THURSDAY, MARCH 10, 1904.

THE ANIMALS OF INDIAN GARDENS.

Some Indian Friends and Acquaintances: a Study of the Ways of Birds and other Animals Frequenting Indian Streets and Gardens. By Lieut.-Colonel D. D. Cunningham, C.I.E., F.R.S. Pp. viii+423. (London: John Murray, 1903.) Price 12*s.* net.

BOOKS on the animals, birds especially, that abound in Indian gardens tend to become numerous. This is not surprising, for the wealth of animal life to be found in Indian cities, and especially in suburban gardens, far exceeds anything known in Europe. Not only is the fauna much richer, but, as Colonel Cunningham points out, all animals are tamer and are protected by the human inhabitants of the country, "who," as he says, "are free from the desire to capture or kill any strange or beautiful living thing that they may meet with, who have no youthful hereditary instinct for bird-nesting, and in mature life no natural appreciation of 'murder as a fine art.'"

Whether the last phrase is quite correctly applied to a race amongst whom Thugs and Dacoits flourished at no distant period in the past may perhaps be open to doubt, but there is no question that veneration for animal life is a living principle amongst Hindoos and Buddhists, and consequently that in but few countries in the world are wild birds and beasts more familiar than in India.

The richness of the vegetation in Indian gardens will in a few months, if not checked, convert any vacant space into a thicket, and the cover that is thus produced affords a great attraction to the wild animals of the neighbourhood. Calcutta, where most of Colonel Cunningham's notes were made, has a richer fauna and flora than Indian cities in general, and amongst its suburban gardens are the beautiful Botanic Gardens of Shibpur, which are unsurpassed in India, and the fauna of which has long been almost as famous as the flora.

Of the opportunities afforded by Calcutta suburban gardens for the observation of birds and other animals Colonel Cunningham has made admirable use, and his notes may be fairly compared with Aitken's well-known "Tribes on My Frontier" and "A Naturalist on the Prowl." So far as it has been possible to check the accounts in the present work, all the animals, birds, beasts, reptiles, batrachians and fishes are correctly identified, and the accounts of their habits are from actual observation, not, as is so frequently the case, from tales told by imaginative natives of the country. Only one instance has been met with in which Colonel Cunningham's experience is opposed to that of other writers. He says that tree-snakes, *Dryophis mycterizans,* are "decidedly ill-tempered animals and very ready to bite" (p. 338). The experience of the present writer is precisely the contrary, but there is probably some explanation of the difference.

It is true that many of the observations now recorded have been made by other writers and published in older works, but they are so interesting that they will bear repeating, and the liability of all observers to error in noting the habits of wild animals is so great that it is only by repeated observations that accuracy can be attained. Moreover, many of the facts noticed, even if they have been observed before, are not generally known. As an instance of such contributions to natural history the following account of the device adopted by a pair of "koils," the famous Indian fruit-cuckoos, when engaged in laying eggs in the nests of crows may be quoted. It is, of course, well known that the sexes in the koil differ much more than they do in the majority of cuckoos, the male being glossy black, the female speckled brown, and it is extraordinary that a bird of inferior intelligence and inferior pugnacity should succeed in foisting its eggs on a crow, its superior in both respects.

"The order of events is this: when everything is ready and a desirable nest has been chosen, the cock-koil, conspicuous in his shining black plumage and crimson eyes, seats himself on a prominent perch, whilst the hen, in modest speckled grey garb, lurks hidden amongst dense masses of neighbouring foliage. He then lifts up his voice and shouts aloud, his voice becoming more and more insistent with every repetition of his call, and very soon attracting the attention of the owners of the nest, who rush out to the attack and chase him away. Now comes the chance for his wife, who forthwith nips in to deposit her egg. Very often she does this successfully before the crows have returned, but every now and then she is caught in the act, and driven off, like her husband, uttering volleys of shrill outcries."

Many of the notes on snakes are interesting, and as in this case even the "snake-stories" may be believed, one may be quoted.

"When there was much demand for stores of dried venom for European laboratories, the old snake-man in the Zoological Garden at Alipur was sent out every autumn to collect as many snakes as possible for use during the ensuing winter. His excursions generally lasted for a week or two, and then he would return laden with sacks full of snakes. Once he came back in great triumph bringing a hundred and fifty cobras, and it was a gruesome sight to watch him loose the mouth of one of his sacks and plunge his arm down into it in order to haul out one after another of his prisoners. . . . The cobras were so crowded and hampered in their confined quarters as to be quite unable to raise their heads and necks for the downward stroke with which they normally lay hold, and the man knew so well where and how to seize them, that the chance of his being bitten was really very small."

It is to be regretted that the plates in this book are by no means so good as the text. Some afford a fair idea of the birds or other animals represented, though even in this case, as in the two coloured views of adjutants by day and at roost, the figures are sometimes caricatures, and the majority appear to be copies of indifferent Indian native drawings. Colonel Cunningham is too good an observer not to be aware that neither the colour nor the relative position of the head, wings, and body during flight of the Indian swifts represented in Plate xiv. is correct, that the ants on Plate vi. (p. 112) should not be shown as larger than the eggs of the blue-throated barbet, and that the crow in the front of the plate opposite p. 60 ought to

have the head and neck grey and not black like the "corbies" in the background. There is evidently some error about these figures, for they are referred to throughout the book as Plates i., ii., &c., whilst the corresponding numbers are only marked on them exceptionally and sporadically.

But although the illustrations are not so good as could be wished—and all who have had experience in similar matters know how very difficult it is to secure good figures of animals—the perusal of the present book may be recommended to all who are interested in the animal life of India. W. T. B.

ENGINEERING SCIENCE.

Strength and Elasticity of Structural Members. By R. J. Woods, M.Inst.C.E. Pp. xi+310. (London: E. Arnold, 1903.) Price 10*s.* 6*d.* net.

DURING the last fifteen years there has been a rapid growth in the number of engineering students taking a full course at one or other of the many institutions in Great Britain and America which offer instruction in the necessary subjects, and as a result there has been a steady stream of text-books written especially for this comparatively new class of college students. The strength and elasticity of materials is a branch of engineering science which must be thoroughly mastered by every student, no matter to what branch of engineering he eventually proposes to devote himself. It is not surprising, therefore, that a number of text-books devoted to this subject have been published during the past few years, and it is hence a somewhat difficult matter for any author to show much originality in his treatment of the problems which have to be solved. Mr. Woods has, however, been able to deal with several points in a fresh and interesting manner. The book will be especially valuable to the private student on account of the very excellent series of examples at the end of each chapter, with the solutions given in every case.

The first chapter is devoted to graphical statics, and after simple definitions of the triangle and polygon of forces, the funicular polygon, and the graphical conditions of equilibrium, the methods of solution are explained, and then applied to the practical problems of the graphical determination of stresses in roofs, girders, and framed structures. In the next three chapters the relations between stress and strain are very fully and carefully discussed, the properties of the ellipse of stress are deduced, and the results are applied to the determination of the principal stresses in a beam. In a text-book of this nature it is very important that complete tables should be given of the weights, strengths, and other properties of the various materials used by engineers in structural work, and it may be well to point out that the tables given on pp. 72 and 73 might have been considerably increased, and certainly would have been improved, by the addition of a column giving the elastic limit in tension for such materials as wrought iron, mild steel, &c.

In dealing with bending and bending moments, a slight inversion of the actual order adopted would probably have facilitated the reading of the private student, that is to say, in chapter v. it would have been better to have placed the formulæ connecting stress and bending moment at the end rather than at the beginning, after all the preliminary work of determination of bending moment, drawing of shear and bending moment diagrams, &c., had been fully treated. The author has introduced into the chapters dealing with beams the graphical methods for finding the equivalent area or modulus of section of beams; this useful piece of work is too often omitted from the ordinary text-books.

As the book was originally written in the form of a series of lectures for students at the Royal Indian Engineering College, it naturally deals with one or two branches of the subject not usually considered in elementary text-books; for example, stresses at the joints in masonry structures, stresses due to earth pressure at the back of retaining walls, and the strength and design of riveted joints for structural work, are all fully discussed. The book is a good, clearly written text-book, and will probably be a useful work of reference not only to the engineering student, but to those engaged in actual practical work.

T. H. B.

SCHOOL GEOMETRY.

Theoretical Geometry for Beginners. Part iii. By C. H. Allcock. Pp. viii+113. (London: Macmillan and Co., Ltd., 1904.) Price 1*s.* 6*d.*

Elementary Geometry. Section iii. By Frank R. Barrell, M.A., B.Sc. Pp. viii + 285 to 360. (London: Longmans, Green and Co., 1904.) Price 1*s.* 6*d.*

Rudiments of Geometry for Junior Classes. By M. Wilson. Pp. 228. (London: W. R. Russell and Co.) Price 1*s.* net.

Geometry on Modern Lines. For Elementary Students. By E. Springfield Boulton, M.A. Pp. viii+126. (London: Methuen and Co., 1904.) Price 2*s.*

THE text-book by Mr. Allcock, of which part iii. is now issued, is an excellent substitute for Euclid for those teachers who wish to confine attention mainly to deductive geometry. Experimental and practical work is not entirely omitted, but it occupies a very subordinate place. The book is very attractive on account of its admirable and incisive style and the beautifully clear manner in which it is got up and printed, and it cannot fail to give satisfaction wherever adopted. The present part includes the more important propositions of Euclid, Book ii., also Book iii., Props. 35–37, and Book iv., Props. 10–16. In many cases the algebraical equivalents follow the geometrical proofs, and mutually illustrate one another. In some of the propositions it would have been a great advantage if simple trigonometrical equivalents could also have been given. A useful chapter on the radical axis is included, and answers to the numerical examples are collected at the end of the book.

The geometry by Mr. Barrell displays very commendable originality in the manner of presentation.

The concluding section treats of solid geometry, after Euclid xi., and of the mensuration of simple solids. Particular care has been taken in regard to the figures; they are drawn in oblique parallel or metric projection, are lightly shaded, and are very effective indeed. A few problems on the setting out of such figures to scale, and of the measuring of dimensions from them, would have been interesting and instructive. Also in this section we should like to have seen some account of the graphic representation and measurement of position in space by means of orthogonal projections. In the geometry of the prism, pyramid, wedge, cylinder, cone and sphere, geometrical, algebraical and trigonometrical methods are very happily and naturally combined, resulting in a fuller treatment than is usually met with in similar text-books; many well selected numerical examples are worked out. The prismoidal formula is explained and applied to specific cases. Altogether the author is to be congratulated on the production and completion of a very excellent text-book of elementary geometry on modern lines.

In the "Rudiments of Geometry" the author gives a course which she claims to have introduced successfully at the Municipal Technical School, Gravesend. It is based on experimental work, and is carried on along with practical geometry. Specific drawing exercises are set, and the pupils are required in each case to write out in their own words an account of what they have done, and of any inferences or discoveries they may have made. Formal proofs then follow, and are intended to be based on the collective suggestions of the class; these in turn are reproduced on paper by each boy or girl independently. There are two appendices containing between four and five hundred exercises in geometry. In these the old school of art course is too prominent. It seems to us that the scheme of the book is unduly extended, and that the work must suffer from lack of freshness and variety before the pupils have proceeded very far.

There is little that we can commend in the geometry of Mr. Boulton. The author attempts to cover too much ground in the comparatively small space available, so that nothing is very satisfactorily accomplished.

OUR BOOK SHELF.

Ansichten und Gespräche über die individuelle und specifische Gestaltung in der Natur. By Franz Krašan. Pp. vii+280. (Leipzig: Engelmann, 1903.) Price 6*s.* net.

THIS quaint but very serious book is an expression of the author's attempts to reach some clearness in regard to the conceptions of species, variety, breed, &c., which he has had to deal with in the course of his botanical studies. He discusses the profoundest questions of biology:—How far is organic form a function of organic substance? What is the nature of reaction to surroundings? Can one distinguish between the original and the accessory characters of individuals? What is the real meaning of metamorphosis and substitution of organs? What is the evolutionary import of variation and mutation and modification? How are we to define species, variety, and breed? What is the scope of hybridisation and in-breeding, of isolation and selection? In short, Franz Krašan traverses the whole field of evolution-theory. And yet the result, to our mind at least, is deplorable—nothing short of a pathetic waste of careful and assiduous thinking, for he has cast his book in the form of dialogues between Arthur, Erwin, Fritz, Julius, Raimund, Walther, and possibly some others whose acquaintance we have not been able to make! They are most honourable gentlemen, with a facility of discourse and a knowledge of biology that make one blush; they bid one another a most courteous "Auf Wiedersehen" after discussing "System und Phylogenie," or the Hieraciums of Central Europe; they reappear cheerful and cocksure, like Job's friends, to reiterate their various convictions, while the reader undevoutly wishes that they would all die off and leave Franz Krašan to tell us in plain German what he really means.

We are told that the "sachkundige Leser," which we had mistakenly assumed to mean ourselves, should have no difficulty in appreciating the incognitos of Arthur, Erwin, Fritz, and Company, but there are puzzles enough in nature without making more in biological literature, and we "give it up." Not, however, without saying that the author has the results of much careful work and thought to communicate, the pity being simply that he has hidden his light under the bushel of a method of presentation which is anachronistic, repellant and absurd. We hope that he will feel himself impelled to part company with Arthur, Erwin, Fritz, &c., and tell us in a short essay what he really thinks about individual and specific characters as these occur in nature. J. A. T.

Vegetationsbilder. By Dr. G. Karsten and Dr. H. Schenck. Plates 48. (Jena: Gustav Fischer, 1903.)

BOTANISTS have been distinctly tardy in taking advantage of the facilities offered for introducing photographic illustration into descriptive books. Some American elementary text-books contain very excellent flower studies and ecological scenes, but practically the only standard work in which full advantage has been taken of photographic reproduction is Schimper's "Pflanzengeographie," in which the epoch-making physiological treatise is embellished with magnificent illustrations.

It may be assumed that the success of Schimper's book prompted the publication of this work, in which the illustrations form the main feature, and the text is added by way of explanation and comment. The work has been issued in eight parts, each of which may be purchased separately, and each part contains six plates illustrative of a particular region or representing plants associated by common characters. Three parts deal with tropical lands in which moisture-loving plants abound, and these contain illustrations of rain-forests in Mexico, Java, and Brazil. The superabundance of vegetation does not lend itself well to photography, but the extraordinary development of climbing aroids and epiphytes is well shown. Another conspicuous feature of these regions is the prevalence of large-leaved plants—species of Heliconia, Calathea, Begonia, and many belonging to the order Melastomaceæ—which constitute the ground vegetation. Owing to the more obvious characteristics and the reduced number of plants growing in dry or exposed situations, the photographs of South African scenes, of the seashore vegetation of Brazil, and of Mexican types are the most successful. Of the general character sketches, interest attaches to that showing the growth of *Ipomoea pes-caprae*, but quite the most striking is the illustration of the spread of the sedge

plant *Remirea maritima* and the grass *Stenotaphrum americanum*. Many of the illustrations are limited to the study of a single tree or shrub, indeed all in the parts which deal with monocotyledonous trees and economic plants.

The editors, Drs. G. Karsten and H. Schenck, have provided a very useful and instructive series of plant studies, and it is to be hoped that the publishers will be encouraged to arrange further series. To the botanist and plant lover, as well as to the student, these carefully prepared illustrations should be of very great interest, and will help to make more definite the written descriptions of travellers.

Photographic Failures. Prevention and Cure. By "Scrutator." Pp. 94. (London: Published for the *Photogram* by Dawbarn and Ward, Ltd., 1903.) Price 1*s.* net.

THE subject of this book will appeal to numerous photographers, for many are the pitfalls which they try to avoid.

Negatives may be too hard or too dense, thin, fogged, unsharp, spotted, curiously marked, &c., and prints may suffer from many similar blemishes.

A book that will inform the photographer of the remedies that may be applied to the particular fault in question is one that should be thoroughly welcomed.

"Scrutator," of the *Photogram*, seems to have supplied this want, and confines his antidotes to the problems which beset the practical photographer. The method of treatment adopted is to describe each failure, fault or defect, then to state the causes to which they are due, and finally to suggest either the preventatives or the remedies to be employed. In the case of negatives he gives some specimen negative prints on thin transparent paper to show how incorrect exposure and development affect the relative tones. The book is one that will be very useful to every photographer.

Up-to-Date Tables for Use throughout the Empire. Weights, Measures, Coinage. Compiled and written by Alfred J. Martin. Pp. 251. (London: T. Fisher Unwin, 1904.) Price 2*s.* 6*d.*

THE compiler of this collection of tables believes that the adoption of the metric system of weights and measures for use within the Empire is near at hand, and it is to be hoped his optimism will be justified. He maintains "that if the metric system were made compulsory for railway companies; were adopted by the Bank of England; and shown on our Ordnance Surveys; that within a very short time the system would be generally adopted throughout the Empire." It is unnecessary to do more than mention a few of the numerous tables provided. There are tables showing the relations of various weights and measures of water and of its density at different temperatures; a comparison of British and international systems of physical units, and of measures of time. The little book should certainly serve to popularise the decimal system. A penny supplement for beginners, intended as a guide to simple arithmetic and to show how decimals can be taught at an early age, is also published.

Arithmetical Examples. By W. G. Borchardt, M.A., B.Sc. Pp. viii+279. (London: Rivingtons, 1903.) Price 3*s.*

THESE examples, with the exception of one paper, are taken from the author's "Arithmetical Types and Examples" recently noticed in these columns. The exercises are numerous and well graded, and in drawing them up Mr. Borchardt has kept the recommendations of the Mathematical Association Committee before him.

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.*]

Röntgen Rays and the γ Rays from Radium.

IT has been proved by Mr. Strutt that, for the γ rays of radium, the relative conductivity of gases varies approximately as the density, whereas there is a wide divergence from this law in the case of Röntgen rays. Taking air as the standard, the figures given are:—

	Density	γ Rays	Röntgen Rays
Air	1·00	1·00	1 00
Carbon dioxide	1·53	1·53	1·60
Sulphur dioxide	2·19	2·13	7·97
Chloroform	4·32	4·88	31 9
Methyl iodide	5·05	4·80	72 0

Prof. Rutherford suggested some comparative experiments to ascertain if the more penetrating Röntgen rays, after passing through thick metal screens, were similar in their action to the γ rays of radium. The experiments have proved that the relative conductivity imparted to gases by Röntgen rays is a function of the penetrating power of the rays employed, and the results obtained approximate to those found for the γ rays rather than to the high figures previously quoted for Röntgen rays.

