THURSDAY, FEBRUARY 17, 1898.

SIMPSON AND CHLOROFORM.

Sir James Young Simpson and Chloroform (1811–1870). By H. Laing Gordon. 8vo. Pp. xii + 233. (London: T. Fisher Unwin, 1897.)

THIS is the third volume of an important series entitled "Masters of Medicine," of which two volumes have already been issued under the editorship of the late Mr. Ernest Hart. The series is intended to contain the lives of men, both of this and other countries, who have done much to advance the science and art of medicine; and the introduction of chloroform is so intimately associated with the name of Sir James Simpson, that any series of the "Masters of Medicine" would be incomplete if it did not contain an account of one who was largely responsible for the general employment of this anæsthetic.

James Young Simpson was born in the year 1811 at Bathgate, a village in Linlithgowshire, where his father, David Simpson, was the local baker and farrier; he was the seventh son, and great things were foretold of him.

He attended the village school, and even as a boy, under the superintendence of his master at school, studied the archæological features of the neighbourhood, and this study he continued later when he attended Edinburgh University, where he was sent by the unselfish assistance of his brothers Alexander and John, who, after he was qualified, found the means to send him abroad.

At college his life was much influenced by his two friends MacArthur and Reid, who had, by their example and precept, much to do with his greatness in the future. In 1838 he became in Edinburgh an independent lecturer on midwifery; and in 1839, although only twenty-eight years of age, he applied for the professorship made vacant by the resignation of Prof. Hamilton. Finding his chance of obtaining the chair as a bachelor would be small, he went to Liverpool and returned with Miss Jennie Grindlay as his wife; and although the professors were opposed to his being appointed, he was elected by the Town Council with the narrow majority of one vote. As a professor he attracted not only the students of the college, but older men who came to hear the recently despised subject of midwifery dealt with in a masterly and scientific fashion.

The increased fame and, in consequence, the increased work attached, did not affect Simpson's homely life. He found time to take pleasure in the companionship of his friends and relatives. It was his custom to keep open house both at breakfast and luncheon time, but his evening meal was reserved that he might enjoy the intimacy of his own family.

It was in 1850 that Simpson took part in the great controversy on the merits of homœopathy, which he condemned as irrational, and it was through him to a great extent that homœopathy was thoroughly crushed in Edinburgh.

Prof. Simpson's versatility was remarkable. He was able to discuss any subject in literature, science, politics or theology; but it was in archæology that he did most work outside his profession. He had correspondents in different parts of Scotland engaged in making researches into antiquities, and in 1861 he became President of the Society of Antiquaries of Scotland.

It is, however, with chloroform that the name of Simpson will chiefly be associated. To many people chloroform is anæsthesia, and the previous introduction of ether is often ignored. It is, therefore, hardly superfluous to repeat that ether was introduced in 1842 by Mr. W. T. G. Morton, a dentist of Boston, Massachusetts; its use rapidly spread, and it was employed extensively in America, Great Britain and abroad. The administration of ether was not unattended with difficulties; the methods employed at that day would now be considered extremely crude, and many—both surgeons and chemists—were looking eagerly for a simple and more convenient anæsthetic; and Simpson, although at this time much occupied with his increasing practice, gave all his leisure to testing for himself the effects of numerous drugs. After innumerable failures he, together with Dr. George Keith and Dr. Matthew Duncan, on November 4, 1847 at last tried chloroform, which was suggested to them by Mr. Waldie, a chemist of Liverpool, but had been discovered and described in 1831 by Soubeiran and Liebig independently. We may quote here the account given of the first employment of chloroform as an anæsthetic:—

"Immediately an unwonted hilarity seized the party—they became bright-eyed, very happy, and very loquacious—expatiating on the delicious aroma of the new fluid. The conversation was of unusual intelligence and quite charmed the listeners—some ladies of the family and a naval officer, brother-in-law of Dr. Simpson. But suddenly there was a talk of sounds being heard like those of a cotton-mill louder and louder; a moment more and all was quiet—and then crash! On awakening Dr. Simpson's first perception was mental. 'This is far stronger and better than ether,' said he to himself. His second was to notice that he was prone on the floor, and that among his friends about him there was both confusion and alarm.

"Hearing a noise he turned round and saw Dr. Duncan beneath a chair—his jaw dropped, his eyes staring, his head bent half under him; quite unconscious, and snoring in a most determined and alarming manner. More noise still and much motion. And then his eyes overtook Dr. Keith's feet and legs making valorous efforts to overturn the supper table, or more probably to annihilate everything that was on it. By and by Dr. Simpson having regained his seat, Dr. Duncan having finished his uncomfortable and unrefreshing slumber, and Dr. Keith having come to an arrangement with the table and its contents, the sederunt was resumed."

It is Simpson, too, whom we have to thank for fighting those who found in the practice of anæsthesia something which was contrary to their beliefs or principles, and for making the giving of anæsthetics an every-day occurrence; and we can hardly at the present day imagine the little-mindedness displayed by those who endeavoured, fortunately without success, to oppose the employment of anæsthetics.

About ten years after the introduction of chloroform he turned his attention to wound healing; at this time bleeding was arrested by tying the cut arteries with ligatures, and the ends of these were left hanging out of

the wound. In 1858 Simpson stated that he had made use of iron, silver, and platinum wires, and after ten years' research he was led to the introduction of acupressure, which essentially consisted in the passing of a fine needle through the tissues across the course of an artery so that by pressure against the muscles the bleeding was stopped. He was much disappointed that acupressure had failed to gain a place such as he would have wished; but the introduction of the antiseptic method by Lister threw his process into the shade.

During the last year or two of his existence he found it hard to carry on his work, and he had to take more rest, but he still kept on his practice although suffering from angina pectoris. However, in February 1870 he was obliged to take to his bed, yet even then he saw patients in his sick room; later his failing strength prevented this, and he passed away on May 5, 1870.

Mr. Gordon has dealt with the facts at his disposal in an interesting manner; but as the book is one of a series connected with medicine, and as Simpson's chief claim to remembrance is associated with the introduction of chloroform, we are somewhat surprised to find that only about forty-four pages have been devoted to this portion of the subject.

We think, also, that more might have been made of Sir James Simpson's contributions to obstetrics, though no doubt the popular character of the series is responsible for the omission. R. T. B.

PROTOPLASMIC FROTH.

The Living Substance as such, and as Organism. By Gwendolen Foulke Andrews. Pp. 176. (Boston: Ginn and Co., 1897.)

THE authoress of this wordy treatise informs us (p. 173) that she started from a neutral position with regard to Bütschli's vesicular theory, or even with a bias against it. Now, however, having become the most ardent of converts, she proceeds, with the proverbial zeal of a proselyte, to carry the original doctrine to extremes. Not content with proclaiming the existence of foams undreamt of by Bütschli—"wheels within wheels" *ad infinitum*—she utters what amounts to a denunciation of all previous statements of biological fact and theory as misleading and inadequate, and urges in effect that the whole science of life needs recasting from the new point of view. So far, she is doubtless within her rights. There is nothing in the expression of even the most singular views which can legitimately form the subject of complaint. Time tries all things; and of the numerous hypotheses that are every year thrown out to take their chance in the world of scientific opinion, some will stand the test and will become the recognised truths of a later generation, while others are simply destined to die a natural death. But there is no excuse for presenting any theory in such a form as that of the present volume. The obscurity of the style, the inordinate length of the argument, the wearisome repetitions, the general want of method and arrangement, form an unfair tax on the patience of the reader, who may be excused if he fails to find the one half-pennyworth of bread to this intolerable deal of sack. The authoress should have given us, in an orderly manner, first the facts she has observed, and secondly such interpretations of them as she thought warranted. Instead of this she has produced a confused and intricate commentary on phenomena that for the most part are either not recorded at all, or are referred to in such a vague and general manner as to make it extremely difficult to judge of their import. It is true that she appeals from time to time to her "researches" and "results," without, however, proving much more than her ignorance of the meaning of those words. Here and there we find an observation of interest, as on pages 58 (chromatin in the cytoplasm), 70 (explanation of apparent Brownian movements), 116 (protoplasmic interchange in colonies of *Raphidiophrys*). But these are scattered and scanty, nor are they recorded with scientific precision. Moreover, the want of arrangement is such that the reader who wishes to refer a second time to any observation will be at a loss to find it. Here and there, also, some semblance of a definite conclusion seems about to emerge from the general chaos. But the expected result, when not of a trite and obvious character, usually proves elusive; and the reader who had hoped to grasp a new piece of knowledge finds himself put off with a handful of empty verbiage—

Ter frustra comprensa manus effugit imago.

If any object is discoverable, it is to show that from nature's point of view the living substance is everything and the individual organism nothing. The authoress does not seem to be aware that so far as this is true, it has occurred to previous thinkers. It is refreshing to come across a few words of common sense like the passage she quotes from Darwin on page 173. But we can assure her that the theory of natural selection not yet being dead, its "re-birth" under her auspices is at present a superfluity. On page 52 she defends her practice of saying the same thing over and over again on the ground that nature herself indulges in repetition. This is true; but nature does many other things that need not be imitated in a scientific memoir. The authoress would do well to supplement her studies from nature by taking a hint from art, especially in the way of compression. "Very few and very weary," said Macaulay of a book which had more excuse for prolixity, "are those who are in at the death of the 'Blatant Beast.'" The authoress would seem (p. 175) to be conscious that her own work may be open to the like criticism; it is a pity that she has not thought it worth while to aim at a different result.

The temptation to pass over the whole book in silence is a strong one. We have not yielded to the temptation, because we think that the authoress is capable of better things. She is apparently possessed of means, leisure, perseverance and enthusiasm—no bad equipment for a scientific career. Let her continue to observe patiently, but let her record with precision. Let her avoid cheap disparagement of the microtome and paraffin bath; they are bad masters, but may be good servants. Let her not think that she can overcome the inadequacy of figures and diagrams by abjuring their employment altogether. Let her condescend to the use of the English language

as it is written by ordinary people. Above all, let her seek the advice of some leading man of science in whom she has confidence, and get him to revise her work before publication—submitting, if necessary, to a severe editing of her "results." We trust that she will take in good part what we have thought it our duty to say, for we feel convinced that if she will but consent to put a check on some of her impulses and to proceed on lines that have stood the test of time and experience, the new work with which she threatens us may yet prove to be a real and valuable contribution to the literature of protoplasm. F. A. D.

CATALOGUE OF MADREPORARIA.

Catalogue of the Madreporarian Corals in the British Museum (Natural History). Volume iii. The Genus Montipora, the Genus Anacropora. By Henry M. Bernard, M.A. Large 4to. Pp. vii + 192. Plates xxxiv. (London: Printed by the order of the Trustees, 1897.)

OF the two genera, Montipora and Anacropora, catalogued in this volume, the latter is stated by the author to be little more than a group of specialised Montipores, so that the contents of the book may be said to relate nearly entirely to the single genus Montipora, Quoy and Gaimard. This genus is one of the reef-building, perforate corals, included with Madrepora, Turbinaria and Astræopora in the family of the Madreporidæ. It is widely distributed in the Indo-Pacific region wherever coral reefs occur, and the Museum collections of it have been largely added to of late years, by specimens obtained by Mr. Bassett-Smith, Surgeon R.N., from reefs in the China Sea, by Mr. Saville-Kent from the great Barrier Reef of Australia, by Prof. Haddon from Torres Straits, and by Mr. Stanley Gardiner from Funafuti.

The distinguishing structural feature of Montipora, as compared with the other members of the Madreporidæ, is the great development of the porous cœnenchyma between the corallites, and the comparatively reduced size and inconspicuous position of these latter. The upper surface of the cœnenchyma in these corals is furnished with an extraordinary variety of minute papillæ, tubercles, and ridges, which appear to be very liable to change, so that even in the same specimen the differences may be sufficient to constitute four or five distinct types. In spite of this fact, the author has based his systematic classification of the species mainly on the characters of this defensive surface ornamentation of the cœnenchyma, and justifies his course on the plea that there is no other available alternative. The result is that each individual specimen, and almost every fragment may, without much difficulty, be regarded as a distinct species, and in practice this is approximately the case. Thus of the eighty-eight new species constituted by the author, fifty-four are founded on single specimens or stocks, and in fourteen others, there are, in the Museum collection, but two specimens or fragments to each species. The remaining twenty new species are represented by three or more specimens each, but it is evident, with regard to most of these, that the puzzled mind of the author has led him temporarily to a wholesale lumping of the specimens. These specimens or reputed species are described with great care and detail, but that they will be accepted as valid species seems very doubtful.

The volume is illustrated by thirty collotype plates, showing the corals either of their natural size or reduced to one-half or two-thirds, and by four lithographed plates of the surface characters enlarged. Many of the collotype figures, owing to their reduced scale, are of comparatively slight value, but the enlarged figures are very carefully drawn, and should prove highly useful for comparison; they would have been of still more service if drawn on a more uniform scale, instead of, as now, ranging between six and forty diameters. We regret to note that eighteen of the *new* species in this volume are not accompanied by any figures, and of several others no enlarged surface drawings are given; it is surprising that such a deviation from the established scientific procedure of figuring new forms should be permitted in a work issued by our leading scientific institution. It would, further, have been desirable to show by figures the "middle streaming layer" and the lower and upper layers of the cœnenchyma with their bent threads, since this terminology appears to be new.

We venture to remark that the numbers of the specimens in the Museum Register are only quoted here and there in this volume of the Catalogue, whereas in the first volume they are scrupulously given in all cases. Any one who has had to hunt up a type specimen in the Museum, will acknowledge the advantage of being able to quote the "registered number," and it is very important where, as in the case of these corals, nearly every specimen is a type (and perhaps unfigured), that the registered number should be given in the published Catalogue, so as to be available for identification.

The maze of variations shown in a collection of recent corals call for the utmost patience, courage and judgment on the part of the investigator, and Mr. Bernard deserves the greatest sympathy and encouragement in the difficult and puzzling task which he has undertaken.

G. J. H.

OUR BOOK SHELF.

Das Wachstum des Menschen. By Dr. F. Daffnfr. Pp. vi + 129. (Leipzig: Engelmann, 1897.)

IN one hundred and thirty pages the author traces the physical development of man from the embryological state through that of fœtal existence to childhood, and thence to puberty, maturity, and decay.

The first few chapters are devoted to the proportions and weights of fœtuses of various ages, along with the causes which determine the sex of offspring. The view adopted is that the more vigorous element prevails, the argument being based upon the fact that young primiparæ (seventeen to nineteen years) bear a large percentage of boys; while women in full vigour (twenty to twenty-one years) bring forth more girls, the percentage of the latter decreasing again as the age of the mother increases.

Puberty, with its accompanying physical changes, together with a severe condemnation of the corset and

modern views on beauty of the female form, occupy the next section.

The average weight of the new-born infant, the greater decrease in weight during the first few days of the male than the female, and of the first-born than the children of multiparæ, along with the subsequent daily increase, is given accurately and in an interesting and comprehensible style.

Although adopting weight *faute de mieux* as a method of comparing brains, the fact that the intellectual qualities of that organ do not vary directly with its mass is recognised, and illustrated by reference to individual cases. Unfortunately, when comparing the results of various observers, no statement is made as to which, if any, membranes are included with the nervous substance.

The book, admirably adapted for students acquainted with anthropometric methods, comprising many original observations, deals mainly with measurements and weights. The absence of instruction as to how they are obtained, detracts from its value to beginners ; while the pathological and anatomical details scarcely recommend it for popular instruction.

Beschreibung der Hauptmethoden, welche bei der Bestimmung der Verbrennungswärme üblich sind. By W. Longuinine. Pp. 112, with 4 copper-plates and 21 figures. (Berlin : R. Friedländer und Sohn, 1897.)

THIS excellent work had already been printed in Russian when Berthelot's "Traité pratique de Calorimétrie chimique" appeared. The German translation may, however, be welcomed, because its scope differs considerably from that of Berthelot's book. The estimation of heat of combustion is alone dealt with by Longuinine, the rest of thermo-chemistry being left untouched. One of the results of discussing only a part of a subject is that, as far as it goes, this book is remarkably complete. Besides a full description of the calorimetric bomb and the precautions to be observed in its use, an account is given of the older methods of estimating the heat of combustion, which are still used to some extent, owing to the high price of Berthelot's bomb. Under certain conditions, duly set forth in the text, these old methods give exact results. The illustrations are capital, though unfortunately not drawn to scale, and the whole volume is handsome. By some strange mischance, it is not furnished with either an index or a table of contents.

Cheltenham as a Holiday Resort. Part I. *The Neighbouring Hill-Country.* By S. S. Buckman, F.G.S. Pp. 100. (Cheltenham : Norman, Sawyer, and Co., 1897.)

THE geology and archæology of Cheltenham and the neighbourhood are described in this book in a way which will induce the reader to make further inquiries into the why and the wherefore of the interesting characteristics referred to. The book will add to the enjoyment of ramblers in the country around Cheltenham, and will be of special value to those who visit the district in search of scientific information. The author has himself made investigations of Cotteswold geology, and his book contains the results of original observations as well as references to the work of others.

Nature's Diary. Compiled by Francis H. Allen. Eight photogravures. (London : Gay and Bird).

ON the left-hand pages are literary extracts, chiefly from Thoreau ; on the right, blank paper for the events of the natural year, with here and there a printed note. The naturalist who uses the book must give it all its value. He would do much better to buy a note-book and a copy of Thoreau's "Walden." This is a book for show and not for use. The eight photographs from nature are capital. L. C. M.

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.*]

Protective- and Pseudo-Mimicry.

I HAVE just been reading the presidential address to the Entomological Society on the subject of mimicry, and one or two statements with regard to mimicry among the *Heterocera* seem to me to stand in need of correction. It is stated on the authority of Colonel Swinhoe that *Teracolus etrida* is accurately mimicked by the geometer *Abraxas etridoides*, and that this supports his contention that the species of *Teracolus* are protected.

I described *Abraxas etridoides* from a single specimen taken on the Palni Hills, South India, by M. Elwes, pointing out its resemblance to the *Teracolus*, which also occurs in South India. This was quite enough for such an ardent student of mimicry as Colonel Swinhoe to base the above statement on, without knowing any more of the species, and probably without ever having seen it, the type being in a private collection. I have, however, lately received more specimens, and been able to learn its habits from collectors on the Palnis, where it rests in damp woods during the day on the plateau, as is the habit of the genus, whilst the *Teracolus* does not occur on the hills, but flies in the hot sun of the plains 6000 feet below ; the fact being that all the species of the genus *Abraxas* secrete acrid juices and are distasteful, whilst *Teracolus* is not protected.

Again, it is stated that Danaid butterflies are mimicked by three genera of the *Chalcosia* group of *Zygænidæ*. These again secrete strong acrid juices, as does the whole family to which they belong, and they are so distasteful that hardly any other animal will touch them ; their habits, too, are extremely different from those of butterflies, and no one who knows them in life could possibly believe in protective mimicry between the two groups. The *Chalcosias* sit about on tree trunks, but are very easily disturbed, when they fly with an extremely wavering flight for a short distance and then settle again. The only exception in this habit known to me is the Papilio-shaped genus *Histia*, which flies high over forest trees backwards and forwards with wavering flight, resembling that of the Vapourer Moth in our London squares, and looking so unlike butterflies that not even the veriest tyro could mistake them, besides being about one-third the size of any *Papilio*. Both these cases, therefore, will, I think, have to be relegated to the rapidly swelling ranks of museum-made mimicry.

