THURSDAY, DECEMBER 14, 1905.

A GREAT NATURALIST.

My Life: a Record of Events and Opinions. By Alfred Russel Wallace. Vol. i., pp. xii+435; vol. ii., pp. viii+459. With facsimile letters, illustrations, and portraits. (London: Chapman and Hall, Ltd., 1905.) Price 25*s.* net.

EVERYONE will be glad that the Nestor of the evolutionist camp has been able himself to tell us the story of his life. It has been a long life of over fourscore years, full of work, rich in achievement, starred with high ideals, and the story of it must have been pleasant to write as it is pleasant to read. It has been many-sided to a greater degree than that of most scientific investigators, for Alfred Russel Wallace has always had more than professional irons in the fire, and has always been as much interested in practising biology as in theorising about it. At the editor's request we have confined our attention, however, to what the author tells us of his work as naturalist and biologist, though it is difficult, and not altogether legitimate perhaps, to abstract off one aspect of a life in this fashion.

There does not seem to have been anything definable in Wallace's inheritance to account for his becoming a great naturalist. Nor was there much in his nurture to lead him in that direction except that he was country-bred in beautiful and interesting places. Thrown early on his own resources to make his way in life, he began when about fourteen to work at surveying—in which Herbert Spencer had also his early discipline—and it was in trying to understand his instruments and the earth he measured that he first became scientific. He tells us that in his solitary rambles, nature gradually laid hold of him, claiming to be understood as well as enjoyed. From the stars and the earth his interest spread to flowers, and, with the help of Lindley's "Elements" and Loudon's "Encyclopædia of Plants," he became a keen field-botanist. He began to feel "the joy which every discovery of a new form of life gives to the lover of nature," and this was the turning-point of his life.

During a year of school-teaching at Leicester (1844), Wallace got to know Bates, who made him an enthusiastic entomologist, "opening a new aspect of nature," and he also read Malthus's famous essay, "without which I should probably not have hit upon the theory of natural selection." Another book that impressed him was Humboldt's "Personal Narrative of Travels in South America," which awakened a desire to visit the tropics, a desire soon strengthened by Darwin's "Voyage of the *Beagle*." It is interesting to find that as early as 1845 Wallace was speculating upon the origin of species, and had a warm appreciation of the "Vestiges of the Natural History of Creation."

Early in 1848, when he was twenty-five, Wallace set out, along with Bates, to explore and collect on the Amazon, and on the tale of his adventures, long since told, the "Life" throws some sidelights. There is a vivid description of the disastrous fire on board the rubber-laden ship which brought Wallace part of the way home in 1852. The holocaust of all his treasures was hard to bear, but what had been sent on during his journey, and those notes and drawings which were saved from the fire, sufficed to lay the foundations of his scientific reputation, and, perhaps, as he says, the disaster was, for him, a blessing in disguise, for it made him continue his *Wanderjahre*.

The "central and controlling" chapter in Wallace's life was his eight years' wandering throughout the Malay Archipelago, the story of which has fascinated many thousands of readers. He had found his vocation, and enthusiasm grew upon him. "Who ever," he wrote, "did anything good or great who was not an enthusiast?" The love of solitude grew upon him; it was so "very favourable to reflection." For though he was earning a competency by collecting, and though his knowledge of many groups of animals became expert, he was always pondering over big problems, and some of his friends at home shook their heads at his "theorising." "The problem of the origin of species was rarely absent from his thoughts," and at Sarawak, in 1855, he wrote what Huxley called a "powerful essay" on "The law which has regulated the introduction of new species"—a hint of what was coming. At Ternate, in 1858, when ill with intermittent fever, he began thinking over what he had learned from Malthus, and the theory of natural selection "suddenly flashed upon him." He wrote straight off to Darwin, and everyone knows how the two papers were read on the same day at the Linnean Society, and how the two discoverers were united in a friendship than which there has been nothing finer in the history of science.

From 1862 to 1871 Mr. Wallace lived in London, and the "Life" gives an account of his scientific and literary labours, and interesting glimpses of many scientific men whom he came to know, such as Lyell, Spencer, Huxley, W. B. Carpenter, and St. George Mivart. He tried for various posts, *e.g.* the secretaryship of the Royal Geographical Society (which Mr. Bates obtained), and the guardianship of Epping Forest (in connection with which he had some luminous ideas), but he was left free to continue his literary and scientific work, and to try to make things better for his country. Soon after his marriage, in 1866, he began to migrate by stages into the country—to Grays (where he wrote his "Geographical Distribution"), to Croydon (where he wrote his "Island Life"), to Godalming, to Parkstone, and was able to live quietly on his earnings and on a well-merited Civil List pension. Apart from his tour in America, where he gave the Lowell lectures in 1886, occasional holidays, *e.g.* at Davos, and occasional unprofitable scrimmages, his life was very uneventful, as men count events. By nature quiet, gentle, and reflective, he had no ambitions save for truth and justice; he was satisfied with plain living and high thinking, and the esteem of all who really knew him. Thus for many years he has cultivated his garden and served his fellowmen.