In the experiments, two electroscopes were placed side by side, completely enclosed in two thin lead vessels the sides of which were 1·8 mm. thick. A large "hard" bulb and a powerful induction coil were used. The rates of discharge for air were ascertained to be identical, and one of the electroscopes was then filled with gas under examination, and the rates were again measured.

In the case of sulphuretted hydrogen, for which a ratio of six to one has been obtained for ordinary Röntgen rays, the present experiments for penetrating rays showed a close equality with air. This is in agreement with the relative conductivity obtained for the γ rays. Results of a similar character have been obtained for chlorine and for air saturated with chloroform. Further experiments are in progress to compare the relative conductivity of a number of gases for the two kinds of rays.

The results so far obtained indicate that the differences in the relative conductivity of gases, previously observed for Röntgen and γ rays, were due to the great difference in the penetrating power of the rays in the two cases, and that, for Röntgen rays comparable in penetrating power with the γ rays, these differences to a large extent disappear.

A. S. EVE.

McGill University, Montreal, February 18.

Nature of the γ Rays from Radium.

THE interesting results recorded by Mr. Eve in the preceding letter on the relative conductivity of gases for very penetrating Röntgen rays removes the strongest objection that has been urged against the common belief that the γ rays are an extremely penetrating type of Röntgen rays. All the experimental evidence so far obtained is now in agreement with the view that the γ rays are very penetrating Röntgen rays which have their source in the atom of the radio-active substance at the moment of the expulsion of the β or kathodic particle. For example, I have found that the γ rays from radium always accompany the β rays, and are always proportional in amount to them. In radium the β and γ rays appear only in the third change occurring in the radio-active matter which causes "excited activity," *i.e.* in the fourth of the chain of radio-active products which result from the disintegration of the radium atom.

In addition, as Mr. Ashworth pointed out in a recent letter to this Journal (January 28), the fact that the amount of γ rays from radium is independent of its degree of concentration points to the conclusion that the γ rays arise from the disintegrated atom, and are not secondary rays set up by the bombardment of the radium as a whole by the β rays.

On the theory of the nature of Röntgen rays, developed

by the late Sir George Stokes and Prof. J. J. Thomson, it is to be expected that Röntgen rays would be set up at the sudden starting as well as at the sudden stopping of the electron or β particle. As a result of the sudden expulsion of the β particle from radium, it is to be expected that a narrow electromagnetic pulse, *i.e.* a "hard" or penetrating type of Röntgen rays, would be generated. In addition, on account of the great speed of the β particle, it is able to penetrate through a considerable thickness of matter before it is stopped. A broad pulse or "soft" Röntgen rays should thus arise at the point of incidence of the β rays.

E. RUTHERFORD.

McGill University, Montreal, February 18.

Learned Societies.

MY attention has recently been directed to the letters of Messrs. Buchanan and Heaviside, and I quite agree that the existing system of referring papers by learned societies is capable of great improvement. But what I wish to point out is that every author who feels aggrieved has a remedy in his own hands, which consists in abstaining for the future from sending papers for publication to the society against which he has cause of complaint.

A sufficient supply of papers for publication in their *Transactions* or *Proceedings* constitutes the life-blood of the societies to which I refer, and if the supply were cut off these societies would soon die of inanition. At the present day there are a large number of mathematico-physical periodicals, most of which supply authors with a reasonable number of *gratuitous* copies of their paper for private distribution, so that authors gain the same advantages which learned societies offer them, without being subjected to the disadvantage of having their papers referred to a *secret inquisition* composed of persons whom I can testify, from personal experience as a former councillor of a learned society, frequently know far less about the subject-matter of the paper than the author does, and whose reports, to my own personal knowledge, have frequently contained errors from not understanding the papers.

There is absolutely no reason why authors should employ learned societies as the medium for the publication of their papers, and if they have a legitimate cause of complaint against any particular society, the practical and common sense course to pursue is to boycott it. If this were done, it would soon be possible to start a "British Journal of Mathematics and Physics" on the same lines as the American and various other foreign journals, the absence of which constitutes a very serious blot upon British scientific enterprise.

A. B. BASSET.

Grand Hotel, Alassio, Italy, March 3.

A Dynamical System illustrating the Spectrum Lines and the Phenomena of Radio-activity.

IN NATURE of February 25 there appeared a letter by Prof. Nagaoka, of Tokyo, relative to the stability and vibrations of a ring of negative electric charges revolving about a central positive charge. Prof. Nagaoka states that such a system is generally stable, but as the result of an investigation by the method used by Maxwell for Saturn's ring, I came to the conclusion some five years ago that the system is unstable if the law of electric force be that of the inverse square and the magnetic force be neglected. Consequently I thought the result not worth publication, but in view of Prof. Nagaoka's letter it may now be of interest to your readers.

Maxwell ("Collected Papers," vol. i. p. 315) finds the frequency equation for displacements perpendicular to the plane of a ring of revolving satellites to be

$$n'^2 = S + (R/\mu)\,J,$$

where S is the mass of Saturn, R/μ that of each satellite, and the radius of the ring is unity. The displacements are of the type $\zeta = C \cos(m\theta + n't + \gamma)$, where C, γ are arbitrary constants, θ is the arc from a point of the ring to the satellite, and m is an integer.

If p be the number of satellites and r an integer, we have

$$J = \Sigma \sin^2 m\theta/2 \sin^3 \theta$$

with $\theta = r\pi/p$; the summation is taken for all values of r from 1 to $p-1/2$ if r be odd, and from r to $p/2$ if p be even, with the coefficient $\frac{1}{4}$ for the last term in place of $\frac{1}{2}$. The disturbance which is most likely to cause instability is that for which $m = p-1/2$, or $p/2$, as the case may be.

In the electrical problem R/μ is to be replaced by $-e^2/Ma^3$, if e be the charge and M the mass of each electron of the ring of radius a; the minus sign is due to the fact that the electrons repel each other. S is to be replaced by $+qe^2/Ma^3$, if the central positive charge be qe. The frequency equation now is

$$n'^2 = (e^2/Ma^3)\,(q - J).$$

In the same way the angular velocity ω is given by the equation

$$\omega^2 = (e^2/Ma^3)\,(q - K),$$

where

$$K = \Sigma\ 1/2 \sin\theta.$$

Steady motion is possible so long as $q > K$; this motion is stable (for these disturbances) if $q > J$.

All the terms of K and J are positive, and the lower terms, due to charges near the one considered, increase very rapidly as p increases. Ultimately K is of order $p \log p$, and J of order $p^3 \log p$. The first few values are as follows:—

p	2	3	4	5	6	7	8	9	10
J	0·25	0·58	1·16	2·24	5·0	6·4	11·2	13·6	21·2

I find that $K > p$ when $p > 4{\cdot}72$ about; obviously $J > p$ when $p > 7$.

For an electrically neutral system it follows that $p < 8$.

Prof. Nagaoka considers the motion to be quasi-stable; let us therefore consider the value of n' when $p = 8$. In this case $K = 2{\cdot}80$. Thus $\omega^2 = (e^2/ma^3) \times 5{\cdot}2$, and $n'^2 = -\omega^2 \times 3{\cdot}2/5{\cdot}2$, $n' = \sqrt{-1}\omega \times 0{\cdot}78$. The time in which the disturbance is multiplied $\epsilon^{2\pi}$ times, that is, 535 times, is thus $1{\cdot}27 \times$ the period of revolution; this implies a high degree of instability for $p = 8$, and *a fortiori* for $p > 8$.

Let us now consider the radial and tangential disturbances; let their frequency be $x\omega$. The frequency equation is of the form

$$(x^2 - a)^2 = b - cx,$$

where a is a positive constant, and $b > a^2$; c is smaller than either, and, in fact, vanishes when $m = p/2$. In the Saturn problem b can be made less than a^2 by making the number of satellites small enough, but in the electrical problem this cannot be done.

Since $b = 0$ for $m = p/2$, all arrangements of an even number of electrons in a ring are unstable; this excludes $p = 2$, 4 and 6.

When $m = (p-1)/2$, I find for

$p = 3$:	$a = 0{\cdot}44$,	$b = 1{\cdot}23$,	$c = 0{\cdot}24$;
5:	0·55,	3·80,	0·47;
7:	0·85,	10 80,	0·66.

The parabolas

$$y = x^2 - a \quad \text{and} \quad y = b - cx$$

in these cases intersect in only two points; thus two frequencies are imaginary, and the system is unstable.

Of course, the whole investigation assumes symmetrical arrangement of the electrons. When there are three rings the frequency equations involve toroidal functions and are difficult to deal with. The effect of magnetic force has not been taken into account, but I do not see any reason why it should seriously affect the conclusions.

G. A. SCHOTT.

University College of Wales, Aberystwyth, February 29.

P.S.—I am at present examining the case of three or more rings; the axial motion for three rings can be made stable by taking the radii nearly equal and the electrons of the middle ring of opposite sign to those of the other two; as to the radial and tangential motions, I am not yet able to express an opinion. Two rings are obviously unstable.

March 7.

The *n*-Rays.

IN trying to repeat Blondlot's experiments I have met with the usual lack of success, but one experiment I have made seems worthy of record. A small quantity of radium salt was accidentally spilled upon a barium platinocyanide screen, which consequently became faintly luminous in the dark. The light was very faint, and in order to see it more

clearly I placed the screen nearly in contact with the eye. On touching the back of the screen with the finger, just under the luminous patch, there was seen to be a perceptible alteration in intensity of the light.

On pressing the screen with the finger the light seemed to become less intense, and on removing the pressure the intensity was restored. A piece of metal, whether cold or hot, produced the same effect as the finger, and therefore vital action is not necessary for the phenomenon.

At first sight it seemed as though the effect was caused by the muscular effort of the observer, for pressing the back of the head against a wall whilst the screen was in contact with the eye apparently made some difference in the brightness of the light, as also did clenching the hands, but in some cases the light was brighter and in others fainter, so that not much reliance can be placed upon the observation. Another person's hand was as efficacious as that of the observer.

I tried the experiment on two other persons without telling them what was to be observed, and in both cases they said "the light is fading."

The experiment is very easily repeated, and it might be interesting to know whether it can be seen more readily than the *n*-ray manifestation. The screen must not be very bright; a zinc sulphide screen does not answer at all.

W. A. DOUGLAS RUDGE.

Woodbridge School, Suffolk.

Earth Structure.

PROF. MILNE, in reviewing Mr. T. Mellard Reade's book, "The Evolution of Earth Structure, with a Theory of Geomorphic Changes," emphasises the demand at the present time for some theory which shall explain "pulsatory movements by which large tracts have been alternately raised and lowered." Mr. Reade has attempted to supply the want, but, as Prof. Milne points out, his explanation is in some respects not very fundamental.

Just before any solidification had occurred, the hot viscous gases which originally composed our earth, under the combined influence of gravity and diffusion, arranged themselves in such a way, each according to its density, that the heaviest swarmed towards the centre, where the pressure was also highest, and diminished in concentration towards the outside, where the pressure was at the same time lowest. In this way an infinite number of layers would have been formed, in which the change of composition varied gradually but continuously from the centre to the outside, and the total composition at depths far apart was widely different. When such a mass goes on cooling, where will solidification take place?

The temperature of the earth's centre is probably much higher than the critical temperatures of substances with which we are acquainted, and such substances would therefore be gaseous there. Possible exceptions are the platinum metals, a few other elements, and *endothermic* compounds. The latter are quite stable and almost certainly easily formed at these temperatures and pressures, and they can also most probably remain solid at enormously high temperatures. If so, it is obvious that solidification in the mass of the earth's gases would have very soon occurred, not merely on the outside, where the temperature gradient was always very steep, but at some one or more, possibly deeply situated places where the layers happened to be of a composition more suitable in the circumstances, for the making of infusible endothermic substances—to us probably unknown—than those nearer the outside. There would then be layers of fluid sandwiched in between layers of solid. If we suppose the temperature coefficient of expansion in these localities to be similar to those met with on the earth's surface, any particular solid layer there would, as the whole earth cools, contract more quickly than the layers underneath it, until the solid would at length give way, and an escape of magma through the rupture would relieve the tension. All the layers above, including the outer crust, would respond to this explosion; but in time the customary steady rate of cooling and contraction would be resumed, which ultimately leading up to another "blow off," would culminate in the continued repetition of the whole process.

Endothermic compounds can store enormous quantities of internal energy, which in suitable circumstances offering conditions of less stability can be discharged. The simple rupture would therefore be complicated by the production of chemical changes, by expansion and contraction locally, and possibly even by regelation. If in the earth's interior the coefficient of expansion increases with the temperature or with the pressure, there would be a tendency for the centre to shrink away from the layers above, and vesicles would result, as pointed out long ago by Fisher. As these vesicles would get larger and larger, a solid layer anywhere here would be subjected to a strain as a result of the differential motion above and below it, and a collapse—obviously tending to become recurrent—would occur, which would ultimately affect the outer crust periodically or spasmodically.

It is tolerably certain that under oceans the outer crust is much thicker than it is under the continents; the temperature gradients teach us this, and plumb-line measurements are also probably, most simply so explained. When a movement occurs below, we should consequently expect that the crust would "give" more under the continents than under the oceans. This would in the long run be an agency tending to counteract the effects of denudation, &c., so that continents should rise relatively to the oceans; and though no doubt local conditions could easily modify the easy applicability of this generalisation to any particular case, this seems an eminently useful conclusion.

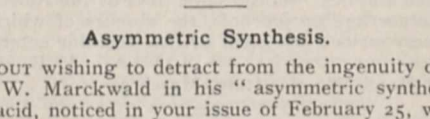
It is not at once obvious that there is anything, so far, at variance with any of the well-known facts discovered by the labours of Hopkins, Kelvin, Delauney, Darwin, Fisher and others; on the contrary, the joint results of their work seem to require a combination of solid and fluid which here appears to find adequate satisfaction. When it is so generally assumed that the first portion of the earth to solidify was the outermost part, it is, perhaps, not unnecessary to point out that that is, as a matter of fact, not quite true. In the atmosphere and hydrosphere we have the lightest—and fortuitously the most volatile—of those gases which originally cooled to make our planet. Quite irrespective of what may happen below us, we know for certain that the outside of the earth must cool some 200 degrees before our descendants or their helium-breathing and demon-like representatives will find solid air among the constituents of the rocks under our feet.

Kristiania, February 5. CHARLES J. J. FOX.

Asymmetric Synthesis.

WITHOUT wishing to detract from the ingenuity displayed by Dr. W. Marckwald in his "asymmetric synthesis" of valeric acid, noticed in your issue of February 25, we desire to point out that it is not a true asymmetric synthesis in the ordinary sense.

The ion of the acid or acid salt of ethylmethylmalonic acid may exist in solution in two enantiomorphously related forms



On the addition of brucine the least soluble salt will crystallise out. This is no more than the resolution of an externally compensated ion by Pasteur's well-known method. Both components of the salt will be active. The subsequent decomposition will, if no racemisation occurs, of necessity give rise to an active acid. Now this is a very different thing from the problem attacked by Fischer and Slimmer, Cohen and Whiteley, and Kipping. In these cases the original substance which is to be rendered active is not capable of existing in enantiomorphously related forms until it is submitted to chemical change in combination with the active substance.

It is for this reason that we consider that Dr. Marckwald cannot claim to have accomplished a true asymmetric synthesis.

J. B. COHEN.
T. S. PATTERSON.

The Yorkshire College, Leeds, February 26.

GEOLOGICAL PHOTOGRAPHS.

GEOLOGISTS will welcome the second issue of photographs by the committee of the British Association, appointed for the collection, preservation, and systematic registration of photographs of geological interest. The circumstances which led to the appointment of the committee were fully set forth in our review of the first issue (NATURE, vol. lxvii. p. 32, November, 1902). The value of these illustrations, both for teacher and student, is beyond question; indeed, as furnishing material for comparative study they may not infrequently prove useful to the investigator also; it may not perhaps be regarded in the light of a compliment when it is added that there is at least one university professor who makes them serve for examination purposes, but this is a perhaps too practical inquisitor, who, when weather permits, sets his examinees in front of previously unseen sections in the field. Every student, not to say teacher, of geology should have seen most of the phenomena somewhere or other which these photographs display, but it is very possible that not everyone has; it is even possible that some geologists have not seen a cirque, an esker, and a pitchstone-lava flow, *i.e.* not all three. Nothing, of course, can be a substitute for direct observation, but these photographs are certainly the next best thing to it.

FIG. 1.—Overfolding in Upper Carboniferous Limestone: South of Lough Shinny, Dublin. Photographed by Mr. J. A. Cunningham.

Their value is greatly enhanced by the fact that the descriptions have in each case been entrusted to a specialist familiar with the structure illustrated; we need only refer to Profs. Bonney, Lapworth, Marr, Watts and Garwood, not to mention many other familiar names, to show that the scientific description of scenery has been placed in the best of hands. The subjects chosen for illustration cover a wide range; the Scúr of Eigg, with its old lava flow filling a valley now exalted into a conspicuous hill, is shown from a point of view not often selected, and with excellent effect; the column of the Hemlock stone, very reminiscent of the Sahara, offers an admirable illustration of wind abrasion, though it is said to have been at one time mistaken for a sea-stack; a cirque in Bala rocks is interesting both in itself and on account of the associated glacial and fluviatile phenomena; the Cheddar ravine is a good example of an unroofed subterranean stream; and a boulder of Silurian rock resting on a glacially polished pedestal of mountain limestone affords a proof of the comparatively trivial amount of subaërial denudation which has taken place since the close of the Glacial period; the cliffs of Muckross are an excellent study in jointing, here, as sharply shown as in a text-book diagram; the raised beach at Saunton Down End, near Barnstaple, is probably one of the finest examples of such beaches to be found in the British Isles; the classic unconformity of Old Red Sandstone on Silurian rocks at Siccar Point, referred to by many of the old masters and figured by Lyell in his "Elements," is well described by Prof. Lapworth; there is a good example of metamorphism produced by the great Whin sill; the rumbling hole in the ravine, Glenariff, co. Antrim, is a triumph of the photographer's skill.

