. Measurements of this kind have been made by Ebert and by Rutherford and Allen. The latter observers found (*Phil. Mag.*, December, 1902) for the number of ions per c.c. of air drawn in from outside their laboratory values which on certain occasions were as low as 30 per c.c., the charge carried by each ion being about 3×10^{-10} electrostatic units, according to recent determinations by J. J. Thomson (*Phil. Mag.*, March) and by H. A. Wilson (*Phil. Mag.*, April). Rutherford and Allen also showed that the velocity of the ions of the free atmosphere under a given strength of field was approximately the same as that of the ions produced by Röntgen and Becquerel rays, being about 1.4 cm. per second for a potential gradient of a volt per cm.; we are probably therefore justified in assuming an identity in other properties also. With the above values for the number of ions and their velocity, the charge on the ground should be neutralised at the rate of about a half per cent. per minute.

In connection with the question of the origin of the ions in the atmosphere, some remarkable phenomena have to be considered. Even in dust-free air in a closed vessel in the dark there is a continuous production of ions, generally at rates not differing greatly from 40 per c.c. per second, if we interpret the measurements in the light of the most recent determinations of the ionic charge. It has, however, been shown by McLennan and Burton,[1] and by Strutt (NATURE, February 19), that the greater part of the effect is due to the walls of the vessel, that ordinary substances in varying degrees resemble radium in being radio-active and producing radio-active emanations, the effects, however, being of incomparably smaller intensity. The two first-named experimenters also found that a part of the ionisation is due to an extremely penetrating radiation from sources outside the vessel. Rutherford and Cooke (NATURE, April 2) have obtained a similar result. Elster and Geitel found that negatively charged bodies exposed in the open air become temporarily radio-active, just as they do when exposed to the emanations from radium or thorium. Vessels in which freshly fallen rain or snow have been evaporated to dryness show a similar temporary radio-activity.[2] The atmosphere apparently contains an emanation like that from radium. Air pumped out of the ground shows these effects to an abnormally marked degree, as Elster and Geitel have proved. The surface of the ground, and to a still greater extent the exposed portions of trees, must, it will be observed, under normal fine weather conditions become radio-active in virtue of their negative charge, and produce, therefore, an abnormal amount of ionisation in the air near them.

It is probable, in the light of Lenard's experiments, that sunlight ionises the air which it traverses, especially in the upper atmosphere, while it is still strong in ultra-violet rays.

The conductivity of the air increases in a sense the difficulty of the problem of the origin of the earth's electric field. For it would seem that the electric field in fine weather regions should rapidly diminish, and in a few hours disappear; there must be some process by which the electric field is continually being regenerated. Leaving aside, however, the consideration of the origin of the electric field, we may attempt to explain its variations as due to the variations in the conditions determining its rate of destruction. Whatever increases the conductivity of the air will diminish the electric field, and *vice versâ*. Examples of the application of this principle will be found in the paper by Geitel already mentioned. To take only one, the increase in the electric field accompanying fogs (a phenomenon well shown in the Kew electrograph curves) may be explained as due to the entangling of the ions by the fog particles; the leakage of electricity under such conditions has been found by Elster and Geitel to be very slight.

In regions enjoying fine weather, if we assume the existence of a flow of electricity in the direction of the electric field, there will be a downward earth-air current; there must then be a compensating current accompanying precipitation, negative electricity being brought down in the rain, and the positive charge being left behind in the atmosphere and carried by upper air currents to other regions. There is, as we shall see later, reason to believe that an excess of negative electricity is brought down to the earth's surface by rain. It is, however, doubtful whether we can explain in this way the existence of the normal electric field at a distance from regions where rain is falling; for the positively charged upper air currents would continually be losing their charges, and we should expect a rapid falling off in the intensity of the field

1 Chauveau, *C.R.*, vol. cxvii. p. 1069 (1893).
2 "Ueber die Anwendung der Lehre von den Gasionen auf die Erscheinungen der atmosphärischen Elektricität." (Braunschweig, 1901.)
3 "Terrestrial Magnetism," vol. vi. p. 97 (1901).

1 In a paper read before the American Physical Society, December, 1902.
2 C. T. R. Wilson, Camb. Phil. *Proc.*, vol. xi. p. 428; vol. xii. pp. 17 and 85; M'Lennan, *Phil. Mag.*, April.

with increasing distance from the region of precipitation.

We may, on the other hand, suppose that there are everywhere other influences opposing or neutralising the ion of electricity in the direction of the electric field; so that no earth-air current results. Geitel has offered an explanation of the maintenance of the electric field in fine weather based on a difference between positive and negative ions which was discovered by Zeleny. Negative ions are more mobile than positive, they travel with greater velocity in an electric field and diffuse more rapidly. In consequence a body exposed to a current of ionised air becomes negatively charged; Geitel suggests that the surface of the earth may acquire its negative charge in a similar way. The difference in the velocities of diffusion of the positive and negative ions could not, however, maintain an electric field except close to the ground, unless air currents were present to carry up the positively charged layers produced at the earth's surface.

It is quite conceivable that we may be driven to seek an extra-terrestrial source for the negative charge of the earth's surface. The study of the aurora borealis has led several observers to the conclusion that the sun emits kathode rays, which are deflected by the earth's magnetic field, and travel in helical paths round the magnetic lines of force towards the poles. It is conceivable that very penetrating rays of this type (*i.e.* negatively charged electrons) may traverse our atmosphere unabsorbed, and be stopped in the solid mass of the earth, giving to it their negative charge.

We have now to consider the electrical phenomena accompanying precipitation. As already indicated, precipitation is nearly always associated with the occurrence of negative values of the potential gradient. Heavy showers of rain, snow, or hail are accompanied by rapid alternations of high positive and high negative values of the electric field, generally too high to be measured by electrograph apparatus arranged to suit fine weather conditions. In extreme cases we have thunderstorms. There are cases of rain not associated with negative potential gradients; these are practically all cases of slight rain, generally mere wet mist or drizzle. Clouds from which rain is not falling rarely show marked electrical effects. To find by direct observation whether rain is charged with electricity is a matter of extreme difficulty. Elster and Geitel's observations appear to show that raindrops are charged, and that the sign of the charge frequently changes during a shower, negative values, however, on the whole prevailing.

The following are possible factors in the production of the intense electrical fields which accompany heavy showers.

A less degree of supersaturation is required to make water condense on the negative than on the positive ions (C. T. R. Wilson, *Phil. Trans.*, vol. cxciii. p. 289). Thus, if condensation takes place from the supersaturated condition, the drops formed are likely to be negatively charged; that the drops, formed in ionised air by expansions slightly exceeding that required to cause condensation on negative ions, are actually negatively charged has been proved by H. A. Wilson (*Phil. Mag.*, April). Since, however, each drop will only carry the very small ionic charge, the electrical effect will be small if only a few large drops are formed; if a large number of negative ions serve as nuclei of condensation, the drops will be small, and will only fall slowly relatively to the air; the resulting electric field cannot exceed that which drives positive ions downwards as fast as the negatively charged drops fall under the action of gravity. The field initially produced may, however, be strong enough to induce coalescence of drops which come in contact (Lord Rayleigh, Roy. Soc. *Proc.* xxviii. p. 406), and we may thus get drops carrying many times the charge of one ion, and large enough to fall rapidly. Strong fields may then result.

Again, we should expect (NATURE, vol. lxii. p. 149) drops falling through ionised air to become negatively charged as a result of the difference in the mobility of the positive and negative ions. This effect has, in fact, been experimentally demonstrated by Schmauss (*Ann. d. Physik*, vol. ix. p. 224).

If collisions resulting in splashing occur between raindrops (and they are likely to be frequent in the uprush of air in thunderstorms), positively charged rain may be formed. For, as Lenard has shown, when splashing of pure water occurs, as, for example, in waterfalls, the air in the neighbourhood acquires a negative, the water a positive, charge.

Apart from the Lenard effect, the splashing resulting from the collision of drops in an electric field may have large effects, either in intensifying or diminishing the electric field already existing, the action being like that of an electrostatic influence machine. The result would be to increase the intensity of the field if the splashes were thrown out from the lower portion of the combined drop. If, for example, the field were such as to produce positive electrification on the lower surface of a neutral drop, a droplet leaving the lower surface would be positively charged, and being carried upwards by the air relatively to the large drop, would add to the intensity of the primary field.

C. T. R. WILSON.

RAINFALL AND RIVER FLOW IN THE THAMES BASIN.[1]

THE Water Committee of the London County Council in December, 1902, called upon their chief engineer for a report on the diminution of the volume of water in the Thames and Lea, and his report was submitted to the Council in February. It deals briefly with the geology of the Thames and Lea basins so far as geology affects waterworks engineering, and in greater detail with the rainfall and the flow of the streams. The general result of the inquiry is thus stated:—

"For the past twenty years there has been a decline over the Thames watershed of an annual average of nearly 2½ inches below the mean rainfall of 28·50 inches, as computed by the late Mr. Symons for the forty years 1850–89; and I may add that this diminution has become more accentuated during the last five years. This decline is reflected in the diminished flow of the river as gauged at Teddington Weir, the natural flow having fallen to an average of 1110½ million gallons daily at the intakes for the 20 years compared with 1350 million gallons over the 1850–89 period, showing a loss to the river of 239½ million gallons per day. As the diminished rainfall of 2½ inches equals 105 million gallons per day (after making an allowance for evaporation, &c., of roughly 70 per cent.), and the above diminished flow of 239½ million gallons shows a difference from this of 134½ million gallons daily, it would appear as though the condition of the river was becoming more acute, inasmuch as more rainfall would be required year by year to produce the long-period average rate of flow; in fact, what this means is that the percentage of total rainfall which reaches the river is diminishing as well as the total rainfall itself. Of course, against these facts we have the possibility of a long series of wet years, which

[1] London County Council. Shrinkage of the Thames and Lea Report by Maurice Fitzmaurice, C.M.G., Chief Engineer. Pp. 18; plates. (London: P. S. King and Co., 1903.)

may bring back the state of affairs which existed on the average during the long period mentioned."

The fact that we are at present in a period of relatively low rainfall is, of course, well known, and as regards the Thames Basin, the following table is quoted, giving the average annual fall deduced from twenty-four well-distributed stations :—

Year	Inches	Year	Inches	Year	Inches	Year	Inches
1883 ...	28·41	1888 ...	28·45	1893 ...	22·08	1898 ...	22·07
1884 ...	22·90	1889 ...	25·65	1894 ...	32·33	1899 ...	24·78
1885 ...	29·15	1890 ...	22·81	1895 ...	26·32	1900 ...	27·88
1886 ...	31·07	1891 ...	33·31	1896 ...	25·82	1901 ...	23·47
1887 ...	21·32	1892 ...	23·02	1897 ...	27·79	1902 ...	21·91

The report points out that the mean rainfall for the ten years 1883–92 was 26.60, and for the ten years 1893–1902 it was 25.44, or more than an inch less. But it is not clearly pointed out that the means of the four consecutive periods of five years give the respective values 26.57 in., 26.65 in., 26.87 in., and 24.02 in., in other words, that on the whole the rainfall was increasing slightly for fifteen years, and fell sharply in the last five. Nor is attention called to the fact that the average rainfall of 28.50 inches for the Thames Basin was arrived at by Mr. Symons in 1893 from the consideration of a much larger number of stations than the twenty-four on which the subsequent values are based, for the ten years 1880–89, which period Mr. Symons showed probably gave the same mean value as the long period 1850–89. It is probable that the latter figures represent the average rainfall of the basin as accurately as so small a number of stations can, and they are at least comparable *inter se*, but it is by no means so sure that they can fairly be compared with the earlier mean value obtained by the consideration of a much larger number of stations. In fact, we are not inclined to look upon the decline in the rainfall as quite so serious as it appears to be from the report, and we are confident that in the course of time, and probably in a comparatively short time, the fall will again reach the average.

The report shows plainly that the diminution in the flow of the Thames (and the same holds good of the Lea) is greater than the diminution of the rainfall. Theoretical considerations suggest that this is what should occur, for the amount of water absorbed by vegetation must be approximately constant, and in a dry year evaporation is usually more active than in a wet one, while, when the water-level in the pervious rocks is lowered, the flow of springs cannot respond to the rainfall with the promptitude usual when the rocks are saturated.

It is a matter of regret that hydrology, as applied to the rivers of the whole British Isles, has not been taken up by any Government department. This report of the County Council shows the interest of the problems involved, and it may be that a more systematic treatment of statistics of rainfall and river-flow would answer the questions which is suggests.

HUGH ROBERT MILL.

ARCTIC GEOLOGY.

AS the report on the geological observations made during the recent Polar expedition of the *Fram*, recently read before the Royal Geographical Society by Mr. P. Schel, of which we have received a separate copy, is only a preliminary one, and the geological terms employed require some revision to make them intelligible to an English reader, a brief notice may suffice, though evidently the results will be very valuable. Under Captain Sverdrup's leadership, Ellesmere Land was crossed, part of its southern and its western coast was traced, with the corresponding side of Grinnell Land, and journeys were made round Axel Heiberg and Ringnes Islands. The collections obtained, which were often considerable, show that the region explored, with the newly discovered islands, consists of formations which were known to occur on the two sides of Smith Sound and on the long chain of islands extending on or near the seventy-fifth parallel from North Devon to Prince Patrick Island, viz. a foundation of crystalline Archæan rocks, largely granitoid, followed by sedimentaries the oldest of which are of Cambrian age, the part immediately following the Archæan being occasionally, as might be expected, an arkose. In some places representatives of the Ordovician and Silurian occur, and, as in the other islands, Devonian and Carboniferous, including the representative limestone, are extensively developed. Mesozoic formations are represented, but apparently on no great scale, and large masses of sandstone, with lignites and shales, are identified by their plant fossils as Tertiary (Miocene or perhaps rather earlier), as in Greenland. In parts of Ellesmere Land and Heiberg Island are various eruptive rocks, porphyrites and diabases, cutting the Archæan and the older sedimentaries. Basalts and dolerites occur in Grinnell Land intrusive in Mesozoic strata, and surface lavas and somewhat similar rocks overlie Carboniferous rocks in Heiberg Island. They are older than the Tertiary shale mentioned above. The region has occasionally been much faulted, and locally crushed up against a "horst" of Archæan rock. It has also been affected by earth movements of late date, indicated by raised beaches and marine terraces, which are at various elevations up to nearly 600 feet, and so prove that the land has risen. There are no large masses of inland ice or signs of glaciers having formerly been on a much more extensive scale than at present. This is probably due, at any rate partly, to a rather small precipitation.