Protective mimicry entirely depends on community of habit, and it used to be considered that accurate field observations were necessary to establish it. Now that it has been degraded to the matching of specimens in a drawer like ribbons in a shop, being a nice easy subject to philosophise on and entailing a minimum of work, it has lost all claim to serious consideration.

February 8. G. F. HAMPSON.

Oat Smut as an Artist's Pigment.

THE deep brown or sepia-coloured spore dust often seen on cereals, and arising from the presence of a fungoid growth, is sufficiently rich in colour to become useful as a pigment for the artist. The colour obtained from smutty oats, for example, is of a deep rich umber shade, sometimes approaching to sepia in tone. Satisfactory experiments were made regarding its fastness to light and atmospheric influences. Specimens of the pigment painted on paper as a water-colour were exposed to direct sunlight for several months ; and after this rather severe trial, they were compared with unexposed duplicate specimens. Little change in the appearance of the colours was apparent. With mild diffused daylight—such as that of an ordinary, well-illumined room—the colour remains quite fast and unaltered. Experiments were made on a small scale with oat smut pigment, and the results seemed highly satisfactory. Several grams of the dry spore dust were collected from smutty oats, and it was found that twelve heads of such oats yielded six grams of the brownish-black dust. This powder, being of a dry and light nature, had first to be moistened with a few drops of alcohol, then mixed with gum and water to form a water-colour pigment. In its deepest tones it is of a fine sepia shade, deepening to a brown-black. On diluting with water or Chinese

white, pleasing tints of a flat brown, of the pheasant-egg cast, are obtained. This colour has met with approval among artist friends to whom it was shown.

The beauty of colour and fastness to light of this pigment, from such an unpromising material, may be of interest to artists' colourmen. DAVID PATERSON.

Leabank, Rosslyn, Midlothian.

Early Spring Flowers.

YOUR readers will doubtless have been observing how the mildness of the weather this winter, so far, has hastened on the spring flowers. I am inclined to think that some of the dates mentioned below have not often been paralleled. The dates in brackets, of the usual flowering times, have been taken from Babington's "Manual of Botany" and Johnson's "Gardeners' Dictionary." December 10, 1897, *Helleborus fœtidus* (February); December 23, 1897, *Eranthis hyemalis* (February, March); December 31, 1897, *Iris histrio* (December to March); January 14, 1898, *Mercurialis perennis*, ♂ (April and May); January 14, *Corylus avellana*, ♂; January 29, ♀ (March, April); January 15, *Galanthus nivalis* (February); January 19, *Anemone hepatica* (March, April); January 20, *Anemone fulgens* (February 20, 1897), (March, April); January 20, *Ranunculus Ficaria* (February 20, 1897), (April, May); January 20, *Viola odorata*, wild (March, April); January 21, *Iris histrioides* (March); January 21, *Tussilago Farfara* (February 20, 1897), (March, April); January 21, *Berberis Aquifolium* (April); January 22, *Potentilla Fragariastrum* (April, May); January 24, *Primula vulgaris*, wild (March to May); January 24, *Crocus aureus* (February); January 26, *Omphalodes verna* (March); January 29, *Aucuba japonica*, ♂ (June). On the ♀ plant there is no sign of flower yet, and the berries have just turned red. January 29, *Ulmus surculosa* (February 21, 1897), (March to May); January 29, *Daphne Laureola* (February, March); January 29, *Arabis albida* (February 21, 1897), (February). Among other plants which began to flower in November, and have gone on until now with unusual luxuriance, we have noted *Garrya elliptica*, ♂ (just over), *Viburnum Tinus*, *Petasites fragrans*, *Lonicera fragrantissima*, *Ionopsidium acaule*, *Erica carnea*, garden violets, and primroses, single and double, and forget-me-not. I may add that on December 1, 1897, in the course of an hour, in and around the garden here, I noted upwards of 120 different kinds of plants in flower. A few were winter flowers, but most of them were belated summer and autumn ones.

Aphides are feeding on young rose and iris leaves, and slugs are playing havoc with young shoots of herbaceous and alpine plants.

A young rabbit was seen ten days ago in Devonshire, and in Gloucestershire a nest containing eggs of the blackbird and one of the robin with eggs were found about the same time.

Dadnor, Herefordshire, January 31. E. ARMITAGE.

Insusceptibility of Insects to Poisons.

IN your review of "Notes of a Naturalist and Antiquary" in the issue of November 18, it is said that the caterpillar of the Spurge Hawk Moth "feeds exclusively on the Sea Spurge, although the plant secretes an acrid juice 'so painfully poisonous that it is difficult to imagine a digestive apparatus competent to deal with it.'"

This recalls to me a case, which came under my notice some years ago, in which a druggist had prepared a quantity of poisoned wheat for killing sparrows, then lately introduced here and a great nuisance, by soaking it in a solution of strychnine coloured with magenta. He found that on keeping it for some time in cardboard boxes it became infested with weevils; so I examined it to find if it really contained the alkaloid. The boxes were full of weevils and their excrement, and the wheat was more than half of it eaten. Strychnine was present in the wheat in the weevils, and in apparently larger proportion in the excrement, so that it had evidently passed through the digestive apparatus unchanged. WILL. A. DIXON.

Sydney, December 31, 1897.

MR. DIXON'S letter supplies a further illustration of the curious fact that certain insect larvæ are able to feed upon poisonous plants with impunity, and can pass through their digestive system an amount of poison sufficient to kill many a more highly organised being. It is perhaps owing to their being less highly organised that they are not susceptible to the poison. Although various instances in support of the fact have been placed on record, I have not met with any attempted explanation.

M. Félix Plateau, in a paper on the phenomena of digestion in insects, published in the *Mémoires de l'Académie Royale de Belgique* (tome xii.), an abstract of which may be found in the *Annals and Magazine of Natural History* (ser. 4, vol. xvi.), has remarked that some substances resist the digestive action and are passed with the excrement—as in the case of the weevils examined by Mr. Dixon. Such, he says, are the chitine of the integuments of insects, vegetable cellulose, and chlorophyll, which by the aid of the micro-spectroscope may be detected at all parts of the alimentary tube of herbivorous insects; but he says nothing of the effects of poison.

Dr. T. R. Fraser has shown (*Ann. and Mag. Nat. Hist.*, ser. 3, vol. xiii.), that the caterpillar of *Deiopeia pulchella* feeds on the virulent poison contained in the kernel of the seed of *Physostigma venenosum*, and is unaffected by the poisonous principle of the kernel—"eserinia." Yet he ascertained by experiment that the caterpillars subjected in various ways to the action of hydrocyanic acid quickly died, proving that this species possesses no universal panacea against all poisons.

Curious to relate, another insect, a weevil *Anthonomus druparum*, feeds with impunity on the very poison which is fatal to the last-mentioned insect, namely on the kernel of *Prunus cerasus*, the poisonous properties of which depend on the hydrocyanic acid it contains. It appears, therefore, that what is one insect's food is another insect's poison, and *vice versâ*. The subject offers a fine field for investigation, and the results of further experiments, if made known, would be of interest to many besides professed entomologists.

THE REVIEWER.

Variation of Water-Level under Wind-Pressure.

IN confirmation of Mr. Wheeler's observations as to the variation of water-level under wind-pressure, two interesting beaches in the Great West Bay may be cited.

At the Chesil Bank (where all forces combine to raise the water-level) a height of 42 feet 9 inches above normal spring tide, high-water, is the height of the shingle-barrier raised by winds, waves, and currents to bar their own progress. Within the same bay, in the minor inlet of Torbay, the beach at Goodrington Sands (exposed to an easterly drift of more than 200 miles, and to waves exceeding 300 feet from crest to crest) rises 5 feet above the mark of fine weather spring tides; and this low bank is, or was when I saw it in 1889, the sole barrier between a grass field and the English Channel. The explanation clearly is that the harder it blows from the east, the more the level of the English Channel is lowered and the waters of Torbay with it.

Torquay, February 4. A. R. HUNT.

Bipedal Lizards.

MY correspondent, Mr. H. Prestoe, has taken the trouble to examine the collections at the Natural History Museum, and by so doing has identified the bipedally-running Diamond Lizard of Trinidad, referred to in my last week's communication, with the *Ameiva surinamensis* of Gray. This identification is of additional interest, since it associates the faculty and habit of bipedal locomotion with yet a third family group of the lizard tribe, namely, that of the Teiidæ.

A good illustration of the species under notice, in a state of repose, is given in vol. v. of Lydekker's "Royal Natural History." W. SAVILLE-KENT.

THE TOTAL ECLIPSE OF THE SUN.

THE first Indian mail dispatched after the total eclipse of January 22 has now arrived, and it brings a number of details of the work done and results obtained during the two minutes of totality. It is therefore now possible to supplement the information derived from cablegrams already published in NATURE (January 27, p. 294) with extracts from the reports of the various eclipse parties. The Government of India appears to have rendered assistance to all the observers, and it has earned the gratitude of men of science

for the active interest shown in the whole of the astronomical operations. Rarely, if ever, has the work of observers been given greater facilities; and the credit for the success of the recent eclipse investigations is due, to a large extent, to the help of the Indian Government, as well as to the perfect weather which prevailed.

The invaluable aid given by the officers and crew of H.M.S. *Melpomene* was described by Sir Norman Lockyer in last week's NATURE. The results obtained by this new eclipse force appear to have exceeded the highest anticipations, and our only source of regret is that the trained perceptions of the officers and men of our ships have not previously been enlisted to advance the knowledge of solar physics by observations of solar eclipses. Naval officers are so familiar with optical instruments, that they need but a few hints to be able to make most of the observations required during eclipses. The "Melpomenes" have proved their efficiency as eclipse observers, and we hope their work will be taken as a model of what can be done upon future occasions by enlisting the sympathies of naval officers and men in astronomical investigations; for the knowledge thus obtained is both abundant and valuable. To the assistance given by Captain Batten, who took charge of all the affairs of administration and organisation, must be ascribed a large portion of the success at Viziadurg.

Sir Norman Lockyer expressed this opinion in the course of a few remarks made by him at the end of the eclipse.

"You have no right to cheer me," the *Times of India* reports him to have said, "but I have the right to cheer you, and had I a hundred and fifty throats I would do it right heartily. It is you, the officers and men of H.M.S. *Melpomene*, who have been running this camp, and we three have just stood by. You have done all the work, and you have been making a bit of history, not only for British science but for the British Navy. The records of this expedition will be logged in one of the Admiralty books, and I am proud to have been associated with you in this Eclipse Expedition of 1898. The work you have done has not only been in proportion to your numbers, a hundred and fifty to three, but you have borne the burden and heat of the day, and I thank you from the bottom of my heart for the admirable manner in which you have behaved towards we land-lubbers. We have done our best, you have done your best, and between us we have to-day accomplished what has never previously been done in the history of the world. A hundred and fifty British Bluejackets have observed an eclipse just as perfectly as if they had been drilled for years instead of a few days. We have been perfectly successful along all the lines of work we laid down, and we have done everything we tried to do. I do not really thank you a bit, but I congratulate you from the bottom of my heart upon the splendid success you have achieved."

From the various reports which have now reached this country, we make a few extracts to show what scientific results were obtained at the eclipse stations, beginning with extracts from the letter contributed by Sir Norman Lockyer to Tuesday's *Morning Post*.

VIZIADURG.

"When I come to the scientific results I hardly know how to begin, for there is so much to tell The 'Melpomenes' have certainly beggared all former records. In the prismatic cameras every plate we hoped to expose at the different times, carefully thought out beforehand and bearing in mind the capacities of the two instruments, now bears a precious record. In the two cameras the number of spectra photographed amounts to about sixty; of these forty are distributed over four plates—'dropping plates,' as they have been called, because they drop inch by inch and second by second at the beginning and the end of the total phase. On each plate therefore we get a history of the visible solar atmosphere for ten seconds; the lengths of the arcs tell how the different chemical constituents are distributed, and their positions tell us exactly what the constituents are. In some of these records it has been roughly estimated that we have to deal with a thousand lines. It is pretty certain, then, that many months of careful measurements will be necessary before we can form a detailed idea of the advance secured.

"As was anticipated, the increased dispersion has distinctly helped us on in our knowledge of the corona. Several beautiful corona images have been secured on both of the prismatic cameras. The want of any visible connection between the materials of the corona and of the chromosphere is again demonstrated. The definition in some of the plates is so good that the bases of the streamers are depicted in the coronal rings, while the prominence and chromosphere rings take no notice of them whatever. This result seems entirely in harmony with the telescopic observations of the structure of the corona which I made with a 3¾-inch Cooke telescope. The prominences seemed entirely disconnected from the corona structure lying near them, and there was no increase of luminosity as the prominences were approached."

The "flash" spectrum was photographed, both at the beginning and end of totality, with the six-inch and nine-inch prismatic cameras. The results of the six-inch camera with the two prisms (see p. 295) surpass all previous records, about double the number of lines photographed in Novaya Zemlya in 1896 being recorded upon the plates. Photographs of the corona were obtained with a four-inch telescope fed by a cœlostat. Lieut. Blackett, R.N., in charge of the star observations, reported the appearance of some object between Mars and Jupiter, where no star down to the third magnitude occurs on the chart. Prof. Pedler, using a grating spectroscope, observed during the total phase "that the strong arc lines of iron and magnesium were visible on the inner corona, while no spark lines were seen."

Meteorological Phenomena.

Mr. J. Eliot, F.R.S., the Meteorological Reporter to the Government of India, says:—

"The meteorological phenomena accompanying the eclipse were much less striking than was anticipated. Observations expressive of the air were taken with a barometer and a Richard Frère's continuous self registering barograph. The trace on the barograph on the 22nd was practically identical with those on the 21st and 23rd, and the influence of the solar eclipse was either nil or very small, and will require careful examination of the traces to detect.

"Observations of the temperature of the air were taken by means of six thermometers by Bailey, which had been carefully tested at Kew, and also by means of a Richard Frère's thermograph. The observations show that temperature rose more slowly than usual from 11 a.m. until about totality, when it fell rapidly about 5° F., and was constant for some time after totality.

"This fall in temperature at Viziadurg was partly at first due to the usual change from land winds to sea breezes, which usually takes place at noon. On the day of the eclipse easterly winds prevailed during the previous night and morning until about 12.15 p.m. A short period of calms and light airs obtained until three minutes before totality, when the wind shifted to west, and blew more or less steadily and strongly during the remainder of the day. The only instrument which showed any large influence due to the eclipse was the solar radiation thermometer. It rose steadily from sunrise until about 5 minutes after the commencement (*i.e.* 11.15 a.m.), when it read 144° F. It fell continuously and with increasing rapidity until the end of totality, when it registered 81½° (practically the temperature of the air.) During the latter part of this period it fell at the rate of upwards of 4° in five minutes."

SAHDOL.

The observations at Sahdol (says the *Pioneer* of January 25) were completely successful. The Astronomer Royal exposed seven large plates during totality, and twenty four more during the partial phases. His photographs show the sun's image four inches in diameter. Prof. Turner took twelve pictures during totality, and two plates in polarised light. The photographs taken by the Astronomer Royal and Prof. Turner during the eclipse have been developed, and are highly successful.

Mr. Mitchie-Smith, the Madras Government Astronomer, took seven good photographs with a 40-foot telescope. Photographs of the coronal spectrum were taken by Mr. Moos. Several draughtsmen of recognised ability, including General Strahan, Sir Thomas Holdich, General Woodthorpe, and Colonel Barr, made coronal drawings during totality.

WARDHAGANJ.

The eclipse was observed here perfectly. Twelve photographs of the corona were secured and twenty-four photographs of the spectrum. All the photographs developed are very good.

Captain Hills' corona spectra are excellent, showing a small radial extension of the lines. Captain Hills obtained a series of exposures for the flash at the beginning and end of totality, showing the whole spectroscopic history of the sun's limb, from the solar spectrum through the flash to the prominence.

Mr. Newall found the coronal spectrum too faint at a quarter diameter from the sun's limb for determination of the velocity in the line of sight, but caught the bright lines in the spectrum on another photograph at the end of totality. Mr. Newall observed very strong polarisation in the corona visually, and also observed the green coronal ring with the objective grating spectroscope.

JEUR.

The eclipse party from the Poona College of Science, under Prof. K. D. Naegamvala, had its camp at Jeur, and within two hundred yards of it were the Lick observers, under Prof W. W. Campbell. At Jeur were also the Japanese astronomers, under the direction of Prof. Taero, with Prof. Hiramaya and two assistants. Two miles further south was Mr. C. Burckhalter, with Major Harkness, Captain Dugon, and others. Every branch of eclipse work was represented at Jeur.

All the eclipse parties at this station may well be congratulated on the successful issue of their arduous labours and careful preparation. Thirty good photographs of spectra, fifteen of which are excellent, were secured by Prof. Naegamvala, and about the same number by Prof. Campbell. In the case of the Poona eclipse party these preparations were rendered particularly arduous by the very late arrival of some of the principal instruments sent out from England; Prof. Naegamvala's Cooke 6-inch spectroscope having only arrived on January 11. Upon this instrument two prisms of 45° were mounted, and the length of spectrum given by them was twelve inches. The "flash" spectrum was caught on three plates, and on one spectrum the length from D_3 to H is eight inches. The Maharajah of Kohlapore, who had liberally supported Prof. Naegamvala with funds for the eclipse instruments, specially deputed Prof. Apte to join the Poona party Prof. Apte secured some very interesting observations on the visibility of planets during the course of the phenomenon, and they will be of value in determining the intensity of the corona light.

In addition to the information given in the foregoing extracts, we learn that at the British Astronomical Association's camp at Talni good photographs of the corona were obtained, and Mr. Evershed succeeded in photographing the "flash" spectrum, and in carrying out the whole of his extensive spectroscopic programme. At Gogra, north of Nagpur, Dr. Copeland obtained photographs of the corona with his telescope of 40 feet focal length. Particulars of the instruments employed at the various stations have already been given in NATURE.

PITCHER-PLANTS.[1]

AMONG recent additions to the attractions of Kew Gardens is a house largely devoted to pitcher-plants; and the past year has seen several important additions to our knowledge of this very interesting class of plants.

Pitcher-plants, as enumerated by Prof. Vines, are found in ten genera, distributed through five widely separated natural orders, viz. (1) Sarraceniaceæ (*Sarracenia*, *Darlingtonia*, *Heliamphora*); (2) Nepenthaceæ (*Nepenthes*); (3) Asclepiadaceæ (*Dischidia*); (4) Saxifragaceæ (*Cephalotus*); (5) Lentibulariaceæ (*Utricularia*, *Genlisea*, *Polypompholyx*, *Biovularia*). Of these the only natives of this country are the "Bladder-worts" (*Utricularia*), of which several species are not uncommon in running and standing water. But the genus with which the name is usually associated is *Nepenthes*, the only representative of the order, to which about thirty-two species are assigned by Bentham and Hooker, natives of the East Indian Archipelago, or scattered through Asia, Africa, Madagascar, and Australia;[2] but the number of known species is now considerably larger. About forty species or hybrids are now under cultivation at Kew. Mr. H. J. Veitch—whose firm has done so much for the introduction of these plants into cultivation—in his admirable account of the genus in the *Journal* of the Royal Horticultural Society, gives twenty-four as the actual number of true species in cultivation, in addition to a large number of varieties, and primary, secondary, or tertiary hybrids.