From so much excellent material (the series comprises twenty-four photographs) it is difficult to choose, but with the kind permission of the photographers we select two examples for reproduction on a reduced scale, which may be taken as fair specimens of the

FIG. 2.—Stems of *Lepidodendron Veltheimianum*, Sternb., *in situ*: Victoria Park, near Partick, Glasgow. Photographed by Mr. J. R. Stewart.

whole. The overfolded mountain limestone of Fig. 1, covered by Boulder-clay, presents many points of interest; the duplication of the fold, just behind the figure in the foreground, is particularly well shown, and the various behaviour of the beds in the anticlinal to the right is most instructive, as is the onion-shaped synclinal, which succeeds it. The second figure illustrates part of an ancient Carboniferous forest which extends over a considerable area around Glasgow, and is not seldom exposed by quarrying operations. The trunks of the trees are rooted in dark coloured carbonaceous shales, and covered with grey sandy shales and flaggy sandstones, in which their débris—branches and fragments of bark—lies scattered; overlying the whole is a sill of intrusive dolerite (unfortunately quarried away, and so not shown in the figure), to which possibly they owe their preservation. It is very gratifying to know that steps have been taken to protect this interesting exposure from the weather by roofing it over, though the scene must thereby lose some of the picturesqueness suggested by the photograph, where the contrast of the graceful living trees with the stumps of the extinct and monstrous Cryptogams (one of these measures 3 feet in diameter) has a very pleasing effect.

The committee is to be congratulated upon the great and general excellence of the work, and the editor of the series for the admirable judgment he has displayed in making a selection from the vast amount of material at his disposal.

ACTION OF ANÆSTHETICS ON PLANTS.

IT not unfrequently happens that the passer-by in autumn is startled to find horse-chestnuts and other spring-flowering trees producing a second crop of flowers. A similar occurrence is not infrequent in pear or apple trees and in the common laburnum. This autumnal flowering is due to one of two causes. In some cases after the flowers have been produced on the "old wood" or on short "spurs," the *Kurztriebe* of the Germans, formed in the previous autumn, other flowers are produced on the long shoots of the present year. The difference in the general appearance of a tree producing its flowers on the " spurs " and of one where the blossoms are produced on the " extension shoots " is often greater than that observable between distinct species, and yet, of course, there is no specific difference between them. The autumnal production of flowers on the yearling shoots is generally assigned, but in a vague, indeterminate fashion, to changes in external conditions. Be that as it may, there are some varieties such as the Napoleon pear which every year behave in this fashion. The operations of pruning are regulated by the way in which the buds are produced on the old or on the new wood of the year, so that the gardener has to take cognisance of appearances which might be, and indeed are, generally ignored by the systematic botanist.

Another cause of autumnal flowering is due to precocity or anticipation. This is the matter which in particular has suggested this note. The flower buds are formed in their usual place, but, for some reason or other, growth and development are hastened, and the flowers which in ordinary circumstances should unfold in the following spring are seen to expand in autumn.

In one of the squares in Paris last autumn the whole or the greater part of the horse-chestnut trees were in bloom, young foliage being interspersed among the flowers. On closer examination it was seen that the older leaves had almost all fallen prematurely or were shrivelled up as if the roots had been deprived in some way of their necessary supplies of water. Similar instances of autumn flowering are familiar to observers, and they seem generally to be due to summer drought, to removal at an unpropitious period, or to any cause which interferes with the normal course of nutrition. Allusion is made to these phenomena because they throw light on the experiments of Johannsen, of Copenhagen, who was the first to show the effect of ether vapour in hastening the flowering period of various shrubs. The action of the vapour of chloroform and that of ether in arresting the movements of the leaflets of the sensitive plant (mimosa) have long been known, but the action has been considered to be purely local.

Matters were in this state when Johannsen pushed his experiments further, and in a different direction, and proved that the flowering of lilacs could be hastened by exposure to the vapour of ether. He thought that if he shortened the resting stage of the shrubs during which their activity is dormant, he would be enabled to induce the earlier and more rapid production of flowers. Exposure to the vapour of ether he found arrested the growth of the plant and secured its earlier and more complete " rest." Johannsen's experiments have been repeated on a large scale in Germany and in France, the general method of procedure being the following. In a case, as nearly air-tight as possible, the lilac bushes are placed at a temperature of about 65° F. Light is excluded. From the top of the case is suspended a small cup into which the ether is poured by means of a funnel through an aperture, made for the purpose, and immediately closed. Owing to the explosive nature of the vapour the greatest care must be taken to avoid the presence of any flame. Thirty or forty grammes of ether are enough for a hundred cubic litres of air. The plants are subjected to the influence of the vapour for forty-eight hours. On their removal from the ether chamber the leaves fall, if they have not already done so. The plants are then removed to a cool house and gradually subjected to forcing in the ordinary manner.

By these means the expansion of the blooms is hastened, the etherised plants producing their blooms several days before those treated in the ordinary manner. The gain of a few days is a matter of great importance to the grower for market in the winter season, as he gets so much better a price for his goods. Moreover, the cost of fuel is reduced, for the same amount of heat is not required for forcing, as we have seen that the time required is diminished. Not only lilacs, but many other flowering shrubs have been experimented upon, and with such good results that the process has been adopted on a large scale, and in our own country Mr. Jannoch has, we learn, adopted the plan with most successful results.

A writer in the *Jardin* of January 20 narrates how he exposed plants of lilacs to the vapour of ether in the manner above described on December 7, removed them to the greenhouse on December 9, and on January 1 the flowers were sufficiently expanded for use in the decoration of his apartments. Other varieties followed at a few days' interval. *Spiraea Thunbergii* etherised on December 7 was in full bloom on December 24.

M. Minier, who made these experiments, placed his apparatus in a temperature of 13°–16° C., and the plants were subjected to the ether vapour for forty hours. They were afterwards placed in a house where the temperature ranged from 13°–16° C. at night to 15°–18° C. by day.

The photographs showing the contrast between the etherised and the non-etherised plants are very remarkable and bear witness to the value of the process in securing bloom in the dull season when the chrysanthemums are beginning to go off. It is noteworthy

that the operation is most successful in November and December, and that if delayed until January the results are not so serviceable, as flowering plants can then be obtained in the ordinary way.

It is surmised that the anæsthetics act by causing the removal of the water from the protoplasm, thus drying it up to a certain extent and causing a suspension of its activity. Dr. Johannsen's observations are summarised in a *brochure* published in French by M. Maumené, and entitled "Nouvelle méthode de culture forçée des arbustes et des plantes soumis à l'action de l'éther et du chloroforme," Paris 1903. Abstracts from these publications have been given in various Continental and English horticultural journals, particularly in the October part of the *Journal* of the Royal Horticultural Society, which contains a paper on the subject by M. E. Lemoine, of Nancy, to which reference may be made for fuller details.

M. O. CALLANDREAU.

IT is but a short time since one read in the *Bulletin Astronomique* the words of generous appreciation and sympathy with which M. Callandreau committed to the grave the remains of his friend and colleague M. Prosper Henry. There was no suspicion then that in a very short time his own funeral oration would have to be spoken, or that the staff of the Paris Observatory was so soon to suffer another almost irreparable loss by the removal of another zealous officer equally renowned, equally devoted to the interests of the observatory, but adding to its reputation in a very different direction.

For many years attached to the service of the observatory, M. Callandreau took part in the routine observations, more especially confining himself to the extra-meridional work. Small planets, comets, double stars, each in turn came under his notice, but though a skilful and painstaking observer, he will not be remembered for his diligence in this direction.

Trained in a school directed by profound mathematicians, in which, perhaps, the influence of Gylden can be recognised, and gifted with an unusual analytical skill, he attacked nearly all the questions of celestial mechanics, and everywhere left traces of his powerful and inventive mind. His acquaintance with all the resources of analysis as applied to the practical needs of astronomy enabled him not only to improve the methods employed in some of the more recondite applications of mathematics to astronomical problems, but induced him to open up new paths of inquiry, which are likely to exercise no inconsiderable influence on many questions of abiding interest and prime importance. It will be sufficient here to refer to his method of treatment of definite integrals which occur in the calculations of planetary perturbation, to the consideration he gave to the troublesome question of perturbations of small planets in which the mean motion is nearly commensurable with that of Jupiter, to his occasional references to the theory of the moon, to the figures of the planets, to problems in geodesy, to show how wide an outlook he possessed over the necessities and the difficulties of mathematical astronomy. It is perhaps in some measure to be regretted that his attention wandered over a variety of inquiries, for if everywhere he illuminated the subject under discussion, greater concentration in a particular subject might have added to his reputation and left a deeper mark on the history of his time. Perhaps his "Contributions to the Theory of Cometary Capture" comes nearest to a complete treatise, and his services in this department of astronomy will be long remembered. Some of his papers bear marks of being suggested by his professorial work in connection with the École Polytechnique, where he occupied the chair of astronomy. His life was a busy one, divided between his duties at the observatory and his professorial engagements, while his kindness of disposition induced him to give willing assistance to those who applied to him. The writer of these few lines gratefully acknowledges more than one kindness he has received at the hands of this distinguished mathematician and astronomer.

Member of the Paris Academy of Sciences and honoured in his own country and among his colleagues, we look in vain for his name among the foreign associates of the Royal Astronomical Society. The kind of work on which he concentrated his attention does not appeal to a numerous class of astronomers, especially would it fail to collect the suffrages of amateurs. But those who read his numerous papers will admit the ability by which they are distinguished and the informing character of their contents. We extend a respectful sympathy to the institution that is bereft of his services, to his colleagues who lose an illustrious example, and to his pupils who are deprived of an able and encouraging teacher. W. E. P.

NOTES.

AN important step has been taken by the Colonial Office, in conjunction with the Imperial Institute, in giving expert assistance to a project of the British Cotton-Growing Association to start cotton growing on a large scale in southern Nigeria. A detailed examination is to be made of several promising districts in the Protectorate, in order to determine the suitability of the soil, climate, &c., for planting cotton, the most important of these districts being the Sobo plains near the coast, where the Ethiope and Jamieson Rivers enter the sea. Mr. W. G. Freeman, of the scientific staff of the Imperial Institute, formerly of the Department of Agriculture of the West Indies, has just left England under instructions from the Colonial Office to cooperate in this matter with Mr. P. Hitchens, the local forestry officer in southern Nigeria, whose services have been placed at the disposal of the British Cotton-Growing Association by the local Government. In the event of a favourable decision being arrived at, the Colonial Office intends to render every assistance to the British Cotton-Growing Association in organising the arrangements for cotton cultivation in southern Nigeria, which will be commenced this season, and on the results of these preliminary operations the extension of cotton cultivation in the Protectorate will depend.

AFTER practically fifty years' connection with the Berlin Observatory, Prof. Förster proposes to retire from the directorship, to which he succeeded on the retirement of Encke. The knowledge that he can survey a long period of activity and of successful work, and that he carries with him the hearty appreciation of his colleagues, will be to him a source of satisfaction in his well merited retirement and leisure. The observatory that he leaves to his successor and the problems that engage attention now are different from those that he took over from Encke. It would be interesting to compare the present state of the observatory and its instrumental equipment with the condition in which Prof. Förster found them when he joined the staff. In those ancient days the work of the observatory was to some extent hampered by the preparation of the national ephemeris, which, under the title of "Encke's Astronomisches Jahrbuch," attained such well deserved consideration. Gradually the Rechen Institut has separated itself more and more from the observatory, until the name of the

director is no longer connected with the publication. Further, though the instrumental equipment has been extended, and is no doubt now in a high state of efficiency, yet the new director will probably find that larger telescopes are necessary to enable the observatory to compete with other national observatories. One may look for considerable expansion in this direction under the guidance of an astronomer so well known as Dr. Hermann Struve, who, it is reported, will take up his residence in Berlin next October as the director of the observatory. His reputation, built mainly on his admirable work connected with Saturn's satellites, will have confirmed him in the importance and advantage of instruments possessed of great optical power.

A REVACCINATION Bill, promoted by the Imperial Vaccination League, has been introduced into the House of Commons by Sir John Batty Tuke, and is backed by Sir M. Foster, Sir J. Dorrington, Sir R. C. Jebb, Dr. Thompson, and Dr. Farquharson among others. The Bill provides for the revaccination of all children between the ages of twelve and thirteen, except those who may be exempted in the way prescribed by the Act of 1898, or on medical grounds. A manifesto in support of revaccination at school age has been circulated by the league, and has already received the signatures of a number of influential persons, including the Chief Rabbi, Lord Kelvin, Sir Frederick Pollock, headmasters of public schools, heads of colleges, &c. Mrs. Garrett Anderson, M.D., the honorary secretary of the league, in a letter to the *Times* solicits further signatures, to be addressed to 53 Berners Street, W., and headed "Manifesto in Support of Revaccination," and with the name, address, and style of the sender clearly written.

WITH regard to the article on the "Fish Hypothesis and the Transmission of Leprosy," that appeared in NATURE of February 25, Dr. John Knott writes to point out that leprosy has disappeared from Ireland, though the condition of the people, especially on the west coast, has but little improved, and half decomposed fish is still freely eaten.

A COMMITTEE has been formed with the object of obtaining subscriptions for a memorial to the late Prof. Nicol, in association with the University of Aberdeen, in which he taught for twenty-five years. The form the memorial should take has not been decided, but a suggestion has been made that if a memorial brass, similar to those erected to the memory of his predecessor and his successor, the late Profs. Macgillivray and Nicholson, were provided, and placed with them in the University of Aberdeen, the ornithologist, stratigraphist, and palæontologist who have brought honour to the university would be fittingly remembered in association with the scene and centre of their life work. The following are among the names of members of the committee:—Prof. J. W. Judd, C.B., F.R.S., Dr. J. Horne, F.R.S., Dr. B. W. Peach, F.R.S., Prof. Stephenson, Prof. Trail, F.R.S., and Prof. J. Arthur Thomson. The secretary and treasurer, to whom subscriptions should be sent, is Dr. W. Mackie, 13 North Street, Elgin.

THE French Association for the Advancement of Science has decided, on the proposition of the president, M. Laisant, to endow a course of astronomical physics in connection with the faculty of science of the University of Paris. The professor is to be M. Pierre Puiseux, of the Paris Observatory.

WE regret to see the announcement, in the *Daily Chronicle*, that M. F. A. Fouqué, the eminent French geologist and mineralogist, died in Paris on March 7 in his seventy-sixth year.

A TELEGRAM from Mayotta, one of the Comoro Islands, states that since February 25 a volcanic eruption has been in progress in Comoro. Lava is being thrown up from three craters, situated about 1000 yards distant from one another. It is reported that at Penzance and some of the neighbouring villages an earthquake shock was felt at 1 p.m. on March 3. A telegram received at New York states that an earthquake, more violent than any experienced in that city during the past thirty years, occurred at Lima, the capital of Peru, at 5.20 a.m. on March 4.

THE death is announced of Dr. A. S. Murray, keeper of Greek and Roman antiquities in the British Museum. Dr. Murray was born near Arbroath, in Forfarshire, on January 8, 1841. He was educated at the Royal High School of Edinburgh and Edinburgh University, and was also for some time a student at the University of Berlin. In February, 1867, he was appointed assistant in the department of Greek and Roman antiquities in the British Museum, the then keeper of the department being Mr. (afterwards Sir Charles) Newton. When Newton retired from the keepership in the spring of 1886, Mr. Murray was appointed his successor. Among the unofficial works written by him were a "Manual of Mythology," a "History of Greek Sculpture," a "Handbook of Greek Archæology," and "Sculptures of the Parthenon." Dr. Murray's scientific position was remarkable for the fact that, almost alone among modern archæologists, he refused to accept the evidences for the early dates that are now assigned to the Mycenæan period of Greek antiquity. Dr. Murray was a correspondant of the Institute of France, corresponding member of the Prussian Academy of Sciences, member of the British Academy, fellow of the Society of Antiquaries, and vice-president of the Hellenic Society.

THE Trustees of the Elizabeth Thompson Science Fund made the following grants at a meeting held in Boston, Mass., on February 5:—300 dollars to Prof. Morris W. Travers, London, for researches on the absolute scale of temperature, by experiments with liquid hydrogen; 150 dollars to Prof. Benjamin L. Seawell, Warrensburg, Missouri, for study of the taxonomy and ecology of the organisms of fresh-water lakes, in relation to fish foods and water supplies; 40 dollars to Prof. A. Nicolas, Nancy, France, for studies on the embryology of reptiles; 250 dollars to Prof. H. S. Grindley, Urbana, Ill., for the separation and purification of the nitrogenous substances of meats; 200 dollars to Prof. R. Hürthle, Breslau, Germany, to determine the relation between pressure and the obliteration of circulation; 143 dollars to Prof. W. J. Moenkhaus, Bloomington, Ind., for studies on the individuality of maternal and paternal chromatin in hybrids; 50 dollars to Mr. S. P. Fergusson, Hyde Park, Mass., to measure the errors of absorption hygrometers; 300 dollars to Dr. Werner Rosenthal, Erlangen, Germany, for researches on the Lombardy chicken pest; and 300 dollars to Prof. Henry S. Carhart, Ann Arbor, Michigan, for the preparation and study of Clark and Weston standard cells.

THE twenty-sixth annual general meeting of the Institute of Chemistry was held on March 1, Mr. David Howard, president, being in the chair. Prof. Tilden moved the adoption of the annual report of the council, at the same time commenting on the general progress of the institute. He considered it satisfactory to note that, notwithstanding the increasingly stringent regulations as to training, the very high standard of the examinations, and in spite of the loss of members by death, the number of fellows and associates, viz. 1098, was 251 higher than in 1894. He also referred

to the scheme for the promotion of the better training of technical chemists, now under the consideration of the council. The president delivered his address, in which he commented on the work of the council during the past year, on the present position of the institute, and on the work the council at present has in hand.

IT is reported by the *Scientific American* that the U.S. Navy Department will establish a branch naval observatory in Samoa, and that 1600*l.* has been allotted for this purpose.