The "Life" contains many interesting appreciations of other naturalists, but we must confine ourselves to the relations between Darwin and the author. From his solitude in Malay Wallace wrote home in regard to "The Origin of Species":—

"I have read it through five or six times, each time with increasing admiration. It will live as long as the Principia of Newton. Mr. Darwin has given the world *a new Science*, and his name should, in my opinion, stand above that of every philosopher of ancient and modern times."

To Mr. Bates he wrote:—

"I do honestly believe that with however much patience I had worked and experimented on the subject, I could *never have approached* the completeness of his book, its vast accumulation of evidence, its overwhelming argument, and its admirable tone and spirit. I really feel thankful that it has *not* been left to me to give the theory to the world."

As everyone knows, Wallace parted company with Darwin over the possibility of giving a "natural history" interpretation of man's highest qualities, and in one of his letters Darwin expressed the fear that his selectionist interpretation would quite kill him in Wallace's good estimation. But the author writes:—

"I never had the slightest feeling of the kind he supposed, looking upon the difference as one which did not at all affect our general agreement, and also being one on which no one could dogmatise, there being much to be said on both sides."

Wallace also differed from Darwin in regard to the reality of sexual selection through female choice, as to the distribution of Arctic plants in south temperate regions, as to the feasibility of the provisional hypothesis of pangenesis, and as to the transmissibility of acquired character. On the whole, however, he admits that those critics are not far wrong who describe him as more Darwinian than Darwin, and even in the title of one of his most effective books he persisted in his magnanimous subordination of himself. The fact is, the friends were too keen in the pursuit of truth to trouble about the boundaries of their personal credit. Neither begrudged the other his due meed of praise. Thus, if we may quote once more, we find Darwin writing to Wallace:—

"I hope it is a satisfaction to you to reflect—and very few things in my life have been more satisfactory to me—that we have never felt any jealousy towards each other, though in some sense rivals. I believe I can say this of myself with truth, and I am absolutely sure that it is true of you."

In addition to his statement of the theory of natural selection, his travels, and his work on distribution, Mr. Wallace has in many ways enriched natural history in the wide sense. There is his theory of the "warning colours" of inedible insects, his theory of the correlation between the colours of female birds and the nature of the nest, his theory of "recognition-marks," his criticism of sexual selection by choice on the female's part, his argument that much that is called "instinctive" is due to instruction and imitation, his conclusions as to the Arctic elements in south temperate floras, his emphasis on mouth-gesture as a factor in the origin of language, his strong opinions as to the part natural selection has played and still plays in the social evolution of mankind. We might mention other contributions—as to the permanence of oceanic and continental areas, as to the causes of glacial epochs, as to the glacial erosion of lake-basins, as to the affinities of the Australian aborigines—but we have said enough. It may be of interest, however, to notice that while Wallace many years ago sided with Weismann, he cannot see his way to recognise the validity of the recent theories of discontinuous variation and mutation.

In thinking of the work of Alfred Russel Wallace, we see him as a "synthetic type," combining the virtues of the old naturalist traveller with those of the modern biologist. On the one hand, we see him with a rich experience of the forms and species of animal life, their distribution, habits, and inter-relations, but with a wide outlook, equally interested in palms and orchids, lakes and mountains. With "a positive distaste for all forms of anatomical and physiological experiment," he never took to any of the usual methods of analysis, and even when he was most preoccupied with species he tells us that he was determined not to become a specialist. So, on the other hand, we see him from first to last as a generaliser, "inquisitive about causes," intent upon "solving the problem of the origin of species," and contributing much thereto. His "Life" also discloses what many have had the privilege of knowing—the delightful personality of one who has had the honour of being "Darwinii æmulum, immo Darwinium alterum," and no ætiologist merely, but a warm-hearted humanist thinker, a fearless social striver, and one who realises the spiritual aspect of the world. He has the satisfaction of a retrospect on a long and happy life of work. J. A. T.

A HIGHER TEXT-BOOK OF ELECTRICITY AND MAGNETISM.

Magnetism and Electricity for Students. by H. E. Hadley. Pp. x+575. (London: Macmillan and Co., Ltd., 1905.) Price 6*s*.

THE object of this volume is to carry students a stage further than that reached in the author's "Magnetism and Electricity for Beginners." It has been written in response to numerous requests from teachers. Its scope is roughly that of a second- or even third-year college course. Elementary differential and integral calculus is employed, but even this is avoided whenever reasonably practicable. Technical applications are dealt with in a minor way only, the author considering, rightly in our opinion, that they are best relegated to a special treatise.