J. V. LABORDE (1830–1903).

DR. LABORDE (Jean Baptiste Vincent), who died recently at the age of seventy-two, was born at Buzet (Lot et Garonne), and received a good education at the Lycée of Cahors, after spending some time in a boarding-school at Casteljaloux. To satisfy his natural bent for medical studies he went to Paris, without any resources, and, in order to provide for his livelihood and his studies, he was obliged to give private lessons. However, he managed to be appointed *externe des hopitaux in* 1854, in the same promotion as Lancereaux, now president of the Académie de Médecine. Four years later, he obtained the *internat*, in which capacity he spent four years more in the hospitals of Paris, after which he was graduated doctor médic. for his thesis on "La Paralysie Infantile" (1864). Meanwhile he had obtained the gold medal of the hospitals, the Corvisart prize, and another prize from the Société Médicale des Hopitaux, and, lastly, in the very year in which he got his doctor's degree, the Godard prize, awarded by the Société Anatomique de Paris.

In 1872 Laborde gave up pure medicine to devote himself to scientific works, particularly to physiology, giving to his researches a solid and safe basis, by means of the experimental method. At first only an assistant to Prof. Béclard, he was soon appointed chef des travaux de physiologie at the Faculté de Médecine, and for many years the demonstrations he gave in his laboratory were attended by numerous pupils. It was in the course of this period that he published the

greater part of his works, always seeking in physiology pathological deductions for the use of practitioners.

As regards pure physiology, he studied the acid of the gastric juice, trying to show that it never existed uncombined (1874–77), the rhythmical function of the heart and its development in the embryo (1876), and more especially the function of the central nervous system, and of the bulb in particular (1877–1880). In this way he showed the existence of two bulbar centres, one acting upon breathing (it was the centre of Le Gallois and Flourens), the other upon the cardiac muscle, which clearly explained the two possible causes of death, either a stop of the respiratory movements with persistence of the beating of the heart or *vice versâ*. He showed also the functional association of the eyes in the binocular vision, owing to the narrow connections between their motor nerves. As regards the physiology of the nerves, again, he revealed the existence of the tractus of crossed hemianæsthesy, published a few notes on the excitability of the nervous centres, the reflex movements, the functions of the semicircular canals (1881), and, lastly, a refutation of the theory which made the cerebellum the seat of muscular strength.

Not less numerous are the works that he published upon experimental and comparative pathology.

But his special study was experimental physiology applied to therapeutics and toxicology; he published works on the properties of many substances, such as the narceine (1866), which he considered as the best sedative of the nervous system; the bromides, the soothing influence of which he investigated (1867–1869); the eserine or alkaloid of the Calabar bean (1869); propylamine (1873); aconitine, the advantages of which he showed as a sedative of sensibility (1875); colchicine, sparteine, boldo, salts of strontium, &c.; lastly, in 1877, he published a study on the alkaloids of cinchona, which he named in the following order, according to their poisonous qualities: Cinchonine, cinchonidine, quinidine. In fact, he made a special study of poisons in general, animal as well as mineral, natural as well as artificial.

In concluding this cursory view of Laborde's works, we cannot do better than mention his ingenious method of the rhythmical tractions of the tongue, which was sufficient to make the name of its inventor known throughout all the world. There is no need to expatiate on this most simple and efficient process of setting the respiratory reflex to work. It is known and used everywhere, and it has called back to life numbers of apparently drowned or suffocated people.

In fact, Laborde was not only a savant, but a great philanthropist, and this quality, together with his profound knowledge of toxicology, brought him to the front as one of the best qualified in the controversy raised recently on the question of alcoholism.

For this reason, Laborde, who had been a member of the Académie de Médecine since 1887, was trusted by this learned body with the report on the essences to be forbidden as noxious, which the Government had required from them. In this work he exhausted what strength was left to him. He strenuously defended every one of his arguments against the objections of his colleagues, and at last succeeded in making them adopt every item of his report. But the work proved too much for him, and he died on April 5. He was vice-president of the Society of Biology, director of the Laboratory of Anthropology at the École des Hautes Études since 1893, and professor at the School of Anthropology. He was besides one of the oldest and ablest scientific journalists. He started *La Tribune Médicale*, a periodical open to all young medical men, which he edited to the last.

He was one of the few French savants who did not belong to the Legion of Honour. Of course, the decoration was several times offered to him, but he thought it a distinction which should be exclusively military, and he never allowed his actions to contradict his opinions. J. DENIKER.

NOTES.

A MEETING of the council of the International Association of Academies is being held this week at the rooms of the Royal Society, that society being the directing academy of the association for the three years' period ending with 1904. The meeting will be attended by delegates from nearly all the principal learned academies of Europe, and will discuss several matters of importance to international science and philosophy, preparatory to the meeting of the general assembly which is to be held in London next year. Representatives of both sections of the association, the natural science section, and the history and philosophy section, will attend the council. In connection with the meeting of the council there will be on Friday a meeting of a special committee appointed to deal with a proposal for the establishment of an international organisation for the investigation of the anatomy of the brain. The foreign delegates were to be received by the president and fellows of the Royal Society at Burlington House on Wednesday evening as we went to press.

THE reply given by Mr. Balfour in the House of Commons on May 26, in answer to a question as to what the Government proposed to do to ensure the safety of the National Antarctic Expedition, was a rebuke which should not be received in silence by the joint Antarctic Committee. Mr. Balfour said:—"The Government are prepared to contribute to the relief of the officers and men on board the *Discovery*, which is now ice-bound in the Antarctic seas. The course taken by the two learned societies responsible for the expedition in respect to the contribution of money and men made by the Government is greatly to be regretted. I have always leaned towards the principle of extending the very limited aid which the British Government have been accustomed to give towards the furtherance of purely scientific research; but such action can only be justified so long as the Government are able to feel absolute confidence that the scientific bodies approaching them have placed before them all the information in their possession as to the estimated cost of their proposed action, and the limits within which they intend to confine it. That confidence has been rudely shaken by the present case." This statement has naturally received much attention, and the Antarctic Committee cannot permit the charges it contains to pass without reply. The two learned societies referred to are the Royal Society and the Royal Geographical Society, and the management of the expedition is in the hands of a joint committee of these bodies. From the beginning, however, the Royal Geographical Society has exerted a preponderant influence in the organisation of the expedition, and the Royal Society has yielded to it against the advice of its own representatives. When vital matters connected with the conduct of the expedition were in dispute in 1901, we on several occasions criticised the methods adopted, and regretted that the Royal Society had not taken a firmer position. Because the council of the Royal Geographical Society would not accept the recommendations of the joint committee, the Royal Society allowed itself to be overruled, though Sir Archibald Geikie, Prof. E. B. Poulton and Mr. J. Y. Buchanan objected to the surrender. The whole story was told in a letter sent by Prof. Poulton to fellows of the Royal Society, and published in NATURE of May 23,

1901. This protest was, however, disregarded, with the result that the Society now finds itself held responsible for management which has really been left to the geographers. The *Daily Mail* has published several articles in which the joint committee is severely handled, and the facts disclosed as to the estimated and actual costs of the expedition are, to say the least, such as will not encourage the public to believe in the foresight and business capacity of men of science.

THE condition of the German Antarctic Expedition which, under the command of Dr. von Drygalski, left Germany in August, 1901, is causing great anxiety, and hurried preparations are being made for the dispatch of a relief expedition this summer. It will be remembered, a correspondent of the *Pall Mall* remarks, that a station was erected on Kerguelen Island in January, 1902, which was intended to serve as a place of observation and as a base for the expedition ship *Gauss*, which was to penetrate much farther south. Those who were at the station, however, suffered terribly from the climate, and then were attacked by beriberi, which appears to be endemic in that part of the world. This malady carried off the greater number of those who were afflicted with it, among them being Dr. Enzensperger, the meteorologist. The *Gauss* sailed south, but as nothing has been heard of her for a long time it is feared that she is lost, and doubts have been expressed that any of her present officers and crew will ever be heard of again. An attempt is, however, to be made to find them. The matter was discussed in the Reichstag a few days ago, and about 25,000*l.* was unanimously voted for a relief expedition. Preparations for departure will not be begun until the middle of next month—the latest time, according to scientific opinion, that the *Gauss* could by any chance make her way out of the vast fields of ice over which the terrible severity of an Antarctic winter is now spreading.

THE fifth International Congress for Applied Chemistry is being held in the Imperial Diet Building at Berlin, under the presidency of Prof. Dr. Otto N. Witt. About 2200 members, accompanied by more than 300 ladies, are attending the Congress, at which the European States and several other States are represented by official delegates. The chief British societies, that is, in addition to the Chemical Society, the Institute of Chemistry, the Society of Chemical Industry, the Society of Public Analysts, the Federated Institute of Brewing, the Royal Societies of London and Edinburgh, the Iron and Steel Institute, the Royal Institution, the British Association and other bodies, nominated delegates for the organising committee. The Congress will deliberate in eleven sections and three subsections. The German Electrochemical Society, which last year adopted the name of German Bunsen Society for Applied Physical Chemistry, will also hold its annual meeting at Berlin during this week, and will take charge of the tenth electrochemical section. This section, however, will meet in the Physical Institute of the University of Berlin. The congress offices, so far at 31 March Str., Charlottenburg, will be removed to the Imperial Diet Building (Reichstags-Gebaüde) on June 2, and a post office has been opened in this building for the convenience of members. There are 350 papers and reports to be read. The great electrical works of Berlin and some other works will be thrown open to members, but no chemical works apparently. The city of Berlin will entertain the Congress, and an excursion to the Havel Lakes has been arranged for Sunday, June 7.

THE proceedings of the International Telegraph Conference, at which nearly fifty different States are represented, commenced last week, and will continue day by day during this month. The proceedings are private. Mr. J. C. Lamb, the principal delegate of Great Britain, has been elected president of the conference, and Messrs. J. Ardron and P. Benton vice-presidents. This is the ninth conference which has been held; at the last the cable companies have been represented as well as the various States. In addition to the business of the conference, dinners and other entertainments have been arranged in connection with it; a dinner was given last week by the Submarine Telegraph Companies at the Hotel Cecil, Sir J. Wolfe-Barry presiding, and nearly 500 guests being present. The president of the Institution of Electrical Engineers entertains the delegates and the Institution at a concert at the Albert Hall on June 11, and the conversazione of the Institution will also be held during the sitting of the conference.

MR. MARCONI is reported to have said on his return to England last week that it will be another six weeks before Transatlantic communication will be resumed. The precise nature of the breakdown has not been published. The American company proposes to extend greatly the system in America by establishing new stations in New York and on the great lakes. It is also stated that the report that Mr. Marconi was suffering from nervous breakdown and would have to take a prolonged rest is unfounded.

THE council of the Institution of Electrical Engineers has received and accepted an invitation from the American Institute of Electrical Engineers to visit the United States in 1904. The McGill University, of Montreal, has invited the two Institutions to hold a joint meeting in their building at this time. The invitations, both from the American Institute and the McGill University, are couched in the most cordial terms, and the council hopes that it may be possible to arrange not only for a visit to the eastern States of America and to the St. Louis Exhibition, but also for the proposed joint meeting in Canada.

THE report of the council of the Institution of Electrical Engineers, adopted at the annual general meeting held on May 28, is a record of real scientific activity and progress. The Institution is exerting the best of influences upon electrical science, and its work and scope are rapidly extending. Mr. Robert Kaye Gray has been elected president in succession to Mr. Swinburne. A new local section has been formed with its centre at Leeds, embracing the whole of Yorkshire with the exception of Middlesbrough and the Cleveland district, which were already included in the area of the Newcastle local section. The council has awarded the following premiums for papers and communications:—the Institution premium, value 25*l.*, to Dr. J. A. Fleming, F.R.S., for "Photometry of Electric Lamps"; the Paris Electrical Exhibition premium, value 10*l.*, to Mr. M. B. Field, for "A Study of the Phenomenon of Resonance in Electric Circuits by the Aid of Oscillograms"; two extra premiums, value 10*l.* each, one to Messrs. A. D. Constable and E. Fawssett jointly, for "Distribution Losses in Electric Supply Systems"; and the other to Dr. W. M. Thornton, for "Experiments on Synchronous Converters"; an original communication premium, value 10*l.*, to Messrs. A. Russell and C. C. Paterson, for "Sparking in Switches." Students' premiums have been awarded to Messrs. J. Griffin, F. J. Hiss, E. Fisher, A. G. Ellis, and T. H. Vigor. Salomons scholarships, value 50*l.* each, have been awarded to Mr. G. B. Dyke, of University College, London, and to Mr. H. W. Kefford, of the Central Technical College. The award of the David Hughes scholarship, value 50*l.*, has been made to Mr. W. H. Wilson, of King's College, London.