THE *British Medical Journal* announces that a congress of experimental psychology is to be held at Giessen on April 18–20. Among the organisers of the congress are Profs. Exner (Vienna), Hering (Leipzig), von Kries (Freiburg), Stumpf (Berlin), and Ziehen (Halle).

ON Tuesday next, March 15, Dr. E. A. Wallis Budge will deliver the first of two lectures at the Royal Institution on "The Doctrine of Heaven and Hell in Ancient Egypt and the Books of the Underworld." The Friday evening discourse on March 25 will be delivered by Prof. Dewar on "Liquid Hydrogen Calorimetry."

AT the thanksgiving service at St. Paul's Cathedral for the centenary of the British and Foreign Bible Society on March 6, the Archbishop of Canterbury referred in his sermon to the relation of science and religion. His Grace said, "It was on the strength of Biblical texts that the scheme of Christopher Columbus was condemned by the Spanish junta in 1490 as vain and indefensible. In 1616 Galileo's teaching that the earth moves round the sun was formally censured by the consulting theologians of the holy office, 'because expressly contrary to Holy Scripture.' A generation or two afterwards English students were warned by high authority against the investigations of so true and profound a Christian thinker as Sir Isaac Newton as being 'built on fallible phenomena and advanced by many arbitrary presumptions against evident testimonies of Scripture.' And the lives of Roger Bacon, of Copernicus, of Kepler, and of many more, down even to our own day, and incidents fresh in the recollection of many here, suggest to the thoughtful student of Holy Scripture the imperative need of a reverent and humble-minded caution in our attitude towards every controversy of the kind. We have been oftentimes reminded that it is only the foundation of God that remaineth sure, and on that foundation have been built also the irrefragable conclusions of science. We are not, indeed, required to accept at once every unproven hypothesis, or to mistake for absolute science mere assertions about that which is unknowable. True science and true religion are twin sisters, each studying her own sacred Book of God, and nothing but disaster can arise from the petulant scorn of the one, or from the timidity or the tyrannies of the other."

THE view of an empire as an organism, presented by Sir John Cockburn in a paper on the biology of federation read before the Society of Arts on February 9, shows that scientific principles may with advantage be borne in mind in the consideration of problems in politics and practical sociology. There is a suggestive analogy between biological development and the life processes of political organisations and institutions. Comte thought that a study of the laws of biology was necessary for the proper comprehension of sociology; Herbert Spencer elaborated the numerous points of agreement between the two sciences, and Sir Leslie Stephen referred to the community as a social tissue. Primitive societies may be regarded as analogous to the simple cell; they are full of vitality, but fall an easy prey to more complex and effective organisations. When an offshoot takes place, the daughter organism completely separates itself from the mother, and there is no coordination between the two bodies. On the other hand, remarked Sir John Cockburn, in the many-celled entities the various groups of differentiated, but not wholly detached, cells undertake different duties, enter into definite relations, and become regularly coordinated in the performance of the functions necessary for the common life. The process of evolution is the same, whether it deals with the primordial cell, which by subdivision forms the various tissues and organs which, grouped together, constitute a complex organism, or whether it deals with a primitive homogeneous society, which by division of labour and coordination of effort becomes a civilised community, and by combination with other communities a nation; or whether, on the highest plane of all, it deals with a race which, by colonisation and subsequent cooperation of its several parts, becomes an empire. Sir John Cockburn's paper contains many other instructive instances of natural law in the political world, and provides a strong case for the cultivation of the scientific spirit in all who are concerned with the progress of the State.

IN the February number of the *American Journal of Science* Messrs. Bumstead and Wheeler give the results of an investigation of the radio-active gas found in the soil and in the tap-water at Newhaven, Conn. They establish its identity with the radium emanation by a careful comparison of the rate of decay of its activity and of its rate of diffusion. Mr. E. P. Adams has recently shown that the radio-active gas discovered by Prof. J. J. Thomson has the general characteristics of the radium emanation, and it seems likely that the gas obtained from the soil in various parts of Germany by Messrs. Elster and Geitel owes its activity to the same source. The authors conclude that radium is probably widely diffused in the earth's crust. They were unable to confirm the existence of a radio-active gas obtainable from mercury.

IN the *American Journal of Science* Dr. C. Barus describes a direct micrometric method for the measurement of the diameter of fog particles. A thin plate of glass is covered with a film of oil and held for a certain time horizontally in the fog, and then rotated back into the field of the microscope, where it is screened from further deposition. The particles caught on the oiled surface appear as brilliant round globules, and persist in a saturated atmosphere for many minutes. Some preliminary results of the number of particles per cubic centimetre and of their diameter are given. The former varies from 4×10^4 to $2\cdot5\times10^5$, and the latter from 4×10^{-4} to 8×10^{-4} cm. In certain cases the diameters of the drops varied between 10^{-3} and 5×10^{-4} cm., all the intermediate sizes being present. The experiments are being proceeded with by means of a photographic method.

THE chief differences observed between the salts of radium and those of actinium can be explained by means of the view that the emanation from actinium disappears in a few seconds, whilst that from radium decays to one-half in four days. In the *Comptes rendus* of February 15 M. Debierne describes a series of experiments made in order to determine the rate of decay of the emanation from actinium. When the ionisation produced by the emanation was used as a criterion of its activity, a uniform rate of decay was observed, the activity diminishing to one-half in 3·9 seconds. On the other hand, the power of exciting induced radio-activity was found to rise (apparently from zero) to a maximum value, but ultimately to decay accord-

ing to the same logarithmic law as in the case of the ionisation to one-half in 3·9 seconds. The rate of decay of the excited activity was also measured, and the half-value was found to be reached in 40 minutes.

A REPRODUCTION, in the *Chemical News* of February 19, of Profs. Curie and Dewar's paper on the examination of a sample of gas occluded in radium bromide contains a number of important details not referred to in the French paper recently summarised in these columns. Thus, in the experiments at the Royal Institution in which radium bromide was heated in a quartz tube, the condensable gases are stated to have contained water, bromine, and carbon dioxide in addition to the emanation, whilst the spectrum observed after freezing out the nitrogen was that of hydrogen, and not of nitrogen as stated in the *Comptes rendus*; in such a tube, it is added, it would be impossible to find small amounts of helium by the spectroscope, seeing that a 10 per cent. helium-hydrogen mixture shows nothing but hydrogen. In reference to the subsequent appearance of the helium spectrum in the vacuous quartz tube, it is pointed out that "until the full spectroscopic examination by Deslandres is published no inference can be drawn as to whether or no the amount of helium has gone on increasing in the quartz tube (as it ought to do if it is a true product of the disintegration of radium), and no conclusion drawn as to the presence of other gases and their origin, whether new or old."

AN exceedingly interesting summary of the recent work of Profs. Elster and Geitel on the radio-activity of the air and the soil is contained in a recent number of the Geneva *Archives des Sciences*. In order to test whether the radio-activity of the air was inherent or induced from outside, a steel boiler of 23 cubic metres capacity was kept closed during six weeks, and an aluminium wire was then introduced and negatively charged to a potential of 2000 volts; no radio-activity was induced on the wire, and the air, isolated in this way from the rest of the atmosphere, was completely inactive. The radio-activity is attributed to an emanation produced by some radio-active substance in the soil which finds its way into the included air, and thence into the free atmosphere as well as into the water of mineral springs. An attempt was made to isolate the radio-active constituent of a specially active earth from the Italian Alps, and the results obtained were in accordance with the view that the soil contained a trace of radium; the hydrochloric acid extract yielded a barium sulphate precipitate about as active as potassium uranyl sulphate, and a platinum kathode immersed in the solution became permanently (?) radio-active. Further support of this view is found in the fact that the induced activity separated from the air decays at the same rate as that induced by radium salts.

WE have received the first part of the "Abhandlungen zur Didaktik und Philosophie der Naturwissenschaft," which are being issued as adjuncts to the *Zeitschrift für den physikalischen und chemischen Unterricht*. These are intended to be monographs in a more extended form on matters such as those considered in the *Zeitschrift*. The present number, by Herr E. Grimsehl, of Hamburg (who is one of the general editors), is on "Die elektrische Glühlampe im Dienste des physikalischen Unterrichts," and deals, so far as is possible in the sixty pages at disposal, with the numerous uses to which electric glow lamps can be put in physical demonstrations. Many of these uses are probably well known to most lecturers who have had experience in demonstrating to large audiences, but the beginner will be able to pick up a great number of hints from the descriptions given. The apparatus described can all be obtained from the firm of A. Krüss in Hamburg.

THE United States Weather Bureau has recently issued a memoir on the climatology of California, prepared under the direction of Prof. W. L. Moore by A. G. McAdie, professor of meteorology. The author points out that the climate of California is controlled by four great factors:—(1) the movements of the areas of high and low barometric pressure; (2) the prevailing drift of the atmosphere from west to east; (3) the proximity of the Pacific Ocean, with a mean annual temperature near the coast line of about 55°; and (4) the exceedingly diversified topography of the country for a distance of 200 miles from the coast inland. To illustrate these leading features, long series of observations at suitably chosen localities have been elaborately discussed in 260 large quarto pages, with 42 diagrams and charts, and furnish a very valuable contribution to meteorological knowledge. The remarkable pictures of fog billows obtained at the Observatory of Mount Tamalpais, and noticed in our columns some time ago, are reproduced in an interesting article on the fog of the district of San Francisco.

WE have received a copy of the second part of the *Psychological Bulletin*, which is devoted to the literary section of the *Psychological Review*. It includes the proceedings of the American Psychological and Philosophical Associations.

THE volume of the *Proceedings* of the Philadelphia Academy for the current year opens with the first part of a paper by Mr. H. Pilsbry on new Japanese molluscs, this instalment being devoted to gastropods. The number of species described is very large; unfortunately, one of the names—*Conus dormitor*—has long been preoccupied for the well-known shell from the Barton Eocene.

IN the *Proceedings* of the South African Philosophical Society, Mr. W. L. Distant describes a number of new South African Tingididæ and other Heteroptera. In a previous paper the author enumerated twenty-six species, distributed in twelve genera as non-Palæarctic species of the African mainland; the present list raises the number of species to forty, and of genera to twenty-one. It may be considered a pity that the author uses the generic name of a common tree, Ulmus, to designate a new genus of insects.

ACCORDING to its report, the efforts of the Society for the Protection of Birds were mainly devoted during 1903 to securing more effectual protection for the breeding-places and eggs of our rarer birds, to the extension of the competitions in connection with "Bird and Tree Day," and to further exposure of certain alleged frauds in regard to so-called artificial osprey plumes and the suppression of birds' plumage in millinery. The "watchers' fund," started in 1902, not having met with so much support as was expected, limited expenditure on the first item. It is suggested that the endeavour may be made to render both the sale and possession of skins and eggs of rare birds illegal, but this is surely far too drastic a measure to meet with public approval. Most or all of the so-called artificial "ospreys" were found to be real egret plumes.

AN excellent portrait of Prof. D. J. Cunningham appears in the report of the Royal Zoological Society of Ireland for the past year. His appointment to the chair of anatomy at Edinburgh has compelled Prof. Cunningham to retire from

the office of president, which he has filled with such conspicuous success for the last seven years, and the society is deeply sensible of the loss it has thereby sustained. The new president is the Lord-Lieutenant, the Earl of Dudley. The purchasing power of the society has been somewhat crippled by two circumstances, namely, the large amount of damage done to the buildings in the gardens by the great storm of February, 1903, and by a falling off in the gate-money. On the other hand, the gifts of large and valuable animals have been unusually numerous, including a young elephant and a young leopard from the Duke and Duchess of Connaught, and a pair of young giraffes from Sir Reginald Wingate.

WE have received from the Smithsonian Institution a batch of papers published in the *Proceedings* of the U.S. Museum. Among these is one, by Mr. G. S. Miller, on bats collected in Cuba, which contains an interesting account of a visit to a bat-cave in the island. Two others, by Mr. H. C. Oberholser, are devoted respectively to the American wrens and great horned owls. In a fourth Messrs. Jordan and Snyder describe and figure two chimæras from Japanese waters, while in a fifth the former writer and Mr. E. C. Starks review the scorpænoid fishes of Japan. Special interest attaches to the account, by Mr. F. A. Lucas, of a new labyrinthodont and a new reptile from the Trias of Arizona, on account of the identification of the former, which is known by the central thoracic shield, with the European genus Metoposaurus (*olim Metopias*), and from the apparent affinity of the latter, which is known from a humerus, and is named Placerias, with the African Pariasaurus.

WE have to acknowledge the receipt of vol. ii. of the third series of the *Anales* of the Buenos Ayres Museum. Dr. Ameghino's article on "diprotodont" Tertiary mammals from Patagonia has already been noticed in our columns. Among the other contents, two articles by Dr. H. von Ihering, the one on "Cretaceous" molluscs and the other on Tertiary brachiopods of Patagonia, are of prime importance. In the former the author, after pointing out what he regards as serious errors in the determinations of previous observers, concludes that strata regarded as Pliocene are really Pleistocene, and others classed as Miocene are truly Pliocene, while the alleged Cretaceous beds are considered to be more probably Eocene. Further observations on the subject, in which it may be hoped that the age of the various mammaliferous horizons will be taken into consideration, are promised. As regards Tertiary brachiopods, the remarkable resemblance between the South American forms and those of New Zealand, coupled with the equally striking difference between the former and their Chilian representatives, justify the opinion that the South American continent was formerly prolonged towards the Antarctic, and for this prolongation the author has suggested the name Archinotis. This Archinotis extended from Patagonia to Kerguelen Island at a comparatively modern (Tertiary) epoch, but if it formed a connection with Africa it must have been quite separated from the Chilian side of South America.

OF the papers which appear in the second part of the last volume of the *Transactions* of the Royal Scottish Arboricultural Society, the description of the Atholl larch plantation by Mr. J. Booth is interesting both from the historical and scientific aspect, and the information concerning the Douglas fir plantation at Taymount refers to a tree of great value which is fairly well suited to our climate. The volume also contains a summary of the principal coniferous timbers which are imported into the country, written by Mr. A. D. Richardson, "Notes for Planters," by Mr. G. V. Macdonald, and other papers.

A COPY of the fourteenth annual report (1903) of the Missouri Botanical Garden has been received. A very fine illustration is given of the *Agave Toneliana*, and another even more interesting photograph figures *Amorphophallus Rivieri* in flower, which is represented growing from a corm in a saucer (Fig. 1). Mr. A. Rehder presents an exhaustive treatise of the genus Lonicera, supplemented with illustrations of new species. He adopts Linné's subdivision into two subgenera, Periclymenum and Chamæcerasus or

FIG. 1.—Saucer Gardening—*Amorphophallus Rivieri*.

Xylosteum, and sinks the subgenus Nintooa in the latter. Another interesting section of this subgenus is named Cœloxylosteum, because the free bracts occur concomitantly with a hollow pith in the branches. The increase in the number of species—the total exceeds 150—is due to the large number of specimens recently gathered in China and other parts of Central and East Asia.

PROF. BOVERI is always interesting when he writes on the cell, and the little volume—"Ergebnisse ü. d. Konstitution der chromatischen Substanz des Zellkerns"—just published by Gustav Fischer forms a useful presentation of the author's views as to the permanence of the nuclear chromosomes. Those familiar with the literature will perhaps not find much that is new, but the clearness with

which the main thesis is kept before the reader considerably enhances the interest of what is mainly a summary of recent work contributed by the author and other investigators.

THE report of the Felsted School Scientific Society for the years 1902 and 1903 shows that the masters at Felsted are encouraging scientific observation of biological and other natural phenomena. Papers by members of the society on the birds, butterflies, moths and plants of the school neighbourhood are printed in the report.

WE have received from the Government of India Department of Revenue and Agriculture a copy of "Agricultural Statistics of India for the Years 1897–98 to 1901–02." The statistics were compiled under the supervision of the Director-General of Statistics, and are published in two parts. The first volume deals with British India and the second with the Native States.

MESSRS. LEPPIN AND MASCHE, of Berlin, have sent us a copy of the catalogue of the physical apparatus to be exhibited by them at the forthcoming St. Louis Exhibition. The first part of the catalogue contains particulars of a set of physical apparatus for the elementary schools in Berlin, and the second section instruments suitable for universities, high schools and colleges.

SOME remarkable examples of positive and negative catalysis are given by Dr. Titoff in the *Zeitschrift für physikalische Chemie*. The case studied was the oxidation by dissolved oxygen of sodium sulphite in dilute aqueous solution, a change which was half completed in 10–20 minutes when the water used was distilled from a boiler with an iron still-head and so contained traces of iron, but required 200 minutes with water distilled in a silvered or tinned copper still, and as much as 1500 to 1800 minutes when the purest available water was used. The oxidation is extraordinarily sensitive to the influence of traces of copper, and it is stated that a marked acceleration is produced by N/1,000,000,000,000 $CuSO_4$, or by merely dipping a piece of bright metallic copper into the water during less than a minute. Mannitol even in N/100,000 solution *reduces* the velocity of oxidation by 50 per cent., and tin salts are even more powerful negative catalysts; at a concentration of only N/250,000 the velocity was reduced to 25 per cent. of the normal value, but even then the tin salt, though 150 times as active as the mannitol, is still 20 to 25 times less active than the copper salts.

THE additions to the Zoological Society's Gardens during the past week include two Nisnas Monkeys (*Cercopithecus pyrrhonotus*) from Uganda, presented by Mr. C. R. Hall; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by the Lady Londesborough; two Cheetahs (*Cynaelurus jubatus*), a Beisa Antelope (*Oryx beisa*) from Somaliland, presented by Captain Barnard; a Horned Capuchin (*Cebus apella*) from South America, deposited; three Gold Pheasants (*Thaumalea picta*) from China, received in exchange.

OUR ASTRONOMICAL COLUMN.

RADIAL VELOCITIES OF TWENTY ORION STARS.—Messrs. Frost and Adams, of the Yerkes Observatory, have just published the complete discussion and results of their determination of the radial velocities of twenty stars, all of which have spectra of the Orion type, in one of the *Decennial Publications* (viii.) of the Chicago University.

The spectra were obtained with the Bruce spectrograph attached to the 40-inch refractor, and a self-induction spark between titanium poles was used as the light source of the comparison spectrum in every case.