Turning to the detailed treatment we find many things to attract us. The method adopted for describing electrical phenomena may be alluded to as the "lines of force method." There are a large number of carefully thought out diagrams showing the play of Faraday tubes in various cases. These are in the main very accurate and suggestive as sketch diagrams. In Fig. 112, however—illustrative

of Faraday's ice-pail experiment—care should have been taken to make the lines emanating from the charged ball fall normally upon the vessel. The properties of these lines are not dogmatically asserted, but in general are derived, in the usual way, from the inverse square law of force; exception must, however, be made with respect to the lateral pressure exerted by such tubes. In stating that the inverse square law was experimentally verified first by Coulomb the author seems to have forgotten Cavendish, who, fully twelve years earlier, proved that the index cannot differ from two by more than 1/50th part.

We have alluded already to the diagrams; more care than usual has been exercised in regard to these. We are particularly attracted by one showing the lines of force and induction of a horse-shoe magnet. Compared with the usual paltry sketches of these lines this is most excellent. The student ought to be warned, however, that it represents rather an artificial case, since the poles are taken as concentrated at points. In the absence of this warning the student may be puzzled to account for the peculiar configuration of the system of lines shown. Another diagram which is now finding its way into text-books is one (Fig. 354) showing the lines of *electric* force due to a current. Much emphasis is usually placed on the magnetic field, but the electric field is almost entirely ignored. We are glad to see it now beginning to take its proper place. It may be mentioned that if the conductors be taken as infinitely deep, so as to reduce the problem to a two-dimensional one, the lines of force are a family of rectangular hyperbolæ, while the equipotential lines are the orthotomic hyperbolæ.

Several omissions and errors require attention. In the chapter on mechanics there is no definition of *mass*—we are not even told that it is the quantity of matter in a body. It is erroneous to state that electrification and electric currents are forms of energy (p. 22). A hollow soft iron cylinder does not act as a perfect screen to magnetic force for points inside it (p. 65). The proof of the formula for the ballistic galvanometer (p. 282) is imperfect, since it assumes that the current is constant while it flows; whereas it essentially is never so in cases for which this kind of galvanometer is used. A very little change in the proof will put this right. In the formula for simple pendulum or suspended coil the time period should not be written with sin θ/θ in the denominator, since when so written the idea is conveyed that this is the proper form when the difference between sin θ and θ is too large to be neglected. In calculating the temperature of a wire when heated by a current the emissivity should not be taken as a constant, for Messrs. Ayrton and Kilgour confirmed Péclet's proof that it depends on the radius; for very thin wires the values go up to many times that quoted, except, of course, in a vacuum. Kelvin's proof of the existence of an E.M.F. *distributed* in a circuit of two metals parts of which are at different temperatures depended on the first law of thermodynamics, and not upon the properties of a Carnot cycle (p. 374). The definition of units is antiquated; those described (p. 515) are now obsolete. On p. 531, in connection with displacement currents the word *displacement* is used on adjacent lines in two senses, with consequent confusion to the meaning. The treatment of the calculation of the propagation of electrodynamic effects (p. 534) which is professedly applicable to the case when the exciting current is travelling along a wire is inapplicable to this case. The display of mathematics in this calculation will convey the erroneous impression of a thorough investigation. The result must be disastrous to a student who is feeling his way toward a knowledge of the subtleties of line-integration round a closed curve. The error arises in part from forgetting that the magnetic induction varies in the direction y as well as in the direction x. Everything is, we believe, put right if the conductor be taken as an infinite plane sheet; the variation which is omitted is in such a case zero.

These few errors are the more unfortunate since we think that the book will prove a very useful one. We frankly think that it has been attempted to put too much into small compass; most sections would be improved by amplification in explanation of principle at the sacrifice of detail. A little excision when this edition is exhausted, a little more attention to logical order and to the development of principles—such suggestions are worth attending to, for the book has the making of a very useful volume.

BUNSEN'S COLLECTED WORKS.

Gesammelte Abhandlungen von Robert Bunsen. Edited by Wilhelm Ostwald and Max Bodenstein. Vol. i., pp. cxxvi+535; vol. ii., pp. vi+660; vol. iii., pp. vi+637. (Leipzig: Engelmann; London: Williams and Norgate, 1904.) Price 2*l.* 10*s.* net.

THE appreciative and critical notices of Bunsen and his work which appeared shortly after his death hardly leave room for a review of the volumes before us. In the Chemical Society memorial lecture, which is justly given the place of honour in the prefatory part of the first volume, Sir Henry Roscoe has given a comprehensive survey of Bunsen's work, and has described the personality of the man in such a way as to earn the gratitude of all old Heidelberg students.[1]

In these three stately volumes we have a complete collection of Bunsen's contributions to science and a book that will form part of the permanent literature of chemistry. It is, indeed, a most striking fact that all Bunsen's writings are in their nature permanent scientific literature, a fact that well deserves pondering at the present time. He made some mistakes, he advanced some conclusions now untenable, but his writings are of faithful observations, careful experiments, laboratory methods. Of speculative theory there is nothing, and of strictly polemical writing also nothing. The books that are included in his writings are accounts of methods of doing things that he him-