IT has been decided to christen the new society of electrochemists "The Faraday Society," the object of the Society, as stated in a subtitle, being to promote the study of electrochemistry, electrometallurgy, chemical physics, metallography, and kindred subjects. It is proposed to start work at once by beginning a half-session on July 1, the first ordinary meeting being fixed for June 30; the papers to be read will be announced in due course. Arrangements have been made to publish the proceedings in the *Electrochemist and Metallurgist*, which will be issued free to members; the papers will be circulated before being read, a plan which it is hoped will improve the discussion upon them. It is also hoped that it will be possible to supply members with the *Transactions* of the American Electrochemical Society, either free or at a very small cost. The first president is Mr. J. W. Swan, F.R.S., and the vice-presidents are Prof. Crum Brown, Lord Kelvin, Sir O. Lodge, Dr. Ludwig Mond, Lord Rayleigh, Mr. A. Siemens and Mr. J. Swinburne. A set of rules has been drawn up by the council; these and any other particulars can be obtained from the secretary, Mr. F. S. Spiers, 82 Victoria Street, S.W. We wish the Society all success.

WE regret to have to announce that Dr. A. A. Common, of Ealing, died very suddenly on Wednesday morning last.

SIR WILLIAM RAMSAY, K.C.B., F.R.S., has been elected a corresponding member of the Academy of Sciences of Vienna.

THE presentation of the Hofmann medals to M. Henri Moissan and Sir William Ramsay is to take place at the Hofmann-Haus, Berlin, to-day, June 4.

THE annual conversazione of the Society of Arts will take place at the Royal Botanic Gardens, Regent's Park, on Tuesday, June 30.

IT is expected, says *Science*, that the International Electrical Congress will be held at St. Louis, during the week beginning September 12, 1904. It will immediately precede the International Congress of Arts and Sciences.

AT the anniversary meeting of the Linnean Society on May 25, Prof. S. H. Vines, F.R.S., was elected president for the ensuing year. The Linnean medal was presented to Dr. M. C. Cooke.

ACCORDING to a Reuter message from Paris on May 30, a telegram from Fort de France, dated May 28, states that the volcano of Mont Pelée is again showing activity, and that the Council-General of Martinique is urging the evacuation of the whole of the north side of the island.

ACCORDING to a Press despatch from Washington, dated May 13, the executive committee of the Carnegie Institution reports that the entire sum of 40,000*l.* allotted to grants for original research has been distributed, and that of the 8000*l.* set aside for publications to be made this year, 4000*l.* has been assigned to special publications. No more grants for researches will be made until after the next meeting of the board of trustees, which will be held in December.

A TERRIFIC tornado passed over the southern portion of Gainsville, Georgia, at noon on Monday, June 1, destroying several large buildings and killing sixty-four persons. The track of the tornado was about one hundred yards wide, and the damage done was confined to it. The storm came with great suddenness, and within a couple of minutes the two upper stories of a four-story brick-built factory were carried away to distances of hundreds of feet. During the tornado deep darkness prevailed, and the air was hot and oppressive. Five minutes later the sun was shining.

EXTRAORDINARY rains in parts of the United States have caused great damage and loss of life by floods in the Indian Territory, Oklahoma, Kansas, Missouri, Nebraska, and Iowa. At North Topeka, Kansas, seven thousand out of the ten thousand inhabitants left the city on May 30 to escape the deluge. One hundred and fifty persons are known to have been drowned. The rescued say that the whole of North Topeka was flooded on Friday faster than the people could get away. On May 30 the level of the Kansas River rose at the rate of three inches an hour. On June 1 the Missouri River was thirty feet above low-water mark at Kansas City, and was rising rapidly.

ON Saturday afternoon, May 30, and following night London was visited by two violent thunderstorms. Storms of a destructive character, resulting in loss of life, also occurred over a great part of England, especially in the Thames Valley, and were apparently due to the passage of small cyclonic depressions moving slowly from south-east to north-west. Heavy downpours of rain accompanied or followed both storms, but its intensity varied considerably; about an inch and a half fell during the first storm in one of the southern suburbs of London, while at a distance of a very few miles, where the thunder and lightning appeared to be equally violent, the fall only amounted to a few tenths of an inch. The heat was oppressive; near London on Whit Monday the thermometer in the screen rose to 83°, and the weather was exceptionally brilliant in the south and east of England generally, but dull and cool in the north and west.

THE *Times* states that the master of the trawler *City of Lincoln*, which arrived at Kirkwall on June 1 from Iceland, reported that on the night of May 27, off the south-east coast of Iceland, a volcanic eruption was observed a considerable distance to the eastward, probably at Mount Hekla. Dust fell on the deck of the trawler, and the sea was discoloured to a distance of about thirty miles from the island.

A REUTER message from Constantinople on May 26 states that belated reports have been received of the earthquake at Van on April 29, by which the town of Melazgerd was totally destroyed, with its entire population, numbering about 2000 persons. More than 400 houses in neighbouring villages collapsed. A somewhat severe shock of earthquake was felt in Constantinople on the morning of May 26, but no damage was done. Further particulars of the earthquake at Van are contained in a despatch from His Majesty's Consul at Erzerum. The villages of Patnotz, Hadjili, Mollah Ibrahim, Zoussicko and Molla Mustapha were completely destroyed with the exception of the mosque, school and two houses. Seventeen other villages have been partially destroyed. In Sipoki the villages of Mollah Hassan, Berdav, Mirzeh, Kara Khelil Alia have been completely destroyed, and eight other villages partially destroyed. It would appear that the centre of the seismic disturbance was in the neighbourhood of Mount Sipan, and the area of its greatest violence extended along the valley of the Eastern Euphrates, covering the Kazas of Boulanyk and Melazgerd, and the Patnotz district.

AS already announced, the autumn meeting of the Iron and Steel Institute will be held at Barrow-in-Furness on September 1-4, under the presidency of Mr. Andrew Carnegie. The programme will embrace visits to works, docks, and iron ore mines, and excursions will be arranged to the Lake District and to Blackpool. A detailed programme will be issued when the local arrangements are further advanced. This programme will contain a list of the papers that are expected to be read.

THE twenty-first congress of the Sanitary Institute will be held at Bradford on July 6–11. The inaugural address to the congress will be delivered by the president, the Right Hon. the Earl Stamford. Numerous sectional meetings will be held, the sections with their presidents being as follows :— (1) Sanitary science and preventive medicine, Prof. T. Clifford Allbutt, F.R.S.; (2) engineering and architecture, Mr. Maurice Fitzmaurice, C.M.G.; (3) physics, chemistry and biology, Prof. C. Hunter Stewart. On July 8 there will be conferences of those engaged in the various branches of practical sanitary science, and in the evening a conversazione and reception by the Mayor of Bradford. The concluding day will be devoted to excursions.

THE Physical Society has for several years held its meetings at Burlington House, but the fellows have been given notice that a change is contemplated. It is proposed to hold meetings on the second and fourth Fridays of the month alternately in the afternoon and the evening at the Royal College of Science, South Kensington. The council trusts that convenience and equipment available when the Society meets in a physical laboratory will encourage fellows to illustrate their papers by experiments, and thus add to the interest of the meetings. The council has also under consideration the formation of a student class in the Society. This matter will shortly be brought forward at a special general meeting.

MR. R. S. EARP writes from Buckfastleigh, South Devon, to say that on comparing the results of Prof. Thorpe's analysis of the dust of "red rain" (p. 53) with his own, the chief dissimilarity was found in the amount of organic matter. This may be explained by the fact of Prof. Thorpe's analysis being of the sediment only of the rain, whereas Mr. Earp's was of the rain itself, or rather of the solid constituents of the rain. The rain collected did not clear itself even on long standing, the supernatant liquid being emulsion-like in appearance. Mr. Earp concludes "that the greater portion of the organic matter would exist suspended in the fallen rain, and so would not appear in the result of Prof. Thorpe's analysis."

THE scientific balloon ascents on April 2 were participated in by France, Germany, Austria, Russia, and Blue Hill, U.S., and were made by means of manned and registering balloons, and kites. At Trappes the registering balloon burst at 8550 metres; minimum temperature −47°·0 C. (at starting 6°·8). At Itteville (Paris) the ascent was made in the evening; temperature −54°·0 at 9560 metres (at starting 8°·0); an altitude of 12,760 metres was reached. At Strassburg a height of 10,000 metres was attained; minimum temperature −44°·4, at starting (5h. a.m.) 5°·7. At Berlin one of the several balloons dispatched reached 10,400 metres; at 8380 metres the temperature was −42°·0 (at starting 2°·0), while another, started two hours earlier (4h. 57m. a.m.), recorded −47°·8 at 8670 metres. At Blue Hill a kite reached 3067 metres, temperature −6°·2; at the same time the temperature at the observatory was 8°·1 (height 159 metres). Atmospheric pressure was fairly uniform over Europe on the day of the ascents, and the type of weather was generally cyclonic in character.

IN a paper read before the R. Accademia delle Scienze dell' Istituto di Bologna on January 11, Prof. A. Righi describes experiments on the ionisation of air by an electrified point. Some striking results depending on the motion of the ions along the electric lines of force were obtained. A sheet of ebonite backed by a metal plate was fixed in front of a point discharge, and between them was placed a wire gauze screen, which closed an aperture in a metal case surrounding the discharge. A spark from a Leyden jar to the metal plate produced for a short time a powerful electric field traversing the ebonite plate and the air space between it and the gauze. A well-defined image of the wire gauze was then developed upon the ebonite by treating it with a mixture of powdered sulphur and red lead, which made visible the portions of the ebonite to which the ions had imparted a charge. The "electric shadow" of the wire remains free from charge.

A NEW form of stereoscope for X-ray work is described by M. T. Guilloz in a recent number of the *Journal de Physique*. A single X-ray tube is used, being so mounted that it can be rapidly oscillated between two positions. A cam rotating at a speed of about 300 revolutions per minute is used to oscillate the tube; this cam is cut so that the time taken in moving from one position of rest to the other is about 1/10th of the time of rotation. Two radiographic images of the object under examination are thus formed on the screen which are displaced by an amount varying as the amplitude of oscillation of the tube and its distance from the screen. Two shutters, controlled electromagnetically by the oscillating apparatus, allow the right eye to view one image and the left the other, vision being entirely cut off during the time the tube is changing its position. There results, naturally, from the combination of these images an apparently solid reproduction of the object. It is claimed that the method is superior to those employing two tubes, or a tube with two anti-kathodes, as in these cases it is always difficult to obtain equal effects from both tubes or anti-kathodes. It is also stated that the tubes used by the author were not injuriously affected by the vibration.

THE Canadian Department of the Interior has issued a clearly printed map of Manitoba on the scale of an inch to 12½ miles. It will be useful to those desirous of taking up land in the country.

PARTICULARS of the mode of occurrence and removal of a carcase of the mammoth which had been discovered in 1901 in the province of Iakousk, in Siberia, are contributed with illustrations by M. L. Elbée (*La Nature*, May 23). The remains were half embedded in the snow and ice, and there were still preserved the eyes, the mouth, and even the stomach. Measurements showed that the animal was about 3 metres in length and 2 metres in height, and must have weighed about 1000 kg. The specimen has not yet been exhibited in public owing to the great difficulties experienced in preserving the skin.

IN the annual report for 1902 of the State Geologist of New Jersey, Mr. H. B. Kümmel, there is an account of the copper deposits of the State, by Mr. W. H. Weed. Copper minerals occur at many localities in the crystalline rocks and in the Triassic Red Sandstones, but only in the Red Sandstones are they of economic value. In these rocks the ores are almost always associated with basalt, dolerite, and diabase of very uniform chemical composition, and from these basic igneous rocks, in the opinion of Mr. Weed, the copper ores have been derived.

IN the account of the embryogeny of Zamia which Profs. Coulter and Chamberlain present in the *Botanical Gazette*, they show that during this stage of development the features of Zamia are intermediate between those presented by Cycas and the Conifers.

IN the Philippine Islands Government laboratories were organised by the United States authorities in 1901, and Dr. R. P. Strong was appointed director. The first annual report gives evidence of much work carried out under un-

favourable conditions in temporary laboratories. The work of the biological department is mainly pathological, and is concerned with the study of Asiatic cholera and other tropical diseases. New laboratory buildings are announced, in which special facilities will be offered to foreign men of science who wish to undertake research work.

THE Californian red wood, *Sequoia sempervireus*, forms the subject of a *Bulletin* issued by the U.S. Department of Agriculture. Natural reproduction by seedlings is rare, as these require plenty of light, but the writer, Mr. Fisher, shows that effective second-growth is produced by sucker shoots. A brown rot disease affecting the standing tree is described by Prof. von Schrenck, but the cause of the disease which is said to arise in the heart wood has not been determined. Another *Bulletin*, by Mr. Foley, affords good proof of the value of careful lumbering as adopted on the Sewanee University Estate, Tennessee.

IN addition to some half-dozen short excursions to places of interest of easy access, and one long excursion to the north Donegal coast, beginning on July 10, which it has arranged, the Belfast Naturalists' Field Club is offering for competition during the session ending March 31, 1904, nineteen prizes, generally of the value of one pound, and in other cases of ten shillings, for collections of different botanical, geological and zoological objects. The prizes are to be in books or suitable scientific objects. Among the collections asked for may be mentioned the best herbarium of local flowering plants, representing not less than 150 species, with notes on variations adapting the plants to special environments; the algæ of Larne Lough, with an account of distribution; the algæ of Belfast Lough; fossils from the Rhætic and Lias of Ulster; and the best set of twelve photographs illustrative of any one branch of Irish archæology. A prize is also offered for the best original account of the habits of any marine annelid.