An analysis of the velocities obtained—which are reduced to the sun—indicates that the Orion stars, as a class, are much more remote than the solar stars, for their *real* radial velocities are much smaller. A classification of thirty-one Orion stars, based on the behaviour of the lines of He, H, Mg, Si, N and O in the region between λ 4300 and λ 4720, is given at the end of the paper.

CATALOGUE OF LONG-PERIOD VARIABLE STARS.—*Circular* No. 74 of the Harvard College Observatory contains a catalogue of 407 variable stars having long periods, published by Prof. Pickering. The positions and photographic magnitudes of some of the sequences of comparison stars for these variables were published in vol. xxxvii. of the Harvard College Observatory *Annals*; others will appear in vol. xlvii. Those sequences not given in either of the two publications mentioned are given in the present *Circular*.

Prof. Pickering expresses the hope that other astronomers will select and publish similar sequences for long-period variables, and that many will regularly observe these objects. He suggests that in using Argelander's method for determining the magnitudes it is quite sufficient to record that the star under observation is brighter than one and less bright than another of two nearly equal comparison stars, for, owing to the errors introduced by personal equations, &c., the estimation by grades is unnecessarily refined. All the comparison stars selected will, so far as possible, be observed photometrically at Harvard in order that the results from various observatories may be reduced to a common scale.

THE LEONID SHOWER OF 1903.—In the current number of the *Observatory* (No. 342) Mr. Denning gives a table of the apparent paths and magnitudes of twenty-six Leonids, six Taurids, and twenty-three other meteors, observed in England between November 14–18 inclusive, all of which were as bright as, or brighter than, Jupiter. In a second table he gives the real paths of nine of these meteors (including five Leonids, two Taurids, one Hydrid, and one Arietid), and then directs attention to the frequent appearance of bright Taurids and Arietids during the November Leonid showers.

M. Fiévez, of Boitsfort, in a communication to the Académie Royale de Belgique (*Bulletin* No. 12, 1903), announces that, during a watch of two hours (12·30 to 2·30) on the morning of November 16, he observed thirty-eight meteors, of which thirty-four were Leonids. In the same *Bulletin* M. Terby states that two other observers, also stationed at Boitsfort, observed thirty-four meteors, of which twenty-eight were Leonids, between 10.5 p.m. on November 15 and 5 a.m. on November 16. The majority of these were of the first magnitude, and they appeared in groups, six of them being seen in six minutes between 1 a.m. and 2 a.m.

THE DISTRIBUTION OF LINES IN BANDED SPECTRA.—At a meeting of the Paris Academy of Sciences held on February 8, M. Deslandres announced the results of his recent researches in connection with the law, announced by him in 1886, concerning the distribution of lines in spectral bands. These results confirm his law of arithmetical progression, but indicate several anomalies in the behaviour of the independent lines in the series.

From a photograph of the negative-pole spectrum of nitrogen he very carefully determined the frequencies of the individual lines in the band at λ 3577, and found that they may be almost exactly represented by the integration of seven series, each obtained by calculation from the formula $N = A(m + p/q)^2 + c$ (where N = the frequency, A and c are constants, m is a whole number, and p and q are small whole numbers), by giving different values to the constants for each series.

Finally, he states the general law, as now confirmed, in the following words:—"In general each band, expressed in number of vibrations, is divisible into series of connected lines, each series being such that the successive intervals are in arithmetical progression. . . ." (*Comptes rendus*, No. 6).

SUN-SPOT VARIATION IN LATITUDE, 1861–1902.

EVERYONE who is acquainted with sun-spot statistics is familiar with the law known as "Spörer's law of sun-spot zones," which was derived after a laborious series of sun-spot observations made by Spörer himself. Previous to this indefatigable worker, Carrington made a series of most valuable observations between the years 1853 and 1861, and it was he who first directed attention to the fact that sun-spots had a general drift towards the equator during a sun-spot cycle. To use his own words, he stated that there was indicated "a great contraction of the limiting parallels between which spots were formed for two years previously to the minimum of 1856, and, soon after this epoch, the apparent commencement of two fresh belts of spots in high latitudes, north and south, which have in subsequent years shown a tendency to coalesce, and ultimately to contract, as before, to extinction."

Discussing these and his own observations, Spörer was led not only to corroborate the deductions made by Carrington, but to formulate more definitely a law of sun-spot circulation, which he stated as follows:—

"Un peu avant le minimum, il n'y a de taches que près de l'equateur solaire, entre $+5°$ et $-5°$. A partir du minimum, les taches, qui avaient depuis longtemps déserté les hautes latitudes, s'y montrent brusquement vers $\pm 30°$. Puis elles se multiplient, un peu partout, a peu près entre ces limites, jusqu'au maximum, mais leur latitude moyenne diminue constamment jusqu'à l'époque du nouveau minimum."

To arrive at this result Spörer made a very complete investigation of the position of every sun-spot that had been observed up to that time in relation to the solar equator. In fact, he brought together all the statistics of the latitudes of sun-spots for each hemisphere, and determined for each period of the sun's rotation the mean heliographic latitude of the spotted area. To indicate the variation from year to year of this mean heliographic latitude he published curves, and the special feature of these was that each commenced in high latitudes about the time of sun-spot minimum, and gradually approached the equator until the epoch of the following minimum, when a new cycle commenced in high latitudes, the two curves overlapping for a short time about the time of sun-spot minimum.

If Spörer's curves be closely examined it will be found that those which pass strictly through the actual points given by observation are of a *wavy* nature, and are sometimes above and below the mean curve from which Spörer deduced his law. In fact, Spörer himself directed attention to this peculiarity, and distinctly remarked on the subsidiary increases of spotted area and a reversion of spots to higher latitudes at times other than at sun-spot minimum. In later times Dr. Braun, of the Kalósca Observatory, pointed out similar anomalies from his own observations made between 1880 and 1884.

From the illustration (Fig. 2) accompanying this article curves B indicate the wavy nature of these mean heliographic curves, and it will be noticed that even up to the present time this peculiarity is a marked feature.

It was with the object of attempting to trace the origin of these variations—variations which indicated that Spörer's law might be only of a very general nature—that a recent investigation was commenced, the results of which were communicated to the Royal Society (February 11).

The method of analysis was to divide the limited region on the sun's surface in which spots appear into strips or zones, in a similar way to that employed in the study of the prominences (NATURE, vol. lxvii. p. 570). As solar prominences appear on any part of the disc, it was sufficient, in order to trace their distribution throughout a year, to divide the sun's surface into nine zones of 10 degrees each. Since, however, spots seldom occur above latitude 40°, the width of the zones had to be considerably diminished. For the present inquiry, it was decided to group the spots into belts 3 degrees wide, for even zones of 5 degrees in width were found to mask many important characteristics.

The necessity for such narrow zones will be seen from the accompanying figure (Fig. 1), in which the yearly distribution of spots is shown for the years 1879–1883, taking zones of 10 degrees, 5 degrees, and 3 degrees in width respectively.

In these curves each broad vertical line corresponds to the solar equator, and the scales to the right and left of each represent the north and south latitudes respectively. The heights of the curves above each horizontal zero line indicate the different amounts of spotted area, and the scales of these are so arranged that the curves are all proportional to the spotted area.

The curves themselves are formed by determining the mean spotted area for each zone, and plotting each value at the point representing the mean latitude of this zone; these points are then all joined together. Thus, in the case of the 0–10° zone, the mean spotted area is plotted at 5°, 10–20° at 15°, &c. The other zone divisions are similarly treated; thus 0–5° is plotted at 2·5°, 0–3° at 1·5°, &c.

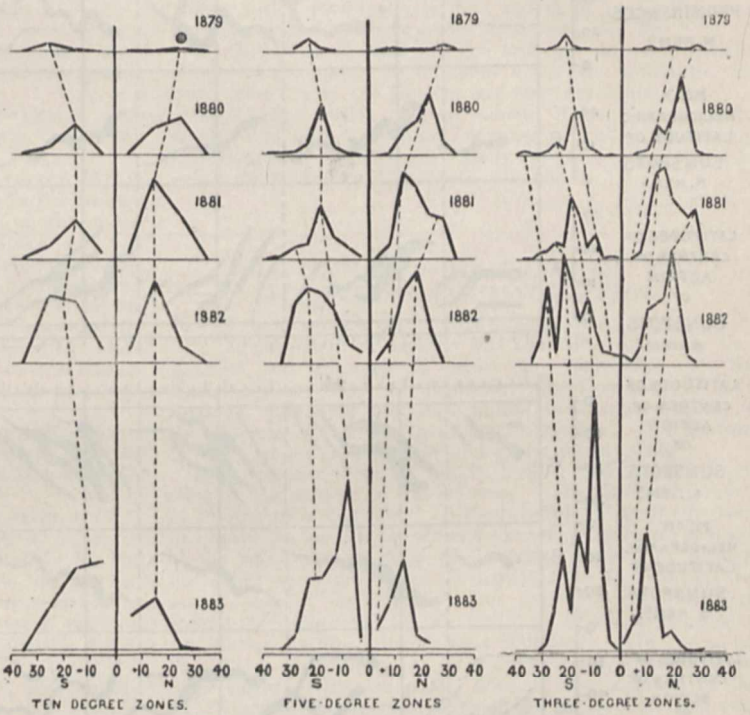


FIG. 1.—Distribution of Sun's Spotted Area.

In the 10° zone curves here shown there is only one maximum in each hemisphere for the years in question, and these, as indicated by the dotted curves which join them, do not progress gradually towards the equator as would probably be the case according to Spörer's law. With 5° zones it is possible to detect the presence of two maxima in one or other of the hemispheres, all of which have a trend towards the equator in succeeding years. Still more detail is displayed in the 3° zones, and here is apparent a spot distribution and movement which is practically masked in the two preceding sets of curves.

The advisability of adopting 3° zones being thus apparent, the whole series of observations from the year 1861–1902 was treated in the above manner, the points plotted, and

the curves drawn as shown in the figure previously referred to.

In this way it was possible to trace the varying positions, as regards changes of latitude, of the centres of action, or maxima points of the curves, from year to year, just as was previously attempted in the case of the prominences. These centres of action were then connected by lines passing from one yearly curve to the next. It is worthy of remark that very little difficulty was met with in deciding the maxima points to be joined. There was always, throughout the whole period, a most distinct march of these points individually towards the equator, and the method of placing the curves one beneath the other rendered such movement at once obvious to the eye.

The diagram (Fig. 1) not only exhibits some of the types of curves met with, but shows how the various centres of maximum spot-activity were joined up with each other, year by year, for the period of time over which the curves extend, namely, from 1879, the year following a sun-spot minimum, to about a sun-spot maximum in 1883.

Considering the curves relating to the sun's northern hemisphere, it will be seen that in 1879, the year following a sun-spot minimum, when the spots were ending a cycle near the equator, two new outbreaks occurred in latitudes about 20° and 30°. These two centres of activity moved towards the equator next year, and by 1881 the former had disappeared, while the other rapidly grew in intensity and reached latitude 15°. During this year a new outbreak in latitude 30° made its appearance, and this in the two following years had an equatorial trend. A somewhat similar occurrence took place in the southern hemisphere, each of the centres of action moving rapidly towards the equator.

It is interesting to note the rapid growth and decay of these centres of action, an example of which is shown commencing in 1879 in latitude 28° in the northern hemisphere. Attention may particularly be directed to the three prominent maxima of the curves for the southern hemisphere in the years 1882 and 1883, which indicate that at this period there were three definite centres of spot-action in existence.

To bring the results of the above analysis for the whole period of time investigated within a small compass the same method was adopted as that employed in the case of the prominence reduction to which reference has already been made.

In Fig. 2 the two sets of curves marked A indicate for each hemisphere the changes in the positions of these centres of spot-activity from year to year, plotted at equal intervals of a year. The striped portion is deduced from Spörer's observations, and the remainder from the Greenwich reductions. These lines have been proportionally thickened to indicate approximately the relative amount of spotted area at these centres of action, or, in other words, the heights of the maxima points on the yearly curves. These curves thus indicate for each year the positions, as regards latitude, of the centres of spot activity, and give an idea of the movements of these centres during each sun-spot cycle.

As these curves have here been called "spot-activity tracks," so "prominence-activity tracks" may be employed to indicate the equivalent variations as regards the prominences.

For the sake of comparison, curves B, C, and D have been added. Curves B show the variations of the mean heliographic latitude of the total spotted area for each hemisphere. Curves C illustrate the distribution and changes of position of the centres of prominence activity, or "prominence-activity tracks" as they may now be called. The small circles in the years 1870–1871 represent Respighi's observations, the curves from 1872–1881 those of Secchi and Tacchini, and the remainder, up to the year 1902, Ricco and Mascari's observations. The dotted curves previous to 1870 are intended

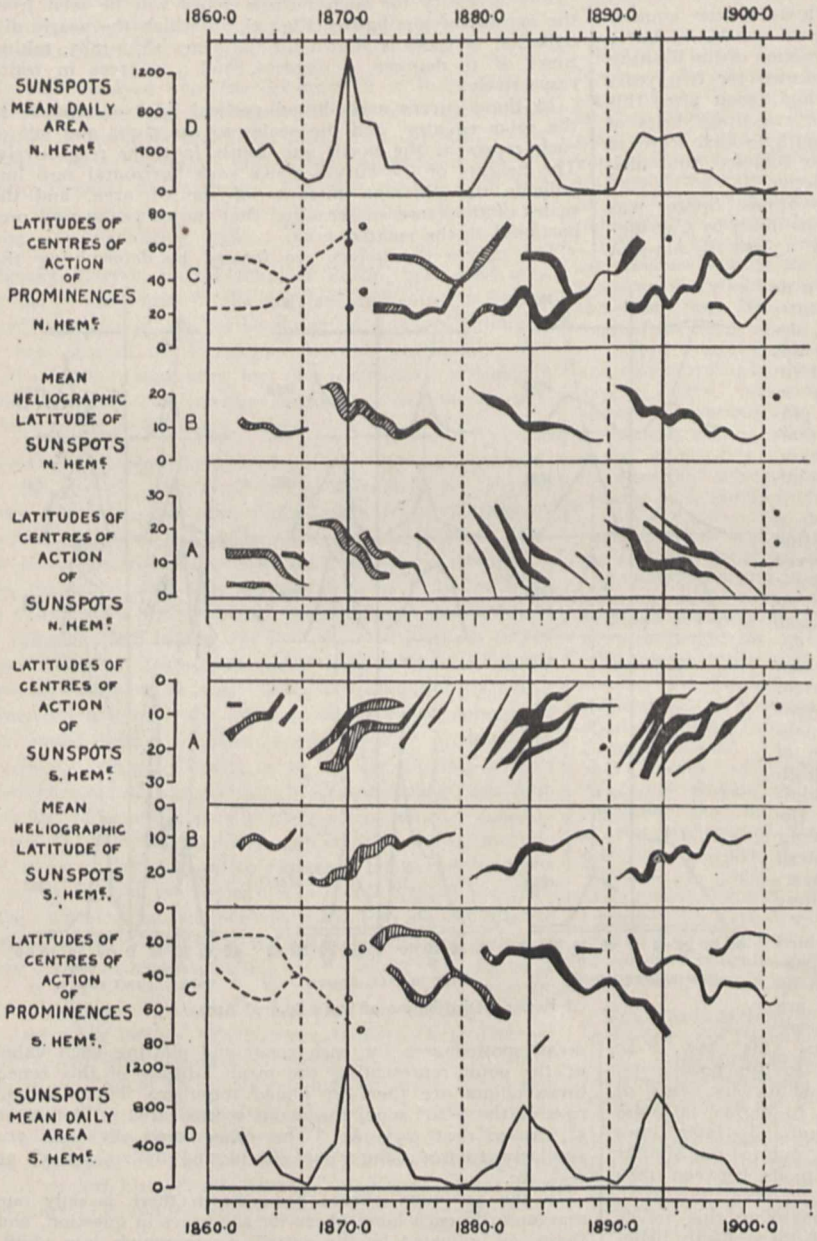


FIG. 2.—A comparison of the curves illustrating (A) spot-activity tracks; (B) mean heliographic latitude of sun-spots; (C) prominence-activity tracks; (D) variation of spotted area. (The continuous and broken vertical lines indicate the epochs of sun-spot maxima and minima respectively, the two hemispheres being taken together.)

only to give a rough idea of the prominence variations based on a repetition of the observations of 1872–1885. The last curves, namely, those marked D, represent the variation from year to year of the total spotted area on each hemisphere of the sun. The vertical broken and continuous lines indicate the epochs of sun-spot minima and maxima as determined by combining the amount of spotted area on both hemispheres of the sun.

Considering now the curves marked A, the following *general* deductions may be made :—

From sun-spot minimum to minimum there are three, but generally four, distinct "spot-activity tracks," or loci of movements of the centres of action of spot disturbance.

The first appearance of each of these "spot-activity tracks" occurs generally between a sun-spot minimum and the following maximum. After about the epoch of maximum no new "spot-activity tracks" of large magnitude are generally commenced.

Their first appearance is mostly in higher latitudes than 20° in each hemisphere.

They are faintly indicated at first, become more prominent and distinct, and finally thin out and fade away.

They all fade away in regions close to the equator.

There seems to be a tendency for each successive "spot-activity track" to make its appearance in latitudes higher than the one preceding it.

At, or a little after, the time of sun-spot maximum there is also a tendency for each "spot-activity track" to retain its latitude for a short time.

It is interesting now to examine these curves (A) in relation to those marked B, which, as previously pointed out, represent the drift from year to year of the mean heliographic spot latitude and illustrate Spörer's "law of zones." These latter (curves B) are individually really nothing more than the *integration* of the corresponding curves A. Every change of curvature in curves B is due to either the outburst of spots in another "spot-activity track" or to one "spot-activity track" becoming more intensified in relation to another, or, lastly, to the extinction of a "spot-activity track" as the equator has been reached, as shown in the curves A.

To illustrate this, let the curve for the mean heliographic spot latitude in the southern hemisphere (curves B) beginning in the year 1879 be considered. This is practically the period referred to above by Dr. Braun.

At this time there is only one "spot-activity track" (latitude 22°) in existence, as shown in curve A, so curve B consequently commences in the same latitude. By the next year the "spot-activity track" (curves A) has reached latitude 17°, and a new one has made its appearance in latitude 25°. Curve B, therefore, takes the mean position of about 20° when allowance has been made for the difference of intensity of these two tracks.