[1] An account of Bunsen's scientific work was given by Sir Henry Roscoe in NATURE of April 28, 1881 (vol. xxiii. p. 597), as a contribution to our series of "Scientific Worthies."—EDITOR

self devised—gas analysis, mineral water analysis, flame reactions. It is not easy to describe Bunsen's relation to chemical science. He was a perfect type of "Naturforscher," a word for which there is hardly an English equivalent. He lived in his laboratory, ever absorbed, he seemed, in finding his way through natural problems, like a navigator always on the bridge sailing in an unknown archipelago. His writings are hardly more than his log, and his lectures were the narratives of his own particular voyage in the region called chemistry. To a listener who had a fair knowledge of chemistry and its literature it seemed as if there were no part of inorganic chemistry which Bunsen had not made in some way his own. In the laboratory it was the same; from the making of a borax bead to the execution of the most complicated analysis there was the Bunsen method of doing things. Spectroscopy, gas analysis, and electrolytic chemistry for long seemed wholly his. No chemist had a broader or more philosophical outlook than he; on the one hand he had a profound distrust of theory that went in advance of experiment, and on the other hand he despised all kinds of aimless or recipe work. Of the periodic classification of the elements he said at one time, "Ja, solche Regelmässigkeiten findet man in den Börsenblättern"; of a well known standard work on analysis he said "Koch-buch!" and indignantly ordered its removal. What a memorable experience it was for a student to work with Bunsen through the Russian Mint residues! The innumerable devices of his own, the "nursing" operations at different stages, the tales of his earlier efforts and disasters, the eager hope "vielleicht steckt etwas neues darin," the dry assurance "ja, alle Wochen werden ein Paar neue Platinmetalle entdeckt"—all these things come to mind to recall the image of a man in whom the art of a past master was combined with the artlessness of a child.

It is impossible to estimate the influence of such a man; but in the volumes which it is the object of this notice to commend, it is possible to read the record of his work and to catch something of the spirit which animated the worker.

The collected works are published under the auspices of the German Bunsen Society for Applied Physical Chemistry, and are edited by Prof. Ostwald and Dr. Bodenstein. We are therefore assured that the task has been performed with pious care and with fulness of knowledge. The original intention of publishing a biography of Bunsen had to be abandoned owing to his express order, so characteristic, that his literary remains should be destroyed. He also desired that from his own letters in the possession of others nothing of a personal character should be published. The gap thus left is probably not so great as might be imagined, and one feels, after reading the prefatory memoirs by Sir Henry Roscoe, Dr. Rathke, and Prof. Ostwald himself, that we have probably all we really need to know. "Bunsen stories" were doubtless good to those who knew him, but to those who did not they were apt to be like most tales of university dons, and the collection which has been privately published seems rather trivial, and jars somewhat on the ears of the faithful. But the collection of his writings makes a noble monument, and the thanks of all chemists are due to the Bunsen Society and to the two editors who have undertaken the laborious task and have executed it so well.

ARTHUR SMITHELLS.

OUR BOOK SHELF.

The Practical Study of Malaria and other Blood Parasites. By Dr. J. W. W. Stephens and S. R. Christophers. 2nd Revised Edition. Pp. iii+396 and xliv. (London: Published for the University Press of Liverpool by Williams and Norgate, 1904.) Price 12*s.* 6*d.* net.

THIS volume gives a very full and complete account of the practical methods employed in the study of malaria and kindred protozoan diseases of man and animals. The book being intended primarily for the use of medical men in the tropics, who may be far from any laboratory, abounds in practical hints and suggestions which will enable good work to be accomplished with a minimum of apparatus, &c.

The methods of making and staining blood-films are given very fully, and the appearances of normal blood and of the various malaria parasites carefully described. In connection with malaria, the methods of catching, breeding, keeping, and feeding mosquitoes for purposes of malaria study receive considerable attention, and the life-history of the mosquito and the characters of a number of the more important species have no less than 200 pages devoted to them. Chapters then follow on the clinical and epidemiological study of malaria, and finally the hæmamœbidæ, trypanosomes, spirochætes, and filariæ are considered. This entails descriptions of the anatomy and classification of the chief species of ticks, fleas, tsetse and other biting flies, and a mass of detail is thus brought together in a form required by the investigator for which he otherwise would have to search in many scattered papers and works of natural history. In this respect the book will be of great value in laboratories of medical protozoology and the like. There are few points to which exception can be taken, for the book is the outcome of the authors' own experience on the subjects of which they write. It may be doubted, however, if methylated spirit can take the place of methyl alcohol for making up the Leishman blood-stain, and the authors' view that blackwater fever is malaria plus hæmoglobinuria excited by chill, quinine, or other simple cause is open to question.

The book can be recommended as a most valuable guide, and the numerous illustrations, diagrammatic though many of them are, enhance its usefulness.