Nepenthes is not grown for the sake of its blossom. The flowers, borne in terminal inflorescences, are small, and of simple type, the perianth consisting of four usually green segments. They are unisexual and dicœcious. I find no reference to any insect-visitors to the flowers; and they are probably anemophilous. The interest of these plants centres in the remarkable terminal appendages to the leaves in all the known species, the ascidia or pitchers, which are constructed on a uniform general type, though varying greatly in size, form, and colour. To promote the formation of these pitchers, cultivators usually "stop" the blossoming, so that special cultivation is needed for the production of hybrids. The pitcher itself is generally regarded as an expansion of the petiole or leaf-stalk; Sir Joseph Hooker describes it as a

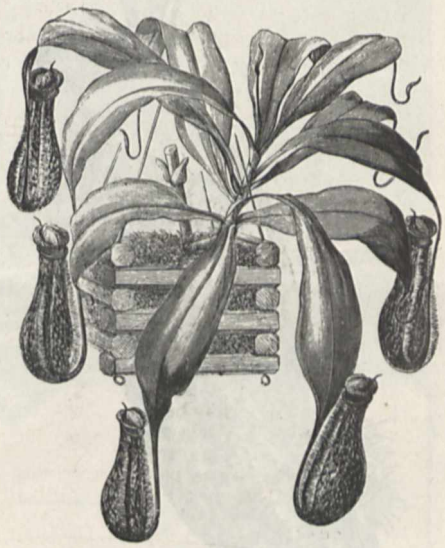


FIG. 1.—*Nepenthes Sedenii*, one-sixth natural size.

"modification of a gland situated at the apex of the midrib of the leaf." The lid is always completely closed until maturity, and the fluid is excreted within the enclosed chamber.

The composition and properties of this fluid have been the subject of many investigations. Notwithstanding that one or two recent inquirers have come to a contrary conclusion, the observations and experiments of Prof. Vines may be said to have finally settled the point that it contains a true digestive principle. The teleological bias of the eighteenth century connected these pitchers of water with the needs of thirsty travellers or of birds. Linnæus describes the pitchers as "aquam dulcem limpidam, amabilem, confortantem, frigidam suppeditantia, ad necessarium hominis usum," and goes into raptures when adopting the name *Nepenthes* proposed by Breyne:—"Cum enim et haec non Helenæ Nepenthes, certe Botanicis omnibus erit. Quis Botanicorum longissimo itinere profectus, si mirabilem hanc plantam reperiret, non admiratione raperetur, totus attonitus, praeteritorum malorum oblitus, mirificam Creatoris manum dum obstupescens adspiciret?" There are unfortunately two valid arguments against Linnæus's theory:—In the

[1] S. H. Vines, "The Physiology of Pitcher-Plants." (Reprint from *Journ. Roy. Hort. Soc.* vol. xxi., 22 pp.)
S. H. Vines, "The Proteolytic Enzyme of Nepenthes." (*Annals of Botany*, December 1897, pp. 563–584.)
H. J. Veitch, "Nepenthes." (*Journ. Roy. Hort. Soc.* 1897, pp. 226–255.)
F. W. Burbidge, Remarks on the above. (*Tom. cit.* pp. 256–262.)
F. M. Bailey, "Contributions to the Flora of Queensland," vol. i. part 1, July 1897.

[2] Mr. Bailey describes and figures two new species from Queensland.

first place the fluid is absolutely unpotable; and secondly, nearly all the known species of *Nepenthes* grow in climates where the traveller need never be thirsty. Mr. Burbidge states that on the great mountain range of Kina Balou, in North-west Borneo, the "paradise of pitcher-plants," there is a deluge of rain every night in the year, while in the day-time the air is in a constant state of "Scotch mist." The internal surface of the pitcher is provided with a large number of specialised glands, from which the secretion is poured out into the pitcher. The fluid has a slightly acid reaction, and yields a large quantity of solid matter on evaporation; and the most trustworthy analyses that have been made show that the preponderating unorganised constituents are potassium chloride and malic and citric acids, with smaller quantities of soda, lime, and magnesia. The researches of Vines have convinced him that the pitcher secretes an enzyme which has the property of digesting organic substances in the presence of an acid which is always found in the fluid; and that this digestion is not due to the putrefactive bacteria which are always present in the liquid. All the species of *Nepenthes* are either

FIG. 2.—Pitcher of *Nepenthes Dicksoniana*, one-fourth natural size.

epiphytic or grow in wet soil, and agree with other carnivorous plants, such as *Drosera* and *Dionæa*, in having a very reduced root-system; the food-substances obtained through the pitchers thus supplying the lack of nutriment from the soil.

None of the other pitcher-plants, with the possible exception of *Cephalotus*, are, according to Vines, truly carnivorous. In most cases they are insect-traps, but they produce no digestive enzyme; the captured insects are decomposed by the microbes which abound in the fluid, and the products of decomposition absorbed by the plant. In *Darlingtonia*, and in *Sarracenia*, one species of which, the "Side-saddle-plant," is abundant in bogs in the Northern United States and in Canada, the lid is replaced by a hood, and insects are attracted by honey-glands placed near the mouth of the pitcher. In *Dischidia* the pitcher, which has no lid, is not nutritive; its main use appears to be to husband the water required by the plant. The pitchers of *Cephalotus* closely resemble in appearance those of *Nepenthes*. Several species of *Utricularia*, or Bladder-wort, are among the prettiest of our water-plants, with their pale yellow flowers and much-divided leaves, ornamented with the minute bladders, which are closed by a valve opening inwards, thus preventing the escape of innumerable aquatic animals which creep into them. It may be added in conclusion that one of our few native non-chlorophyllous root-parasites, the Tooth-wort (*Lathræa squamaria*), belonging to the Scrophulariaceæ, has singular hollow underground scale-leaves, which may be regarded as rudimentary pitchers, and resemble those on the exotic terrestrial species of *Utricularia*. Their purpose appears to be the reverse one to that of the pitchers of *Dischidia*, viz. to serve as organs for the excretion of superfluous moisture.

Our illustrations are taken from Mr. Veitch's paper on *Nepenthes* in the *Journal* of the Royal Horticultural Society. Fig. 1, a hybrid known as *N. Sedenii*, a cross

FIG. 3.—*Nepenthes Edwardsiana*.

between *N. Khasiana* and an unknown species, shows the general habit of the genus. Fig. 2 represents the magnificent pitcher of *N. Dicksoniana*, a cross between *N. Rafflesiana* and *N. Veitchii*. In Fig. 3, *N. Edwardsiana*, Hook. f., a spike of male flowers is shown; also a magnified portion of the glanduliferous surface of the pitcher.

A. W. B.

A NEW ARTILLERY CHRONOGRAPH.[1]

THE ordinary chronograph used in artillery experiments consists of a falling shutter held suspended by an electromagnet whose circuit is broken by the projectile, which cuts a wire in its passage. Other wires are

[1] Based upon an article in *La Nature*, pp. 97 and 122, 1898.

cut at intervals along the path of the projectile, and as each one is cut a knife is liberated which strikes the shutter and imprints a mark upon it. These marks form a record of the speed of the ball in terms of the known speed of a falling body.

This apparatus, which has been perfected by many devices, is open to a fundamental objection. The release of the shutter and of the knife takes time, a short time may be, but an amount of time which becomes objectionable when intervals as small as one-twentieth of a second have to be dealt with. Projectiles nowadays attain velocities of half a mile per second, and a new and more accurate means is required for dealing with them.

Such an instrument has been devised by Prof. Cushing Crehore, of Dartmouth College, and Mr. Owen Squier, lieutenant of artillery in the United States Army. It is based upon an electro-optical principle of comparatively recent discovery, that known as the Faraday effect. When a beam of light is polarised by a Nicol prism and then sent through another Nicol prism, it is transmitted if the polarisation planes of the two prisms are parallel, but is totally extinguished if the planes are crossed. If, however, a tube containing carbon bisulphide or other rotatory substances is interposed between the crossed Nicols, the light reappears as soon as the tube is exposed to a strong magnetic field. This magnetic field is produced by a coil of wire surrounding the tube, and hence it will be seen at once that an electrical contrivance is possible which interrupts or restores the beam of light. Add a photographic recording apparatus, and the scheme underlying the Crehore-Squier arrangement is complete.

The recording apparatus is shown in Fig. 1. P is the polarising Nicol, A the analyser, T the tube containing the carbon bisulphide and surrounded by the magnetising coil. W is the camera containing the revolving sensitive plate driven by the small motor *m*. The camera is provided with a falling shutter which covers a thin brass disc provided with two small openings. One of these openings admits the polarised light. The other admits light which has had to pass through a hole in a piece of aluminium foil carried on the prong of the vibrating tuning-fork shown in the figure. The vibrations interrupt and restore the light at perfectly constant known intervals, and make a record of dots on the plate, which serve to determine the time for the projectile record. The falling shutter serves to limit the exposure to a portion of one revolution of the plate, and to prevent the superposition of records.

The projectile, in starting from the mouth of the cannon, breaks the first wire and the magnetising circuit, thus extinguishing the light. When it reaches the second wire, it restores the circuit in a manner explained by No. 2 (Fig. 1). B and B' are terminals of the circuit, A is an insulating piece, and C C are elastic metallic plates kept apart by the insulated wire D. The projectile in its passage whips out the wire D, and allows C C to touch and establish the circuit. The next wire breaks it again, the next restores it, and so on. In the figure, four circuits are indicated, which may be brought into play one after the other, thus providing for the measurement of eight time intervals. By placing these wires at suitable distances from the cannon's mouth, any portion of the path may be minutely investigated.

The most striking information derived from such measurements is that the speed of the projectile goes on increasing for some time after it has left the cannon's mouth. Starting with a muzzle velocity of about 480 m. per second, the projectile increases its speed to, say, 515 m. per second in traversing the first 6 feet from the mouth. It is only after having travelled some 25 yards that the projectile is reduced to its original muzzle velocity. This proves that the impulse of the expanding gas is felt some distance along the path of the projectile.

By a modification of the arrangement described, the inventors have also succeeded in determining the speed of the projectile inside the barrel of the gun. For this purpose they secured a wooden lath to the cone of the projectile (Fig. 2), provided with rings of metal at decreasing intervals. These rings were connected among themselves and to the projectile by a wire running along the length of the rod, the whole being smoothed and turned into an accurate cylindrical shape. A wooden block, A (Fig 3), was fastened on the muzzle of the gun by means of screw clamps, and a brass collar with steel rings, C, was made to embrace the rod, which in the original position of the projectile just projected from the muzzle.

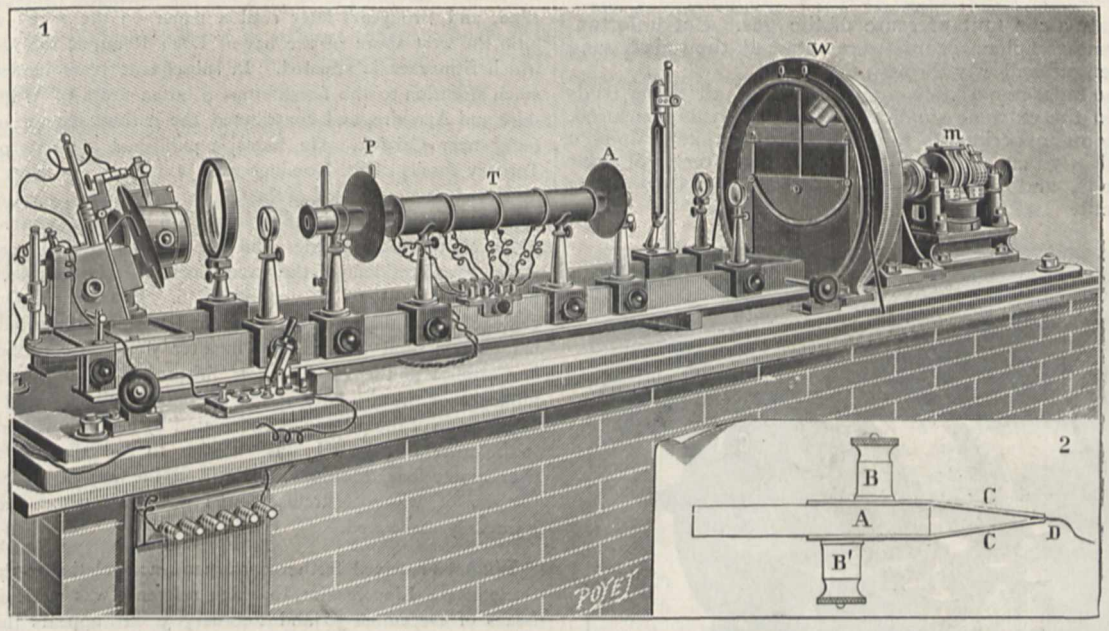


FIG. 1.—Recording apparatus. T tube containing carbon bisulphide surrounded by magnetising coils. W camera. No 2, arrangement for closing circuit.

A circuit through the steel rings, the brass collar, the metallic rings on the rod, the projectile and the body of the gun was completed whenever the brass collar touched one of the rings on the rod. It was broken when the wooden portions passed, and so an alternate transmission and extinction of the polarised beam was brought about, which served the same purpose as in the arrangement first described. The curves obtained showed a constant acceleration of the projectile within the barrel, which would

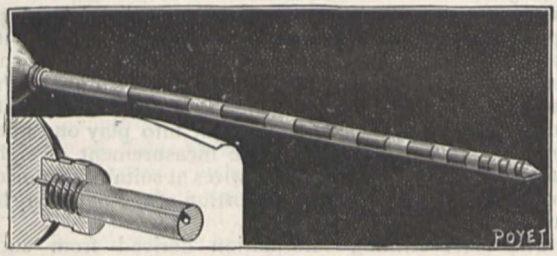


FIG. 2.—Apparatus for measuring velocity of projectile inside the barrel.

indicate a constant pressure of the gas. But unfortunately no complete records were obtained, the rods having broken off half-way through the barrel.

The most remarkable circumstance of all these trials lies in the extreme smallness of the intervals measured. In some experiments ten points were taken along a length of 72 cm., which corresponds to a duration of 0·005 seconds, and reduces the interval observed to 0·0005 seconds.

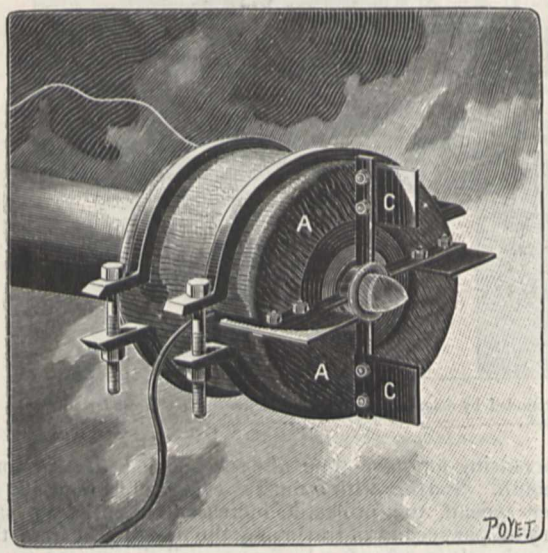


FIG. 3.—Block attached to muzzle for making circuit.

Needless to say, the apparatus may with equal success be applied to other fields of micro-chronographic investigation.

NOTES.

At the meeting of the Royal Society next Thursday, February 24, for the discussion of the scientific advantages of an Antarctic expedition, the following are likely to take part in the discussion which will be opened by Dr. John Murray:—The Duke of Argyll, Sir Clements Markham, Sir Joseph Hooker, Sir Archibald Geikie, Dr. Neumayer (Director of the Deutsche Seewarte), Dr. Sclater (Secretary of the Zoological Society), Prof. D'Arcy Thompson, and others.

PROF. ALEXANDER AGASSIZ writes to Prof. Ray Lankester from Sura, Fiji, under date January 3, as follows: "I got here first days in November, and found my steamer awaiting me; started the day after reaching Sura, and have been on the full run ever since. I have learned more about coral reefs than on all my former expeditions. Naturally my experience elsewhere has been of great service. The problem is getting more and more complicated. My boring was a fizzle. I only got to 80 feet; but in a region where there are elevated reefs nearly 1000 feet thick, that means nothing. From all I hear about the Funafuti boring (700 feet), and from what Prof. Davld writes, I fancy the bore-core will not bring us any nearer to a conclusion. It certainly can not help us to ascertain how atolls have been formed."

THAT until a few days ago (February 10) there lived in Eaton Square a nephew of Sir John Moore, and a man who many years ago attained a considerable distinction in geology, was little known to the present generation of scientific workers. John Carrick Moore was born in 1804, and inherited an estate in the northern part of The Rhinns of Wigtownshire, near Stranraer. He became a Fellow of the Geological Society in 1838, and two years later read a paper on the rocks which form the west shore of the bay of Loch Ryan, at the head of which Stranraer is situated. In subsequent years he devoted much attention to the fossiliferous Silurian strata of Wigtownshire and Ayrshire, and contributed the earliest account of the rocks near Carrick. He likewise published accounts of the Tertiary fossils of St. Domingo and Jamaica. For many years he served on the Council of the Geological Society, terminating his official connection in 1875. In 1846 he was appointed one of the Honorary Secretaries, and later on for several years he was a Vice-President of the same Society. He was elected a Fellow of the Royal Society in 1856. Educated at Queen's College, Cambridge, he early gained a sound knowledge of mathematics and physics, and in after years he contributed a few articles to the *Philosophical Magazine*, dealing with the influence of the obliquity of the ecliptic on climate, and criticising some of the principles enunciated by Ramsay with regard to the erosion of lake basins. Living to the advanced age of over ninety-four, Moore long outlived the majority of his old friends, of whom Murchison was one with whom he was intimately associated.

WE have received further correspondence relating to the two Societies in Lincolnshire, to which reference was made in our issues of December 30 and February 3. It appears that the older Society, the Lincolnshire Naturalists' Union, does not regard with unmixed friendliness the newer and possibly more vigorous Science Society. Into this unfortunate conflict of interests it is not our province to enter, and we can only repeat with renewed emphasis that it is a most serious mistake to allow the spirit of rivalry to enter into the matter at all. The welfare of both Societies can only suffer, and the progress of science in the county can only be retarded by friction. The Lincolnshire Science Society explains its origin by accusing the Union of failing to carry out the objects for which it was founded. There may or may not be truth in the accusation, but we are bound to admit that evidence of scientific activity on the part of the Union has not been obtainable. We cannot find the latter body among the corresponding societies of the British Association; neither can we learn that any publication has been issued under its auspices. Attention may be called to an article by Prof. Meldola, on the work of local societies, published in these columns in 1896 (vol. liv. p. 114), in which some of the causes of the decay of such societies are pointed out, and the advantages of federation insisted upon. We can only hope that Lincolnshire will not present to the scientific world a divided front on a

question in which both parties are really striving for the same end.