In the following year, 1881, both these "spot-activity tracks" have approached nearer the equator, but another has appeared in latitude 25°, so that the mean latitude for the whole hemisphere has only slightly changed.

By the year 1882 still another "spot-activity track" has come into existence in latitude 28°, while the first "spot-activity track" mentioned above has vanished. The mean latitude for the whole hemisphere, as is indicated in curve B for this epoch, is increased to latitude 20°. After this all three "spot-activity tracks" approach the equator, and curve B does the same, but owing to the relative changes in the amount of the spotted area in each of these "spot-activity tracks," as indicated by their thickness, the mean heliographic latitude curve suffers another change of curvature in 1885. In a similar way the various changes of curvature in all the other curves (curves B) can be accounted for.

Particular attention has been directed above to the fact that about the times of sun-spot maxima there is considerable spot-activity in the highest spot latitudes, which according to Spörer's law would not be expected. If reference be made to the sun-spot observations of Messrs. De La Rue, Stewart, Lœwy, and also to those by the Wilna observers, it will be seen that as early as 1872 it was pointed out, as an unlooked for fact, that at the sun-spot maximum of 1871 numerous spots appeared in high (spot) latitudes.

Finally, if a comparison be made between the curves A and C it will be seen that from the time of a sun-spot minimum, when the "prominence-activity tracks" are approaching more rapidly high latitudes, up to about a sun-spot maximum, when they reach their highest positions, nearly all the "spot-activity tracks" come into existence. Further, the nearer the "prominence-activity tracks" approach the poles the higher in latitude do these "spot-activity tracks" make their appearance, and this is the case for each hemisphere of the sun separately.

What the actual connection between these two different systems of currents is, it is not possible yet to say, but these facts suggest a close relationship.

The result of the present investigation thus leads to the following conclusions :—

(1) Spörer's law of spot zones is only approximately true, and gives only a very general idea of sun-spot circulation.

(2) Spörer's curves are the *integrated* result of two, three, and sometimes four "spot-activity track" curves, each of the latter falling nearly continuously in latitude.

(3) Spörer's and many other previous reductions have indicated the peculiar "wavy" nature of the integrated curve, which peculiarity is here shown to be for the most part real and not due to errors of observation, &c.

(4) Outbursts of spots in high latitudes are not restricted simply to the epochs at or about a sun-spot minimum, but occur even up to the time of sun-spot maximum.

(5) The successive commencement of the "spot-activity tracks" in higher latitudes between a sun-spot minimum and maximum seems to be closely related to the "prominence-activity tracks" at these periods.

WILLIAM J. S. LOCKYER.

THE DUNEDIN MEETING OF THE AUSTRALASIAN ASSOCIATION.

THE tenth session of the Australasian Association for the Advancement of Science was opened at Dunedin, New Zealand, on January 6, under the patronage of His Excellency the Earl of Ranfurly, the Governor of New Zealand, who took the chair at the inaugural meeting in the absence of the past president, Captain F. W. Hutton, F.R.S., whom ill-health prevented from attending.

The president, Prof. T. W. E. David, F.R.S., of Sydney, took as the subject of his address, "The Aims and Ideals of Australasian Science." Although this was wholly local in immediate interest, it was an extremely valuable epitome of the work already done by Australasian men of science. He dwelt upon the value of organisation in scientific research, and of the investigations carried out by research committees appointed at the meetings of the Australasian Association for the Advancement of Science. He applauded the good work done by the New Zealand Government in the preservation of the fauna and flora of New Zealand by the establishment of reserves, as well as in the establishment of a magnetic observatory at Christchurch, and urged the Commonwealth and State Governments of Australia to follow this lead.

In discussing the "Aims and Ideals," Prof. David, amongst other matters, referred to the proposed establishment in New South Wales of a branch of the Lick Observatory, to the importance of investigating the nature of the aurora australis, of carrying out a geodetic survey of Australia, and of continuing to support the high-level meteorological stations on Mt. Koscuisko. He insisted on the crying need for a systematic geological survey of New Zealand, and for the identification by competent palæontologists of the numerous fossils now stored in the Colonial Museum at Wellington, where there are "30,000 specimens in the museum cases, most of which are unnamed, and in the cellars about 500 unopened boxes full of undescribed fossils."

The president is of opinion that "nowhere in the southern hemisphere is there such a thorough and complete record of the succession of animal and plant life from the close of the Palæozoic time up to the present as in New Zealand, and nowhere else is there evidence of such a wonderful range of the Spiriferidæ high up in the Mesozoic rocks."

That important line of work in modern geology, viz. "the

reading of the past geographical history of a country from a study of its surface features," has already found exponents in Australia; it must be continued also in New Zealand. He went on to refer to the "wonderfully developed alkaline series of eruptive rocks" which have been and are at present receiving attention in various parts of Australasia, and characterised the tuffs around Dunedin as being "one of the most interesting groups of its kind in the world."

In biology he dealt with Mr. Chas. Hedley's important study of the molluscan fauna in the ocean near the edge of the continental shelf of East Australia, and pointed out the desirability of examining this fauna off the shore of New Zealand (a committee was later appointed to initiate this investigation).

Prof. David passed on to the importance of marine biological stations, and expressed his satisfaction that recently the New Zealand Government, at the instance and with the aid of the Otago Institute and the Otago Acclimatisation Society, had already established such a station near Dunedin. He reviewed some of the more important recent work by various biologists on the fauna and flora of Australasia, and noted the publication, under the editorship of Captain Hutton, of the "Index Faunæ Novæ Zealandiæ."

In reference to geography, he naturally looked forward to interesting results from the work of the various Antarctic expeditions as bearing on the former extension and connection of these southern lands. After dealing with the oceano-geographical work that has recently been carried out off the Australian coast, Prof. David expressed the opinion "that it would be possible to put a bore down in the bed of the ocean at a depth of about 100 fathoms, and in such a way as to secure a core of the strata encountered. If the boring at these shallower depths were successful, attempts would be made to bore at greater depths."

In discussing agricultural studies, he stated that "an important fact of late brought into prominence is that the barren-looking red soils of the west plains of New South Wales are formed of material which is exceptionally rich in mineral plant food." After indicating other lines of work which ought to be carried out, the president insisted that "the importance of science to national wealth can scarcely be overestimated, but the advance of education should be our grandest ideal."

He then turned to the "duty of the association in science teaching," quoting Sir Norman Lockyer's address to the British Association, as well as the reports, lectures and writings on the subject by various Australasian men of science, and emphasised the need of carefully thought out schemes of science teaching in elementary schools along "heuristic" lines.

As an outcome of the address a committee was appointed to inquire into the science teaching of these colonies, and to suggest a way in which it could be made effective in primary and secondary schools, colleges and universities.

The following are the authors and titles of the presidential addresses to sections:—Prof. W. H. Bragg, of Adelaide, some recent advances in the ionisation of gases; Mr. Brownlie Henderson, of Brisbane, chemistry and food; Mr. W. H. Twelvetrees, of Tasmania, some aspects of modern petrology; Colonel Legge, of Tasmania, on the relationship of the avifauna of Australasia with that of Austro-Malayan and Polynesian regions; Prof. Baldwin Spencer, F.R.S., of Melbourne, dealt with totemism in Australia; Mr. T. W. Kirk, Government biologist, Wellington (in the absence of the president), gave a short account of the importance of agriculture. The president of the section for architecture and engineering, Mr. H. Deane, engineer-in-chief of railway construction in New South Wales, discussed day labour on Government works; Dr. Frank Tidswell, of the Department of Public Health, Sydney, spoke on the hygienic aspect of boric acid; Mr. John Shirley, chief inspector of schools, Brisbane, took education and national trade competition, in the mental science and education section; and Prof. J. W. Gregory, F.R.S., of Melbourne, discussed the Southern Ocean and its climatic control over Australasia.

Among the papers read before the various sections, the following are of more than local importance:—Dr. Coleridge Farr, of the Christchurch Magnetic Observatory, on some continuous observations on the rate of dissipation of electrical charges in the open air, showed that in ordinary weather the atmosphere is a better conductor for negative than for positive charges, but during the "Canterbury nor'-westers" the reverse is the case.

A communication on the heating effect of radium emanation, by Prof. Rutherford, was presented.

Dr. Greig Smith, of Sydney, in a paper on the production and identification of vegetable gums, showed that some gums are the products of certain bacteria, which inhabit the tissues of the gum-bearing trees. The bacteria were isolated and made to produce their gums in the laboratory. Thus "arabin," the soluble gum of wattles, "metarabin," the insoluble gum of wattles and of certain fruit trees, and "pararabin," the insoluble constituent of Sterculia gum, are each produced by a distinct bacterium. The author suggests that all other vegetable gums are bacterial products, and that the world's supply of gum might be increased by judicious injection of susceptible trees.

Prof. Easterfield and Mr. G. Bagley (Wellington), in the chemistry of colophony, raised the question whether any particular chemical structure is common to the resin acids obtained from coniferous trees.

Prof. Easterfield and Mr. B. C. Aston, in the acids of some New Zealand timber trees, find that the resinous matter contains crystalline constituents, to which the name "rimuic acid" is given, closely related to "podocarpic acid," which occurs in one of the timber trees of Java.

In the geology section, Dr. P. Marshall (Dunedin) described a trachydolerite from Dunedin; this rock, which has a very peculiar association of minerals, belongs to a rare type, which has been described also from East Africa.

An important note on the geology of the New Hebrides, by Mr. D. Mawson, showed that at Sandwich Island there is a series of raised coral reefs, at least nine in number, up to a height of 2000 feet above sea-level. The coral rock occurs as a mere veneer over fine-grained submarine tufaceous muds, like "Fiji soapstone," or over other volcanic rocks. At Santo three unconformable series of rocks were discovered, the oldest of which is a tufaceous calcareous group, dipping off the syenites at an angle of 50°; this contains vast numbers of foraminifera (Orbitoides), showing that the oldest rocks in the New Hebrides are not older than Tertiary.

In Section D, Miss G. Sweet described the structure of the eye of Notoryctes, the marsupial mole. The eye has sunk below the surface, and is merely represented by the pigmented choroid, all trace of iris, lens, retina and optic nerve having practically disappeared. The lachrymal gland, however, is of great size, and opens into a closed conjunctival sac, derived from the closure of the eyelids of the eye-vestige; thence the naso-lachrymal duct takes the usual course.

Prof. Chilton, of Christchurch, read papers on some subterranean isopods.

In the anthropological section, Mr. E. Tregear, of Wellington, in a paper on the language of Maori and Malay, drew a comparison between the language of Celebes islanders and that of the Polynesian; a considerable number of words are identical in the two languages, too great to be a coincidence, suggesting, probably, a derivation from a common ancestral language or from one another.

Prof. Baldwin Spencer gave an account of fire ceremonies in Australia.

In the agricultural section, Mr. J. A. Gilruth, Wellington, read a note, and gave a demonstration, of a means of making innocuous injections of virulent cultures of anthrax. This he does by inoculation with a mixture of the culture of anthrax bacillus with some non-pathogenic microbe, in certain proportions. He also pointed out the toxic effects of ragwort (*Senecio jacobaea*) upon cattle and horses, resulting in a disease known in Nova Scotia as "Picton disease," and in New Zealand as "Winton disease." Sheep can eat the weed with impunity, but direct experiments show that in the case of cattle and horses inflammation of the liver ensues, which causes death.

An evening lecture was given by Prof. Baldwin Spencer on the Central Australian aborigines, their habits and customs. This was illustrated by numerous lantern slides showing the aborigine from infancy to old age, and by

kinematographic and phonographic records of corroborees and ceremonies. The lecture was an outcome of two journeys with Mr. Gillen from Adelaide to the Gulf of Carpentaria; the most important ceremony, not dealt with in their book, referred to certain burial customs, notably the removal of the bones from their first "tree-grave," their burial in an ant-hill, but the reservation of one arm-bone for future elaborate ceremonial, which was shown by the kinematograph.

The session, at which nearly 1000 members and associates were present, closed on January 13.

At the close of the session the "Marine Fish Hatchery and Biological Station," situated in the Otago Harbour, was visited and formally opened, although it is not yet complete. The establishment of this, the first biological station in Australasia, is the outcome of the persistent efforts of Mr. Geo. M. Thomson, of Dunedin.

On the following day a small party—Mr. Hedley, Prof. Benham, and Prof. Kirk—made an excursion to the edge of the "continental shelf," which is about 15 miles due east of the Otago Head, but owing to the rough sea part of the deep-sea dredging gear was carried away as it was being hauled up, and later efforts with other gear resulted in but a small reward for the day's work. The association has made a grant for pursuing this work.

BREWING AND RESEARCH.[1]

IN 1901 the great brewing firm of Messrs. Guinness in Dublin instituted a research laboratory, in which the work has been conducted by four trained investigators under the direction of Dr. Horace T. Brown. With characteristic generosity, Messrs. Guinness have rendered the results so far obtained available for other workers in the same field by the publication of a first volume of *Transactions*. Appreciation of these results will by no means be confined to the circle of scientific men technically interested in brewing, for Messrs. Guinness' investigators have been seeking for that exact knowledge which is of permanent scientific value and at the same time affords a basis whereon technical process can be built with some degree of confidence and promise. The problems of the brewer really appeal to a very wide circle; because they are the problems involved in the biological chemistry of the germinating plant and of the yeasts and other lower organisms, they become the problems of the plant physiologist, of the agricultural chemist, and even of the animal physiologist. As Dr. Brown says in his preface, "Could we determine, in the early stages of the germination of a grain of barley, all the 'down grade' chemical changes of the nitrogenous substances stored in the endosperm, and follow the products as they enter the embryonic plant and are once more built up into proteid, we should have a key to many obscure problems connected with the life processes of plants and animals."

The first problem dealt with in the present volume is the investigation of the nitrogenous constituents of malt, *i.e.* of the soluble bodies which are formed by the hydrolysis of the barley proteid under the action of the enzymes produced during germination, or which may turn out to be built up from simpler substances as the new plant develops. No one who has not worked amongst that maze of bodies generally "lumped" as amides can appreciate the thick darkness which envelops their separation, and consequently all attempts to appreciate their physiological significance. In the first place Dr. Brown decided upon a critical examination of the various processes which have been proposed for the determination of bodies of the amide and amino acid type; none of the previous results, not even those of Schultze, hitherto the chief worker in this field, have been accepted without examination, and the figures given show the need for revision that existed.

As a result, the Sachsse method, which depends on the hydrolysis of the amide group, and the Sachsse-Korman method, which depends on the reaction of the amide and amino group with nitrous acid, have been improved until they are capable of giving exact results, as tested with pure specimens of asparagin, aspartic acid, glutamic acid, leucine, tyrosine, alanine, &c. Thus by a combination of the two methods the amount of nitrogen present in a complex mixture as amide and as amino acid can be distinguished and determined. A novel and exact method for the direct determination of tyrosine in such mixtures has also been devised.

Much yet remains to be done before each one of these bodies can be estimated separately, probably, as Dr. Brown indicates, by the application of E. Fischer's esterification method, but the processes here set out with careful detail will be of the greatest possible service to other workers in plant chemistry.

Another old stumbling block has been the want of an accurate method for the estimation of so fundamental a substance as starch; O'Sullivan's method is exact enough, but is too prolonged to be anything but a research method, whereas it is often desirable to repeat starch determinations by the dozen. The volume contains a critical examination of a new starch method, which depends on a preliminary removal of the reducing sugars, &c., with alcohol, followed by hydrolysis to the standard conditions which have already been laid down by Brown and Morris, whereupon the maltose is determined by its cupric reducing power. This method is likely to be of general service in the analysis of a large number of bodies containing starch.

Finally, the volume contains an examination from the plant physiological side of the factors associated with "quality" in barley, including an interesting cytological test of maturation.

The standard of the work recorded in these papers is so high, and their value so great to all others who are engaged with the chemistry of the plant and plant products, that we can only again express our thanks to Dr. Brown and his co-workers, and to Messrs. Guinness for allowing the record of their investigations to be made public. Would there were many great industrial firms with the same enlightened views on research!

A. D. H.

[1] *Transactions* of the Guinness Research Laboratory, vol. i. part i. Pp. 141. (1903.)

MARINE BIOLOGY.

THE number of the *Journal* of the Marine Biological Association recently issued (new series, vol. vi., No. 4) contains a detailed report on the trawling and other investigations carried out by the association in the bays on the south-east coast of Devon during 1901 to 1902. The report has been prepared for the information of the Devon Sea Fisheries Committee by Mr. Walter Garstang, the naturalist in charge of the fishery investigations of the association, and is based upon a series of experimental trawlings and fish-marking experiments carried out by Dr. H. M. Kyle. The bays investigated are at present closed to trawlers, and as this closure has been found to press somewhat hardly on the smaller fishermen, the Sea Fisheries Committee were anxious to ascertain to what extent it was likely to be beneficial to the fisheries of the district as a whole. The general conclusion arrived at in the report is that, having regard to the permanent maintenance of the fishery, it would appear to be highly inadvisable to rescind the regulation which prohibits trawling in Teignmouth Bay and Torbay, where small fish congregate. On the other hand, there are no biological reasons against the reopening of Start Bay, since small fish are found in inappreciable numbers, whilst large plaice concentrate there during the autumn months.

A particular feature of these experiments was the success attained in the study of the migrations of plaice by marking individual fishes, which were subsequently recovered by the fishermen. Of 349 fish 9 inches and upwards in length marked and liberated in the bays, 96 were subsequently recovered, that is, 27·5 per cent., whilst of 71 fish liberated outside the bays 25 were recovered, or 35·2 per cent. The fishes had in many cases travelled considerable distances.