AN interesting interim report upon Cape horse-sickness has been published by Dr. Watkins Pitchford, the Government bacteriologist of Natal. In some respects this disease resembles human malaria, for it especially attacks horses kept on low-lying marshy ground, and those animals left to graze all night. In affected districts horses may be moved during the day without contracting the disease. Dr. Pitchford now suggests that a mosquito, probably of the genus Anopheles, is responsible for the conveyance of the infection. He has stalled horses by night in stables protected by wire gauze, or by a smoky atmosphere, in an infected district, with the result that they all remained perfectly well, whereas horses kept around and similarly treated, with the exception of the protection afforded by the wire gauze or smoke, succumbed. He therefore believes that it is established that horses protected from the attacks of winged insects enjoy immunity from horse-sickness.

THE January issue of the *Proceedings* of the Philadelphia Academy contains a list of the polycistid gregarines of the United States, by Mr. H. Crawley, and an account of the habits of spiders, by Dr. T. H. Montgomery.

WE have received three parts (Nos. 10–12) of Manchester Museum *Notes*, in two of which Prof. W. B. Dawkins deals with the older rocks of the Isle of Man, while in the third he describes certain iron implements found in the old "camp" in Bigbury Wood, near Canterbury. These implements prove that the camp belonged to the prehistoric period, and from this it is inferred that the well-known "Pilgrims' Way," which traverses such a large extent of country in the south of England, likewise dates from that epoch.

THE greater portion of the May number of the *Quarterly Journal of Microscopical Science* is occupied by an important paper from the pen of Mr. H. J. Hansen, of Copenhagen, on the genera and species of the myriopod order Symphyla. The first known species was described 138 years ago, and the order is now known to contain at least 100 species. The other contents of this part include an account of the body-cavity and nephridia of the Actinotrocha larva, by Mr. E. S. Goodrich; a description of various acorn-worms (Enteropneusta) from Madras, by Mr. R. K. Menon; and a notice of the radiolarian *Planktonetta atlantica*, by Dr. G. H. Fowler. The latter organism is distinguished from all other members of its group by the possession of a float, a diaphragm, and a single bundle of tubes of communication.

THE *Times* of May 19 contains a notice of the results of the survey of the fishes of the Nile, undertaken by the Egyptian Government, in cooperation with the trustees of the British Museum, which has just been brought to a conclusion, after three and a half years' hard work by Mr. W. S. Loat, who has had charge of the operations. The scheme was due to the initiation of the late Dr. John Anderson, and although, so far as the discovery of new species is concerned, its results have been disappointing, it has yielded important information with regard to distribution. Previous to the survey, the number of species of fish known to inhabit the Nile was about 90; it is now more than 100, Mr. G. A. Boulenger having described 14 new species from among a collection of between 9000 and 10,000 specimens. Mr. Loat carried his survey far up both the Blue and the White Niles, and thus completed the work begun in the early "sixties" by Consul Petherick. It is satisfactory to learn that Mrs. Anderson has made arrangements for the publication of a volume on the fishes of Egypt in the same style as those on the mammals and reptiles.

A USEFUL manual for practical photographers, by Mr. Alfred Watkins, entitled "The Watkins Manual of Exposure and Development," has reached a second edition. The text-book is published by the Watkins Meter Company, of Hereford, and contains much information likely to prove of service to photographers who already have some acquaintance with the subject, as well as to beginners.

THE fourth edition of the "Official Guide" to the Belfast and Northern Counties Railway, which has reached us, will provide the visitor to the north of Ireland with just the information he will want. The guide is liberally supplied with maps and illustrations, and there are notes on places and objects of scientific interest. The book is published by Messrs. R. Carswell and Son, of Belfast, and costs sixpence.

A NUMBER of attempts have been made at various times to introduce standard points on the temperature scale other than the freezing point and boiling point of water, and for high temperature work, especially the standardisation of platinum resistance thermometers, Messrs. Heycock and Neville have recommended the use, as a third standard temperature, of the boiling point of sulphur. The *Zeitschrift für physikalische Chemie* for April 23 contains an account of a very careful determination, by Messrs. T. W. Richards and R. C. Wells, of the position on the international hydrogen scale of a standard temperature intermediate between the freezing point and boiling point of water. As the mean result of twenty-two determinations made with four different thermometers, it was found that the transition temperature at which the monohydrate and the dekahydrate of sodium sulphate were both in equilibrium with an aqueous solution of the salt lay at $32{\cdot}383^{\circ} \pm 0{\cdot}001$.

The water used was purified by distilling twice and freezing in a platinum vessel, and the sodium sulphate was crystallised until it gave a constant transition temperature.

THE additions to the Zoological Society's Gardens during the past week include a Serval (*Felis serval*) from South Africa, presented by Mr. C. H. Firmin; a Harlequin Elaps (*Elaps fulvius*) from Central America, presented by Captain J. B. Gilliat; a Greater Sulphur-crested Cockatoo (*Cacatua galerita*) from Australia, deposited; a Chinchilla (*Chinchilla lanigera*) from Chili, purchased; a Japanese Deer (*Cervus sika*), a Sambur Deer (*Cervus aristotelis*), a Red Deer (*Cervus elaphus*), a Thar (*Hemitragus jemlaicus*), an American Bison (*Bison americanus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

A REPORTED PROJECTION ON MARS.—A Reuter's correspondent at Cambridge, U.S.A., states that the Harvard College Observatory at Flagstaff reports the discovery of a large projection on Mars at 3.35 a.m. (G.M.T.) on May 26. The position angle of the projection is given as 200°.

REPORT OF THE OXFORD UNIVERSITY OBSERVATORY.—From the report of this observatory for the period May 1, 1902, to April 30, 1903, just issued by Prof. H. H. Turner, we learn that of the 1180 plates which had to be measured and reduced for the Astrographic Chart, 1100 are now completed, 170 of them having been finished during the period with which the report deals.

When these measurements are completed it is proposed to undertake the measures of the plates, obtained during the opposition of 1900–1901, of the planet Eros, for the purpose of obtaining a more trustworthy value for the solar parallax, this work having been undertaken as a supplementary labour by the International Astrographic Committee.

Paragraph vi. of the report gives an account of the fortuitous discovery of Nova Geminorum, which possibly would not have been discovered at Oxford but for the fact that the first batch of plates used in photographing the Nova's region for the Chart proved faulty, and thereby rendered it necessary that this zone should be rephotographed. It was whilst photographing the zone the second time that Mr. Bellamy used the Nova as a "setting" star, thereby causing the inquiry to be set on foot, when the plate came to be measured, which led to the happy discovery that the bright star he had used in setting his instrument was a hitherto unknown object.

PERIODICITIES OF THE TIDAL FORCES AND EARTHQUAKES.—In a paper communicated to No. 3, part ii., vol. lxxi. of the *Journal* of the Asiatic Society of Bengal, Mr. R. D. Oldham, of the Geological Survey of India, discusses the relations between the periodicity of the earthquake shocks recorded by a seismograph set up at Shillong, Assam, during the period August, 1897, to December, 1901, and the periodicity of the tidal forces obtaining at that place during the various relative positions of the sun and moon.

After deducing the reasons for expecting the shocks to appear at certain times during the day and night when the tidal force is at a maximum at the place of observation, Mr. Oldham sets out the recorded shocks in a series of tables and curves. On examining these it is clearly seen that there was a real and a very large variation in the diurnal distribution of shocks in Assam during 1897–1901, their greatest frequencies occurring at 10–11 p.m. and 6–7 a.m., and superimposed on this regular but unexplained variation there was a smaller one, which appears to have been due to the tidal stresses set up by the attraction of the sun. If this latter variation is really due to tidal stress, it then appears that the horizontal component of the stress is much more effective than the vertical component, whilst the effects are more dependent on the rate and range of the stress than on its amount.

Mr. Oldham points out that these results are purely provisional, dealing as they do with only a short period of observation in one particular locality, but urges that they are definite enough to warrant the obtaining of a longer record at a place, situated within or near the tropics, where earthquakes are of frequent occurrence.

MISHONGNOVI ANTELOPE-SNAKE CEREMONIES.[1]

IN each of five of the seven Hopi pueblos of Arizona are performed during each year from eight to twelve ceremonies of nine days' duration. The rites of the first eight days are secret, and have certain elements in common; all terminate on the ninth day in a public performance, which has many elements of a gorgeous pageant.

Of the summer ceremonies, those held by the Antelope and Snake societies, which cooperate, are the most spectacular and best known. They alternate in each village annually, with the ceremonies performed by the Drab- and Blue-Flute societies. Thus, in even years, the Snake and Antelope societies perform in Oraibi, Shumopovi and Shipaulovi, and all Flute societies in Mishongnovi and Oraibi; in odd years, the reverse is true.

The time of the Snake-Antelope ceremonies is determined by the date of the last day of the Niman ceremony, which occurs in July, and at which time the Katcinas and masked gods disappear until the following winter.

Four days from this time, certain priests of the Snake-Antelope societies meet in a room, make certain *bahos* or prayer sticks, which are deposited in a shrine on the following morning, at which time the village Crier announces from the house-top the date of the first day of the Snake-Antelope performance, four days hence.

At that time, the chief priests of the Snake-Antelope fraternities meet in their respective *kivas* or underground chambers. During the next four days, the Antelope priests gather in constantly increasing numbers in their *kivas*, make *bahos*, indulge in fraternal smoking, and on the fifth day, prepare on the floor of their *kiva* a sand picture and erect their altar.

During this time the Snake priests have been engaged in a ceremonial hunt for snakes, scouring the country to the north on the first day, on the west on the second, &c.

Very early on the sixth, seventh, eighth and ninth days the Antelope priests gather about their altar, and, reinforced by the chief priest of the Snake society and two personages representing the Snake Youth and Antelope Maiden of the legend, sing eight traditional songs. These performances are the most beautiful and sacred of the entire ceremony. On the eighth and ninth days of this singing ceremony there is the added element of two Snake men, dressed as Kalehtaka or Warriors, who perform with the bull-roarer and lightning-shooter, after which they, with an Antelope priest and fifty or sixty young men of the village, repair to a spot in a plain far below the mesa, where, after the deposition of *bahos* and the laying of cloud symbols by the Antelope priest, there begins a spirited and exciting race on the part of the young men to the summit of the mesa. The winner of the race on each morning receives from the hands of the chief of the Antelope priests a small netted gourd containing water from the medicine bowl, which has been fertilised by smoke, which he later deposits in his field.

On the afternoon of the eighth day occurs a public performance in the plaza, participated in by all the Antelope and Snake priests, properly costumed, at which time the Antelope men in turn carry in their mouths a corn-husk packet, receiving it from the *kisi* or booth of cottonwood especially erected in the plaza for this purpose.

On the ninth day occurs the most sacredly guarded event in the Snake *kiva*. At noon the snakes, numbering from sixty to eighty, one-third or one-fourth being rattlesnakes, which have been guarded in this *kiva* in earthenware jars, are placed in one large bag. The Snake priests gather along one side of the *kiva* in line, seated upon stones. In front of the chief priest is a bowl containing medicine water.

[1] "The Mishongnovi Ceremonies of the Snake and Antelope Fraternities." By George A. Dorsey and H. R. Voth. Field Columbian Museum Publication 66, Anthropological Series, vol. iii. No. 3.

The Snake priests begin shaking their snake whips, beating time to the set of traditional songs which they now sing; the chief priest now plunges his hands into the sack and grabs as many snakes as possible, and thrusts them into the medicine bowl in front of him, then violently casts them upon the floor of the *kiva* immediately in front of the priests, the floor having been covered with a two-inch layer of sand. This continues until all the snakes have been

FIG. 1.—Antelope Priests leaving the Kiva.

washed, the priests herding the snakes with their whips, hands and bare feet.

The remainder of the afternoon is spent by the priests of both fraternities in properly costuming themselves for the final and public performance, which begins as the sun is about to sink behind the San Francisco Mountains in the west.

In the meantime three or four naked boys have been herding the snakes in a corner of the *kiva* and playing with them, tossing them, one to another, with a reckless abandon which at first is startling and finally commonplace.

The hour having arrived for the dance, the snakes are again gathered up, thrust into a sack, and carried by one of the priests to the *kisi* in the plaza, within which he secretes himself. The Antelope priests are first to leave their *kiva*, and proceed in single file, led by their chief priest, to the plaza, which they circle four times and halt in line in front of the *kisi*. They are closely followed by the Snake priests, who perform similar evolutions, halting also in front of the *kisi*, but facing the Antelope priests. The appearance of the men at this time, as they proceed to the plaza, is very striking and beautiful, forming a sight not to be forgotten. In this attitude they sing several songs, the time to which is kept by the snake men with their snake whips and long black *bahos*, and by the antelope men with their peculiar Antelope rattles. As the singing proceeds the positions of the bodies of the men are changed from time to time, in accordance, presumably, with the movement of the drama. As the end of a certain song is reached the man at the head of the line of the Snake priests leaves his position, passes down to the centre of the line of the Antelope priests and in front of the *kisi*, where he stops, passes his hand in between the Antelope priests, and receives from the priest within the *kisi* a snake, which he grasps with his lips, at a position about four inches from the snake's head. He is called the "carrier." He is followed by a second Snake priest called the "hugger," who passes his arm over the first priest's shoulder and, with his snake whip, guards the "carrier's" face from the snake's head. The "hugger," in turn, is followed by the third Snake priest, known as the "gatherer," whose duty it is to pick up the snake should it wriggle from the "carrier's" mouth; and so the entire line of Snake priests files by the *kisi*, every third man receiving a live snake, which he places in his mouth. Thus they proceed in an elongated circuit, each "carrier" dropping his snake as he again approaches the *kisi*, where he receives a fresh snake. By the time all the snakes have been passed out, the hands of the "carriers" are well filled with the wriggling snakes.

A circle of white meal is now spread upon the ground in front of the Antelope priests, into which the "carriers" cast the snakes in one heap. The Snake priests now run by the snakes, and each man plunges both hands into the mass, and, grasping as many as he can, starts off down the mesa-side, the first man to the north, the second to the west, and so on, until all the snakes have been removed, each priest depositing his snakes together with a *baho* half-way down the side of the mesa.