R. T. HEWLETT.

Pictures from Nature. By Richard and Cherry Kearton. Portfolio of fifteen Rembrandt photogravures. Size 15in. × 11in. (London: Cassell and Co., Ltd.) Price 10*s.* 6*d.* net.

THE remarkable photographs taken by the Brothers Kearton of animal life in many aspects have often been described in these columns in terms of the highest praise. The fifteen pictures of birds and other animals, among their natural surroundings, reproduced for the present portfolio, represent the high-water mark of faithful portraiture in natural history.

The plates include the following subjects:—Black throated diver, kittiwakes at home, leverets in their form, kingfisher waiting for its prey, squirrel, puffins

at home, young willow wrens, ring dove or wood pigeon, young cuckoo and sedge warblers, hedgehog, young long-eared owls, gannet or solan goose, peewit or lapwing, sparrowhawk adding sticks to her nest, and the great tit or oxeye.

These handsome pictures provide the best possible tribute to the patient power of silent watching which the Brothers Kearton have developed during the last thirteen years in order to take advantage of opportunities of photographing animals in their natural surroundings.

Meteorologie und Klimatologie. By Prof. Dr. Wilhelm Trabert. Pp. 127; with 37 figures in the text. (Leipzig: Deuticke, 1905.) Price 5 marks.

In this little book, which forms part xiii. of Prof. Klar's "Die Erdkunde," the author attempts to outline the general principles of meteorology and their application to the study of climate in a single work. The meteorological elements, and the making and reducing of observations are first dealt with; next comes a section on atmospheric physics, the distribution of temperature and its variations, the circulation of the atmosphere, evaporation and condensation; and, finally, a section on weather and climate, which includes chapters on weather forecasting, the chief types of climate, and the climatic characteristics of the main land divisions of the globe.

Where so much is attempted in so small compass, there is, of course, constant risk of the treatment of parts of the subject becoming hopelessly inadequate, but Prof. Trabert has succeeded in avoiding this; the essential points are selected with extraordinary skill and presented with great clearness and conciseness. The omission of details of construction of instruments in part i. is especially satisfactory—most books on meteorology are overburdened with matter which is only wanted by practical observers—although in some cases more modern types of instrument might have been selected for illustration. The most successful section of the book is, in our opinion, that on atmospheric physics, in which the vertical distribution of temperature and the forms of isobaric surfaces are given the prominence they deserve, but do not always get.

Prof. Trabert's book is an excellent introduction to such classics as Hann's "Lehrbuch" and "Klimatologie," on which it is to a certain extent modelled, and we strongly commend it to elementary students and teachers.

A Popular Introduction to Astronomy. By the Rev. Alex. C. Henderson. Pp. 114. (Lerwick: T. and J. Manson, 1905.) Price 2*s.* 6*d.* net.

In this book there are three chapters, occupying sixty-three pages, and a series of thirteen "notes" which take up the remainder of the text. In chapter i. we find a very general, yet simple and instructive, description of the solar system, its probable origin, and the nature, appearance, dimensions, and distances of its various individual components. The explanations given are brief, but they are lucid, and the verbal illustrations are homely enough to appeal to the simplest minds. Chapter ii. deals with the apparent and real motions of the heavenly bodies, and here again the beginner should find no difficulty in grasping the fundamental ideas. Comets are discussed in chapter iii., which really consists of a description of Biela's famous comet and of the meteoritic genesis of these bodies.

The thirteen "notes" comprise a *mélange* apparently consisting of extracts and examples taken from the author's note-book, and it is rather difficult to see to what class of reader they will appeal. Portions of them are certainly too erudite to suit real beginners, whilst they are not of the form to appeal to more advanced students. For example, the observing of the sunrise, combined with the consultation of a year book, would hardly answer to the description of an "accurate method" of determining time. Double stars, climatic variations, auroræ, eclipses, the lunar phases, and the zodiac are amongst other things dealt with in this section of the book. W. E. R.

Fragmenta Phytographiae Australiae occidentalis. By L. Diels and E. Pritzel. Pp. 608. (Leipzig: W. Engelmann, 1905.)

Although the floras of the different Australian colonies present a certain homogeneity that unites them into a definite "Flora Australiensis," there is also a considerable diversity between the floras of the eastern and western sides of the continent; that of the western half is distinguished by its richness, the singular modifications due to physical conditions and the large proportion of endemic species. Exclusive of the northern tropical region, the vascular plants of Western Australia, according to the evidence of the Government botanist, Mr. A. Morrison, do not fall far short of 4000 species, and most of these are found in the south-west. The writers of this volume travelled through this portion of the colony, and also penetrated into the interior from Geraldton to Cue, and as far as Ranowna and Menzies in the Coolgardie district. Phytogeographical limits are determined mainly by the rainfall, which reaches a maximum of 39 inches in the neighbourhood of Cape Leeuwin and diminishes rapidly to 9 inches at Shark Bay in the North and Southern Cross inland; the botanical provinces outlined in this volume have been mapped out in accordance with the rainfall.