To the same number of the *Journal* Dr. Petersen, of Copenhagen, contributes a paper entitled "What is Overfishing?" in which an attempt is made to define the problem now receiving so much attention from those responsible for fishery administration. Dr. Kyle furnishes notes on the physical conditions existing within the line from Start Point to Portland, and a paper on fishing nets,

with special reference to the otter-trawl. Mr. R. A. Todd writes on the invertebrate fauna and fish-food of the bays between the Start and Exmouth, Mr. Robert Gurney on the larvæ of certain British Crangonidæ, and Mr. Frank Balfour Browne on the eggs and larvæ of Teleostean fishes. The number, which is of larger size than usual, contains three plates and a chart.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Smith's prizes in natural philosophy for Bachelors of Arts are awarded to Mr. E. Cunningham, St. John's; Mr. J. C. M. Garnett, Trinity; Mr. H. A. Webb, Trinity; and Mr. P. W. Wood, Emmanuel. The names are in alphabetical order, and are respectively those of the senior wrangler, sixteenth wrangler, and the two (bracketed) third wranglers in 1902.

The Worshipful Company of Girdlers has made a grant of 100*l*. a year to the university for the endowment of a university lecturer in economics. The appointment is in the first instance for three years.

The general board proposes the appointment of an assistant curator of the Botanical Museum at a stipend of 100*l*. a year.

A special syndicate proposes the establishment in the university of a board of anthropological studies, for the purpose of systematising and directing work in anthropology by advanced students.

Prof. Adami and Prof. Bovey, F.R.S., of McGill University, Montreal, have been appointed representatives of the university at the jubilee of the University of Wisconsin, to be celebrated at Madison in June.

The Senate has adopted an address of sympathy with the University of Turin on the destruction by fire of the Biblioteca Nazionale.

DR. G. E. RICHMOND has been appointed demonstrator of hygiene and public health at University College, London.

THE Misses Riddell, of Beckmount, Belfast, have presented 5000*l*. to Queen's College, Belfast, for the establishment of a Riddell demonstratorship of pathology.

WE learn from *Science* that Lord Strathcona has given 4000*l*. to Manitoba University to extend its scientific work, and that Mr. John A. Creighton has given a further sum of about 50,000*l*. to Creighton University, a Catholic institution at Omaha, Nebraska.

THE death is announced, at the early age of thirty-nine, of Dr. E. A. de Schweinitz, director of the Biochemic Laboratory of the U.S. Department of Agriculture, dean of the Medical Department of Columbia University, and well known for his contributions to bacteriology.

A BILL on higher education has, says a *Times* correspondent, been introduced in the Second Chamber of Holland by Dr. Kuyper. The Bill has for its object the granting to private universities, under certain guarantees, of the same rights and privileges as are accorded to the State universities, including the faculty of conferring degrees upon students wishing to enter the public service. The Premier, it appears, attaches great importance to this piece of legislation, and the *Standaard*, the recognised organ of his party, has already threatened the resignation of the Cabinet should the Government fail to obtain a majority in the final division.

THE authorities of the Yorkshire College, Leeds, have received a letter from the Committe of the Privy Council to announce that the committee "see no reason to modify their opinion that the proper title to be assumed by a university with its seat in Leeds is the University of Leeds." Their lordships have recommended to His Majesty the restriction of the title, both on the score of precedent and convenience. The Charter will now soon be laid on the table of the House of Commons, and it is not expected there will be any further delay in the matter. The movement for a new university at Leeds, towards establishing which some 40,000*l*. has been promised, has been throughout regarded as a county movement. The West Riding County Council has promised something like 6000*l*. in the aggregate annually towards the Leeds and Sheffield Universities.

IN a lecture at University College, London, on the universities and colleges of the United States, Dr. T. Gregory Foster, one of the members of the Mosely Education Commission, referred to social and industrial conditions as affecting university life. He pointed out that at every university and college he visited—whether at ancient Yale and Harvard or at the infant University of Chicago, or at the State universities—at all alike one found rich and poor. Each university issued a leaflet to show how the poor man could pay, or help to pay, his way during the university course without loss of caste. Business men in the United States are glad to employ men who have more than a common school or high school education. There is a certain prospect of employment for all who have passed through a university course.

THE Committee of the Privy Council has considered the case presented on behalf of the petition of the University College of Sheffield praying for the grant of a Charter incorporating a university in Sheffield and the resolutions in its support adopted by various bodies. The committee understands that the promoters are engaged in raising a sum of 170,000*l*. for the purposes of the university, by the appropriation of part of which new buildings of a suitable character will be in readiness by the spring of 1905, and that in addition to a considerable yearly sum which the city council has promised to provide, material assistance may be looked for from the county council of the West Riding of Yorkshire, and probably from Derbyshire and the large urban communities in the neighbourhood of Sheffield. In these circumstances their Lordships are willing to entertain favourably the application, and, subject to a substantial realisation of the hopes mentioned, will be prepared to recommend to His Majesty the grant of a Charter in general conformity with the draft accompanying the petition.

MR. LYTTELTON, Secretary of State for the Colonies, was the guest of the Liverpool University Association on March 5 on the occasion of the first dinner under the auspices of the association. The right hon. gentleman, in replying to the toast of his health, said "the object of all education is to endow the mind of the student with strength, accuracy, and elevation. It is well also that such a mind should have power to express its thought with clearness and, if possible, with attractiveness. That is the reason that classical languages have been for so long the main study of the country. But things have altered now. Around and competing with us are all the great communities of Europe, which are becoming more and more organised, intelligent, and specialised in knowledge. Hence has arisen a necessity for the equipment of our young men by study for the immediate struggles of life. We have been frequently met by the criticism that to teach the young to snatch greedily at mental improvement with the sole purpose of disposing at a profit of what has been learned is but a narrow education; but it is well competent for us to learn worthily the great principles which underlie practical professions, and not to despise those principles because they have practical achievement as their result."

MR. GRAY, M.P., has asked in Parliament for an explanation why the Board of Education have recently reduced the value of the national and research scholarships from 30*s*. to 25*s*. per week, and whether, having regard to the desirability of keeping these scholarships open to students unable to supplement them by private means, he would advise the Board to reconsider their decision. In the course of his reply to the question, Sir W. Anson remarked:—"The Board have never intended that these scholarships should be of an eleemosynary character. They believe that the amount of the scholarships is sufficient to attract good candidates, and that in the majority of cases they provide an adequate supplement to the other resources of the students, and they consider that in any cases where more is needed the assistance should be provided under the supervision of local authorities rather than from funds administered by the Board. The students who gain these scholarships have, as a rule, been for a period of years under the direct observation of local school authorities, who thus

necessarily possess, or can readily obtain, a more intimate knowledge of the circumstances of each student than can the Board. The scholarships now provided by local authorities offer in many places the further assistance required. In these circumstances I do not consider it desirable that the decision of the Board be reconsidered." It would be interesting to know how many national scholars receive any assistance from local authorities or have any resources beyond the 25*s.* per week now allowed them by the Board. Certainly it is desirable for local bodies to supplement the value of national scholarships, but while the Board of Education and local authorities are evading responsibility for support, the students who have not the additional resources referred to by Sir W. Anson have to cultivate high thinking on very poor living. The only satisfactory solution of the difficulty is the provision of a hostel or residential college so that students may learn something of the corporate life which should be an essential part of a university education.

SOCIETIES AND ACADEMIES.

LONDON.

Chemical Society, February 17.—Dr. W. A. Tilden, F.R.S., president, in the chair.—The following papers were read:—Observations on some intramolecular and originally reversible changes extending over prolonged periods of time: R. J. **Friswell.** It was suggested (1) that the labile condition is not confined to hydrogen, and (2) that the constitution of a compound may vary according to the particular "stress" to which it is subjected. Experiments illustrating these points were described, such as the slow decomposition of aniline hydrochloride by aminoazobenzene even in presence of excess of aniline.—Note on magnesium oxybromide: G. W. F. **Holroyd.** This substance was obtained by saturating an ethereal solution of magnesium phenyl bromide with acetylene, when it separated in the form of colourless crystals consisting of one molecule of the oxybromide with two molecules of "ether of crystallisation."—The arrangement in space of the groups combined with tervalent nitrogen atoms: F. S. **Kipping** and A. H. **Salway.** The authors have attempted to detect asymmetry in a number of tervalent nitrogen compounds by treating these with *d-l*-benzylmethylacetylchloride. The products of these reactions remained homogeneous after fractional crystallisation, whence they conclude that the three radicles and the tervalent nitrogen atom itself in such compounds are situated in one plane, and that each pair of the radicles is symmetrically situated with regard to the third.—The esterification of *r*-mandelic acid by menthol and borneol: A. **McKenzie.** The esters obtained were described.—Certain organic phosphorus compounds: A. E. **Dixon.** Phosphorus trithiocyanate, a colourless oil readily hydrolysed by water into phosphorous and thiocyanic acids, and phosphoryl trithiocyanate, a pale yellow, highly refractive oil, were obtained respectively by the action of phosphorus trichloride and phosphorus oxychloride upon ammonium thiocyanate. These substances behave both as thiocyanates and thiocarbimides, and this tautomerism is being further investigated.—Note on the relation between the chemical composition of some organic substances and the densities of their solutions: C. E. **Fawsitt.** Determinations of the densities of solutions of homologous carbamides, amines and acids have shown that this property is of an additive character, though slightly modified by constitutional influences.—The so-called hydrocellulose: A. L. **Stern.** It was shown that the pulverulent substance formed by the action of dilute acids upon cellulose contains soluble hydrolytic products, and that the bulk of the material has the same composition as cellulose.—(1) Isomeric change of diacylanilides into acylaminoketones; (2) intramolecular rearrangement in derivatives of the aromatic aminoketones: F. D. **Chattaway.**

Royal Microscopical Society, February 17.—Dr. Hy. Woodward, F.R.S., vice-president, in the chair.—A paper by Mr. **Stringer** on an attachment for reading the lines in a direct vision spectroscope was read. The attachment consists of a light rigid arc of phosphor-bronze of about 40 degrees and 6¼ inches radius, cast in one piece with two radial arms that project from a broad ring, by which it is clamped to the body of the instrument. It lies just below the telescope, which is traversed across the spectrum by a screw that works through one of the radial arms and presses against a lug projecting downwards from the telescope to which it is clipped. A spring attached to the other radial arm acts on the opposite side of the lug and forces the telescope back when the motion of the screw is reversed. The arc carries a millimetre scale, divided in white on a black ground, and a vernier reading to tenths is carried by the telescope. Immediately below the eye-piece is a magnifying lens through which the scale and vernier can be read without any change in the observer's position.—A paper by Mr. **Nelson** on the vertical illuminator was then read. The author said that after lying in abeyance for twenty-five years, the vertical illuminator has lately come into notice for the examination of opaque objects and especially for the microscopic examination of metals. He said a vertical illuminator must not be an oblique illuminator only, but must be capable of illuminating the full aperture of the back lens with a parallel beam of light. It must not be a permanent attachment to an objective so as to impair its performance for ordinary work. The reflector must be placed near the back lens, and there must be some method for regulating the illumination. To obtain the best advantage with vertical illumination it is necessary to use oil immersion objectives.—Another paper by Mr. **Nelson** on the influence of the antipoint on the microscopic image shown graphically was read. The author referred to a paper in the *Journal* for 1903 on a micrometric correction for minute objects, wherein he stated by way of illustration that if one of the minute spinous hairs on a blowfly's tongue was examined on a bright ground and on a dark ground, a considerable difference in the sizes of the two images was discernible, and that the difference was caused by antipoints. A table was also given showing the amount to be added to the micrometric measurements of the image seen on the bright ground to bring it up to its true value. Mr. Gordon, who had originated the theory of the antipoint, had made accurate drawings of the two images of the hair, and the ratio of the breadths of the hair in these drawings was as 45 to 65. Applying the corrections given in the table to the measurement of the apparent size of the hair on a bright ground, the actual size works out to 12 per cent. more.—Mr. Keith **Lucas** followed with a paper on a microscope with geometric slides. He defined a geometric slide as one in which each motion which is not desired is separately eliminated by a single stop so arranged as not to interfere with any other possible motion. This principle he had applied in the design of a microscope to the slides of the fine and coarse adjustments and to the substage.

Royal Meteorological Society, February 17.—Captain D. Wilson-Barker, president, in the chair.—Mr. E. **Mawley** presented his report on the phenological observations for 1903. He showed that owing to the mildness of the winter and early spring wild plants flowered in advance of their average dates until about May, after which time only backward dates were recorded. In no previous year since the present series of reports was first instituted, in 1891, have such spring migrants as the swallow, cuckoo, and nightingale been so late in reaching our shores. The yield of wheat, barley, potatoes, turnips, and swedes was somewhat under average, but all the other farm crops yielded well, especially those of hay and beans, which were unusually abundant. On account of the wet and protracted harvest most of the grain of the cereals was more or less discoloured, while potatoes were almost everywhere much diseased. Throughout the country this was one of the most disastrous years for fruit ever known. In fact, the only crop which gave anything like an average yield was that of strawberries.—Mr. W. H. **Dines** gave an account of the observations which he had made by means of kites at Crinan, off the west coast of Scotland, during last summer. These observations were carried out by Mr. Dines under the auspices of a joint committee of the Royal Meteorological Society and of the British Association, the Government Grant Committee of the Royal Society providing funds for the hire of a vessel for the purpose. The author, after describing various improvements which he had effected in the kites, stated that the weather last summer was most un-

favourable for kite flying, as not only was there heavy rainfall, but gales were of frequent occurrence. The results of the observations show that in August last the mean temperature gradient for the first 5000 feet was 3°·2 per 1000 feet. This is substantially the same as that obtained during the preceding summer, although the conditions of weather were very different.

Linnean Society, February 18.—Prof. S. H. Vines, F.R.S., president, in the chair.—Mendel's laws and their application to wheat hybrids: R. H. **Biffen.** An investigation of the various characters of the different races and varieties of wheat showed that the following characters were dominant:—beardless paleæ, keeled glumes, lax ears, velvet chaff, grey coloration, red coloration in the chaff and red coloration in the grain, the corresponding recessive characters being bearded paleæ, rounded glumes, dense ears, glabrous chaff, white coloration in the chaff and grain. Evidence was brought forward to show that certain anatomical characters, such as the presence of groups of bristles, the arrangement of sclerenchyma girders, the presence or absence of pith in the internodes, also followed Mendel's laws. The same also appears to be true of certain "constitutional" characters, such as the time of ripening and the immunity to attacks of rust.—Mr. W. **Bateson,** F.R.S., exhibited a series of *Primula sinensis*, about 240 in number, lent by Messrs. Sutton and Sons, illustrating the phenomena of heredity and variation which he had been permitted to witness in their nurseries during five seasons. As was well known, the species, since its introduction about 1820, had given off numerous mutational forms, *e.g.* fern-leaved, ivy-leaved, the "*stellata*" type, and others. Many of these in their inheritance follow simple Mendelian rules.

Anthropological Institute, February 23.—Mr. H. Balfour, president, in the chair.—The Hon. W. L. **Allardyce,** C.M.G., delivered a lecture on the Fijians in peace and war. The lecturer directed attention to the native legend of the colonisation of the islands, and pointed out the presence of two types, a Melanesian and a Polynesian. Passing to their domestic life, he described their methods of personal adornment, houses, food, industries, and canoes. He then gave an account of the punitive expedition of 1894, in which he had taken part, and described the native methods of warfare. Finally, he gave a very interesting description of the fire-walking ceremony on Mbengha.

Physical Society, February 26.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—A new dilatometer, exhibited by Mr. B. Bonniksen, was described by Mr. B. F. E. **Keeling.** The instrument was originally designed for measuring the expansion of balance-wheels of watches, and has latterly been applied to the determination of the coefficient of dilatation of specimens of materials, used in the form of wires about 1¼ inches in length. The increase in length with change in temperature is magnified about 1500 times by means of a chain of accurately mounted gear-wheels, the last one of which moves a pointer over a circularly graduated scale. With an ordinary specimen of steel one degree rise in temperature causes a movement of the pointer over about one-third of a scale-division, and a mean coefficient of expansion of such a substance over a range of 100° C. can be obtained to about 1 per cent. in a single experiment of five minutes' duration.—A quartz-thread vertical force magnetograph: Dr. W. **Watson.** The instrument resembles, in principle, the quartz-thread gravity balance of Prof. Threlfall. In addition to the advantages derived from the suppression of the knife-edge, the instrument can be simply and accurately compensated for the effects of changes of temperature. The principle of the instrument is to have a magnet suspended on a horizontal quartz fibre kept stretched by means of a spring. The centre of gravity of the magnet and the torsion of the fibre are so adjusted that the axis of the magnet is horizontal. Any variation of the vertical force produces a rotation of the magnet about the fibre which can be suitably recorded by means of a mirror attached to the magnet. The temperature compensation is effected by weighting the magnet on the same side of the axis of the fibre as the south pole, so that the magnetic couple and the couple due to the torsion of the fibre act in the same direction. Hence, since an increase in temperature causes one of these couples to decrease and the other to increase, by suitably adjusting the weight, and therefore the magnitude of the torsion couple, complete compensation can be obtained. The suspended system in the instrument shown at the meeting consists of two magnets 8 cm. long and 1 mm. diameter attached by means of small platinum straps to two fused rods of silica, which form part of the plate of fused silica forming the mirror. The upper surface of the mirror is platinised. The fixed mirror is supported on the base of the instrument, and is capable of adjustment.—On stresses in a magnetostatic field: G. W. **Walker.** Quincke found that when a glass bulb containing a solution of ferric chloride was placed between the poles of a strong electromagnet, the level of the liquid, in a capillary tube attached to the bulb, fell. This has been held to require for its explanation a system of stress which differs from the magnetic stresses of electrical type. The object of this paper is to show that the experiment can be quite well explained by the stresses of electrical type.—Dr. W. **Watson** gave some hints on the preparation of diagrams.—Mr. R. J. **Sowter** exhibited a portable electroscope of high insulation and adapted to show and measure the discharging effect of radio-active substances.