The antelope priests, in the meantime, have again circled the plaza four times, and have returned to the roof of the Snake *kiva*, where they and the now returning Snake priests drink freely from the great bowls of emetic which produces violent vomiting. The priests now repair to their respective *kivas*, where they disrobe. In the Snake *kiva* there is an additional discharming ceremony, followed by a feast, this being the first food the chief priests have taken for four days, and the other priests since the preceding day.

FIG. 2.—Line of Snake Priests leaving the Kiva.

The four days following this public performance are devoted largely to sports and games of children, in which struggles for prizes of corn, melons, &c., together with rabbit hunts, play an important part.

The performances just described in outline only dramatise the legend of the Snake clan. The entire movement of the ceremony has for its immediate and ultimate object the

preparation of a medicine or magic which will be so efficacious as to overcome the magic of the rain clouds, and cause them to give up their stores of water; for the August suns in the south-west are rapidly drying up the corn, which, without rain at this period of the year, would be a failure. But when it is remembered that the Hopi live almost entirely upon vegetable products, of which corn forms almost 80 per cent., it will readily be understood that, should the combined efforts of the two sets of priests be not successful, famine must be the result. As each snake is released with a *baho*, it bears with it prayers which it is supposed to transmit to the great plumed serpent, who has influence with the rain gods of the four world quarters. It may be added that the fundamental element of nearly all Hopi ceremonies is the production of a magic which will overcome the magic of the rain clouds.

So far as the writer is aware, no Hopi has ever died as a result of a snake-bite during these ceremonies. Nor has he ever seen a priest bitten by a snake. He is positive that nothing is done to render the snakes harmless. Nor do the Hopi have any antidote for the poison of the rattlesnake. The Hopi seems thoroughly to understand the rattlesnake, and is cautious never to attempt to pick him up when in a coiled position. The Snake priest always carries with him his snake whip, which he shakes over the snake when coiled, as he is about to pick it up in the fields during the hunt, or in the *kiva* as he transfers it from the snake bag to the receptacle, or as he herds the snakes in the *kiva*, or picks them up on the plaza. Rarely is a snake seen coiled, its ambition being to escape.

GEORGE A. DORSEY.

FIG. 3.—Priest using the Snake Whip preparatory to picking up a Snake.

WERE THE FERN-CYCADS SEED-BEARING PLANTS?

THIS was the burden of a preliminary paper read at the Royal Society on May 7 by Prof. F. W. Oliver and Dr. D. H. Scott, F.R.S., entitled "*Lagenostoma Lomaxi*, the seed of Lyginodendron."

During recent years the petrified remains of many fern-like plants from the Carboniferous rocks have received close attention, with the striking result that the internal organisation of not a few shows a marked approach to that characteristic of the Cycads, the most primitive of existing seed plants. These plants, therefore, whilst retaining the outward form of ferns, are in reality transitional types. For convenience, these plants, which include the genera Heterangium, Lyginodendron, Medullosa, and many others, have been placed in a special group, the Cycadofilices or Fern-Cycads. The recognition of this group is one of the more interesting results that has accrued in recent years in fossil botany, and the view that the Cycadofilices are the remains of a natural bridge connecting the ferns and the Gymnosperms has received wide support.

In no case, however, had the fructification of any Fern-Cycad been definitely recognised, hence it remained an open question whether the Cycadean advance which was so marked a feature of the vegetative organs found its counterpart in the reproductive process.

In the paper under notice the authors bring forward what they regard as adequate evidence for assigning a seed to Lyginodendron, perhaps the best known of all Cycadofilices, owing to its admirable preservation and very common occurrence in the calcareous nodules of the Lower Coal-measures.

Numerous detached seeds are known from the Palæozoic rocks, but in no case has it been ascertained by what plants these seeds were borne, with the exception of certain forms which have been traced to the extinct family of the Cordaiteæ, and the curious seed-like fructifications of two Lycopods, Lepidocarpon and Miadesmia. The rest, although of great interest in the details of their organisation, have remained unassigned, being without traces of their origin, like fallen acorns in a forest.

In the case, however, of the seeds placed by Williamson in his genus Lagenostoma, a re-examination has revealed unexpected points of agreement between the structure of the envelopes of certain of these seeds, on the one hand, and the vegetative organs of Lyginodendron on the other. It appears that the seed named *Lagenostoma Lomaxi* after its discoverer, and occurring chiefly at Dulesgate, in Lancashire, is sometimes still attached to its pedicel, and is found enclosed in an envelope or cupule springing from the stalk just below the base of the seed, and extending above the micropyle, at least in young specimens. The cupule, in its relation to the seed, which is quite small,

not larger than a pea, may be compared to the husk of a hazel-nut in miniature.

Both cupule and stalk bear numerous capitate glands, some stalked, others sessile, which present the closest agreement in size, form and structure with the glands which occur on the vegetative organs of Lyginodendron. It is the agreement between these glands, so close as to amount to identity, that forms the basis of the attribution of the seed to Lyginodendron. There is no other known plant from the Coal-measures with glands at all similar, nor is it likely that any unknown Gymnosperm should exactly resemble Lyginodendron in these characters. The vascular strands which traverse stalk and cupule present the closest agreement with those of Lyginodendron, and these and other characters go to strengthen the conclusion drawn from a comparison of the glands, and further support the attribution. The evidence will, of course, be weighed by botanists. Should it find acceptation, we have the following position. Lyginodendron, a fern-like plant with certain Cycadean characters, possessed seeds (on its leaves, so it may be inferred from the structure of the stalk and cupule) as fully characterised as those of any known Palæozoic gymnosperm. It retains, so far as its vegetative structure is concerned, the intermediate position already assigned to it, but whereas the fern-like characters have hitherto seemed to preponderate, the discovery of the seed inclines the balance strongly on the Gymnospermous side. The germ of the present discovery dates from the time when it became apparent on anatomical grounds that Lyginodendron was a transitional type. Dr. Scott in his published writings had already prepared the way, and the position now gained is the logical sequel. Nor is it likely that Lyginodendron stood alone; we must be prepared to find, what has long been recognised as a possibility, that many of the plants grouped under Cycadofilices already possessed seeds, and thus that a considerable proportion of the so-called "fern-fronds" of the Palæobotanist really belonged to seed-bearing plants. The status of these "ferns" may be expected to take many years to unravel, owing to the difficulties that will be encountered in discriminating between such as bear true fern-sporangia and those the sporangia of which are really the pollen-sacs of Gymnospermous plants, and in allocating the numerous impressions which are quite sterile. It is premature to speculate how far back in the fern-series a seed habit obtained, but the results of further investigations in this field will be awaited with interest.

"TABLOID" PREPARATIONS FOR PHOTOGRAPHY.

THERE is probably no one who has reason occasionally to take a photograph, whether for simple pleasure or for scientific or business purposes, without having at command a well-equipped photographic laboratory, who does not consider the preparation of the various solutions required as a messy, troublesome and tedious performance. And the getting of some of the chemical substances in a fit state for use is a very real difficulty, only to be got over in some cases by procuring the original packages or bottles as issued by the manufacturer, and containing perhaps twenty times as much as is required. We have known several cases where so common a substance as sodium sulphite has been obtained only after seeking for it at several druggists, and other cases where the work was spoilt by reason of the gross impurity of the material.

These and similar difficulties are now matters of the past for those who use the "tabloid" preparations of Messrs. Burroughs, Wellcome and Co. Instead of a large bottle of stuff awkward to manipulate because either the substance is in hard lumps or light feathery crystals, one has a little bottle of little pills that need no weighing, because the contents of each are indicated on the label. In the majority of cases each tabloid has in it the quantity of material needed for one ounce of solution, so that any bulk can be made up without the possibility of error in calculation. The tabloids required are put into the measure glass, water added, stirred a little or crushed with a glass rod, and the solution is ready for use, with the advantage that it is fresh, and made with materials that can be relied on.

In many cases the requisite chemicals are mixed in the one tabloid, sulphite, alkali, and bromide, for example in developers, but there are no secret formulæ, as the contents of every tabloid are clearly set forth on the label. The formula, if necessary, can be modified to any extent by adding to it a tabloid of one or the other ingredients; or, if preferred, tabloids of simple unmixed substances may be used throughout.

So far as variety goes, practically everything that is required in photographic practice is supplied, including even such rarely used chemicals as potassium percarbonate and ammonium persulphate. There is a large selection for making gold baths for the toning of prints, and potassium ammonium chromate is supplied in 24-grain tabloids for sensitising carbon tissue. Ferrous oxalate and mercuric chloride are the only two omissions that we note; perhaps there is some difficulty with regard to these.

It appeared not unlikely that some of the chemicals might show signs of deterioration from their manipulation in the preparation of the tabloids, but those that we have tested have proved unexceptionable in quality. These preparations are worthy the attention of even the best equipped photographer working at home in his own laboratory, particularly with regard to the chemicals that are rarely required.

A NEW INDEX OF APPLIED SCIENCE.

WE have received a copy of the first issue of a new monthly periodical[1] published at Brussels. The title, *Index of the Technical Press*, appears on it in the three languages French, English and German. The object of the publication is to supply a monthly index of articles of general interest appearing in the technical Press throughout the world, and giving the title with a brief explanation, the name of the author, the origin, the date of publication, and the length. In the case of articles appearing in the English, French, and German papers, these details are given in the languages in which they originally appeared. In the case of articles printed in other languages they are translated into French.

One very good characteristic of the publication is that it is printed on one side of the paper only, and in a convenient form for cutting out and pasting on cards for use in connection with card indices.

The publishers undertake to supply cuttings from the original papers of most of the articles indexed, at prices indicated by a letter affixed to each entry. Translations can also be obtained on a fixed scale. Such a publication should be of considerable value if the scheme is carried out with completeness, and the subscription price of five francs per annum is not a heavy one. Much, however, will depend on the interpretation given to the expression "general interest."

The greater part of the issue is taken up with entries of engineering articles under various headings; some of these cover rather a wide field—electrical engineering, for example, forms one of the sections, without any subdivisions.

Besides engineering articles, there are sections devoted to statistics, political science, political economy, law, legislation and jurisprudence, administration, constabulary, insurance and partnership, commerce, communication and transport, mathematics, astronomy, physics, chemistry, geology, medicine. Various trades and manufactures are also included.

The "brief explanation" promised is confined to very slight extensions of the title in some cases, so that the only guide to the value of an article is the name of the author and that of the paper from which it is taken. This, however, if the indexing is really comprehensive, should be of considerable value, more especially with regard to subjects in which systematic abstracts are not obtainable.

Rather numerous errors are made in printing the English and German entries, especially in the former. They are not of a character to cause any inconvenience to those familiar with the languages, but they are unsightly, and their occurrence might easily be obviated by the employment of a proof reader familiar with the languages.

G. W. DE T.

[1] *Index of the Technical Press*. (20 Rue de la Chancellerie, Brussels.)

TRIASSIC CEPHALOPODS.

ALL who are interested in the invertebrata of the Trias will be pleased to see the supplement recently issued to "Die Cephalopoden der Hallstätter Kalke," by Dr. Edmund Mojsisovics (*Abhandlungen der k.k. Geologischen Reichsanstalt*, Band vi., 1902). The first volume of this detailed and beautifully illustrated memoir, published in 1873 and 1875, contained 174 pages of text and 70 finely executed lithographic plates. The second volume appeared in 1893, and extended to 835 pages and 130 plates. The part now published is a supplement to the first volume, and continues the paging from 175 to 356, while the plates are numbered from 1 to 23 as supplementary. It is somewhat difficult for geologists familiar only with the English Trias to realise the richness of the fauna described in this memoir, which, for the sufficient illustration of the Cephalopoda alone, needs 223 large quarto plates. The author speaks in the preface of the somewhat primitive nomenclature of the earlier parts of the first volume, but the most forward student will have nothing to complain of in this direction in the present supplement, unless it be the use of such impossible names as Pompeckjites. Some interesting remarks are made on the subdivisions now adopted for the "Hallstätter Kalke," and a table of these is given on p. 345. Among the forms of Cephalopods here described, none perhaps are more remarkable than the primitive types included in the Belemnitidæ. In transitional deposits such as the Trias one expects to find the lingering of antique forms and the foreshadowing of types yet to come; but it is a little startling to find the Carboniferous genus Pleuronautilus so nearly associated with such forms as Rhacophyllites, which so strongly reminds us of the Liassic *Phylloceras heterophyllus*. The author is to be congratulated on the successful completion of this monumental work, which has engaged his attention for so many years, and, by this supplement, is brought fully abreast of the present time.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The Romanes lecture will be delivered by Sir Oliver J. Lodge, F.R.S., in the Sheldonian Theatre on Friday, June 12, at 5 p.m. The subject of the lecture is "Modern Views on Matter."

On Saturday last Prof. Tylor, F.R.S., was elected an honorary fellow of Balliol College, of which he has been a member since his appointment as Keeper of the University Museum and reader in anthropology in 1883.

Last week's *Gazette* contained the report of the museum delegates for 1902. Considerable additions have been made, particularly to the Pitt Rivers and Hope collections. An important change in administration took place after Prof. Tylor resigned the keepership, this office being abolished and replaced by a secretary to the museum delegates. Prof. Miers, F.R.S., was appointed to the new position. During the past year three new laboratories have been added to the chemical department, and an electric installation has been put into the museum

The Junior Scientific Club held a conversazione in the museum on the evening of Tuesday, May 26. Lectures were given by Sir David Salomons, Bart., on "Motor Cars," by Prof. Arthur Thomson on "Man's Cranial Form," and by Prof. Miers on "Klondyke." Among the exhibits were an excellent demonstration of the properties of radium by Mr. F. Soddy, a show of collotype and three-colour printing from the Clarendon Press, an improved form of capillary electrometer by Mr. H. S. Souttar, photographs of the new star in Gemini by Prof. Turner, a collection of living British fresh-water fish by Mr. Morison, a demonstration of the principles of wireless telegraphy by Mr. Littlehailes and Mr. Lattey, and a collection of apparatus from the Cambridge Scientific Instrument Company and the Magdalen College Laboratory.