The book is primarily a systematic compilation of the authors' collections, and although there are interesting notes on morphology and habit, the principal feature is the intimate knowledge which the authors display of the distribution of the various species. A revised arrangement of the Verbenaceæ is given, with analytical keys and numerous illustrations. Additions have been made to most of the typical genera, to mention only Acacia, Drosera, Hibbertia, and several of the Myrtaceæ. Taken in conjunction with Bentham's "Flora Australiensis," Baron von Mueller's "Fragmenta," and Spencer le Moore's notes, these "Fragmenta" provide the necessary data for a fairly complete flora of the colony. Dr. Diels proposes to write a continuous phytogeographical account later, wherein it may be expected that he will summarise the extraordinary modifications of the desert and other plants that are no less unique than those of the Egyptian desert flora which Volkens has so vividly portrayed.

Sporting Sketches. By E. Sandys. Pp. vii+389; illustrated. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1905.) Price 7*s.* 6*d.* net.

Mr. Edwyn Sandys is so well known to bird-lovers and sportsmen in general by such works as "Upland Game Birds" that any volume of a somewhat similar nature is almost sure of a hearty reception on the part of that section of the public to which it more specially appeals. In the volume before us the author has collected together a number of articles on sporting subjects which originally appeared in that excellent American sporting magazine *Outing*, and to these he has apparently added others which now see the light for the first time. Whether, however, new or old—and the author seemingly gives us no clue on this point—the articles have such a freshness about

them, and savour so strongly of the prairie or the river bank, that the lover of an outdoor life must be hard indeed to please if he cannot find matter of interest on almost any page to which he may happen to turn. The chapter-headings in some instances appear to be designed, at least to an English reader, to conceal rather than to elucidate the author's subjects, and we venture to think that some less recondite titles than "The Witchery of Wa-Wa" and "A Matter of Mascalouge" might have been selected without detriment to the picturesque style which the author apparently favours. But when once this little difficulty has been overcome, the reader will be able to find his way about the book, and select those sections in which he may be more specially interested.

The greater part of the book is devoted to fishing—both in sea and river—and feathered game shooting, and the English reader who desires to know the kind of sport afforded by ruffed grouse and "bob white" will find his requirements fully satisfied in the author's pages. Nor will the naturalist fail to find matter well worth his notice; and personally we have been specially interested in the account of the death-feigning instincts exhibited by the Carolina rail. Seemingly, when it thinks itself unable to escape, one of these birds suddenly "stiffens, topples over, and apparently expires. It may be taken up and examined for a considerable time without its betraying any signs of life. Place it among its dead fellows in the shooting-boat, and after a longer or shorter interval it may astonish its captor by either starting to run about, or by taking wing and fluttering away in the characteristic flight."

This is only one of many instances where strange habits of animals are recorded, and if not new they are always interesting and worth the re-telling. As a sample of the better class of sporting literature Mr. Sandys's work would be difficult to beat. R. L.

Ships and Shipping. By Commander R. Dowling. With a preface by Lieut. W. G. Ramsay Fairfax, R.N. Second Edition. Pp. xv+423. (London: A. Moring, Ltd., 1905.) Price 5s. net.

A VERY excellent little volume and a most handy addition to any shipping office. The naval information makes it also a very useful book to naval officers. One slight improvement would be useful—port-to-port distances round the coast of Great Britain and Europe; for example, London to Plymouth.

H. C. LOCKYER.

LETTERS TO THE EDITOR.

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

The late Sir John Burdon-Sanderson.

THE account of the life of Sir John Burdon-Sanderson in NATURE of December 7 is so admirable that any addition to it may seem superfluous. Yet, as one who knew Burdon-Sanderson for more than thirty-seven years, and who owed more to him than language can well express, I shall be grateful if you will allow me to say a few words more about him. It seems to me that in one respect men may be likened to mountains. The Matterhorn rises sharply to a single peak, and there can be no doubt as to its summit. Monte Rosa has more than one summit, so nearly on a level that a stranger would be unable to say which is highest, and although each is higher than the Matterhorn, the enormous bulk of the mountain takes away from their apparent height and makes them less imposing. In the same way it is easy to say what the great work has been of any man who has distinguished himself in a limited subject, but when a man's work ranges over a wide sphere it is not so easy. The account of Sir John Burdon-Sanderson's life in last week's NATURE clearly shows the wide extent of his activity and the great number of epoch-making discoveries which he made. If a scientific man were asked which of these is the greatest, he would probably answer according to his own personal bias. One man would name his unique researches on motion in plants; another his discovery of the possibility of attenuating anthrax virus and thus producing immunity from the disease; a third his researches on circulation and respiration; and a fourth his work on muscle and nerve. But all these things, important as they are, each one being sufficient to make a man famous in a special department, were only isolated outgrowths of his great work, and did not constitute it. I believe that I am right in saying that Burdon-Sanderson's life-work may be defined in three short sentences:—(1) He revolutionised physiology and pathology in this country; (2) he found them consisting of book-learning and microscopic observation; (3) he left them experimental sciences.