IT is announced that in connection with the completion of his twenty-fifth year of office as Woodwardian Professor of Geology at Cambridge, Prof. T. M'Kenny Hughes, F.R.S., is to be the recipient of an illuminated address, to be presented at a public dinner to be held in London on Saturday, the 26th inst. Sir Archibald Geikie has consented to preside.

THE death is announced of Dr. Rudolf Leuckart, professor of zoology and zootomy at Leipzig.

PROF. ALEXANDER GRAHAM BELL has been elected president of the National Geographic Society, Washington.

MANY men of science will grieve to learn that there is no improvement in the condition of Sir Richard Quain, who has been in ill-health for some time, and is gradually getting weaker.

WE regret to see the report that Sir William Dawson, C.M.G., F.R.S., formerly principal and vice-chancellor of the M'Gill University, Montreal, has had a stroke of paralysis.

DR. NANSEN has consented to deliver a lecture at the Queen's Hall on the evening of Monday next, February 21. Lord Lister will take the chair.

The organisation of the Corps of Electrical Engineers, Royal Engineers (Volunteers), has now been completed, and applications for membership may be made to the adjutant, Captain Brady, R.E., at the headquarters of the Corps, 13 Victoria Street, S.W. Major J. Hopkinson, F.R.S., is in command, and Lord Kelvin is honorary colonel. The War Office is offering every encouragement to the development of this new Corps of Volunteers.

IN the House of Commons on Monday, Sir H. Vincent asked the Under-Secretary of State for Foreign Affairs what grant would be proposed from public funds for the representation of the United Kingdom at the Paris Exhibition of 1900; and if he could state what sums Germany, the United States, and Italy proposed to allocate for the representation of their national industries. In reply Mr. Curzon said:—It is proposed to ask Parliament for a grant of 75,000*l.* to provide for the expenses connected with the British section. The German Government has sanctioned a grant-in-aid of 5 million marks, or about 250,000*l.* The United States Government has made a Treasury estimate of 350,000 dollars, or about 70,000*l.* In Italy nothing has yet been officially settled as to the exact amount to be devoted to this purpose.

A GREAT authority on iron and steel has passed away in the person of Prof. Styffe, who died in Stockholm on February 3, having just entered his seventy-fifth year. After completing his studies at the University of Upsala (says *Engineering*) he passed through the School of Mines at Falun, and was afterwards engaged as a mining engineer in the Sala silver mines, but he was soon called by his Government to be the chief director of the Royal Technical Institution at Stockholm. Here he rendered great services during more than a quarter of a century, and was consulted at the same time by the Board of Iron and Steel Works (Jernkontor) in Sweden. When the construction of railways was begun in Sweden, some forty years ago, the question naturally arose of using the excellent native iron and steel for the railway plant, and the State appointed a Committee to make careful researches as to its adaptability for the purpose. Director Styffe was appointed chief of this Committee, and carried out these researches during a period of five years in the most minute and scientific manner. His results were published in the *Annals* of the Jernkontor, or Board of Iron and Steel Works in Sweden. They were translated into English by C. P. Sandberg, and published under the title of "The Elasticity, Extensibility, and Tensile Strength of Iron and Steel." The work caused a great deal of interest in the engineering press at the time. Styffe was juror for Sweden for mining and metallurgy at the London International Exhibition in 1862, and at the subsequent exhibitions in Paris and Vienna. Last summer he was present as an honorary member of the International Congress for the Testing of Materials at Stockholm, and was duly honoured for his long and valuable services.

AMERICAN geographers appear to be far from pleased with the projected plans of Captain Sverdrup. He purposes this summer to use the *Fram*, with Dr. Nansen's approval, for the exploration of the northern shores of Greenland. These plans, it is objected, materially affect and invade Lieut. Peary's field of work, who has not only already done a great deal on the north coast of Greenland, but has for a long time had in view a project for its continued exploration this summer. The American Geographical Society, in its recently-issued quarterly *Bulletin*, publishes two strong protests. It is asserted that Captain Sverdrup, by setting out at the same time, adopting Peary's route and aims, utilising his experience, and interfering with his resources of men and dogs in North Greenland, will frustrate the labour of ten years, and turn to advantage all that skill and courage has already accomplished. The caustic comment is made: "There is no legal impediment in Captain Sverdrup's way. He can do these things if he will, and men will remember him as the one Arctic voyager whom they would gladly forget."

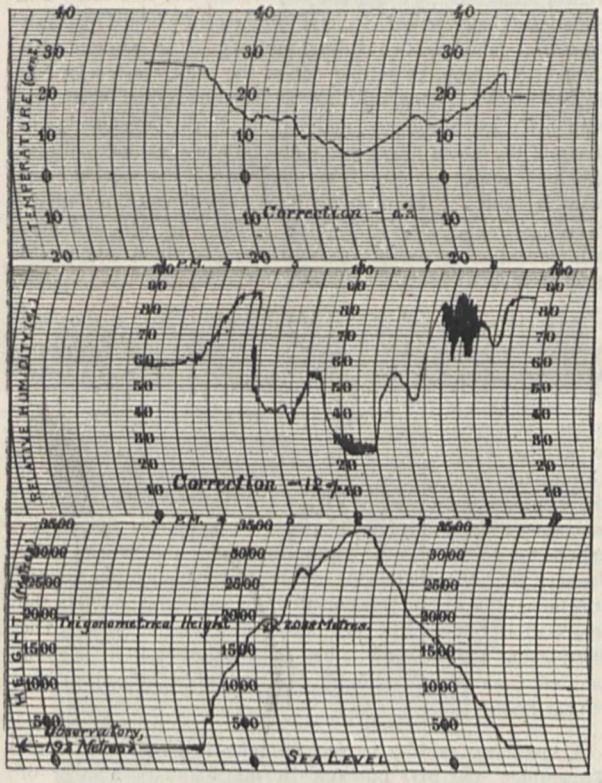
THE "Year-Book" of the Royal Society, No. 2, 1897-98, has just appeared. There are several features in it which lend additional interest, and form an improvement on the last issue. For instance, the scheme of regulations for the administration of the Publication Grant of 1000*l.* from H.M. Treasury is given, as well as a good deal of information regarding the annual Government Grant for scientific research, such as an account of the appropriations, and a list of the Boards recommending assignments from the fund. A note on p. 1 states that applications for grants, and the reports on them, must be sent in by January 31; but the late issue of this "Year-Book" (apparently it is brought down to November 30, in each year) renders the information valueless, at any rate for the current year. The President's address and other anniversary matter is now omitted from the *Proceedings*, and published instead in the "Year-Book."

A STRIKING novelty in vacuum tubes is described by Prof. Trowbridge and Mr. Burbank in the February number of the *Philosophical Magazine*. The space between anode and kathode is done away with, and a continuous wire is led through the exhausted tube, which is then inserted in a circuit containing a spark gap and one of Trowbridge's improved "rheostatic machines." The latter is charged by means of a battery of 10,000 storage cells. The condensers constituting the machine are charged in parallel, and then discharged in series, thus giving rise to a voltage which may be made to approach a million. It is not surprising that by this means novel results are obtained. The tubes glow all over with a brilliant phosphorescence. X-rays are developed; but their photographic effect cannot well be brought into evidence, owing to the fact that brush discharges pass between the tube and the sensitive plate, which on development has a star-spangled appearance. The skin of the hand shows all the symptoms of X-ray burning. An aluminium mirror attached to the wire inside the tube throws a beam of kathode rays upon the wall, which may be deflected by a piece of tinfoil. At extreme exhaustions no difference is noticeable

whether the tube is on the anode or the kathode side of the spark gap. The distinction between anode and kathode rays disappears.

FROM the Blue Hill Meteorological Observatory, of which Mr. A. Lawrence Rotch is director, we have received a *Bulletin* (the first issued from the Observatory), by Mr. S. P. Fergusson, on the highest kite ascensions in 1897. On September 19, 1897, as already described in NATURE (vol. lvi. p. 540), the meteorograph was raised to a height of 3013 metres above sea-level. The highest kite was 40 metres above the meteorograph, or 3052 metres above sea-level. The kites and meteorograph were sent up from near the summit of the hill, which is 192 metres above sea-level. On October 15, 1897, the meteorograph was raised to a height of 3571 metres above sea-level, or 558 metres higher than on September 19. The highest kite was 40 metres above the instrument, or 3611 metres above sea-level. At the

KITE METEOROGRAM OF OCT. 15, 1897.



top of the line were a Lamson ribbed kite with curved surfaces, having an area of 6·60 square metres, and a self-adjusting Hargrave kite, having an area of 3·35 square metres. Two other Hargrave kites, each having an area of 2·13 square metres, were respectively attached at distances of 2000 and 3500 metres from the top of the line. The length of line employed was 6300 metres, and the pull, when all the line was in the air, varied between 56 and 68 kilograms. The instrument left the ground at 3.48 p.m., and reached the highest point at 6 p.m. The work of reeling in the line began at 6 p.m., and the instrument reached the ground again at 8.20 p.m. The meteorogram obtained during this flight is one of the best that has been secured, being complete, with very clear and smooth lines. It is here reproduced from the *Bulletin*. At the highest point reached the temperature was 5·0° C., and at the Observatory it was 22·2°. An interesting feature of this flight was the passing of the meteorograph through the cumulus and alto-cumulus levels of clouds, as shown by the increase followed by a decrease of humidity at heights of 1500 and 2800 metres. At the Observatory the wind was from the south-west during the entire flight, and the velocity varied between 5·4 and 8·0 metres per second, true velocity. Above the height of 1000 metres the direction of the wind was north-west.

PROF. GEORGE M. STRATTON, of the University of California, has made a novel experiment in inverted vision by wearing for eight days a mask fitted with lenses which invert the visual image, thus projecting it upon the retina in an erect instead of the normal inverted position. He soon learned to refer all objects to their correct positions, in other words to see them right side up; but, on removing the apparatus at the expiration of eight days, everything appeared to be upside down at first. He therefore concludes that the seeing of objects right side up is due to a mental rectification of the visual image actually projected upon the retina.

AT the meeting of the New York Academy of Sciences on January 24, Mr. E. L. Thorndike, of Columbia University, gave an account of a long series of interesting experiments on comparative psychology. These experiments were made upon cats, chickens, dogs, monkeys and other animals, and were supplemented by the experience of professional animal trainers. According to a report in *Science*, cats were placed in boxes with doors so arranged that they could be opened from the inside in various ways, in one set of experiments by pressing a latch, in another by pulling a cord, by pulling a hook attached to a cord, or by turning a button. Again the arrangement was more complicated, and two or three separate movements had to be combined in order to release the door and let the animal out to reach the fish placed outside the cage. Curves were given showing the rate at which the kittens learned the various tricks, the time taken to get out becoming gradually shorter. The trick was always learned by accident; one lucky hit would prepare the way for another. There was no trace of rational inference. Seeing another animal do the trick a hundred times was no help. Nor was it possible to teach the trick by taking the kitten's paw and putting it on the latch, and so opening the door, no matter how often it was repeated. A habit once formed artificially will overpower natural instincts. A chicken that had been compelled to jump from a box to the floor in a roundabout way by a cardboard placed in its way, felt unable to jump down to its food directly when the card was taken away.

SIR A. HARDINGE'S report on the East Africa Protectorate, 1897 (c.-8683), contains a careful summary of the manners and habits of the native tribes. There are many broken or slave tribes, besides full tribes. One common characteristic appears to be the looseness of the tribal tie and the small amount of direct government, either by chief or council. The Wagiriama of the Malindi district are a vigorous and handsome race of a dark brown, almost black, colour; and closely allied to them, though politically distinct, are the Wakauma. They have a loose republican sort of organisation, based partly on tribal subdivisions and partly on a kind of freemasonry known as "kambi," which involves several degrees, each attended by its special ceremony of initiation. The Wapokomo of the Tana River district are a fairly handsome and intelligent Bantu race, dwelling in thick clusters of beehive-shaped straw huts all along both sides of the river. The Wakamba occupy the Attri district, and a very useful table is given of the internal subdivisions so far as they are known. Each family occupies its own "boma" or hamlet, and a man on marrying usually forms a boma of his own, consisting at first, perhaps, only of his own hut, but gradually expanding into a hamlet and thence into a village, of which its founder is regarded as the chief. Here is Sir Henry Maine's famous patriarchal family in the making; but we should much

like to have further particulars and assurance that this description is justified by accurate scientific observation. The tribes of the interior have neither idols, priests, nor temples; but there is a vague general belief in spirits, mostly evil, dwelling in or near certain trees or sacred spots, in witchcraft and in ghosts, as well as a more vague belief in a kind of supreme being. The various tribes have each their sacred animal or totem, which it is unlawful for them to eat or kill. Altogether this is an excellent report, and the accompanying maps make it of some value to anthropological students.

AN exploration of considerable importance has lately been undertaken by the East Siberian branch of the Russian Geographical Society (*Izvestia*, xvii. 1, 2; xviii. 3). M. Sibiryakoff, a well-known owner of gold-mines, having put a large sum of money at the disposal of this society, about twelve persons, thoroughly acquainted with the Yakutsk province from a many years' stay in different remote parts of it as political exiles, were invited to join in a detailed exploration—anthropological, ethnographical, linguistic, and economical—of the Yakut and Tungus population of the province. The exploration, which has now been carried on for three years, has resulted in the accumulation of most valuable materials. Anthropological measurements and photographs of Yakuts, Tunguses, and Russians were made by MM. Gekker, Mainoff, and Vitashevskiy, on a very large scale, and part of the data has already been published in the *Memoirs* of the East Siberian branch. Special excursions to inquire into the economical conditions of the population were made; all materials which are kept in the archives of the local administration, and which could be utilised for historical, ethnographical or economical purposes, were consulted. The common law of the natives was carefully studied, as also their folk-lore and their traditions; and, finally, the exploration was extended by the exiles who are kept in Sredne-kolymsk to the extremely interesting, and almost quite unknown, Yukaghires of the Arctic littoral; while S. Kovalik has nearly prepared for print a complete history and ethnographical description of the Yakuts of the Olekma region. At the same time E. Pekarsky, who speaks in Yakut as in his mother tongue, has prepared for publication a most elaborate and highly appreciated Yakut dictionary. For compiling it, he has utilised all formerly printed materials, as also many MSS. which were kept in the library of the East Siberian branch, and a considerable amount of notes collected by his comrades within the last fifteen years. A special sum was subscribed by M. Sibiryakoff for the publication of this dictionary.

A NEW process for preventing the decay of wood has recently been introduced, and extensive works set up at Millwall for treating timber. The inventor, Mr. Samuel Edward Haskin, has been engaged for the last twenty years in experimenting and perfecting the process in America. Hitherto the method adopted for preventing wood from decay has been by the withdrawal of the sap, and the injection of creosote or other antiseptic substances. The Haskin process, on the contrary, retains the sap, but destroys its germinative principle. To procure this result the wood to be treated is placed in a cylindrical heating-chamber, and submitted to a medium of superheated air at a pressure fourteen times as great as the normal pressure of the air. The substances composing the sap are by this means chemically changed, and form a powerful antiseptic mixture, which becomes consolidated with the fibre, thus strengthening and preserving the wood.

MR. H. L. RUSSELL is continuing his experimental investigations on the ripening of cheese, and, in conjunction with Mr. S. M. Babcock, has recently published an important paper describing what the authors consider to be a new factor in this process. Hitherto these changes have been solely ascribed to the direct or indirect action of the bacteria that are present in the milk, and the lactic acid bacteria have been credited with playing the chief *rôle* in this matter. But Russell and Babcock have shown that profound changes of a physical and chemical nature occur in milk in which bacterial fermentations have been excluded, and by means of carefully carried out experiments they have obtained results which they consider justify the assumption that these changes are of a non-vital character, and due to the presence of ready-formed enzymes in the milk as obtained from the cow. They have, moreover, succeeded in separating out proteid-converting (proteolytic) enzymes which, when applied to milk, exerted a curdling as well as a digestive function. The authors believe that the ripening of hard cheese, instead of being due solely to bacteria, is caused by the joint action of both organised (bacteria) and unorganised ferments (enzymes). This is a novel suggestion, and will doubtless stimulate research in this direction. Meanwhile the characteristic flavours of cheeses still remains a problem, and it is probable that in this department investigations may teach us to credit bacteria with yet more importance than we are even at present inclined to ascribe to them. The authors' memoir is to be found in the fourteenth annual report of the Wisconsin Agricultural Experiment Station, issued in December last. Agricultural research in this country may well take a lesson from the splendid work which flows so continually from the recently equipped scientific stations in the United States; formerly the investigator had but little more than German journals to take into consideration, but now he has to refer on all sides to American publications.

THE *Bulletin* No. 2 (December 1897) of the Laboratories of Natural History of the State University of Iowa consists of two articles—"The Coleoptera of the Lower Rio Grande Valley," by Mr. H. F. Wickham, and "The Ferns of Nicaragua," by Mr. B. Shimek. In the latter paper the number of species enumerated, including Ophioglossaceæ and Marattiaceæ, is 198, belonging to 39 genera, justifying the author's description of Tropical America as the "fern-paradise of the earth." (In the British Islands we have 38 species belonging to 17 genera.) The larger number of these were collected by the author in a botanical expedition undertaken for the University. The high mountains in close proximity to the sea afford a climate remarkably well adapted for the growth of ferns, which are stated to form the most conspicuous feature of the vegetation excepting palms. A large number are epiphytic, and they vary in size from tiny species of *Trichomanes*, with fronds only a fraction of an inch in height, to clinging "vines" like *Blechnum volubile*, single fronds of which often exceed 30 feet in length, or to splendid tree-ferns. The paper is illustrated by twenty excellent plates.

Farmers' Bulletin, No. 68, of the U.S. Department of Agriculture is devoted to a description of the black rot of the cabbage, and the best remedies or preventives, by Mr. E. F. Smith. The disease is due to *Pseudomonas campestris*, a parasite especially destructive to plants belonging to the Cruciferæ.

MESSRS. SWAN SONNENSCHEIN AND CO. have in the press a work on "Epidemic Diphtheria," by Dr. Arthur Newsholme. The work embodies a research on the origin and spread of the disease, from an international standpoint.

MESSRS. CROSBY LOCKWOOD AND SON ask us to state that the forthcoming work on "Submarine Telegraphs: their History, Construction, and Working," by Mr. Charles Bright, will be published very shortly, and to remind our readers that the subscription price ceases to apply on the date of publication.

A THIRD and revised edition of Mr. W. Arnold Buffum's interesting book on amber, entitled "The Tears of the Heliades,

or Amber as a Gem," has been published by Messrs. Sampson Low, Marston and Co., Ltd. The volume brings together many facts of interest concerning the origin and decorative uses of amber.

THE determination of the density of a gas has, till comparatively recently, been regarded as an operation of great difficulty, requiring elaborate apparatus and a large quantity of material. In the course of his researches on argon and helium, however, Prof. Ramsay has shown that it is possible by direct weighing to arrive at a reasonably accurate result upon as small a quantity as thirty cubic centimetres. In two recent numbers of the *Comptes rendus* are two contributions to this subject by M. Th. Schlœsing, jun., in which he gives a most ingenious method of measuring the density of a gas, based upon the balancing of two columns of the gases in a U-tube. Two vertical tubes about one metre in length communicate at their lower ends by a three-way tap; in one is placed an easily absorbable gas of known density, such as carbon dioxide, and in the other the gas under examination. On allowing the columns to communicate through the tap, a state of equilibrium between the gas, carbon dioxide, and air is set up after about four minutes, and the level of the invisible surfaces of separation then determined by absorbing the carbon dioxide with potash. In order to reduce the unavoidable diffusion of the gases, very narrow tubes were taken (1·6 mm. to 2·7 mm. in diameter), with the resulting advantage of reducing the quantity necessary for a determination. In the second paper data are given for nitrogen, oxygen, and methane, from which it would appear that an accuracy of 1/1000 is obtainable upon five to seven cubic centimetres of gas. With hydrogen only was there a failure, the mutual diffusion of the two gases being too rapid to allow of equilibrium being set up. There can be no doubt that the method will admit of many useful applications.