Zoological Society, March 1.—Dr. A. Günther, F.R.S., vice-president, in the chair.—Dr. A. **Günther,** F.R.S., exhibited and made remarks upon some specimens of hybrids between Reeves's pheasant (*Phasianus reevesi*), ♂, and the silver pheasant (*Euplocamus nycthemerus*), ♀.—Mr. Oldfield **Thomas,** F.R.S., exhibited and made remarks upon the skull of a buffalo which had been obtained by Colonel Delmé-Radcliffe in south-west Uganda. The horns differed in certain respects from those of *Bubalus caffer*, and Mr. Thomas considered the specimen to represent a distinct local race and entitled to subspecific rank. Mr. Thomas also exhibited a specimen of a fruit-bat from Fernando Po, which he described as a new species of the genus Scotonycteris.—Mr. J. G. **Millais** exhibited a series of skins illustrating the life-history of the grey seal (*Halichoerus grypus*), and made remarks upon its geographical distribution.—Mr. J. ffolliott **Darling** exhibited photographs of, and made remarks upon, a very large specimen of the woolly monkey (*Lagothrix humboldti*) which he had observed in southern California.—Dr. Walter **Kidd** exhibited a drawing of, and read a note on, the arrangement of the hair on the nasal region of the parti-coloured bear (*Ælurop us melanoleucus*).—Mr. R. E. **Holding** exhibited and made remarks upon a double head of a lamb and the skull of a Spanish four-horned ram fractured in fighting.—Mr. E. R. **Sykes** read a fourth instalment of Sir Charles Eliot's paper entitled "On some Nudibranchs from Zanzibar and East Africa." It contained an account of twenty-two species of Doridida Cryptobranchiatæ, of which eight were described as new.—A communication from Mr. Robert T. **Leiper** contained a detailed account of the turbellarian *Avagina incola*, which had recently been described by the author, and a note on the classification of the Proporidæ.—Dr. Einar **Lönnberg** contributed a paper on two specimens of hybrid grouse between *Lyrurus tetrix* ♂ and *Lagopus lagopus* ♀.

CAMBRIDGE.

Philosophical Society, February 15.—Dr. Baker, president, in the chair.—On the occurrence of radio-active constituents in common substances: Prof. J. J. **Thomson.** The author described the results of the examination of a large number of specimens of water from different parts of England. In nearly every case the radio-active gas which occurs in Cambridge tap-water, and is probably identical with the emanation from radium, was present. In order to find the source of this gas a number of clays, gravels, and sands were examined, and it was found that in many of these radium was present. Radium was found in garden soil from the laboratory garden, in the Cambridge gault, in gravel from a pit at Chesterton, in still greater quantities in sand from the sea-shore at Whitby, in the blue lias at Whitby, in powdered glass, in one specimen of flour, and in a specimen of precipitated silica; other specimens of flour and silica did not contain any appreciable amount of radium. The question whether ordinary metals such as tin, bismuth, platinum and lead give off a radio-active emanation was investigated; no trace of such an emanation could be found even when the metals were in the exceedingly finely divided

state in which they occur in colloidal solutions, and were exposed to the bombardment of Röntgen and kathode rays. Although ordinary substances do not give off a radio-active emanation, reasons are advanced for believing that they give out rays similar to Röntgen rays.—On the temperature effect on the rate of combination of hydrogen and chlorine: P. V. **Bevan.**—On the convection of heat: H. A. **Wilson.**—On the calculation of capacities in terms of the coefficients of electrostatic induction: G. F. C. **Searle.**

DUBLIN.

Royal Dublin Society, February 16.—Mr. W. E. Wilson, F.R.S., in the chair.—Prof. E. J. **McWeeney** described his recent investigations on the distribution of *Bacillus coli communis, Bacillus enteritidis sporogenes,* and Streptococci in shell-fish, sand, and sea-water from various points on the Irish littoral, with special reference to the value of these organisms as evidence of sewage-contamination. The author began by referring to the evidence that had convinced hygienists that shell-fish, and especially oysters, may serve as vehicles for pathogenic organisms, especially those of enteric fever. It is along with other organic matters of sewage origin that these bacilli gain access to the oyster, hence the necessity for establishing some test whereby the actual contamination of shell-fish with sewage, and, inferentially, their potential contamination with specific disease germs, may be recognised. With this object he had, under the auspices of the Local Government Board for Ireland, carried out a systematic bacterioscopic examination of shell-fish, water and mud, collected by Dr. Browne from the several layings round the Irish coast. A leading feature of the work was its independence of the local inspection conducted by Dr. Browne. Each oyster was tested for coli and enteritidis, the quantity of the mingled shell-water and body-fluid tested being as a rule 1 c.c. The author very much doubted the positive value of enteritidis, but considered that its absence was a valuable evidence of purity. Both it and coli were absent from deep-sea oysters. Enteritidis was present in nearly 100 per cent. of oysters from a polluted locality when, for some unknown cause, coli was not demonstrable. In view of the occasional occurrence of coli in material from unpolluted localities, to condemn a laying on the strength of its presence in a few oysters from a chance batch was, in his opinion, unjustifiable. The occurrence of coli in a large percentage of molluscs from an apparently pure locality was to be taken as a danger signal, indicating the need for renewed and more stringent local inspection. The author considered that the delimitation of the species-idea *B. coli communis* was of much importance. With regard to the characters of *B enteritidis sporogenes,* the author was in agreement with Klein.—Mr. W. B. **Wright** and Mr. H. B. **Muff** communicated a paper upon the pre-Glacial raised beach of the south coast of Ireland. A raised beach resting on a wave-worn platform which subtends an old cliff has been traced along the south coast of Ireland from Carnsore Point to Cape Clear. The beach is overlaid by "head" or "rubble drift," and by the Boulder-clays of the Irish Sea and west Cork ice-sheets. It fringes the shores of the drowned river-valleys, proving their pre-Glacial submergence. It is similar to the raised beaches on the shores of the Bristol and English Channels, and to that near Bridlington, Yorkshire.—Dr. F. G. **Donnan** read a paper on the reactivity of the alkyl iodides. This was a discussion of the relative reactivities of the saturated aliphatic iodides as measured by the determination of velocity-coefficients in a homogeneous medium. The experiments of Wislicenus, Menschutkin, Hecht, Conrad, and Brückner, and those carried out by Miss K. A. Burke and the author were discussed in this connection, and their bearing on Nef's dissociation hypothesis pointed out.

PARIS.

Academy of Sciences, February 29.—M. Mascart in the chair.—The president announced to the academy the death of M. Émile Laurent, correspondant for the section of rural economy.—On quadratic forms invariant by a given linear substitution (mod. p): Camille **Jordan.**—On a condition necessary for the initial stability of any elastic medium whatever: P. **Duhem.**—On a new species of *n*-rays: R. **Blondlot.** These rays are differentiated from the *n*-rays by the fact that they diminish the luminosity of a phosphorescent calcium sulphide screen instead of increasing it. They are present, along with the *n*-rays, in the light of a Nernst lamp, formed into a spectrum by means of an aluminium prism. Measurements of the refractive indices and wave-lengths are given.—Peculiarities presented by the action of the *n*-rays on a feebly lighted surface: R. **Blondlot.** On a phosphorescent or feebly lighted screen the effect of *n*-rays is to increase the luminosity when the screen is viewed normally, to diminish it when viewed very obliquely. The n_1-rays, described in the previous note, have exactly the opposite effect.—On the transparency of certain bodies for the *n*-rays: E. **Bichat.** Silver is transparent, and palladium, nickel and iridium opaque, for all the radiations. Other metals are transparent for some wave-lengths and opaque for others.—Particular cases in the emission of the *n*-rays: E. **Bichat.** Liquids under pressure emit *n*-rays, the gases above them do not, and it is possible in this way to trace the change at the critical point by means of a phosphorescent screen.—Observation of the occultation of a star made on February 24 at the Observatory of Toulouse: L. **Montangerand.**—On the continued deformation of surfaces: G. **Tzitzéica.**—On the friction of pivoting: L. **Lecornu.** After a comparison of the expressions deduced by Léauté and by Hertz, a demonstration is given of the correctness of the former.—Method for the experimental study of the secondary movements of vehicles in motion: M. **Sabouret.**—On the diastoloscope and the results obtained by it: C. **Chabrié.** A description of a magnifying instrument in which the lenses are replaced by cones. The images are highly magnified, but distorted in a regular manner.—The stato-voltmeter, an apparatus capable of measuring electromotive forces over a range of from 2 to 40,000 volts: V. **Crémieu.**—On the magnetic rotation of the plane of polarisation of the *n*-rays: H. **Bagard.** From the minuteness of the wave-lengths of the *n*-rays, as determined by M. Blondlot, it is probable that the phenomenon of magnetic rotatory polarisation would be shown by these rays in a much higher degree than for ordinary light. This was found by experiment to be the case.—The action of magnetic fields on phosphorescent substances: C. **Gutton.** An increase in the lustre of a phosphorescent screen is observed whenever variations in the intensity of a magnetic field produce a displacement of the lines of force in the neighbourhood of the screen.—Appearance of the sparks given by a coil with a Wehnelt interruptor on closing or opening the primary current: M. **Gagnière.**—On entanglement by coagulation: Jacques **Duclaux.**—Theoretical study of the dissociation of oxyhæmoglobin. The effects of concentration and temperature: Victor **Henri.** By the application of van 't Hoff's equation and the measurements of Berthelot on the heat of combination of oxygen with reduced blood, the variations of the dissociation constant with temperature are calculated.—On a cadmium arsenide: Albert **Granger.** Cadmium, heated in arsenic vapour carried over by hydrogen or an indifferent gas, forms a crystalline arsenide, of composition Cd_3As_2.—The combination of salts of dinaphthopyryl with di-alkylated aromatic amines: R. **Fosse.**—Ethylidene-camphor. Ethyl-homocamphoric acid: J. **Minguin.** A description of the preparation and properties of ethylidene-camphor. It shows a large increase in the rotatory power as compared with the corresponding ethyl-camphor, resembling in this respect the methyl compounds previously described.—On the synthesis of αα-dimethylglutaric and αα-dimethyladipic acids: G. **Blanc.** The reduction of αα-dimethylsuccinic ester by sodium in boiling alcohol gives a glycol, already described, and a lactone. The latter, heated in sealed tubes with potassium cyanide at 270° C., gives dimethylglutaric acid, identical with the acid obtained by the oxidation of isolauronolic acid.—The production of acetylmethylcarbinol by bacteria of the group *Bacillus mesentericus*: Henri **Desmots.** Acetylmethylcarbinol is produced by the action of several varieties of bacilli belonging to the group of *B. mesentericus,* and as this ketonic alcohol can be easily identified by means of its osazone, it may serve as a useful biochemical test.—On mother-of-pearl: Raphael **Dubois.**—The action of the *n*-rays on the senses, especially on the smell, and on the emission of the *n*-rays by substances possessing smell: August **Charpentier.** A body emitting the *n*-rays, when brought near the nose, sensibly increases the intensity of the sensation of smell. Conversely, such substances are capable of

emitting the rays, which can pass through aluminium and show the other properties of the *n*-rays.—On the pigment of the suprarenal capsules: C. **Gessard.** The chromogen of the suprarenal capsules, in the colourless state which results from the absence of oxygen, is the product of the action of tyrosinase on tyrosine. It becomes coloured on exposure to the air.—The action of the rays given off by phosphorescent calcium sulphide on the lactic fermentation: Charles **Richet.**—The mechanism of the movement of the wing in insects: Lucien **Bull.** It has been shown by Marey that the trajectory described by the end of the wing of an insect is a lemniscate, and has suggested that the deviation from a straight line is due to the resistance of the air. This view is now experimentally confirmed.—On the lignification of the subterranean organs of some plants in Alpine regions: André **Dauphiné.**—On the morphological phenomena of germination, and on the structure of the plantule in palms: C. L. **Gatin.**—On the hibernation of the mildew of the vine: G. **de Istvanffi.**

DIARY OF SOCIETIES.

THURSDAY, MARCH 10.

ROYAL SOCIETY, at 4.30.—On Electric Resistance Thermometry at the Temperature of Boiling Hydrogen: Prof. J. Dewar, F.R.S.—A Study of the Radio-activity of certain Minerals and Mineral Waters: Hon. R. J. Strutt.—Some Uses of Cylindrical Lens-Systems: G. J. Burch, F.R.S.

ROYAL INSTITUTION, at 5.—Electrical Methods of Measuring Temperature: Prof. H. L. Callendar, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—On Inner Limiting Sets of Points: Dr. E. W. Hobson.—On the Unique Expression of a Quantic of any Order in any Number of Variables with an Application to Binary Perpetuants: Mr. P. W. Wood.—The Derivation of Generalised Bessel Coefficients from a Function Analogous to the Exponential: Rev. F. H. Jackson.—Illustrative Examples of Modes of Decay of Vibratory Motions: Prof. A. E. H. Love.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Railway Electrification Problem and its Probable Cost for England and Wales: F. F. Bennett.—The Rated Speed of Electric Motors as affecting the Type to be Employed: H. M. Hobart.

SOCIETY OF ARTS, at 4.30.—China Grass; its Past, Present, and Future: Frank Birdwood.

FRIDAY, MARCH 11.

ROYAL INSTITUTION, at 9.—The Motion of Viscous Substances: Prof. F. T. Trouton, F.R.S.

ROYAL ASTRONOMICAL SOCIETY, at 5.—On the Determination of the Division Errors of a Graduated Circle: S. S. Hough.—On the Degree of Accuracy of the New Lunar Theory: E. W. Brown.—On the Comparison between the Purely Theoretical and Observed Places of the Moon: E. Nevill.—On the Relative Efficiency of Different Methods of Determining Longitudes on Jupiter: A. Stanley Williams.—Positions and Photographic Magnitudes of Ninety Stars surrounding the Variable R Cygni: J. H. Metcalf.—Note on the Instrumental Errors affecting Observations of the Moon: H. H. Turner.—Comparisons of the Geocentric Places of the Sun and Major Planets calculated from the Tables of the American Ephemeris Office with their Places calculated from Le Verrier's Tables for 1906: A. M. W. Downing.—Note on the Drawings of the Mare Serenitatis by John Russell, R.A.: S. A. Saunder.—Note on the Date of the Passage of the Vernal Equinox from Taurus into Aries: E. W. Maunder and A. S. D. Maunder.—*Papers promised*: On the Chromatic Correction of Object Glasses, Second Paper: A. E. Conrady.—Note on the Optical Defects of the Microscope of a Measuring Machine for Astronomical Photographs: H. C. Plummer.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Premium System of Payment for Labour: W. G. Banister.

PHYSICAL SOCIETY, at 8.—The Whirling and Transverse Vibrations of Shafts: Dr. C. Chree, F.R.S.—Notes on Non-homocentric Pencils, and the Shadows produced by Them—Part II. Shadows produced by Axially Symmetrical Pencils possessing Spherical Aberration: W. Bennett.

MALACOLOGICAL SOCIETY, at 5.—A *Résumé* of Recent Researches on the Structure of Pelecypod Gills: Dr. W. G. Ridewood.—Descriptions of two new Species of Opisthostoma from Borneo: E. A. Smith.—On some Non-Marine Hawaiian Mollusca: C. F. Ancey.—New Species of Mollusca from New Zealand: Rev. W. H. Webster.

SATURDAY, MARCH 12.

ROYAL INSTITUTION, at 3.—The Life and Work of Stokes Lord Rayleigh.

MONDAY, MARCH 14.

SOCIETY OF ARTS, at 8.—Recent Advances in Electro-Chemistry: Bertram Blount. (Cantor Lecture, II).

TUESDAY, MARCH 15.

ROYAL INSTITUTION, at 5.—The Doctrine of Heaven and Hell in Ancient Egypt and the Books of the Underworld: Dr. E. A. Wallis Budge.

ZOOLOGICAL SOCIETY, at 8.30.—Contributions to the Anatomy of the Lacertilia.—I. On the Venous System in certain Lizards: F. E. Beddard, F.R.S.—Note on the Skull and Markings of the Quagga: R. Lydekker, F.R.S.—On Additions to the List of Rhopalocera of Dominica: P. I. Lathy.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Barrage across the Nile at Asyut: G. H. Stephens, C.M.G.—The Use of Cement Grout at the Delta Barrage in Egypt: Sir R. H. Brown, K.C.M.G.

ROYAL STATISTICAL SOCIETY, at 5.—Statistics of London Traffic: E. J. Harper.

SOCIETY OF ARTS, at 4.30.—Recent Developments in Devonshire Lace Making: Alan S. Cole, C.B.

WEDNESDAY, MARCH 16.

CHEMICAL SOCIETY, at 5.30.—Mercuric Nitrite and its Decomposition by Heat: P. C. Ray.—Note on the Higher Glycerides: J. B. Hannay.—The Nature of a Solution of Iodine in Aqueous Potassium Iodide: C. H. Burgess and D. L. Chapman.—The Reduction of 2:6-Dinitrotoluene with Hydrogen Sulphide: J. B. Cohen and J. Marshall.—Isomeric Change of Diacylanilides into Acylaminoketones. Transformation of the Dibenzoyltoluidines into the Isomeric Benzoylaminotoluophenones: F. D. Chattaway and W. H. Lewis.—Acid Esters of Methyl Substituted Succinic Acids: W. A. Bone, J. J. Sudborough, and I. H. G. Sprankling.—Action of Ethyl β-Iodopropionate on Ethyl Disodioacetylenetetracarboxylate: O. Silberrad.

ENTOMOLOGICAL SOCIETY, at 8.

SOCIETY OF ARTS, at 8.—Artificial and other Building Stones: L. P. Ford.

ROYAL MICROSCOPICAL SOCIETY, at 8.—A Note on Some New Methods of Measuring the Magnifying Power of the Microscope and of Lenses Generally: Prof. A. E. Wright.—Exhibition of Hand-painted Lantern Slides illustrating Botanical Histology prepared by Mr. A. Flatters.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Water Vapour: R. H. Curtis.

THURSDAY, MARCH 17.

ROYAL SOCIETY, at 4.30.

LINNEAN SOCIETY, at 8.—On the Bryozoa from Franz Josef Land: A. W. Waters.—Natural-Colour Photographs of Living Insects and Flowers: F. Enock.

AERONAUTICAL SOCIETY, at 8.—Experiments with Aërial Screw Propellers: Major B. F. S. Baden-Powell.—The Beedle Airship: W. Beedle.—Mechanical Flight: Thomas Moy.

INSTITUTION OF MINING AND METALLURGY, at 8.—Annual General Meeting. Followed by Discussion on "The Equipment of Laboratories for Advanced Teaching and Research in the Mineral Industries."

FRIDAY, MARCH 18.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Compound Locomotives in France: M. Edouard Sauvage.

SATURDAY, MARCH 19.

ROYAL INSTITUTION, at 3.—The Life and Work of Stokes: Lord Rayleigh.

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