When he first constructed a kymographion in 1867 by the aid of a tin-plate worker near the Middlesex Hospital, to which he was then attached, there was not, with the exception of a few specimens of Marey's sphygmograph, a single recording physiological instrument in use in the whole of this country. Now they are to be found in every physiological laboratory, and every student knows how to use them. When he began to work at pathology, it consisted chiefly in descriptions of the naked-eye and microscopical appearances of specimens of morbid anatomy. Now the action of disease-germs and of toxins and the reaction of the organism to them, the processes of disease and not its results, engage the chief attention of pathologists, and the knowledge which experiments on these processes have afforded regarding the means of producing immunity and of curing by antitoxic sera has lessened, and is daily lessening, the wholesale destruction of life by epidemic diseases.

How Burdon-Sanderson accomplished his great work by his researches, by his writings, by his example, and by his personal influence was well described in last week's NATURE, but I may perhaps be permitted to mention my own case as an example of what Burdon-Sanderson did for young men. I came to London knowing only one man, who from age and infirmity was unable to help me; but fortunately for me I had a letter of introduction to Burdon-Sanderson. Instead of merely saying a few civil things and then leaving me alone, as he might well have done, he invited me to his house, advised me as to my career, obtained for me a lectureship in the Middlesex Hospital, to which he was then attached, gave me the free use of his laboratory, afforded me facilities for both experimental and literary work, and, in short, laid for me the foundation of any success I may since have had, so that it is mainly to him that I owe it. How many there are whom he has treated as he did me I do not know, for he did not let his left hand know the good his right hand was doing, but I do know that at least two others, Dr. Ferrier, who has done such splendid work in physiology, and Dr. Klein, who has done the same in pathology, owe, like me, their first establishment in London to Burdon-Sanderson. Such personal help as this in enabling young men to pursue a scientific career must not only be regarded as an evidence of the kindness and benevolence of his character, but must be reckoned along with his researches, his writings, his example, and his personal influence as a means whereby he accomplished his great work of revolutionising physiology and pathology in this country.

LAUDER BRUNTON.

Nomenclature of Kinship; its Extension.

THE method I adopted in your columns, August 11, 1904, of briefly expressing kinship has proved most convenient; it has been used in a forthcoming volume by Mr. E. Schuster and myself on "Noteworthy Families." I write now to show that it admits of being *particularised* by the use of foot-figures, as in the following example, which

refers to the more highly placed relatives of the newly elected King of Norway.

Haakon VII., King of Norway (*b.* 1872).

fa_{1s}	Frederick, Crown Prince of Denmark (*b.* 1843).
fa_{1s} *fa*	Christian IX., King of Denmark.
fa_{1s} bro_2	George I., King of the Hellenes (*b.* 1845).
fa_{1s} si_2	Dagmar, widow of Alexander III., Tsar of Russia, who *d.* 1894.
fa_{1s} si_2 son_1	Nicholas II., Tsar of Russia (*b.* 1868).
fa_{1s} si_1	Alexandra, Queen of England (*b.* 1844).
fa_{1s} si_1 son_1	George, Prince of Wales (*b.* 1865).
fa_{1s} si_1 da_3	also *wife*, Princess Maud (*b.* 1869) of England.

The formulæ are to be read thus:—"his (the K. of Norway's) father is the 1st (eldest) son, and is Frederick, C.P. of Denmark; "his (the K. of Norway's) father's father is Christian IX."; . . . "his father's 2nd sister's 1st son is Nicholas II."; . . . "his father's 1st sister's 3rd daughter, who is also his (the K. of Norway's) wife, is the Princess Maud." These foot-figures need not interfere with the simplicity of the general effect, while they enable a great deal of additional information to be included.

FRANCIS GALTON.

Atomic Disintegration and the Distribution of the Elements.

MR. DONALD MURRAY'S letter (p. 125) deals with a subject which I have been attempting, now for more than a year, to attack experimentally. A similar experience to that which Mr. Murray describes as the experience of a lifetime occurred to me eighteen months ago in a visit to the gold mines of Western Australia. Since then my thoughts have been less concerned with the radio-elements than with those like gold, platinum, thallium, indium, &c., which resemble radium in the minuteness and approximate constancy of the proportion in which they occur in nature.