THE additions to the Zoological Society's Gardens during the past week include a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Mr. Robert O'Callaghan; a Horned Lizard (*Phrynosoma cornutum*) from California, presented by Mr. Charles Iseard; three Shaw's Gerbilles (*Gerbillus shawi*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

A PROBABLE NEW STAR.—In Circular No. 45 from the Wolsingham Observatory, dated February 14, the Rev. T. E. Espin states that an eighth-magnitude red star not in B.D. was found the previous night, its place being R.A. 7h. 12m. 16s., Decl. + 32° 19′ (1855).

NEW PHOTOGRAPHS OF NEBULÆ.—With a reflector having the extraordinary ratio of 1 metre aperture to 3 metres focal length, M. A. Rabourdin has taken some remarkable photographs of several nebulæ at the Meudon Observatory, and he gives a detailed account of them in *Comptes rendus* for January 31. On the ring nebula in Lyra he made three exposures—of twenty, thirty-five and fifty-five minutes. "These three plates," he remarks, "show that for this annular nebula the nebulosity of the interior increases with the time of exposure, whilst the total diameter increases very little. The final result is an elliptical nebula in place of the annular one taken with the short exposure. The photographs also show very plainly a star at the centre of the ring, which is, moreover, visible to the eye in the telescope; but neither the drawings of Herschel in 1833, Lord Rosse in 1844, nor that of Trouvelot in 1873, give any indication of it. Hence this would tend to show a comparatively recent change."

With an exposure of fifty minutes on the planetary nebula in Aquarius, a photograph was obtained showing two protuberances diametrically opposite, which would lead one to suppose that the central globe is surrounded by a diffuse belt analogous to Saturn's ring.

A photograph of the nebula in Andromeda, with only one hour exposure, is said to exhibit as much detail as those previously obtained with four times the exposure; and the nebula is so extensive, that it was quite impossible to photograph the whole region on one single plate.

A photograph of the nebula in Triangula shows that it is a beautiful spiral one.

The region of the Pleiades was also photographed, giving one hour exposure, with Alcyone in the centre of the plate. Even with this comparatively short exposure, MM. Henry have discovered nebulæ absolutely invisible in the telescope, enriching this region still more with two other new nebulæ surrounding Atlas and Pleione. This photograph also shows more than the beautiful chart of the Pleiades taken by MM. Henry, and exhibits additional streams of nebulous matter which apparently bind together certain stars of this group.

CARBON IN THE CHROMOSPHERE.—That carbon existed in the solar spectrum itself was at one time a matter of doubt, but its existence was established long ago by the early researches of Sir Norman Lockyer. Now, with the aid of the 40-inch telescope of the Yerkes Observatory, Prof. Hale has observed the presence of carbon in the chromosphere, and his paper on this subject is to be found in the December number of the *Astrophysical Journal*. The observations were made last September, and the green fluting near *b* was distinctly seen as a bright reversal in the chromosphere. M. Deslandres, who was visiting the observatory at the time, had no difficulty in seeing the lines, and they have since been observed by Profs. Runge and Keeler.

These results are interesting, in the light of the fact that the photographs of the total eclipse of 1896 show a decided influence of the prominences on the corona, and the examination of the corona itself at the last eclipse, for the presence of carbon might possibly have led to fruitful results.

PARALLAX OF SIRIUS.—In the *Monthly Notices* for January, Dr. Gill discusses a series of observations for the parallax of Sirius, made by him in 1888–89 with the Cape heliometer. The comparison stars used were both of 8·7 magnitude; one, which he denotes by γ, being 4310″ distant, and the other, δ, 4536″ away from Sirius, with respective position angles of 279°·17 and 101°·26.

From these observations he deduces a value of 0″·370 ± 0″·0097, which is in remarkably close agreement with his well-known result of 0″·370 ± 0″·009 from his 1881–83 observations.

Dr. Gill states that by this method of measurement it was possible to determine parallaxes so small as 1/50 of a second with some confidence—a degree of accuracy not previously attained in astronomical researches of any kind. He therefore thinks we may regard the parallax of Sirius as now satisfactorily determined, and that the corrections depending on a parallax of 0″·37 might with advantage be introduced in the apparent places of Sirius given in the national ephemerides.

WE note with pleasure that Mr. A. C. D. Crommelin, in the *Monthly Notices* for January, continues his paper which appeared in the December number, on the "Ephemeris for physical observations of Jupiter, 1898." We had been so long accustomed to seeing the late Dr. Marth's name attached to these and similar tables for the moon and other planets, that it was doubtful who would volunteer to fill his place; but we are glad to find that one so able as Mr. Crommelin has undertaken this task.

THE ATOMIC WEIGHTS OF NICKEL AND COBALT.

THE determination of the atomic weights of nickel and cobalt has attracted a considerable amount of attention during the last few years, the numbers obtained by different workers exhibiting relatively startling variations. Thus, including only the four most recent results, the values for cobalt vary between 58·78 (Hempel and Thiele, 1895) and 60·12 (Schützenberger, 1892). Similar variations observed for nickel by Krüss, led him to the conclusion that this metal contained a new element, to which he gave the name of "gnomium"; but recent work has not tended to confirm this view. In the *Proceedings* of the American Academy of Arts and Sciences for November and December last, are two important contributions to this subject, by Richards and Cushman and

Richards and Baxter respectively, giving the results of analyses of the bromides of nickel and cobalt; which show in a decisive manner that properly purified nickel and cobalt are homogeneous substances. After stating the advantages pertaining to the use of the bromides, for the sublimation and bottling of which a highly ingenious apparatus is described, they show how two totally distinct methods of purification, starting from metals of different origin, lead to a bromide of the same composition.

For nickel bromide the material was obtained from two sources—the "pure" nickel of commerce, and Mond nickel prepared by the carbon monoxide process. The steps for the purification of the first of these included fractional precipitation as sulphide, then as hydroxide, conversion of this through the bromide into the violet crystalline ammonia compound $NiBr_2.6NH_3$, and this, after several recrystallisations, converted through the oxide into spongy nickel. For the Mond nickel, in which a little iron was practically the only impurity, the same process was adopted, except that to remove alkalis the hydroxide was converted into sulphate and the latter subjected to electrolysis several times. After conversion into bromide, these were analysed, and for the final analyses further purification was attempted by repeated deposition by electrolysis. All three samples gave identical results, 58·69, for the atomic weight of nickel (O = 16).

The cobalt was purified with equal care, the cobalt bromide being obtained by two distinct methods of purification, the one through potassium-cobalt nitrite, and the other through a cobalt-amine, and these again purified by a combination of both processes. The results of the three series were practically identical, the atomic weight of cobalt being 58·99 (O = 16).

While recognising that data obtained from one compound only are not sufficient to finally settle the atomic weights of these metals, the authors conclude that if "gnomium" exists, it must have an atomic weight about equal to that of nickel and cobalt; and hence, that the wide variations observed in the results of other experimenters cannot be considered a valid argument in favour of the late Prof. Krüss's doubtful discovery.

CRATER LAKE, OREGON.

THE Mazamas of the State of Oregon are no ancient tribe of redskins, but the members of a very active and most praiseworthy mountaineering club in the city of Portland. The President in his last annual address observed: "Within two years the name *Mazama* has been heard throughout the world, and to-day it stands as a synonym for all that is unique, progressive and inspiring in mountaineering societies"; and even if the European Alpine clubs hesitate to accept this statement in its entirety, all must agree that the second number of the publication entitled *Mazama* justifies the "guid conceit" the members of that lively club have of themselves. As no American University commands respect without a rousing "yell," so no mountaineering club can organise excursions without a "cheer," and this is the Mazamas':—

"Three cheers for the mountaineers,
'Rah! 'rah! 'rah!
Nesika klatawa sahele
Ma-za-ma."

The obscurest line is Chinook jargon for "We go up." Led with such a slogan, the Oregon Highlanders have carried many peaks by storm, and have opened to the public much of the grand mountain scenery of the Cascade Range. Part 2 of *Mazama* is devoted to the remarkable natural feature known as Crater Lake, to which the club made an excursion in 1896. The description is not a piece of amateur geography, but a solid description put together out of reports by the first scientific authorities.

Crater Lake is situated nearly in 43° N. and 122° W. It may be reached from several stations on the railway between Portland, Oregon, and San Francisco, by roads, usually bad, and as yet there is no house of any kind near its shore. Leaving the Southern Pacific Railway at Midford, one may reach it by 85 miles of road up the Rogue River valley. From Ashland a road of 95 miles must be traversed; but the best road—one which is practicable for bicycles—is from Ager, Cal., past the deserted Fort Klamath, a distance of 116 miles. The whole country is covered with dense coniferous forest. In approaching the lake, there is a steep climb for about three miles; then the forest-clad mountain slope gives place to a nearly level plateau, carpeted in autumn with flowers, across which one walks a few hundred yards with nothing to see, until suddenly a precipice of 900 feet yawns at one's very feet, and deep below the dazzling blue water of Crater Lake spreads far and wide. The weird grandeur of the scene accounts to the full for the superstitious awe with which the Indians of the district regard the lake.

Crater Lake may have been discovered in 1847, but the first authentic account of its existence came from a composite party of prospectors in 1853. A party of Californian gold-seekers crossed secretly into Oregon to search for a mythical lost digging of fabulous richness, and for as long a time as provisions lasted they were followed by a party of Oregonians who could not be shaken off The rivals united at last, and, continuing the search for gold together, came upon Crater Lake, which they named "Deep Blue Lake," or "Lake Mystery." The next recorded visits were in 1862, 1865, and 1869. From that time its fame began to spread, but it was not geologically examined by experts until 1883. In 1885 a party of the United States Geological Survey, under Captain Dutton, was detailed to sound the lake and make a topographical survey of its surroundings; and a detailed contour map was constructed.

The roughly circular lake, from four to six miles in diameter, is without outlet, and without tributaries; the upper edge of the

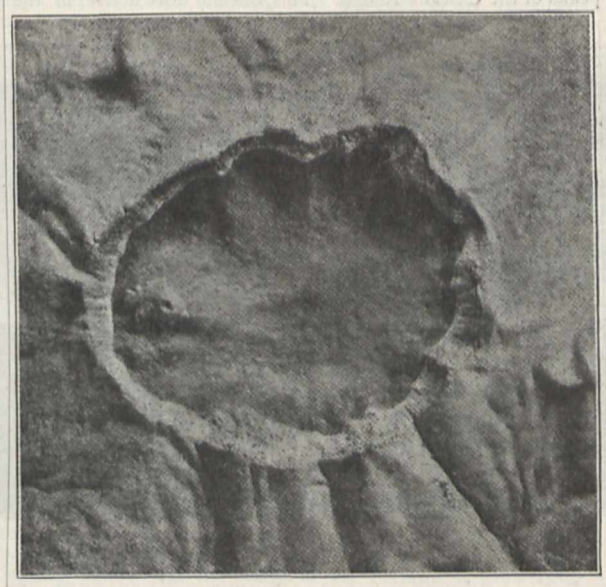


FIG. 1.—Photograph of a relief model of Crater Lake.

rim is a water-parting, from which streams radiate down the slopes towards the sea through deep cut valleys. The outer slopes have a gradient of from 10° to 15°, and are richly wooded. The inner slopes are precipitous, and allow of a descent being made to the water only at one or two points. The water-level stands 6239 feet above sea-level, and the crest of the rim varies from 520 to 1989 feet higher. The greatest depth ascertained in the lake is 2008 feet. A relief model of the lake and its surroundings has been constructed, and shows a remarkable similarity to the larger ring-craters of the moon. One island of some size rises in the lake in the form of a cinder-cone, bearing a well-marked crater on its summit. It goes by the name of Wizard Island, and a fantastically weathered islet is named the Phantom Ship.

A description of the geology of the region is given by Mr. J. S. Diller. The rim is composed entirely of lava streams and beds of volcanic conglomerate dipping away from the lake. At one point, however, there is a remarkable lava-flow, which appears to have run down the inner slope.

The lavas of the rim are mainly andesites forming the earlier flows, but rhyolites associated with pumice occur among the later. There is no basalt on the rim, but basalts occur on the outer slopes several miles from the lake, being related to cinder cones adnate to the central crater. Numerous andesite

dykes radiate from the lake, cutting through the older lavas as exposed on the inner slope. The inner slope appears to have been formed by fracture, and not by flow. The old crater did not occupy the whole extent of the present caldera; if it had done so the lava would have overflowed at the lowest part of the rim, but the whole rim is formed of lava-flows from some higher and now vanished centre. One very remarkable feature of the geology is the strong glaciation of the rim, shown by well-marked striæ and great morainic deposits. There are traces of glaciers radiating down the slope, in some cases to a distance of five miles. There is evidence of volcanic activity during the glacial period; on one of the peaks of the rim an ice-planed surface of old lava is covered by two layers of pumice separated by a flow of rhyolite. The severe floods, which must have accompanied eruptions at that period, would account for the vast masses of sediments which fill the radiating valleys. The observed phenomena can only be accounted for by the presence of a great volcanic peak covering the present area of the lake, and sweeping upward as a continuation of the present outer slopes. The probable history of this mountain is summarised thus:—

The history of Crater Lake and its rim began in the up-building, by normal volcanic processes, of a large volcano—to which the name Mount Mazama is given—comparable in the nature of its lavas and in its structure and size with the greater peaks of the Cascade Range. This volcano was active in the glacial period, lava and glaciers combining to mould its form. Somewhere near its final eruption, and perhaps in consequence of the rapid draining away of lava by the small cones near the base of the mountain, the molten material from the interior was withdrawn, the summit of Mount Mazama collapsed and sank away, leaving a huge gulf measuring six miles by four, and about 4000 feet deep. Volcanic activity continued on the floor of the caldera for some time; but since rainfall is in excess of evaporation in that region, water gradually accumulated to form the present Crater Lake.

FIG. 2.—Crater Lake, showing Wizard Island.

The water of the lake is remarkably transparent, free from any visible organic matter, and fresh to the taste, but no analysis of its saline contents seems to have been made. The temperature of the water when examined in August 1896, averaged about 60° F. on the surface. The deep-temperature, taken by means of a Negretti and Zambra reversing thermometer in the unsatisfactory Magnaghi frame, was reported as 39° at 555 feet, 41° at 1040 feet, and 46° at 1623 feet. If these figures were trustworthy, it would appear that the water in Crater Lake still derives heat from the rocks; but if this interpretation is correct, it is difficult to account for the minimum at the maximum density point, unless indeed the water is saline enough to have a maximum density point perceptibly lower than that of fresh water. Dr. Evermann, of the U.S. Fish Commission, who made the observations, does not seem to have entire confidence in their accuracy.

Only three species of invertebrates were found living within the rim of Crater Lake—a frog, a snake, and a salamander. By the use of tow-nets several minute algæ were found in the water, and many minute crustacea, of which *Daphnis pulex pulicaria* was the commonest. Several larval insects, a leech, a species of *Gordius*, and one species of mollusc, an undetermined *Physa*, were also found. No fish could be discovered, but an attempt to introduce trout is to be made.

Dr. Merriam gives an elaborate classification of the life-zones on Mount Mazama, and a complete list of all the animals found; an extensive flora is also published, and in all respects the special number of *Mazama* is highly creditable to the Society which has produced it. The Mazamas are to popularise the lake for the use of tourists by introducing various attractions, which we fear will detract from its present charm by destroying the absolute wildness of the whole surroundings. H. R. M.

ADDRESS TO THE ROYAL ASTRONOMICAL SOCIETY.[1]

IT is the duty of your President at this annual meeting of our Society to address you on a very important subject. I allude, of course, to the award of the Gold Medal which is annually conferred by the Royal Astronomical Society on some astronomer who has rendered signal service to our science. The discharge of that duty is, perhaps, the most responsible official act which devolves on the occupant of this chair during his tenure of the distinguished position of President. I am to set forth the ground upon which on the present occasion the medal has been awarded by your Council to our distinguished Fellow, Mr. W. F. Denning.

The contributions of Mr. Denning to astronomy may be ranged under three heads.

(1) Discovery of Comets.

(2) Observation of Planetary Phenomena.

(3) Researches on Meteors.

It will be convenient for me to describe his work in these three different departments in the order just given. The first and second departments must, however, be treated with comparative brevity, for it is on the third department that your Council laid special stress in making their award.

(1) COMETS.

Each year usually brings the announcement of certain new comets, the discovery of such objects being the rewards of those observers who patiently scan the heavens, evening after evening and morning after morning, with the particular object of detecting these shy visitors to our skies. Mr. Denning has been one of those who have engaged in this work, and his success has been noteworthy. The following list gives the designations of five comets which have been discovered by our medallist.

Comet 1881 V. Period, 8·68 years.
Comet 1890 VI.
Comet 1891 I.
Comet 1892 II.
Comet 1894 I. Period, 7·3 years.

While searching the skies for comets, Mr. Denning has not unfrequently discovered nebulæ which had escaped the attention of previous observers. No fewer than twenty new nebulæ have thus been added by Mr. Denning to the lists of those already known. Most of these new objects lie in the vicinity of the North Pole.

(2) PLANETARY OBSERVATIONS.

A striking characteristic of Mr. Denning's work is the methodical accuracy with which he has carried through whatever astronomical research he has in hand. Mr. Denning never spared himself any pains in the efforts necessary to give his work the inestimable charms of thoroughness and precision. This may well be illustrated by his planetary observations. We here

[1] Delivered on February 11 by the President, Sir Robert Ball, on the occasion of the presentation of the Gold Medal to Mr. W. F. Denning.

specially refer to his work on Jupiter. It is well known that this very difficult object not only demands instruments of much optical perfection, but also calls for the exercise of the highest qualities which constitute a consummate astronomical observer. Mr. Denning, using a 10½-inch reflector by Browning, made admirable sketches of the planet, in which he represented a remarkable amount of detail with a skilful pencil. But he was not content with work of this kind merely, however valuable such work may be. He watched the revolutions of a large number of spots individually, and determined as accurately as possible their times of transit over the central meridian of the planet. By such observations he ascertained the period of rotation of a large number of the most notable spots. Thus he illustrated the very interesting fact that the individual spots were animated by large proper motions on the surface of the planet. The famous red spot, so well known to every astronomer, has been in particular most diligently followed by Mr. Denning, and he has demonstrated the remarkable circumstance that its period of rotation varies from year to year. The results at which he has thus arrived are in close accordance with the observations of other accomplished astronomers.

(3) RESEARCHES ON METEORS.