CAMBRIDGE.—Dr. Chase, president of Queens' College, has been re-elected Vice-Chancellor for the ensuing academical year.

Mr. F. W. W. Griffin, King's, has been appointed to the university table in the Plymouth Marine Biological Laboratory.

In the mathematical tripos, part i., sixty-five men and eighteen women have acquitted themselves so as to deserve mathematical honours.

The memoirs of Mr. J. Parkinson, advanced student of St. John's College, on the geology of Tintagel and Davidstow, and on the rocks of Guernsey, have been adjudged to be "of distinction as a record of original research."

DR. THOMAS SLATER PRICE has been nominated to succeed Mr. Woodward as director of chemical studies at the Birmingham Municipal Technical School.

AN exhibition of practical work executed by candidates at the technological and manual training examinations of the City and Guilds Institute will be opened at the Imperial Institute on Thursday, June 11, at 3 p.m., by the Marquess of Londonderry, K.G.

Science announces that Prof. William H. Brewer has resigned the professorship of agriculture at Yale University and has been appointed professor emeritus. At Cornell University Prof. T. F. Hunt, dean of the Agricultural College, of the Ohio State University, has been appointed professor of agronomy, and Dr. B. F. Kingsbury has been appointed assistant professor of embryology.

ON the occasion of the commemoration day proceedings at Livingstone College, Leyton, on June 10, the Bishop of St. Albans will preside. Livingstone College has rendered valuable services, not only to missionaries, but also to many travellers in unhealthy regions, and it is hoped that the present opportunity will lead to much greater interest being taken in the work carried on under its auspices.

IT is worthy of note that in connection with a short course of popular lectures on nature-study just given by Mr. C. Carus-Wilson at Ramsgate and Margate, excursions were arranged to places of geological interest in the neighbourhood. Field-work and personal observation of natural objects and phenomena are essential in the study of nature, and it is to be hoped that wherever popular lectures are given on natural science subjects, outdoor work will be arranged in connection with them.

THE draft charters incorporating universities in Manchester and Liverpool have, the *Times* reports, been approved by the Privy Council and laid before Parliament. In the case of Manchester, the charter provides that the University shall be called "the Victoria University of Manchester." A description is given of the powers conferred upon the University relating to such matters as the granting and conferring of degrees, the granting of diplomas, the provision of instruction in such branches of learning as the University may think fit, the examination and inspection of schools, and the affiliation of other institutions. The authorities of the University will be the Chancellor, the Vice-Chancellor, two Pro-Vice-Chancellors, the Court, the Council, the Senate, the Board of Faculties, and the Convocation, besides a treasurer and other proper officers. In the case of Liverpool, the charter provides that the University shall be known as "the University of Liverpool." It is provided that Lord Derby shall be the first Chancellor of the University, and Mr. A. W. W. Dale, now principal of University College, Liverpool, the first Vice-Chancellor. The supreme governing body of the University is to be the Court, and the governing body and executive of the University is to be the council; and the Senate, consisting of the Vice-Chancellor, the deans of all the faculties, all the professors of the University, and the librarian, will, subject to the statutes of the University and the control and approval of the council, regulate and superintend the education and discipline of the University.

IT is announced in the *Times* of May 28 that the council of the Yorkshire College has agreed upon the principles upon which the charter for the proposed new Yorkshire University should be based. These are that the Yorkshire College be merged in the University; that the University be founded on a non-federal basis, but that it be empowered to affiliate other institutions; and that the University be governed by a court of governors and by an executive

council. Substantial agreement has been arrived at between the three colleges, which have constituted Victoria University, as to a common matriculation examination for all the three Universities of Yorkshire, Manchester, and Liverpool, and provision has been made for a joint board to be constituted from the three Universities to deal with the question. The additions to the staff and equipment of the college essential to the proper carrying on of an independent University will, it is thought, require a *minimum* additional expenditure of about 7000*l.* a year, while extensive additions will also be required to the college buildings. The coal-owners of Yorkshire have decided to erect a separate building for the mining department, and have collected a sum of 5500*l.* for the purpose. The council of the college is desirous also of completing the main block of the college, and it is estimated that this would cost about 60,000*l.* Three friends of the college have each promised 5000*l.*, while a fourth has promised 2000*l.* The Clothworkers' Company of London offers to transfer to the new University as its absolute property the whole of the buildings and equipment of the textile industries, dyeing and art departments, which are at present held in trust by the college for the Clothworkers' Company. Attached to the offer is a condition that these departments shall be recognised as integral parts of the University. The Company has also promised to grant in perpetuity to the University for the maintenance of these departments an annual sum of not less than 4000*l.* This means a gift to the University of a capitalised sum of upwards of 200,000*l.*

WE learn from the *Pioneer Mail* that the Government of India has addressed to the Bombay Government a long letter on the subject of the proposed Tata endowment of a research institute for India. It is in the main an explanation of the delay of four years which has occurred in giving effect to the scheme. As has been already explained in these columns, the scheme owes its origin to the munificent intentions of Mr. J. N. Tata, who in 1896 proposed to vest in trustees properties in Bombay, representing a capital of thirty lakhs of rupees, in order that the net income, amounting to some 8000*l.*, might be applied towards the endowment of a research institute for India. The proposal soon assumed the form of an Imperial teaching university, intended to train Indian graduates in scientific research, to confer degrees, and to select the best students for further training in Europe and America. Mr. Tata was later asked to consider whether the original scheme was not too ambitious, and whether it might not be proceeded with, so far as funds permitted, leaving the further development to come with the growth of income. Mr. Tata met a small conference of educational experts, and with them defined the general principles to be kept in view in launching the scheme. Sir William Ramsay was invited to visit India to advise, and the help of other experts was obtained. Much delay has been caused by a consideration of numerous recommendations received, but we are glad to know that financial difficulties appear to have been overcome, and that legislation will probably soon follow with a view to provide India with an institution for higher scientific instruction. The institute is to be located at Bangalore, and the Mysore durbar, in addition to making a free grant of land, has undertaken to contribute 3333*l.* per annum for a period of ten years. The Government of India is prepared to make a similar annual subsidy. This will raise the income to 15,000*l.* per annum, which exceeds by 1000*l.* the highest estimate of necessary expenditure framed by Sir William Ramsay. The Government also proposes to contribute one lakh of rupees towards the cost of the construction and equipment of the necessary buildings. The institute is to comprise a department of chemistry, a department of experimental physics, and a department of experimental biology.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 14.—"The Combination of Hydrogen and Chlorine under the Influence of Light." By P. V. **Bevan.** Communicated by Prof. J. J. Thomson, F.R.S.

The first point studied in this investigation was the initial expansion, or Draper effect, when light is allowed to fall on a mixture of hydrogen and chlorine. This expansion was shown to be due to heat developed by the combination of the hydrogen and chlorine to form hydrochloric acid. The heat effect was measured by the change in resistance observed in a fine platinum wire sealed through the bulb in which the gas mixture was exposed to light. The investigation then considers the period of induction of Bunsen and Roscoe, and the effects of various intensities of light on the rate of combination. Experiments were also made on the effect of illuminating chlorine before mixing with hydrogen, and the original observation of Draper—that the combination takes place more readily after this preillumination—was confirmed. If, however, the gases be bubbled through water after preillumination of chlorine, this effect is destroyed, and the gases behave like the ordinary mixture. To obtain evidence of an intermediate compound, the gases were submitted to sudden expansion producing supersaturation. When the gases were dust free a nucleus-forming substance occurred after illumination, so that on the expansion a cloud was formed when the supersaturation reached a certain amount. In the non-illuminated gas mixture no cloud-producing substance could be observed with yellow light. This cloud is produced in chlorine alone. In the mixture of hydrogen and chlorine the cloud appears before any hydrochloric acid is formed. The theoretical part of the paper considers the action as taking place in three stages, combination to form complex molecules containing hydrogen chlorine and water molecules occurring, and then a break down of this complex system giving hydrochloric acid and water. The view thus taken explains the chief features of the induction period, and can be extended to apply to other similar actions where a catalyser is necessary for the progress of the action.

"On the Photo-electric Discharge from Metallic Surfaces in Different Gases." By W. Mansergh **Varley,** M.Sc., Ph.D. Communicated by Prof. J. J. Thomson, F.R.S.

The object of the experiments was to study the effect of the pressure and nature of the gas with which a metal surface is surrounded upon the magnitude of the photo-electric current from that surface, the method used being to draw the complete curves connecting the current and the potential difference at each pressure or in each gas examined, keeping the intensity of the ultra-violet illumination and the other conditions unaltered.

A suitable source of ultra-violet light which would remain constant in intensity while long series of observations were being taken was ultimately found in the spark between iron terminals in an atmosphere of pure dry hydrogen. The spark gap was in parallel with three Leyden jars in the secondary circuit of an induction coil used as a transformer. The photo-electric currents were measured from a metal surface placed a few millimetres behind a fine gauze, through which the light passed, and which served as the positive electrode. A brass vessel, with a quartz window to admit the light, served to contain the electrodes.

Series of curves were obtained showing the relation between the photo-electric current and the potential at pressures ranging from 760 mm. to 0·0014 mm. They show that down to pressures of about 1 mm. no true saturation currents exist, the currents always increasing with the potential, but less rapidly for a certain range of potential gradients than for lower or higher potential gradients, while at pressures below the critical pressure true saturation currents exist.

Curves connecting the potentials and corresponding photo-electric currents in air, carbon dioxide, hydrogen and carbon monoxide at various pressures were also obtained, and it was shown that the curves could all be explained on the ionic theory of conduction, both qualitatively and quantitatively. Zinc, platinum and aluminium electrodes were employed.

"On the Discovery of a Species of Trypanosoma in the Cerebro-spinal Fluid of Cases of Sleeping Sickness." By Aldo **Castellani,** M.D. Communicated by the Malaria Committee of the Royal Society.

The author states that he has found trypanosomes to be present in the cerebro-spinal fluid in twenty out of thirty-four cases of sleeping sickness examined; in two of the cases trypanosomes were also found in the lateral ventricles, and in one in the blood taken from the finger. The cerebro-spinal fluid was obtained by lumbar puncture, and as the trypanosomes are not numerous, it was first centri-

fugalised and the deposit examined microscopically. This species of trypanosoma seems to differ from that found in human trypanosomiasis (*T. Gambiense*, Dutton) by being less motile, by the micro-nucleus being situated nearer the extremity, and by the vacuole being larger. Should it prove to be a new species, the author suggests that it should be named the *Trypanosoma Ugandense*. The author had previously isolated a streptococcus in this disease; he now suggests as a working hypothesis that sleeping sickness is due to a trypanosoma, and that in the last stages there is a concomitant streptococci infection.

In a note to this communication the secretary of the Royal Society (Sir M. Foster) states that a telegram has been received from Colonel Bruce, who is continuing Dr. Castellani's investigations in Uganda, announcing that he has found trypanosomes in the cerebro-spinal fluid in every one of thirty-eight cases examined, and in the blood in twelve out of thirteen cases.

Physical Society, May 22.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—Mr. J. **Stöttner** gave an exhibition of Nernst lamps, showing their development from the experimental form up to the most recent types. The oxides used for the glowers are thoria, zirconia, and other rare earths thereto related, such as oxides of yttrium and cerium. A paste of these is formed, and small rods or tubes are pressed through a suitable nozzle. These are hardened and cut into small lengths, and practically the principal part of the lamp is finished. The chief difficulty in the practical lamp is in the design of a durable automatic heater to heat the filament up to conducting point. A number of automatic arrangements which have been designed for disconnecting the heater were shown. Another important part of a Nernst lamp is the bolstering resistance, which in its final development consists of a thin iron wire sealed in a glass bulb filled with hydrogen gas. If a lamp is used without a bolstering resistance, as soon as a certain critical potential is reached the current increases, at first slowly and then quicker and quicker, the potential remaining constant, until the lamp burns itself out.—Mr. T. H. **Blakesley** gave an exhibition of a diagram for single-piece lenses. The properties of a single-piece lens are determined by four factors:—the two radii of curvature, the thickness of the lens, and the value of the refractive index of the material of which it is composed. In the case of a lens of a particular thickness made of a material of definite refractive index, the variables reduce to two, namely, the ratios of the radii of curvature to the thickness of the lens. Any property of the lens requires a relation between these quantities. It is therefore possible, for any property, to draw a curve, with r_1/d as ordinates and r_2/d as abscissæ, such that any point on the curve represents a lens having that property. Mr. Blakesley has drawn curves representing several properties. Where two curves cut there is a point which gives a lens having the properties due to both curves. By means of such a diagram various lenses have been constructed, and three of them were shown at the meeting. Of these, one was equivalent to a Huyghens eye-piece and another to a collimator.—A paper on an instrument for measuring the lateral contraction of tie-bars, and on the determination of Poisson's ratio, was read by Mr. J. **Morrow**. Practical methods for the determination of the ratio of lateral to linear strain in a tie-bar may be divided into three classes. First, those in which two coefficients of elasticity are determined and Poisson's ratio calculated; second, those depending on the deformation of the section of a beam; and lastly, methods by which the two strains are actually measured. The experiments described in the paper belong to the third. From a table of results, it appears that the average values of σ are for mild steel 0·275, Sheffield spindle steel 0·276, wrought iron 0·277, Muntz metal 0·341, and drawn copper 0·327. The specimens were not annealed, and were mostly about one inch in diameter. For the experiments on cast iron, two series of specimens were carefully cast of material of good average quality. These were loaded several times in order to eliminate permanent set. The first series gave an average value $\sigma = 0{\cdot}246$ and the second $\sigma = 0{\cdot}252$.