But the great work of Mr. Denning's scientific career, and that which has been mainly instrumental in deciding your Council to confer on him the distinction of the Gold Medal, has been connected with the very interesting subject of luminous meteors. The labours of Mr. Denning have been extensive enough to cover nearly every branch of the subject of meteoric astronomy. It would be difficult, indeed I may say it would be impossible, to render any adequate account of it within the limits of an address. I am, therefore, obliged to restrict myself to those more salient points which have specially been under the consideration of your Council.

The papers on luminous meteors communicated to the Royal Astronomical Society by Mr. Denning, and printed in the *Monthly Notices*, number altogether forty-two. In bulk they would, if collected together, constitute two-thirds of an ordinary annual volume in that form of the Society's publications. These papers are illustrated much more copiously than has usually been the custom with graphic and instructive figures.

A considerable number of these memoirs contain valuable lists of meteoric radiants derived either exclusively from Mr. Denning's own work at Bristol, or from his own observations in comparison with the work of other astronomers in the same field.

Mr. Denning's first published list of radiants appeared in 1876. It contains the determinations of twenty-seven radiant points, derived from his own observations of nearly 900 meteor tracks which he had himself mapped at Bristol between 1871–76. In this early list the periods of the recurrence of the showers are occasionally indicated by single days or short periods. But usually the month of recurrence is alone given. The list contains careful determinations of the radiant-points of the chief annual showers, such as Quarantids in 1873, the Lyrids in 1873 and 1874, the Perseids in 1871 and 1874, the Orionids in 1874, and the Andromedids in 1872. It is interesting to note that showers were found in correspondence with all but four radiants in the list contained in Mr. Greg's first general Star Shower Catalogue. This was published in comparison with Dr. Heis' similar list of the same year in the British Association volume of Reports for the year 1874. The four radiants which Mr. Denning was not able to corroborate are, it ought to be observed, marked as doubtful by Mr. Greg.

The latest list of radiants which has been issued by Mr. Denning, and the longest paper that he has as yet communicated to the *Monthly Notices*, was published in 1890. This important work gives remarkable evidence of the unflagging dilligence of our medallist. It contains a list of nine hundred and eighteen radiant points, deduced from the observations of no fewer than 9177 meteors, mapped at Bristol, between the years 1873 and 1889. This list, it should be remarked, includes repeated observations of the same radiants. This is the case not only with regard to the chief showers, but also with regard to various minor showers, whose yearly dates of recurrence cannot in the present state of our knowledge be assigned with any certainty.

Though many of these showers are but sparsely characterised by meteors, or, to use the more technical expression, are showers of great tenuity, they have not escaped the diligent scrutiny of our medallist. In such cases the dates are generally assigned to the single days when they have had apparently a maximum abundance. A column of supplementary dates have been added, which seldom range over more than a week. It will thus be seen that this catalogue presents an extensive series, not so much of averaged results as of exact and valuable individual determinations.

In other papers by Mr. Denning, mean results have been given which may be regarded as expressing, with regard to many important showers, the present state of our knowledge. For the chief meteoric showers a list of this kind was published in 1887. In it will be found mean positions for 1880, derived from fifteen years of observations of the radiant-points of the nine chief yearly showers. These contain the seven well-known periodic swarms of January, April, August, October, November (two showers) and December, adding to these the striking and very regularly visible displays of May 6 and July 28.

The most important contributions which our medallist has made to the general problems connected with luminous meteors are connected with the long duration of certain meteoric radiants. The fact of long persistency of radiant-points, and of close assemblages about the points of groups or compact families of simultaneous or successive meteor streams, is as old as Heis' first essays in meteor showers. It is, however, to Mr. Denning's persistent inquiries that we are mainly indebted for our knowledge of this subject. In his important paper of December 1884, Mr. Denning writes: "The fact of stationary radiants exhibiting visible activity during several months is a phenomenon so unaccountable and so utterly opposed to the approved theories as to the orbits of shooting stars, that it must receive a most crucial examination before it can be accepted."

The long-continued labours of Mr. Denning on this important subject have demonstrated the existence of these enduring radiants. The theoretical difficulties connected with the subject may be still not altogether removed, but we can hardly refuse assent to Mr. Denning's words when he says: "It must be conceived that a well-attested fact of observation, however hard to reconcile with known theories, ought on no account to be disregarded on account of its nonconformity."

It is, of course, known that the Perseids from the August shower are found, not only on the special nights with which the swarm is chiefly associated, but they are also displayed on many preceding and following nights. Mr. Denning has traced meteors of this group for the twenty-six nights from July 25 to August 19, and their radiant advanced in that interval over a distance of 40 degrees. In one of those admirable diagrams by which the interest of Mr. Denning's papers is so greatly increased, he gives a curve of the ordinary number of Perseids from one on July 25 to a maximum of 57 on August 10, and then declining to 1 on August 19. In his paper of 1890 Mr. Denning shows that the range of the Perseids is even wider still. I cite this case of the Perseids, because the gradual shift of the radiants as days and weeks passed by is, of course, no more than should be expected from the change of the place of the earth in its orbit. The extraordinary fact is that in the case of certain other showers, which are visible for weeks or months, the radiant undergoes no appreciable change in position. Mr. Denning selected for discussion in his "Memoir" of 1884 six special showers. Among these we may particularly note the α-β Perseids, which show a constant radiant from July 6 to November 30.

Such a paper as that to which I am now referring must be regarded as a classic which every one who is interested in the fascinating subject of meteors would do well to study. It is full of interesting facts and suggestions. We learn that in the catalogues published up to this date there are no fewer than 2100 radiants resulting from the projected paths of upwards of 6200 meteors; many of these are, however, duplicate observations of identical showers, and Mr. Denning adds that he does not believe the total number of well-defined streams would exceed 350.

In his introduction to the great catalogue of 1890, Mr. Denning has given a statement of his methods of work.

"My plan of work may be briefly described as follows. All the observations were made in the open air and from the garden adjoining the house. Attention was almost invariably given to the eastern sky. In mild weather I sat in a chair with the back inclined at a suitable angle, but on cold frosty nights I found it expedient to maintain a standing posture and some-

times to pace to and fro, always, however, keeping the eyes directed towards the firmament in quest of meteors."

Our medallist has recently published in the *Observatory* an instructive and opportune series of papers on the great showers of Leonids which may reasonably be expected in the next year or two. This subject is here discussed with characteristic wealth of knowledge and experience. He commences with the remark: "It may be safely said that in the month of November during the next few years, all astronomers and a large majority of the general public will become meteoric observers, for the phenomena presented will be of an exceptional kind and of a character to interest every one."

We all echo these words. I think I am justified in adding that much of the recently awakened interest in the subject has been due to the worthy example Mr. Denning has himself given us. Which of us would not be proud to emulate his single-hearted and enthusiastic devotion to the discovery of truth in this beautiful department of astronomy?

It is a matter of great regret to every one here assembled that our medallist, whom we greatly wish to honour, is not now present to accept in person our award. We regret this all the more when we learn that ill-health is the cause of his absence. We all join in a hearty wish for his speedy recovery, and in the hope that he may shortly be able to resume those observations which we receive with such interest and pleasure. We desire to assure him not only of our appreciation of his admirable work, but of the high esteem which we entertain for the spirit in which that work has been conducted.

On your behalf, therefore, I now hand the Gold Medal of the Royal Astronomical Society to our Secretary, to be by him transmitted to Mr. W. F. Denning in recognition of the valuable services to our science he has rendered, especially in the department of meteoric astronomy.

HISTORY AND OBJECTS OF THE PHYSICAL SOCIETY.[1]

I PROPOSE on this occasion to begin with a few words on the history and objects of our Society, and afterwards to glance briefly at the principal events of physical interest which have occurred during the past year.

The Physical Society was founded in 1874, and owed its origin mainly to the initiative of the late Prof. Guthrie. From the first years of its existence up to the present time it has included among its members nearly all the leading physicists of the United Kingdom.

In the early days our meetings were, by permission of the Lords of the Committee of Council on Education, held in the Physics lecture-room of the Royal College of Science at three o'clock on Saturday afternoons, members being allowed the free use of the laboratory apparatus for the illustration of their papers. The proceedings were at that time rather less formal than is customary at present. The papers were rarely, if ever, "referred" before being read; often, indeed, they were read long before they were actually written, while a large proportion of the communications were of a purely oral character, and never intended for publication at all, except perhaps in the short notes which the reporter sent to the scientific journals. Special prominence was given to experimental demonstrations illustrative not only of original researches, but also of such work carried on outside the Society as happened to be attracting attention at the time. . . .

Under the somewhat lax *régime* which then prevailed, it necessarily happened that the communications made to the Society were not always of a very high order of merit. . . . But from the very beginning the Council has always been careful not to print in the *Proceedings* anything that was not of sound scientific value, and while the number of important papers that have been published through the medium of the Physical Society is large, very little of doubtful quality has found a place in the *Journal*.

The first material change in our routine took place in the year 1889, when the day and hour of meeting were altered from Saturday afternoon at three to Friday at five o'clock. . . . I may here mention that the Council has more than once considered whether it might not be expedient to hold our meetings in the evening. Many, no doubt, would consider this preferable, but the balance of convenience appears to be clearly in favour of the afternoon. . . .

During the South Kensington epoch the Physical Society published and presented to its members a number of valuable books, including, among others, Prof. Everett's well-known treatise on the C.G.S. system of units and the works of Wheatstone and of Joule. It also issued twelve volumes of *Proceedings*, in which were collected such of the communications to the Society as had been approved for publication. By an arrangement with the proprietors of the *Philosophical Magazine* the same papers were also (as now) printed in that journal, being thus, to the author's great advantage, assured of a wide circulation throughout the scientific world. In the same period, notwithstanding the small amount of the annual subscription paid by members and of the composition fee for life membership, the Society's income so far exceeded its expenditure that it was able to accumulate and invest a capital of nearly 3000*l*.

When the Society entered upon its twenty-first year with a position which, if somewhat unpretending, was well recognised and firmly established, it was felt that the time had come when, in the interests of physical science, something more than had been already achieved might fairly be demanded of it. British physicists had long been at a serious disadvantage in that they were without any means of readily ascertaining what was being done by their fellow-workers in other countries; with the multiplication of scientific literature the need of some periodical digest similar in character to the German *Beiblätter* was becoming year by year more urgent. To endeavour to meet this want was a duty which clearly devolved upon the Physical Society, and the Council anxiously considered the question whether the publication of monthly abstracts of physical papers appearing in foreign journals could be undertaken by ourselves.

The only serious objection to the enterprise was of a financial nature. The work, if it were to be carried out efficiently, would certainly necessitate an annual expenditure exceeding by some hundreds of pounds the total income of the Society. This could only be met by raising the amount of the annual subscription and composition fee, which, as I have mentioned, were unusually low. But it is a delicate and difficult matter to ask existing members of a society for increased subscriptions unless very excellent reasons can be shown for the demand. The Council therefore determined that they would publish a series of abstracts for one year at least before taking any steps to provide additional income, defraying the cost from cash in hand and, if need should arise, drawing upon the invested capital. In this way it was hoped to convince members of the utility of the undertaking which they were to be called upon to support.

I need not remind you of the highly satisfactory result of the experiment. The work of the able and assiduous body of abstractors whose names appear on the cover of our *Proceedings* was on all sides cordially approved, and at a special general meeting, held in 1896, a resolution submitted to the Society for increasing the subscription to two guineas per annum was passed almost, if not quite, unanimously. The number of those who in consequence of this increase have resigned their membership has been unexpectedly small, while on the other hand many of the life members have, in response to the invitation issued to them, voluntarily contributed an additional fifteen guineas to the funds of the Society, in recognition of the fact that they are now in enjoyment of greater and more costly advantages than were contemplated at the time when they paid their very moderate composition fees. To such as have not yet responded I venture to repeat the invitation.

Although the abstracts were actually published for two years before the increased subscriptions began to come in, the whole cost was met out of uninvested cash, supplemented by grants liberally made by the British Association and the Royal Society, and it was never found necessary to draw anything at all from the reserve fund. I wish to emphasise this fact because the abundant caution properly exercised by the Council in entering upon a new and uncertain enterprise appears to have led to a very general impression that the Society had outrun its means and was on the verge of bankruptcy, whereas in truth it was never in a more prosperous financial condition than it is at present.

On October 26, 1894, the Society met for the first time in this room. Although the privileges so generously accorded to us by the authorities at South Kensington were highly valued, it was nevertheless deemed advisable that we should leave the home of our youth and seek a footing in Burlington House, the

[1] Presidential Address to the Physical Society. (Abstract.) February 11. By Shelford Bidwell, F.R.S.

headquarters of scientific associations. Here the Chemical Society offered us a most kindly and cordial welcome, and provided us with a meeting-place which is not only more generally accessible than the old one, but is also on other grounds more convenient to most of our Fellows.

By this time the general affairs of the Society had assumed a more business-like condition. Amongst other things, greater care was exercised with regard to the acceptance of communications. I need hardly say that no paper is in these days allowed to be read unless it has been first referred to some competent authority and favourably reported on. The most distinguished physicists in the kingdom have given their services as referees, and our heartiest thanks are due to them for the care and patience which they have ungrudgingly bestowed upon a somewhat ungrateful task.

The practice was also introduced of putting the more important papers into type before they were read, and distributing proofs among such of the Fellows as were known to be specially interested in the subjects to which they related. This course has led to a considerable improvement in the value of the discussions.

The most recent step in advance consists in the adoption of a scheme for greatly extending the list of journals from which the monthly abstracts are made. Hitherto the papers abstracted have been exclusively such as had been published in foreign journals, and were of primarily scientific interest. In the present year, as the result of an agreement with the Institution of Electrical Engineers, the number of the abstracts is to be largely increased, British publications and papers of a technical character being included in their scope. The arrangement in question is open to the objection that it entails the loss of our monopoly in the publication, for members of the Institution of Electrical Engineers will, like ourselves, receive copies of the abstracts, and will share with us whatever credit attaches to their production. The objection, however, appears to be in the main only a sentimental one, and of small weight in relation to the substantial advantage accruing to our members—an advantage which could not possibly have been provided out of our own unaided resources. [Reference was then made to the advantages afforded by the Physical and other kindred Societies in promoting friendly intercourse among fellow-workers in a particular branch of science.]

Through the kindness of certain influential gentlemen belonging to the Society, we have from time to time been afforded the opportunity of holding a meeting in some well-known physical laboratory either in town or in the country. I myself have had the privilege of taking part in most agreeable pilgrimages to Oxford, Cambridge and Bristol, and have also been among those who enjoyed the hospitality of Profs. Adams, Carey Foster, Ayrton and Thompson at their laboratories in London. I have pleasure in announcing that the Council has accepted an invitation from our Fellow, Mr. Porter, to go to Eton for the next meeting on February 26, and I trust that our appreciation of his kindness will be testified by a large gathering. It is a little difficult to beg for favours, but I may be allowed to suggest to those who are in a position to exercise similar hospitality, that they have it in their power to contribute, in a material degree, and in more than a merely scientific sense, to the well-being of the Society.

[The second part of the address dealt with the discovery of the Zeeman effect; some of the principal papers published by the Physical Society in 1897; the appointment of the National Physical Laboratory Committee, and the foundation of the Röntgen Society.]

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE annual general meeting of the Institution of Mechanical Engineers was held in the theatre of the Institution of Civil Engineers on the evenings of the 10th and 11th insts. The usual formal proceedings having been gone through, the retiring President—Mr. E. Windsor Richards—introduced the new President, Mr. Samuel W. Johnson, who is locomotive superintendent to the Midland Railway. There were two papers down for discussion, and there was also an adjourned discussion on a paper entitled "Mechanical Features of Electric Traction," which had been read and partially discussed at the last meeting of the Institution. This paper was contributed by Mr. Philip Dawson, who is largely interested in the introduction of mechanical appliances in connection with electrical engineering into this country from America. Under these circumstances it was natural that the contribution should be of a general rather than a scientific character. The prominent feature in the paper was the fact that electrical traction has spread so rapidly in America, whilst very little has been done in this country. For instance, out of a total of nearly 15,000 miles of tramways in America in the year 1895, 12,583 miles are worked electrically. Cable traction, which was at one time so popular, and which seemed to have so promising a future before it, has been quite eclipsed by electrical methods, there being only 600 miles of rope tramway in the States in the same year. Steam has even a lower total, there being but 519 miles. Horse traction supplies the balance of something over 1200 miles. Great Britain and the Colonies in the year 1896 had but 167 miles of electric tramway, thus being far below Germany, which had a total of 618 miles. The only other European country having more than 100 miles was Austro-Hungary, with a total of 120 miles. Belgium had 90 miles, France 67, Italy 50, and Switzerland and Russia 30 miles each; whilst other European countries contribute 30 miles altogether.

It is not necessary we should follow the author in the practical details he gives regarding the various features of motors, trucks, cars, permanent way, conductors, methods of transmission, generating stations, &c. The long discussion on this paper resolved itself very largely into a controversy as to whether English engineers should follow American precedents. Prof. Unwin, in the speech that he made, entered a timely protest against the spirit of detraction which animated a good many of the speakers. As he said, American engineers may not be perfect in all their practice, and it is quite possible improvements may be made upon their methods, still they have had considerable experience, and what they have done represents actual work, whilst in this country we have practically no precedents in regard to electrical tramway practice.

The only paper read at the meeting was a contribution by Prof. Frederic W. Burstall; it embodied the first report of the Gas Engine Research Committee that had been appointed by the Institution, and of which Prof. Alexander Kennedy is the chairman. The object of the experiments described was to determine the effect produced on the economy of gas engines by altering one or more of the conditions which govern their working. The problem is one of a complex nature and presents considerable difficulties, especially as the gas engine has not like the steam engine been made the object of investigation by many authorities for a great number of years. The factors considered by the Committee were the amount of compression, the speed, the ratio of air to gas, and the amount of heat rejected through the walls of the cylinder. The engine used was of small size, perhaps too small to afford altogether satisfactory results; but the Committee were not to blame for this, for they had to work with such tools as they could command. The nominal power of the engine was 2 N.H.P., and the maximum that could be developed was 5 I.H.P; it was made by Messrs. Fielding and Platt, of Gloucester. The author stated that an increase of compression in a gas engine is often regarded as being conducive to more economical results, but it is uncertain whether the increase in economy is really due to the compression alone. It is, perhaps, fair to state that the Committee recognised that the absolute economy of the engine tried—which was specially constructed for experimental purposes—would be inferior to the economy that could be obtained by a larger motor; still, it was concluded that the comparative economies under different conditions would not be different in the two sizes; moreover, it was stated that it would have been impossible to measure with precision certain quantities, such as the volume of air, had the engine been larger. The compression employed in the expertments varied between 35 lbs. and 90 lbs. per square inch. The observations taken included measurements of the gas and of the air supplies, measurement of heat rejected into the jacket, sampling of exhaust gases, and determination of the I.H.P. developed. Seventeen tests were taken, and the mechanical efficiency of the engine was found to vary from 76 to 84 per cent., the mean value of the whole seventeen tests being 81 per cent. On a full power test the engine was running at 197 revolutions per minute, the compression per square inch absolute was 103 lbs., the ratio of clearance to cylinder volume was 0·25, and the ratio of explosions to the maximum possible was 92 per cent. Under these circumstances the

I.H.P. was 5·10, the gas per I.H.P. per hour 20·35 cubic feet, the heat expended per I.H.P. per hour was 12,186 thermal units, or 10·95 thermal units per explosion. The thermal efficiency was 21 per cent. Taking one of the low-speed experiments, with the ratio of air to gas of 10·4, the compression per square inch absolute was 86 lbs., the ratio of clearance to cylinder volume was 0·37, the revolutions per minute were 117·6, and the ratio of actual explosions to the maximum possible was 75 per cent. With these conditions the I.H.P. was 1·84, the gas used per I.H.P. per hour 28·2 cubic feet, the heat expended was 17,041 thermal units per I.H.P. per hour; that gave a thermal efficiency of 15 per cent., a result which, as the author remarks, was distinctly uneconomical. In the following test the compression was 102 lbs. absolute, the ratio of clearance to cylinder volume being 0·25, the revolutions and the I.H.P. were practically the same, but 31 cubic feet of gas were used per I.H.P. per hour; the thermal efficiency, therefore, being 13·6 per cent, although the compression was so much higher than in the previous test mentioned, almost approaching that of the full-speed test first referred to.