Chemical Society, May 20.—Prof. W. A. Tilden, F.R.S., president, in the chair.—The following papers were read:—The conditions of decomposition of ammonium nitrite, by V. H. **Veley**. The decomposition of ammonium nitrite into nitrogen and water proceeds according to the general law $\log A/A - x = \alpha\theta$, whether the reaction follows its normal course or is accelerated by the addition of another substance. The decomposition is either impeded or stopped by ammonia, aliphatic, benzenoid or pyridine amines and aromatic hydrazines, and to a less degree by oximes, but is accelerated by aliphatic amides.—Freezing point curves for some binary mixtures of organic substances, chiefly phenols and amines, by Dr. J. C. **Philip**. When freezing point curves for mixtures of two substances are constructed two types are obtained:—(*a*) a curve consisting of two branches, starting from the freezing points of the constituents and cutting each other at a eutectic point; (*b*) the two branches are cut by a third intermediate curve, which may sometimes have a summit. Examples of the latter type have been found for the systems *phenol—urea*, p-*cresol—aniline*, *phenol—α-naphthylamine*, *phenol—*p-*toluidine*, *α-naphthol—*p-*toluidine*, *phenol—picric acid*.—Isomeric partially racemic salts containing quinquevalent nitrogen. Part xi. Derivatives of *dl*-methylhydrindamine and *dl-neo*-methylhydrindamine. Isomeric salts of the type $NR_1R_2H_3$, by G. **Tattersall** and F. S. **Kipping**. A description of these compounds was given.—The action of liquefied ammonia on chromic chloride, by W. R. **Lang** and C. M. **Carson**. In this reaction a salmon-coloured powder is produced from which water extracts two unstable, crystalline compounds with the formulæ $Cr_2Cl_6,12NH_3,2H_2O$ and $Cr_2Cl_6,10NH_3$.—Note on the action of methylamine on chromic chloride, by W. R. **Lang** and E. H. **Jolliffe**. The reaction is similar to the foregoing, the product being a pink substance of the composition $Cr_2Cl_6,10CH_3.NH_2$.—Cholesterol, by R. H. **Pickard** and J. **Yates**. The oxidation and hydrolytic products of cholesterol obtained from gall stones have been studied; among the former is arachidic acid.—Sulphocampholenecarboxylic acid, by Messrs. **Hardy** and **Lapworth**.—Optically active esters of β-ketonic and β-aldehydic acids. iii. Azo-derivatives of menthyl acetoacetate, by A. **Lapworth**.—Hydrogen cyanide in fodder plants, by J. C. **Brünnich**. The observation of Dunstan and Henry that the amount of prussic acid producible from the Sorghum plant increases as the plant matures and decreases after the production of seed has been confirmed by a series of determinations of the prussic acid obtainable from manured and unmanured plants at all stages of growth.—The chemical reactions involved in the rusting of iron, by Prof. W. R. **Dunstan**, F.R.S. It is shown that the presence of liquid water and oxygen is necessary for the formation of iron rust; this action is merely accelerated, not conditioned by the presence of carbon dioxide. No rusting occurs when pure iron is kept in presence of oxygen and water vapour at constant temperature; the rusting of iron is prevented by the presence of solutions of such salts as decompose hydrogen peroxide, whilst its formation is not inhibited in solutions of salts in presence of which hydrogen peroxide is stable. The deduction is therefore drawn that hydrogen peroxide is the active agent in the production of iron rust.

Geological Society, April 29.—Mr. J. J. H. Teall, F.R.S., vice-president, in the chair.—The age of the principal lake-basins between the Jura and the Alps, by Dr. Charles S. Du Riche **Preller**. The author deals with the question reserved from a preceding paper, that is, to which subsequent period the formation of Swiss lake-basins should be assigned. By the light of further recent investigations in the different localities, he first considers the conditions of the Zurich lake-valley, and then applies his conclusions to the other principal lake-basins lying in the same zone along the edge of the Alps. Evidence is adduced to show that the deep-level gravel-beds in the Limmat Valley near and below Zurich are essentially fluviatile, composed of the characteristic Alpine material of the Rhine and Linth drainage-areas, and similar to the gravel now carried by the River Sihl. These gravel-beds rest upon Glacial clay of the second glaciation, which fills the Molasse-bed of the valley to a great depth, and are overlain by the moraine-bars of the third glaciation, the latter being overlain by the post-Glacial alluvia of the Sihl. On mechanical grounds, it is difficult to conceive how glaciers could either bridge or completely fill with ice such extensive basins as those of the principal Alpine lakes. As regards the more recently enunciated

argument of the Deckenschotter and overlying gravel-exposure in the Lorze Valley, apart from the difficulty of differentiating the second and third glaciation materials in that locality, it is hazardous to deduce from a local phenomenon, and more especially from any dip of loose gravel, the date of the zonal bending extending over more than 200 miles along the edge of the Alps. The author suggests that the deep-level Limmat gravel beds were deposited by a river during the second inter-Glacial period; that the lowering of the valley floor was initiated in the course of the third glaciation; that the zonal subsidence continued throughout the retreat of the ice; and that the simultaneous formation of the lake-basin should be assigned to the end of the Glacial period. The same arguments apply also to the origin and age of the other principal zonal lake-basins. In his view, the position and depth of these basins, as well as the intervening ground, point to the probability that the bending took place not only along one line, but along several, that the bending was by no means of uniform depth, and that therefore the Alps did not subside as a rigid mass, but that the zonal bending along their edge merely extended locally for some distance from the deepest points of the lake-basins along the floors of the principal Alpine river valleys.—On a shelly Boulder-clay in the so-called palagonite formation of Iceland, by Helgi **Pjetursson**. There is no equivalent in the Tertiary basalt plateaux of Britain of the great palagonite formation of Iceland. The basement layer of the breccia formation, resting directly upon the basalts, contains glaciated blocks of all sizes. These ground moraines are followed by tufaceous sandstones, conglomerate, columnar basalts, other ground moraines, and volcanic tuffs and breccias. At Birlandshöfdi a shelly Boulder-clay, 70 to 80 feet thick, rests upon the fundamental basalt, which here shows a glaciated surface. Unbroken shells are very rare. *Astarte borealis* is the most common shell, and *Saxicava arctica* and *Mya truncata* are less common, indicating that some of the older moraines are of Pleistocene age. The author concludes that volcanic activity did not pause in Iceland during the Glacial period, but that it was especially active at the beginning and the close of glaciation.

Anthropological Institute, May 5.—Mr. H. **Balfour**, the president, exhibited a stone celt, worn as an amulet, from Benin; some silver *ex voto* offerings from Malabar, and a dagger from Siam, on the sheath of which were natural markings, interpreted by the natives to represent the name of Allah.—Mr. A. L. **Lewis** read a paper on some stone circles in Derbyshire. Mr. Lewis first dealt with the Arborlow circle, which has recently been excavated by Mr. Gray under the auspices of the British Association. Like the Avebury circle, Arborlow is surrounded by an embankment outside a ditch, the latter, therefore, obviously not intended for defensive purposes. All the stones are now flat, with the exception of one which is leaning, and in consequence of this it is extremely difficult to fix the circumferential line or diameter. The general plan, however, is oval. Mr. Lewis was of opinion that in the centre there was a group of three upright stones opening to a point somewhat north of east, and facing probably to the Beltane sunrise. A skeleton—apparently a late interment—was found in the centre, but part of the embankment on the south-east has been formed into a tumulus, which was found to contain an interment of the Bronze age. Mr. Lewis was of opinion that sepulture was no part of the original purpose of the monument. Mr. Lewis also referred to other Derbyshire circles, including the "Wet Withins" and the "Nine Ladies." With regard to the latter, he was of opinion that the term "nine" as applied to standing stones simply meant "holy," and in support of this view he cited several instances of the sacred or mystic significance of the number. —Mr. **Lewis** also read a paper on some notes on orientation. He began by referring to the association—pointed out by Dr. Rivers—between south and right in Welsh and other languages, and considered that the reason was that, when the connection first arose, the people, for some ceremonial purpose, were accustomed to turn to the east on certain occasions, when their right sides would become their south sides, and he incidentally referred to the almost universal practice of church-goers of turning to the east at the recitation of the Creeds. He felt, therefore, that it was possible that the connection went no further back than the origin of this present-day custom, but still it might have originated in far remoter periods. The Greeks looked upon the right side as prosperous, while the Romans looked upon it as unlucky; but this was due to the fact that, while both peoples looked upon the north-east as the favourable quarter, the Greeks in their auguries turned to the north, while the Romans turned to the south. Mr. Lewis mentioned many instances showing how the north was looked upon as unlucky and the south as lucky, but this belief is by no means universal, and on the whole the north-east seems to be considered the most favourable quarter, and then the east. Summarising, Mr. Lewis was of opinion that on the whole the quarter from which the sunlight came was considered most favourable, and that the question of the favourableness of the right or left sides depended on the position taken up at the ceremonies. In conclusion, Mr. Lewis referred to a sort of symbolism of three and one which he had noticed in several stone circles. In a small circle in the Isle of Man there was a combination of one and three stones, but in many instances natural objects—especially the peaks of hills—have been used to suggest the symbolism. This is particularly noticeable at the circle at Penmaenmawr, where the Great Orme and two other hills make a trinity to the north-east, and at the circle on Bodmin Moor, where the three tips of Brown Willy are visible, due east of the circle, over a low intervening ridge.

Entomological Society, May 6.—Prof. E. B. Poulton, F.R.S., president, in the chair.—Mr. Willoughby **Gardner** exhibited nest cells of *Osmia xanthomelana* from Conway, North Wales. He said the species, one of our rarer mason bees, places its beautifully constructed pitcher-shaped cells at the roots of grass, usually four or five together. There is no previous record of the nest having been found since Mr. Waterhouse discovered and described it from Liverpool about sixty-five years ago.—Mr. M. **Jacoby** exhibited *Arsoa longimana*, Fairm., and *A. aranea*, from Madagascar, the only other specimens of these species he knew of being in the British Museum collection. He also exhibited *Megalopus melipona*, Bates, and *M. pilipes* from the Amazon, which bore a remarkable resemblance to a bee.—Mr. A. J. **Chitty** exhibited *Hydroporus bilineatus*, Sturm., a water-beetle new to Britain, discovered by Mr. Edward Waterhouse among some specimens of Hydroporus from Deal, given by Mr. Chitty to him as *H. granularis*. He also exhibited a specimen of the rare *Trechus rivularis* (*incilis* of Dawson), taken at Wicken Fen in August, 1900.—Mr. O. E. **Janson** exhibited specimens of *Neophaedimus melaleucus*, Fairm., a goliath beetle from Upper Tonkin, and remarked that the white colouring was derived from a dense clothing of peculiar semi-transparent coarse scales which were apparently easily removed by abrasion, and seemed to partake of the nature of the "fugitive" scales found upon freshly-emerged specimens of Hemaris and other Lepidoptera.—The president read a communication from Mr. G. F. **Leigh** on protective resemblance and other modes of defence adopted by the larvæ and pupæ of Natal Lepidoptera. He also exhibited the cocoons of *Eublemmistis chlorozonea* to illustrate the paper. Prof. Poulton also showed a specimen of *Polygonia C-album* in the attitude of prolonged repose, together with specimens of *Anaea moeris* set in different ways to illustrate its probable resting position. He said that probably the "C" or "comma" on the under surface of the hind-wings in butterflies belonging to the genus Polygonia (Grapta) represented in bright, strongly-reflecting "body-colour" the light shining through a semi-circular rent in a fragment of dead leaf.—Mr. G. A. J. Rothney communicated descriptions of twelve new genera and species of Ichneumonidæ, and three new species of Ampulex from India, by Peter **Cameron**.

Linnean Society, May 7.—Prof. S. H. Vines, F.R.S., president, in the chair.—The Ingolfiellidæ, fam. n.; a new type of Amphipoda, by Dr. H. J. **Hansen**. The greatest depth explored by the Danish *Ingolf* expedition in the summers of 1895 and 1896 was that of 1870 fathoms, a little south of the entrance to Davis Strait. A small quantity of bottom material showed several forms new to science, amongst which was a single specimen, having a likeness to the Caprellidæ, but with pleopods markedly differing from those of any known Amphipod. Some years later the

author examined a specimen of an allied species obtained by Dr. Th. Mortensen from an island in the Gulf of Siam. These two new species, *Ingolfiella abyssi* and *Ingolfiella littoralis*, one abyssal from the North Atlantic, the other from shallow water in the Pacific, agree in being extremely minute.—On the evolution of the Australian Marsupialia; with remarks on the relationships of the marsupials in general, by Mr. B. Arthur **Bensley**. The paper contains a minute description of the dentition of more than forty genera, and treats also of the structure of the hind foot. Mr. Bensley considers that the primary division of the Marsupialia should be based on the condition (syndactylous or eleutherodactylous) of the second and third digits of the hind foot, rather than on the condition (polyprotodont or diprotodont) of the incisor teeth; and he is disposed on this account to associate the Peramelidæ more closely with the Phalangeridæ than has hitherto been customary. The author regards the Australian marsupials as probably monophyletic, and considers, with Winge, that the ancestral forms were primitive members of the Didelphidæ, a family which must have had a wide geographical distribution in past times. A study of the dentition impels him to the conclusion that the primitive types were all insectivorous, but that the subsequent radiation, or divergent evolution, proceeded along two primary lines, one carnivorous, culminating in Sarcophilus, the other omnivorous and finally herbivorous. In the second line all of the advanced forms are diprotodont, and all of the typical terminal forms are highly specialised herbivora.—Copepoda Calanoida, chiefly abyssal, from the Faroe Channel and other parts of the North Atlantic, by Canon A. M. **Norman**, F.R.S. Most of the Copepoda mentioned were procured by Sir John Murray in the *Triton* expedition of 1882, at various depths to 600 fathoms; a few were from the *Valorous* expedition of 1875; the remainder from a gathering sent by Prof. Haddon from 200 fathoms forty miles N.N.W. of Achill Head. Some of the specimens have been examined and named by Prof. G. O. Sars, and the great interest of the observations now laid before the Society consists in the record of the geographical distribution of these small but ever active crustaceans. Thus, some of the Faroe Channel species found at considerable depths were taken by F. Nansen near the surface at the point reached by him nearest the Pole; the varying depths at which these organisms occur constitute isothermal lines, which largely determine their dispersion.

DUBLIN.

Royal Irish Academy, May 11.—Prof. Atkinson, president, in the chair.—Captain G. E. H. **Barrett-Hamilton** read an abstract of some results of his researches into the meaning of winter whitening in mammals and birds inhabiting snowy countries, and the occurrence of white markings in Vertebrates generally. He finds that the first-named colour-change is not a merely external factor having as its purpose the adaptation of the animal to its environment, but a peripheral atrophy symptomic of deep physiological changes occurring in species possessing a metabolism which varies with the season. Thus the white colour affects the different parts of the body in the same order as that in which subcutaneous fat is accumulated in the panniculus adiposus. The author further finds a connection between much of the permanently white parts of Vertebrates and the accumulation of subcutaneous fat. Such white colour is then due to peripheral atrophy. This atrophy may manifest itself either in deficiency of pigment or in complete absence of hair.—Captain **Barrett-Hamilton** also read a description of a remarkable addition to the list of British mammals of boreal type. This is a bank vole (Evotomys) inhabiting the small island of Skomer, off the coast of Pembrokeshire.—Mr. G. H. **Carpenter** read a paper on the relationships between the classes of the Arthropoda. In opposition to certain recent speculations as to the independent origin of insects, arachnids, and crustaceans from annelid worms, the author advocates a common Arthropod ancestry for the various classes. The conclusion drawn from the numerical agreement in segmentation between typical members of the three great Arthropod classes is that the ancestral arthropods possessed such a definite and limited number of segments, and that those groups with a large number of segments, such as most centipedes and millipedes, and many branchiopoda and trilobites, represent abnormal developments.

PARIS.

Academy of Sciences, May 25.—M. Albert Gaudry in the chair.—The action of acetylene upon cæsium-ammonium and rubidium-ammonium. The preparation and properties of the acetylenic acetylides $C_2.Cs_2, C_2H_2$, $C_2Rb_2.C_2H_2$, and the carbides of cæsium and rubidium, by M. Henri **Moissan**. By the action of acetylene upon solutions of cæsium and rubidium-ammonium compounds of the type C_2R_2, C_2H_2 are formed, from which the carbides C_2R_2 can be obtained by heating *in vacuo*. These carbides react with water, giving the alkali and pure acetylene; they are extremely energetic reducing agents, acting upon the peroxides of lead and manganese with explosive violence.—The influence exerted on the rotatory power of cyclic molecules by the introduction of double linkages into the nuclei containing the asymmetric carbon atom, by M. A. **Haller**. The condensation products obtained by acting upon methylhexanone with aldehydes in presence of sodium methylate have been examined for their rotatory power. The effect of the double linkage is in every case to increase the rotation.—On new sources of radiations capable of traversing metals, wood and other substances, and on the new actions produced by these radiations, by M. R. **Blondlot**. By applying the method described in an earlier paper, using the electric spark as a detector, radiations similar to those detected in the light from an incandescent mantle have now been found to be emitted from an ordinary Argand burner, and from a sheet of incandescent silver. The effects are observed after the radiations have passed through 0·3 mm. of aluminium, black paper, &c., and in the case of the polished silver sheet are polarised, but the polarisation disappears when the silver is covered with lamp black. The name *n*-rays is suggested for these radiations. The *n*-rays are incapable of exciting phosphorescence in bodies which acquire this property under the action of light, but sulphide of calcium, already slightly phosphorescent, shows an increase in lustre when exposed to these rays.—M. Munier-Chalmas was elected a member in the section of mineralogy in the place of the late M. Hautefeuille.—On the development of a given function in series by means of Jacobi polynomials, by M. W. **Stekloff**.—On the integrability of a differential expression, by M. P. **Montel**.—On a theorem of Lejeune-Dirichlet, by M. A. **Pellet**.—On double cylindrical networks, by M. L. **Raffy**.—On the deformation of surfaces, by M. Maurice **Servant**.—The law of displacement of thermodynamic equilibrium, by M. E. **Ariès**.—On the simultaneous variation of solar spots and terrestrial temperatures, by M. Alfred **Angot**. If at any given station the mean annual temperatures, t, present a variation parallel to the number of sun-spots, r, the relation $t=t_0+ar$ will hold approximately, t_0 and a being constants characteristic of the station. This formula is applied to ten years' observations from Guadeloupe.—The thermal conductivity of crystallised bismuth, by M. F. Louis **Perrot**. The conductivity is greatest perpendicular to the axis, and in the direction of the line of easiest cleavage.—On Hertzian waves in wireless telegraphy, by M. G. **Ferrié**.—On the polarised light diffused by refraction, by M. A. **Lafay**.—On the combined hydrogen contained in reduced copper, by M. Anatole **Leduc**. Five litres of air passed over a column of red-hot copper, in such a manner as to ensure superficial oxidation along its whole length, still leaves a weighable amount of hydrogen in the copper.—On the decomposition of lithium carbonate by heat, by M. P. **Lebeau**. Dissociation of lithium carbonate commences at about 600°, the dissociation pressure increasing to 91 mm. at 1000° C., and approaching 300 mm. at 1200° C. An attempt to prepare lithium oxide by heating the carbonate in a vacuum at 1000° was unsuccessful, as the oxide is itself volatile at this temperature, in which respect lithia is sharply differentiated from the alkalies and alkaline earths.—The electrolysis of barium sulphide with a diaphragm, by MM. André **Brochet** and Georges **Ranson**. Polysulphides of barium are formed at the anode, and baryta at the kathode. The latter being placed in a porous pot, the baryta is obtained in a pure state.—On the mode of splitting up of mixed organo-magnesium compounds; the action of ethylene

oxide, by M. V. **Grignard.** The experiments of M. Blaise have been repeated under slightly different conditions, the ether being distilled off before water is added. Good yields of primary alcohols are thus obtained, ethyl magnesium bromide and ethylene oxide giving 82 per cent. of the theoretical yield of normal butyl alcohol.—On acetones containing acetylene linkages. A new synthesis of the pyrazols, by MM. Ch. **Moureu** and M. **Brachin.** Ketones of the type $R—C\equiv C—Co—R^1$, which can be prepared by the action of acid chlorides or anhydrides upon the sodium derivatives of substituted acetylenes, react with hydrazines to form pyrazols. The constitution of pyrazols prepared from unsymmetrical β-diketones can thus be fixed with certainty.—On some addition products of vinyl-acetic acid, by M. R. **Lespieau.**—The electrolytic separation of manganese and iron, of aluminium from iron or nickel, and of zinc from iron, by MM. **Hollard** and **Bertiaux.** The separations are simplified by the reduction of the iron to the ferrous state by means of sulphur dioxide before proceeding to the electrolysis.—On a reaction of methyl violet in presence of sulphurous acid, by M. H. **Causse.**—On the determination of the respiratory exchanges in aquatic media, by MM. J. P. **Bounhiol** and A. **Foix.**—The mandibular glands of the larvæ of the Lepidoptera, by M. L. **Bordas.**—On *Degeeria funebris*, a parasite of *Haltica ampelophaga*, by MM. C. **Vaney** and A. **Conte.**—On the browning of the vine, by MM. L. **Ravaz** and L. **Sicard.**—On the start of a lateral branch inserted on the axis after the division of the embryo, by M. P. **Ledoux.**—On the specialisation of parasitism in *Erysiphe graminis*, by M. Em. **Marchal.**—Sexuality in the genus Monascus, by M. P. A. **Dangeard.**—Contribution to the cytological study of chlorphyllian bodies containing metachromatic corpuscles, by M. Jules **Villard.**—On the presence of cadaverine in the products of the hydrolysis of muscle, by MM. A. **Etard** and A. **Vila.** Cadaverine was isolated in notable quantities from the products of the hydrolysis of muscle in a slightly decomposed state. The occurrence of considerable quantities of this alkaloid in slightly decomposed meat would appear to exclude the hypothesis of microbial formation.—The arrangement of the scales in *Mesosaurus tenuidens*, by M. Léon **Vaillant.**—Retinal inertia relating to the sense of form; its variation according to the criterium adopted. The formation of a wave of sensibility on the retina, by MM. André **Broca** and D. **Sulzer.**—The destruction of termites, by M. A. **Loir.** The ravages of these ants at Bulawayo were so great that special attempts were made to destroy them on the large scale. The use of gaseous sulphur dioxide proved very effectual.—On the artificial culture of the truffle, by M. Raphael **Dubois.**

DIARY OF SOCIETIES.

THURSDAY, JUNE 4.

ROYAL INSTITUTION, at 5.—Electric Resonance and Wireless Telegraphy: Prof. J. A. Fleming, F.R.S.

CHEMICAL SOCIETY, at 8.—Imino-ethers corresponding to Ortho-substituted Benzenoid Amines: G. D. Lander and F. T. Jewson.—(1) Formation of an Anhydride of Camphoryloxime; (2) The Mutarotation of Glucose as influenced by Acids, Bases and Salts; (3) The Solubility of Dynamic Isomerides: T. M. Lowry.—(1) Isomeric Partially Racemic Salts containing Quinquevalent Nitrogen. Part X. The Four Isomeric Hydrindamine *d*-Chlorocamphorsulphonates $NR_1N_2H_3$; (2) Isomeric Compounds of the Type $NR_1R_2H_3$: F. S. Kipping.—The Hydrolysis of Ethyl Mandelate by the Fat Splitting Enzyme, Lipase: H. D. Dakin.

RÖNTGEN SOCIETY, at 8.30.—On the Electric Field surrounding the X-Ray Tube: Rev. P. Mulholland.

LINNEAN SOCIETY, at 8.—Anatomy and Development of *Comys infelix*, Embleton, a Hymenopterous Parasite of *Lecanium hemisphaericum*: Miss Alice L. Embleton.—Notes on the Transition of Opposite Leaves into the Alternate Arrangement; a New Factor in Morphologic Observation: Percy Groom.

FRIDAY, JUNE 5.

ROYAL INSTITUTION, at 9.—The New Star in Gemini: Prof. H. H. Turner, F.R.S.

PHYSICAL SOCIETY, at 5.—Special Meeting at University College.—Radio-active Processes: Prof. Rutherford.

GEOLOGISTS' ASSOCIATION, at 8.—The Geology of Lower Tweedside, with Special Reference to the Long Excursion: J. G. Goodchild.

SATURDAY, JUNE 6.

ROYAL INSTITUTION, at 3.—The "De Magnete" and its Author: Prof. S. P. Thompson, F.R.S.

MONDAY, JUNE 8.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Journeys in Mongolia: C. W. Campbell.

INSTITUTE OF ACTUARIES, at 5.—Annual General Meeting.

WEDNESDAY, JUNE 10.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The First Year's Work of the National Antarctic Expedition: The President.

THURSDAY, JUNE 11.

ROYAL SOCIETY, at 4.—Election of Fellows.—At 4.30.—*Probable papers*: The Bending of Electric Waves round a Conducting Obstacle; Amended Result: H. M. Macdonald, F.R.S.—On the Propagation of Tremors along the Surface of an Elastic Solid: Prof. H. Lamb, F.R.S.—The Diffusion of Salts in Aqueous Solutions: J. C. Graham.—On the Structure of Gold Leaf, and the Absorption Spectrum of Gold: Prof. J. W. Mallet, F.R.S.—On Reptilian Remains from the Trias of Elgin: G. A. Boulenger, F.R.S.—A Method for the Investigation of Fossils by Serial Sections: Prof. W. J. Sollas, F.R.S.—An Account of the Devonian Fish, *Palaeospondylus Gunni*, Traquair: Prof. W. J. Sollas, F.R.S., and Miss Igerna B. J. Sollas.—The Measurements of Tissue Fluid in Man; Preliminary Note: Dr. G. Oliver.

MATHEMATICAL SOCIETY, at 5.30.—Quaternions: Major P. A. MacMahon.—Automorphic Functions and the General Theory of Algebraic Curves: Mr. H. W. Richmond.—Jacobi's Construction for Quadric Surfaces: Prof. G. B. Mathews.

FRIDAY, JUNE 12.

PHYSICAL SOCIETY, at 5.—Some Experiments on Shadows in an Astigmatic Beam of Light: Prof. S. P. Thompson.—The Positive Ionisation produced by Hot Platinum in Air at Low Pressures: O. W. Richardson.—On a Method of Determining the Viscosity of Pitch-like Solids: Prof. F. T. Trouton and E. S. Andrews.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 8.—A List of Species of Mollusca from South Africa, forming an Appendix to G. B. Sowerby's "Marine Shells of South Africa": E. A. Smith.—On a New Genus, Planorbia, Moore, from the Albert Edward and Albert Nyanzas: J. E. S. Moore.—Notes on Some Jurassic Shells from Borneo, including a New Species of Trigonia: R. Bullen Newton.—Description of *Marginella lateritia*, n.sp., from the Andaman Islands: J. C. Melvill and E. R. Sykes.—New Mollusca from New Zealand: Rev. W. H. Webster.

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