In connection with this matter, the fact commented upon during the discussion may be referred to. The older gas engines were designed for lower pressures; and it is found with them that increasing the compression does not add to economy. The ratio of clearance has an important bearing on the case, the port surface acting as a condenser, and an increase in the compression induces a degree of cooling which is not economical. There is also the loss by leakage through the indicator, the proportion of which will be considerable in the case of a small engine. The Wayne indicator used during the experiments has a rotating piston not touching the sides of the cylinder, and therefore admitting of constant leakage. In the steam engine the loss from leakage through the indicator is comparatively unimportant, being governed by the pressure present in the cylinder at any given time. With the gas engine, however, this is different, as the working mixture escapes through the cylinder before ignition. One of the speakers humorously likened the effect of an indicator on a small gas engine to a big whistle on a steam launch boiler. He said that in the early days of steam launches a friend of his had a small paddle yacht with a very big whistle, which was fitted in order that he might let his friends know when he was coming. He found, however, that when he paddled he could not whistle, and when he whistled he could not paddle.

A brake was used in the experiments, and perhaps it would have been better if Brake H.P. had been given in the tables. It was found that the measurement of gas by means of an ordinary meter, although giving a correct aggregate result, possessed the disadvantage of not controlling the fluctuations of pressure in the mains; a calibrated gas-holder was therefore used. The amount of air used per stroke was measured by a meter into which air was forced by a Sturtevant blower, the pressure being kept constant by means of a gas governor; precautions were taken to prevent back ignition; a rubber gas bag was used to obviate the fluctuation in pressure in the meter during the suction stroke. No difficulty was found in working this apparatus. Records were taken of pressure and temperature of the air; measurement of the heat rejected was effected by running the cooling water from the calibrated tank through the water jacket and thence to the discharge, the capacity of the tank being sufficient to hold water for a single test. The temperatures of the inlet and outlet water were taken. The glass stems of the thermometers were attached to brass plugs by means of soldering with Thomas's fusible metal, which enables glass and brass to be fixed together with a pressure-tight joint. To obtain samples of the exhaust gases, a single bubble of gas was taken from just below the exhaust-valve after each explosion stroke by means of suitable apparatus, which was illustrated by a wall diagram shown during the reading of the paper. The Wayne indicator used to find the I.H.P. was considered superior to the Richards, Crosby, Darke or Tabor indicators. It was made by Messrs. Elliot Brothers. This indicator appears to be similar in principle to one introduced by Mr. Michael Longridge some years ago. For reducing pencil friction to a minimum, cards of smoked mica were introduced in place of the usual paper. An iron tube was used for ignition, electrical methods having been tried, but were not found satisfactory.

The author, in giving a summary of the experiments, concluded that it was probable that the influence of increased compression on economy was due to the fact that weaker charges can be burnt completely during the stroke when the compression is high. It should be stated that in the test of which we have given particulars, in which the thermal efficiency was 21 per cent., the author considered that more economical results than this could be obtained, as the ratio of air to gas was 8·6, which was certainly higher than necessary. It may be added that the best mixture for a modern gas engine is considered to be one of gas to ten of air by volume. The report continued that the test seemed to indicate that economy depends on the choice of the correct ratio of air to gas, and that this ratio increases with compression. The number of experiments was not yet sufficient to determine what any ratio was for any given compression, but it is stated that further tests are to be made for arriving at this important point.

The summer meeting of the Institution will be held this year in Derby.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. Charles Godfrey, of Trinity College, has been elected to the Isaac Newton Studentship in Physical Astronomy.

The General Board of Studies propose that the Professorship of Surgery, held by the late Sir George Humphry, be suspended until the Senate shall otherwise determine. Meanwhile the duties of the office are to be discharged by a Reader in Surgery, at a stipend of 240*l.* a year.

The General Board also propose to recognise the continued liberality of the Royal Geographical Society in providing for the endowment of geographical teaching, and the importance of encouraging the study of the subject in the University by raising the present Lectureship, held by Mr. Yule Oldham, to a Readership in Geography, with a total stipend of 200*l.* a year.

DR. KARL HÜRTHLE, assistant professor of physiology at Breslau, has been appointed professor of physiology and director of the Physiological Institute, in succession to the late Prof. Heidenhain.

THE Council of King's College, London, have received from the Trustees of the British Museum a valuable series of fossils, in aid of the teaching collection for the Geological Laboratory in the Science and Engineering Faculty.

AN anonymous donor has offered 10,000*l.* for the completion of the extension scheme of Aberdeen University, on the condition that 20,000*l.* is obtained from the Government for the same object. The Chancellor of the Exchequer has agreed to receive a deputation on behalf of the movement for the extension of the University.

Science states that at the semi-annual meeting of the Board of Trustees of Beloit College it was announced that the College had received a gift of 25,000 dollars for the endowment of the chair of Chemistry, now occupied by Prof. E. G. Smith. The donor wishes to remain anonymous. It was also reported that the sum of 70,000 dollars had been raised towards the 100,000 dollars necessary to secure Dr. Pearson's gift of 50,000 dollars.

THE rapid progress of medical education and the enlargement of the requirements of the Examining Boards have rendered it imperative to provide more space for the teaching of several important subjects in the London Hospital Medical College. Consequently a large portion of the College is about to be rebuilt and enlarged, and all the necessary class-rooms and laboratories provided. It is intended that the work will be completed by the commencement of next winter session.

THE magnitude of the operations of the Department of Science and Art may be judged from the figures given in the Calendar of the Department for 1898. The total number of individual students in science classes held under the auspices of the Department was 157,984. The subjects which attracted more than ten thousand students in the year covered by the Calendar are: Mathematics (Stages 1, 2, 3), 40,244; Inorganic Chemistry (Theoretical), 26,433; Practical Plane and Solid Geometry, 24,069; Physiography, 22,409; Machine Construction and Drawing, 19,952; Building Construction, 15,195; Magnetism and Electricity, 12,591; Hygiene, 10,143. At the other end of the scale we find that mineralogy only attracted 152 students, and zoology 189. Nine of the depart-

mental subjects are practical; and the number of students who took practical work is as follows: Inorganic Chemistry, 15,169; Magnetism and Electricity, 2694; Sound, Light, and Heat, 1793; Organic Chemistry, 1538. The remaining practical subjects—human physiology, general biology, zoology, botany, and metallurgy—divided 1852 students between them. There are now 169 Schools of Science in which organised courses of study are taken in connection with the Department, and the number of students attending them is 20,879.

SCIENTIFIC SERIALS.

THE most important contribution to *Himmel und Erde* for this month is a long paper on the terminal moraines of North Germany. The other papers comprise one in which is given the conclusion of a lecture by Dr. Drygalski on Greenland, dealing mainly, in this part, with the habits and customs of the Esquimaux; and another by Herr G. von Gleicke treating of the existence of an intra-mercurial planet or planets, generally surveying the various theories that have been put forward to explain the motion of the perihelion of Mercury. The only result that appears certain in the paper is the practical confirmation of the reality of the motion, originally determined by Le Verrier. The presence of a single planet or of a ring of meteoric matter; the existence of an unknown satellite of the planet itself, or an ellipticity in the figure of the sun; an alteration in the expression of the law of gravitation or the introduction of terms suggested by electrodynamic considerations; all seem to offer insuperable objections, or to be based on pure empiricism. The enigma is not solved yet. The subjects to which the shorter notes refer have generally been mentioned in these columns. They include some account of the Greenland Meteor; the sinking of the surface of the earth in the neighbourhood of the Canadian lakes, and its effect on the Niagara Falls; the depth of the sea and the determination of ocean currents around Australia derived from floating bottles. A short notice is also added of a proposed attempt on the part of MM. Godard and Surcouf to reach the North Pole by means of ballooning. The expedition would start in the summer of 1898, selecting Spitsbergen as a base of operations. The peculiar feature of the attempt seems to consist in carrying twelve small balloons, filled with hydrogen to serve as a gasometer to supply the main balloon, which is of gigantic dimensions, with the gas which may leak or waste. M. Godard counts on spending sixty days aloft, and to carry with him the means of support of no less than seven people, among whom will be found a chemist, a meteorologist, and a physician.

Memoirs of the Caucasian Branch of the Russian Geographical Society, vol. xviii.—On the distribution of precipitation in Caucasia during the spring and summer of 1894, by A. Woznesensky, with four maps.—Journey in the Chernomorsk district, in 1894, by N. Alboff; with a map (on the scale of seven miles to an inch) of the Chernomorsk district and the western part of the district of Sukhum; and botanico-geographical researches in Western Transcaucasia, by the same author, being a continuation of his paper inserted in a preceding volume of his *Memoirs*. In this paper two important excursions across the main ridge of Abhasia are described. The flora of the limestone-mountains having been the special subject of studies, it is dealt with in detail. The rare new species *Amphoricarpus elegans*, which was formerly found at two places only of Abhasia and Mingrelia, was met with in thousands. A bush-like *Campanula*, which M. Alboff considers as a new species, was found and was named *C. regina* for its rare beauty. Numbers of other rare species were found. Detailed lists of the limestones' fauna in Abhasia and Mingrelia are given. In addition to the glaciers previously discovered on the northern slope, a hanging glacier was found on the southern slope. Very interesting remains of the ancient population of the region are mentioned.—On the Kumyks, anthropological sketch by J. Pantukhoff. The paper contains a sketch dealing with the possible origin of this Tartar stem, anthropological measurements made by the author, and a comparison of the same with measurements on other Caucasian stems.—The Pshaves and their land, by D. Khizanachwili.—A journey in the central portion of the Mountain-Chechnya, by Madame A. Rossikoff, with a map three and a half miles to the inch. Detailed and lively account of a journey in that imperfectly known part of Daghestan, the seat of Shamil's wars.—Statistical description of, and statistical data relative to, the provinces of Baku, Kars, Erivan, Daghestan, and Elisabethpol.—On the condition of glaciers and of the lakes on the northern slope of Central Caucasus, by K. Rossikoff.—In a very interesting appendix we find (1) a beautiful atlas of eight ethnographical maps of Transcaucasia, one for each separate province, on the scale of thirteen miles to an inch (it is the work of E. Kondratenko); (2) a map of the distribution of the Armenian population in Asia Minor, on the basis of V. Cuinet's data, 1890-94, accompanied by a paper by General Zelenyi and Colonel Sysoeff; and (3) the distribution of Armenian populations in Transcaucasia.

WE have received the number of the *Irish Naturalist* for February, and are always glad to say a word on behalf of these local natural history journals, which have done so much to encourage the early enthusiasm of many who have afterwards become eminent naturalists. In the present number Mr. Allan P. Swan describes and figures a new species of *Leptolegnia*, *L. bandoniensis*, belonging to the *Saprolegniaceæ*.

THE *Journal of Botany*, in its numbers for January and February, still continues to cater chiefly for descriptive and "critical" botanists. Mr. F. Townsend describes and figures a new species of *Euphrasia*, *E. canadensis*, from the neighbourhood of Quebec; and Miss Ella M. Tindall enriches British Hepaticæ with a species new to science, *Fossombronia Mittenii*, from North Devon, which is also figured

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 20.—"Fergusonite, an Endothermic Mineral." By William Ramsay, Ph.D., LL.D., Sc.D., F.R.S., and Morris W. Travers, B.Sc.

The mineral fergusonite, discovered by Hartwall, occurs in felspar and mica deposits, in the same manner as most of the rare Norwegian minerals, such as euxenite, orthite, samarskite, &c. The position in which such minerals are found, embedded in masses of felspar, or encrusted with mica, leaves the question of their origin an open one. Whether they are deposited in the felspar by water, or whether they are contemporaneous with the felspar, is a matter of speculation. Fergusonite is a black lustrous mineral, not unlike obsidian in outward appearance, but of considerably higher density. Seen under the microscope, even with the highest power, there is absolutely no sign of crystalline structure, though in thin slices the substance is translucent, and transmits yellow-brown light. It is, however, macrocrystalline, occurring in quadratic sphenoids. It is quite homogeneous, and displays no sign of cavities. Like similar minerals, it contains helium, which is expelled on the application of heat.

But this mineral presents a peculiarity, which has led us to publish this note. When heated to a temperature not exceeding 500° or 600°, it suddenly becomes incandescent, and evolves much of its helium; while its density decreases.

The analysis of the mineral was kindly undertaken by Miss Emily Aston, to whom we desire to express our indebtedness.

It showed that fergusonite is mainly a niobate of yttrium, containing oxides of uranium, but in no great quantity.

The gases evolved by the incandescence of nearly 5 grams (4·852) of the mineral, heated in a vacuous tube, were analysed and found to consist of helium, hydrogen, carbon dioxide, and nitrogen.

The density was determined before and after heating. Great care was taken to make sure of the absence of air-bells, by warming the powdered mineral under water in a vacuum, before weighing it.

Density before heating	5·619
,, after ,, ...	5·375

It is thus seen that the mineral loses density on incandescence.

The amount of heat lost by this curious mineral in parting with its helium was determined. The plan of operation was to burn in oxygen a known weight of hydrogen, ascertained by measuring it, under a small platinum crucible, in a calorimeter. The rise of temperature was noted. This operation was repeated several times, so as to standardise the calorimeter. Some grams of mineral were then placed in the crucible, and the operation was repeated; the heat evolved by the incandescing mineral added itself to that from the burning hydrogen, and the

rise of temperature was greater. Knowing the heat of combustion of hydrogen, a simple calculation gave the heat evolved by the exothermic change in the mineral.

Various questions are raised by the behaviour of this interesting mineral. Its evolution of heat, accompanying its parting with helium, suggest the idea that it is a true endothermic compound of helium. Had its density, as is the case with alumina, and with other oxides which rise spontaneously in temperature when heated, increased instead of decreased, the evolution of heat might justly have been ascribed to polymerisation. But an evolution of heat, accompanied by a *fall* in density, leads to the conjecture that the loss of energy is the result of the loss of helium; and that, conversely, the formation of the compound must have been concurrent with a gain of energy. That the helium is actually in combination, and not retained in pores in the mineral, is evinced by there being no pores in which the helium might be imprisoned. Surface-absorption is equally out of the question, for the mineral is compact. The only remaining possibility is that the helium is in chemical combination. And if this is true, then the compound must be an endothermic one.

There is one other substance at least which decreases in density, while it evolves heat; that substance is water, in changing into ice. The effect of compressing ice is to lower its melting point, and at the same time to reduce its heat of fusion. At a sufficiently high pressure there would be a continuous transition from ice to water, no heat change taking place during the transition. Matters would be in a similar condition to those which accompany the change of a liquid into gas at the critical temperature; the smallest alteration of temperature would be enough to bring about the change. In speculating on the origin of such a remarkable compound, is it not allowable to guess that it represents a condition of our earth realised only before solidification had set in? That these minerals, containing the rare elements, represent a portion of the interior of our planet; and that under the enormous pressure obtaining at the centre, combination with helium was an exothermic event; and that such compounds, having by some unexplained accident come to the surface of the globe, where they are no longer exposed to such pressure, they have, in consequence of the change, become endothermic? The frequency of the helium spectrum in the stars, and its presence in the sun, makes it less improbable that some such explanation may lie not far from the truth.

February 3.—"Note on the Experimental Junction of the Vagus Nerve with the Cells of the Superior Cervical Ganglion." By Dr. J. N. Langley, F.R.S., Fellow of Trinity College, Cambridge.

The author concludes from his experiments that there is no essential difference between the efferent "visceral" or "involuntary" nerve fibres, whether they leave the central nervous system by way of the cranial nerves, by way of the sacral nerves, or by way of the spinal nerves to the sympathetic system. All of these fibres he takes to be pre-ganglionic fibres. And he thinks that any pre-ganglionic fibre is capable, in proper conditions, of becoming connected with any nerve-cell with which a pre-ganglionic fibre is normally connected; although apparently this connection does not take place with equal readiness in all cases. On the whole it appears that the functions exercised, both by pre-ganglionic and by post-ganglionic fibres, depend less upon physiological differences than upon the connections which they have an opportunity of making during the development of the nervous system and of the other tissues of the body.

Physical Society, Annual General Meeting, February 11, 1898.—Mr. Shelford Bidwell, President, in the chair. The Report of the Council was read by Mr. Elder. Dr. Atkinson then presented the Treasurer's Report, and informed the Society of the improved condition of its finances. The difficulties of the previous year had arisen from the expenses incurred by the publication of abstracts of current scientific literature; those difficulties had been surmounted without drawing upon the reserve fund. Very few Fellows had objected to the increase of subscription. In acknowledgment and appreciation of the abstracts, now presented to all Fellows, many of the original life-members had lately made additional voluntary donations to the funds of the Society, thus sharing with new Fellows the extra outlay involved by the abstracts. It was to be hoped that all life-members would adopt this course, more especially as the scope of scientific literature covered by the abstracts was now being extended to British as well as to foreign sources. Votes of thanks were passed to the Council, the officers, and to the Council of the Chemical Society for the use of their rooms at Burlington House. Two Honorary Fellows were unanimously elected by ballot, *i.e.* Riccardo Felici, professor in the University of Pisa; and Emilio Villari, professor in the University of Naples. Council and officers for the forthcoming year were elected as follows. President: Mr. Shelford Bidwell. Vice-Presidents (who have filled the office of President): Dr. J. H. Gladstone, Prof. G. C. Foster, Prof. W. G. Adams, The Lord Kelvin, Prof. R. B. Clifton, Prof. A. W. Reinold, Prof. W. E. Ayrton, Prof. G. F. Fitzgerald, Prof. A. W. Rücker, Captain W. de W. Abney. Vice-Presidents: Prof. C. Vernon Boys, Major-General E. R. Festing, Mr. G. Griffith, Prof. J. Perry. Secretary: Mr. H. M. Elder, 50 City Road, E.C. Foreign Secretary: Prof. S. P. Thompson. Treasurer: Dr. E. Atkinson. Librarian: Mr. W. Watson. Other Members of Council: Prof. H. E. Armstrong, Mr. Walter Baily, Mr. L. Clark, Dr. A. H. Fison, Mr. R. T. Glazebrook, Prof. A. Gray, Prof. J. Viriamu Jones, Mr. S. Lupton, Prof. G. M. Minchin, Mr. J. Walker.—The President then read an address in which the aims and history of the Physical Society were outlined. (An abstract of this address is published in the present issue, p. 378.) Prof. Rücker said that among the new and useful departures lately made by the Physical Society the institution of a presidential address was particularly worthy of notice; it was very desirable, from time to time, to hear a summary of what had been achieved during the year; it was also desirable that the objects of the Society should be, from time to time, definitely stated; this departure had been fully justified by the address of Mr. Shelford Bidwell.—A paper by Mr. G. H. Bryan on electro-magnetic induction in plane, cylindrical and spherical current sheets, and its representation by moving trails of images, was read by Mr. Elder. The phenomena of induction in a cylindrical conducting sheet in a two-dimensional field, and of induction in a spherical sheet in any field due to the generation or motion of poles, magnets, or currents, in the presence of the sheet, can be represented by moving trails of images which are but slightly more complicated than the well-known trails of images in a plane sheet. The images, representing the potentials of the induced currents on the two sides, start from the source of disturbance and its inverse point, and move normally away from the surface of the sphere and cylinder, with velocity varying directly as the disturbance. At the surface of the sheet this velocity becomes equal to the corresponding velocity for a plane sheet. The images are in most cases similar in nature to the inducing source of disturbance, and their intensities are found, in every case, to vary as a power of the distance from the centre. The images due to the sudden generation of a magnetic pole in the presence of a spherical sheet are, however, analogous to the hydro-dynamical image of a source in a sphere. Dr. S. P. Thompson said the method and the results obtained would find useful application in the solution of many allied problems.—The President proposed a vote of thanks to the author; the meeting was then adjourned until Saturday, February 26, on which occasion the Physical Society will visit Eton College. [Fellows are informed that a train leaves Paddington for Windsor at 2.25 p.m. This arrives in time for the meeting, which is at 4 p.m.]

Zoological Society, February 1.—Dr. St. George Mivart, F.R.S., Vice-President, in the chair.—Mr. Oldfield Thomas exhibited the skull of a giraffe from the Niger region, which had been shot by the late Lieut. R. H. McCorquodale, and presented to the British Museum by his brother, Mr. W. Hume McCorquodale. No giraffes had previously been received from this region, and as the skull proved to differ from that of the typical species in its greater size, longer muzzle, and more divergent horns, it was considered to represent a special subspecies, for which the name of *Giraffa camelopardalis peralta* was suggested.—Mr. Sclater exhibited some photographs of giraffes in order to show the differences in markings between the two forms *Giraffa camelopardalis typica* and *G. c. capensis*.—A letter was read from Mr. J. Graham Kerr, containing notes on the habits of the Paraguayan Lepidosiren, as observed by Mr. R. J. Hunt. It was shown that during the dry season it retired into burrows like its African relative *Protopterus*.—Mr. G. A. Boulenger, F.R.S., gave an account of the fishes collected by Dr. J. Bach in the Rio Jurua, Brazil. Fifty-one species were enumerated, of which nine were described as new.—Mr. F. E. Beddard, F.R.S., read a paper on the anatomy of

an Australian cuckoo, *Scythrops novæ-hollandiæ*, which he was disposed to regard as being more nearly allied to *Eudynamys* than to any other form of the Cuculidæ.—Dr. A. G. Butler read a paper on a collection of Lepidoptera made by Mr. F. V. Kirby, chiefly in Portuguese East Africa. Ninety-two species were enumerated, of which one (*Euralia kirbyi*) was described as new. The paper also contained the description of a new species of *Cyclopides*, viz. *Cyclopides carsoni*, from Fwambo, collected by Mr. A. Carson.—A communication from Dr. N. H. Alcock, on the vascular system of the *Chiroptera*, was read by Prof. Howes. The anatomy of the vascular system of *Pteropus medius* was described and shown in its general plan to resemble in many respects that occurring in the Rodentia, and observations of a comparative nature were added on the pleuræ, pericardium, and lungs. A summary of the literature upon the *Chiroptera* was also included in the paper.

Entomological Society, February 2.—Mr. G. H. Verrall, Vice-President, in the chair.—The Secretary read a letter from Mr. A. D. Michael asking if any entomologists, who might find insects attacked by mites (*Acari*) among their disused boxes, would be willing to send him such insects, with the mites still on them or accompanying them, or at least, the mites themselves, with the name of the insect given in all cases, for the purpose of his forthcoming monograph of the Tyroglyphidæ.—Mr. J. W. Tutt showed a fine series of forms of *Hemerophila abruptaria*, Thunb., captured and bred by Mr. W. S. Pearce at Holloway, varying from the normal colour, through mahogany-brown to dark fuscous, some of the specimens of the second brood showing a purplish hue. One gynandromorphous example was shown, with the wings and right antenna of the female type, the left antenna being strongly pectinated. He also exhibited two specimens of *Dianthœcia luteago*, bred by the Rev. F. Lowe, from larvæ obtained in Guernsey, and of a very distinct character, having a tendency to the ochreous coloration of the type-form, but being differently marked.—On behalf of Mr. Heyne, Mr. Jacoby exhibited a series of temperature-varieties of Lepidoptera.—Mr. G. H. Carpenter read a paper by himself and the Rev. W. F. Johnson on the larva of *Pelophila borealis*, describing its structure and life-history. On the larval characters the species, hitherto considered as of doubtful relationship, was regarded as being closely allied to *Elaphrus*.—Papers were communicated by Mr. F. D. Godman, F.R.S., and Mr. O. Salvin, F.R.S., on new species of American Rhopalocera, and by Mr. M. Jacoby, on some phytophagous Coleoptera (Eumolpidæ) from the Islands of Mauritius and Réunion.

Chemical Society, February 3.—Prof. Dewar, President, in the chair.—The following papers were read:—The volumetric estimation of sodium, by H. J. H. Fenton. Sodium dihydroxytartrate is very sparingly soluble in water at 0° and the solubility in presence of excess of a dihydroxytartrate is practically negligible; since dihydroxytartaric acid is readily oxidised by permanganate in sulphuric acid solution, the formation of the sodium salt affords a simple and accurate method of estimating the metal.—The atomic weight of boron, by F. P. Armitage. From determinations of the water of crystallisation in borax, $Na_2B_4O_7$, H_2O, the atomic weight of boron is calculated as 10·928.—Rate of escape of ammonia from aqueous solution, by E. P. Perman. After drawing a volume V of air through a dilute solution of ammonia at a uniform rate, the amount q of ammonia left in solution is $\log q = a - bV$, where a and b are constants; with variable temperature t, $\log b = \alpha + \beta t$, α and β being constants.—On the dissociation of potassium platinichloride in dilute solution; and the production of platinum monochloride, by E. Sonstadt. Potassium platinichloride, in a 0·1 per cent. aqueous solution, is scarcely changed on heating; in a 0·01 per cent. solution platinum monochloride is gradually precipitated on heating, in accordance with the equations (1) $K_2PtCl_6 = 2KCl + PtCl_4$; and (2) $2PtCl_4 + 6H_2O = 2PtCl + 6HCl + 3H_2O_2$.—Effect of the mono-, di- and tri-chloracetyl groups on the rotatory power of methylic and ethylic glycerates and tartrates, by P. Frankland and T. S. Patterson. In order to ascertain the rotatory effect of the halogens when attached at a point in the molecule remote from the asymmetric carbon atom, the authors have examined the mono-, di- and tri-chloracetyl derivatives of the methylic and ethylic tartrates and glycerates; tables of the optical data are given.—The rotation of ethylic and methylic dimonochloracetyltartrates, by P. Frankland and A. Turnbull.

MANCHESTER.

Literary and Philosophical Society, January 25.—Mr. J. Cosmo Melvill, President, in the chair.—Mr. Louis Schwabe was elected an ordinary member of the Society.—The President referred to the loss sustained by the Society through the death of Mr. Thomas Ashton, who, since the death of Mr. James Heywood, was the "Father" of the Society, having been elected in 1837.—Mr. J. J. Ashworth called attention to a paper by Mr. J. Smith, in vol. xxi. of the Society's "Memoirs" (1859) on the origin of colours and the theory of light, in which is given a complete description of the colour phenomena seen when a black and white disc is rapidly rotated. As the phenomena have been to some extent re-discovered during the past few years, and have attracted considerable interest, he thought it advisable to direct attention to a paper which appeared to have been forgotten, in which the subject is treated with great thoroughness.—*Apropos* of an inquiry at a recent meeting of the Society, as to the origin of wheat, the President exhibited specimens of *Ægilops*, *Triticum*, and *Agropyrum* from his herbarium. Mention was made of a grass, *Ægilops ovata*, L., which was declared by a French botanist some fifty years ago to become wheat on being cultivated, and subsequent experiments appeared to confirm this statement. The opinion generally held by botanists now, however, is that in all probability wheat had its origin in *Triticum monococcum*, L., a plant found in Asia Minor, Mesopotamia and Greece.—Mr. Melvill afterwards communicated a paper by Mr. Peter Cameron entitled "Hymenoptera Orientalia, or Contributions to a Knowledge of the Hymenoptera of the Oriental Zoological Region," part vii.

February 8.—Mr. J. Cosmo Melvill, President, in the chair.—Mr. Brothers exhibited and described the latest form of Mr. F. E. Ives' photo-chromoscope, called the "Krōmskōp." Stereoscopic photographs were shown in which the various objects, when viewed through the arrangement of red, blue, and green glasses, were seen in all the colours of nature-groups of flowers, landscapes, &c., being thus realistically reproduced.—On the collision of two explosion-waves, by Messrs. R. H. Jones and J. Bower. This paper was a description of experiments carried out in the research laboratories of Owens College to examine whether there was any increase of pressure on the collision of two explosion-waves. This was shown to be the case, both by direct hydraulic tests of the tubing used and by photographs of the explosions. It was also argued that the increased luminosity at the point of collision and the increased speed of the reflected wave from the point of collision above that of reflection from a hard surface established the fact of greater pressure.

PARIS.

Academy of Sciences, February 7.—M. Wolf in the chair.—The President announced to the Academy the death of M. Jean Albert Gauthier-Villars.—Histological mechanism of cicatrisation; immediate synaptic reunion, by M. L. Ranvier. If two parallel incisions of equal length are made in the cornea of the rabbit, one going only a third to a half through the membrane, the other penetrating right through into the chamber behind, the latter heals more quickly than the simple wound. These effects are due to the part played by fibrin in cicatrisation.—On the development of real non-analytical functions, by M. P. Painlevé.—Transparency of bismuth in a magnetic field, by M. H. Buisson. The electromagnetic theory of light requires a relation between the transparency and electrical resistance of a body. By placing a thin sheet of bismuth in an intense field caused by an electromagnet, it is possible to cause sudden variations in the resistance of the plate. Since not the slightest variation in the intensity of the transmitted light could be detected under these conditions, the author concludes that the conductivity which intervenes in luminous phenomena is probably of a different order to that ordinarily measured.—Cycles of magnetic torsion and the residual torsion of soft iron, by M. G. Moreau.—On a method of comparing curves of torsion, by M. H. Bouasse.—Transformation of the X-rays by transmission, by M. G. Sagnac. A continuation of preceding work on the properties of the secondary rays, or rays emitted by bodies struck by the X-rays.—On photographic development, by M. R. Colson.—On the melting points of gold and silver, by M. Daniel Berthelot. The metals in the form of wire were heated in the furnace described in a previous paper, and the temperature of fusion measured by a platinum-iridium thermo-

couple, the latter being standardised in place by the interference method of air thermometry previously described. The temperatures found were 962° C. for silver and 1064° for gold.—Determination of the density of gases upon very small volumes, by M. Th. Schlœsing, jun. (see p. 374).—On the correlation between reduction by nascent hydrogen, electrolysis, and photolysis of carbonic acid, by M. A. Bach. The reduction of a solution of carbon dioxide in water by hydrogenised palladium gave rise to some formic aldehyde, the latter being identified by conversion into methylene-aniline and hexamethylenetetramine. The electrolytic reduction of carbon dioxide is shown to be parallel with the reduction by solar radiation.—On the aromatic urethanes of conicine, by MM. P. Cazeneuve and Moreau,—New colour reaction of phenylhydrazine, by M. Louis Simon. The solution of the hydrazine is warmed with a little aqueous trimethylamine, some drops of a solution of nitroprussiate of soda added, and then concentrated potash. A blue coloration results which allows of the detection of one part of phenylhydrazine in 50,000 of water.—On the influence of the frequency of the movements and of the weights sustained upon the maximum power of muscle under regular treatment, by MM. André Broca and Charles Richet.—On the development of the conjunctive fibrilla, by M. P. A. Zachariadès.—On the constitution of cannel coal, by M. B. Renault.—On the polymorphism of fluorspar, by M. F. Wallerant.

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 17.

ROYAL SOCIETY, at 4.30.—On the Connection between the Electrical Properties and the Chemical Composition of Different Kinds of Glass: Prof. A. Gray, F.R.S., and Prof. J. J. Dobbie.—On the Magnetic Deformation of Nickel: Dr. E. Taylor Jones.—Upon the Structure and Development of the Enamel of Elasmobranch Fishes: C. S. Tomes, F.R.S.—On Artificial Temporary Colour-Blindness, with an Examination of the Colour Sensations of 109 Persons: G. J. Burch.—Contributions to the Mathematical Theory of Evolution. On the Inheritance of the Cephalic Index: Cicely Fawcett, and Prof. K. Pearson, F.R.S.

ROYAL INSTITUTION, at 3.—Some Italian Pictures at the National Gallery: Dr. Jean Paul Richter.

SOCIETY OF ARTS (Imperial Institute), at 4.30.—The Plague in Bombay: Dr. Herbert Mills Birdwood.

LINNEAN SOCIETY, at 8.—On the Genus Arenaria: F. N. Williams.—On the Histology of the Salivary and other Glands of the *Colubridæ*: G. S. West.

CHEMICAL SOCIETY, at 8.—Some Lecture Experiments: J. Tudor Cundall.—Observations on the Influence of the Silent Discharge of Electricity on Atmospheric Air: W. A. Shenstone and W. T. Evans.

FRIDAY, FEBRUARY 18.

ROYAL INSTITUTION, at 9.—A Yorkshire Moor: Prof. L. C. Miall, F.R.S.

GEOLOGICAL SOCIETY, at 3.—Annual General Meeting.

EPIDEMIOLOGICAL SOCIETY, at 8.30.—The Relationship of Variations of the Ground-Water Level to the Incidence and Seasonal Distribution of Malarial Fevers in India: Surgeon-Captain Leonard Rogers.

SATURDAY, FEBRUARY 19.

ROYAL INSTITUTION, at 3.—The Structure of Instrumental Music: William H. Hadow.

MONDAY, FEBRUARY 21.

IMPERIAL INSTITUTE, at 8.30.—The Nile and its Tributaries: Colonel C. M. Watson, R.E., C.M.G.

SOCIETY OF ARTS, at 8.—The Principles of Design in Form: Hugh Stannus.

VICTORIA INSTITUTE, at 4.30.—Purpose in Nature: Dr. W. Kidd.

TUESDAY, FEBRUARY 22.

ROYAL INSTITUTION, at 3.—The Simplest Living Things: Prof. E. Ray Lankester, F.R.S.

ANTHROPOLOGICAL INSTITUTE, at 8.30.—Ethnographical Notes on the Murray Islands, Torres Straits: Rev. Archibald E. Hunt.—There will be exhibited two Tattooed Heads carved in Kauri Gum from New Zealand, lent by Edge Partington; and a Collection of Objects obtained during the Recent Exploration of a Cairn in Breconshire, lent by T. C. Cantrill.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Theory, Design, and Practical Working of Alternate-Current Motors: Llewelyn B. Atkinson.—Dublin Electric Tramways: H. F. Parshall.

WEDNESDAY, FEBRUARY 23.

SOCIETY OF ARTS, at 8.—Children's Sight: R. Brudenell Carter.

THURSDAY, FEBRUARY 24.

ROYAL SOCIETY, at 4.30.—Meeting for Discussion.—Subject: The Scientific Advantages of an Antarctic Expedition. The Discussion will be opened by Dr. John Murray, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—On the Manufacture of Lamps and other Apparatus for 200 volts Circuits: G. Binswanger Byng.

FRIDAY, FEBRUARY 25.

ROYAL INSTITUTION, at 9.—The Theory of Colour Vision applied to Modern Colour Photography: Captain W. de W. Abney, C.B., F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Problem of Train Resistance: C. E. Wolff.

SATURDAY, FEBRUARY 26.

ROYAL INSTITUTION, at 3.—The Structure of Instrumental Music: W. H. Hadow.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—The Arrangement of Atoms in Space: J. H. van 't Hoff, 2nd edition, translated and edited by A. Eiloart (Longmans).—On Laboratory Arts: Prof. R. Threlfall (Macmillan).—Motion: its Origin and Conservation: Rev. Dr. W. McDonald (Dublin, Browne).—Calendar, &c., of the Department of Science and Art, 1898 (Eyre).—Evolutional Ethics and Animal Psychology: E. P. Evans (Heinemann).—The Flora of Berkshire: G. C. Druce (Oxford, Clarendon Press).—Researches on Tuberculosis: Dr. A. Ransome (Smith, Elder).—Pasteur: Prof. and Mrs. P. Frankland (Cassell).—Lehrbuch der Entwickelungsgeschichte des Menschen: Dr. J. Kollmann (Jena, Fischer).—Organographie der Pflanzen: Dr. K. Goebel, Erster Teil (Jena, Fischer).—Das Optische Drehungsvermögen: Dr. H. Landolt, Zweite Auflage (Braunschweig, Vieweg).—Die Gattung Cyclamen L.: Dr. F. Hildebrand (Jena, Fischer).

PAMPHLETS.—Museum Handbooks: Catalogue of the Hadfield Collection of Shells from the Loyalty Islands, Parts 2 and 3 (Manchester, Cornish).—A Visit to Giessen: Prof. Senier (Dublin, Ponsonby).

SERIALS.—Physical Review, November, December, and January (Macmillan).—American Journal of Psychology, January (Worcester, Mass.).—Observatory, February (Taylor).—Bulletinde la Société Impériale des Naturalistes de Moscou, 1897, No. 2 (Moscou).—Geographical Journal, February (Stanford).—Boletim do Museu Paraense, &c., Vol. 2, No. 2 (Parà, Brazil).—Quarterly Journal of Microscopical Science, January (Churchill).—Engineering Magazine, February (222 Strand).—Atlantic Monthly, February (Gay).—Zeitschrift für Physikalisches Chemie, xxv. Band, 1 Heft (Leipzig, Engelmann).—Annales de l'Electrobiologie, &c., No. 1 (Paris, Alcan).—Memorias y Revista de la Sociedad Cientifica, Tomo x. Nos. 5-12 (Mexico).—Memoirs of the Boston Society of Natural History, Vol. v. No. 3 (Boston, Mass.).—An Illustrated Manual of British Birds: H. Saunders, 2nd edition, Part 4 (Gurney).—Journal of the Institution of Electrical Engineers, Feburary (Spon).—Memoirs and Proceedings of the Manchester Literary and Philosophical Society, Vol. 42, Part 1 (Manchester).—American Journal of Science, February (Newhaven).—Among British Birds in their Nesting Haunts: O. A. J. Lee, Part 9 (Edinburgh, Douglas).—The West Australian Settler's Guide and Farmer's Handbook, Part 5 (Perth, W.A., Wigg).

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