It is wonderful to reflect that mankind for thousands of years has been passionately and determinedly engaged in the search for gold, not on account mainly of its useful qualities, but on account of its comparative scarcity. The history of gold-getting presents a strange uniformity. The search has been rewarded always with about the same qualified measure of success, never with such success that the value of gold has seriously depreciated. The common saying that about the same amount of gold has to be put into the earth in order to dig it out holds an economic and probably a scientific truth. For may we not consider that the history of these centuries of search, carried on with a tenacity of purpose and a continuity approached in the case of no other element, shows clearly that a natural law is here involved no less than in the case of radium or polonium? The history of gold-getting appears to be substantially the same in all countries in all times. We have the initial prospecting in which the chances and difficulties are so great that only the most adventurous attempt it; the discovery of surface gold and the rush from all parts of the earth; the phenomenal finds and the invariably much greater proportion of failure; the tracing of the gold to its source and the discovery of some cubic acres, or it may be miles, of gold-bearing earth. Then at first only the deposits averaging several ounces to the ton are thought worthy of attention; but these rapidly give out, and attention is directed to the poorer and still poorer veins, while at the same time the steady progress and evolution of the pioneer camp, where often gold seems to be commoner than water, into the civilised community served with railways, electric power, and often elaborate water supply, cheapens the cost of extraction to such an extent that deposits averaging only a few grains to the ton can be made to yield a profit. Finally, we have the same inevitable end when science and organisation have done all in their power, and the remaining ore contains just so much gold as *not* to pay.

Let the case be stated a little differently. What would be the effect of the sudden discovery in any one place of some really large quantity of gold? There seems no doubt that utter chaos would ensue in the commercial world, which might involve before it was got under control a rearrangement of the map of the world. Since nothing of the sort has ever happened, in spite of the most unprecedented struggles to that end, it is in accord with the principles of natural evolution to conclude that such a contingency probably violates some law of nature. Thus the gentlemen in charge of the national exchequer and of the Bank of England, who on a casual examination appear to be placing the most blind and implicit confidence on the future continuance of the existing order of things, are in reality secure in a fundamental if previously unrecognised law of nature. Eighteen months ago, after my visit to the gold deposits of Western Australia and New Zealand, and by the information which all concerned in the industry so readily placed at my disposal, I became convinced that in all probability gold, like radium, is at once the product of some other parent element, and is itself changing to produce "offspring" elements, so that its quantity, and hence its value, was fixed simply as the ratio of these two rates of change.

My experiments with gold have been both by the direct and indirect methods. The former have been dogged by misfortune and have so far been without result, while in the indirect experiments on ancient gold the results until now have been conflicting. Certainly some nuggets did not contain helium in appreciable quantities, while in others I did find a minute quantity of helium. This, however, was before the elaborate precautions afterwards employed had been adopted, and as I can now repeat the experiments with certainty as soon as occasion permits I am keeping a quite open mind. On the other hand, I have established to my own satisfaction that helium is an invariable constituent of native platinum in all the samples I have tried. The above reasoning, from rarity, after extended search, applies to platinum to a degree only less complete than in the case of gold.

The experiments with the other elements have not yet been proceeding long enough to have furnished results, but I have made a great many experiments with uranium and thorium in the attempt to detect directly the production of helium from these elements. These elements have been, in fact, the standards, for their rate of change is accurately known, and, assuming with Rutherford that the α particle is an atom of helium, may be expected to yield helium at a known rate. The methods of search have been perfected in the case of these two elements, and I am glad to be able to say that it is now only a question of time and patience before the rate at which helium is being produced from these two elements is accurately measured. On the other hand, if helium is not being produced, the experiments will indicate a maximum possible limit of the rate of production (set by the smallest quantity of helium detectable) far below the rate to be expected from theory. This method, which is, of course, applicable to any other element, would detect any other gas of the argon-helium family if produced. So far, however, I have only had one completely successful experiment with each element. In the case of uranium the result was positive, and indicated a rate of production of the same order as that required by theory. In the case of thorium, the experiment was of the nature of a blank test, and it proved that the rate of production is certainly not greater than ten times that required by theory.

Mr. Murray's letter induces me to put on record these imperfect results, and I do this the more readily as they may perhaps serve to emphasise and support his suggestion that experiments along the lines and on the scale he suggests should be carried out. But what laboratory in England could deal with ten tons of lead over a term of ten years?

After a year's work, I confess I am less hopeful than I was of the ability of the individual worker to carry out direct experiments in this subject of atomic disintegration. I wonder if the individual with his humble kilogram and his single lifetime is not starting on an almost forlorn hope, and is unduly and unnecessarily handicapped. Due consideration should be given to the supreme consequences that must follow from successful discoveries in this field. Not only is there to be considered the effect such results must exert on the whole trend of philosophic thought, but certain definite economic problems would be solved. For example, the proof of the disintegration of gold would reduce the doctrine of bimetallism and the theory of

currency to a branch of physical science, while in the mining industry the results would possess a fundamental significance. For the first time in the history of mineralogical chemistry it is possible, thanks to the researches of Boltwood, Strutt, and McCoy, to predict with considerable certainty the percentage of one element (radium) present if the percentage of another (uranium) is known; and one asks to what this discovery may not grow.

It seems to me that the individual and his single lifetime is too small a stake for the prize in view. Such a work should be national, and carried on from century to century if necessary; and what nation has such a right or such a duty as the one in which the subject of atomic disintegration originated? I confess to a feeling of impatience, to the sense of the inadequacy of the single lifetime, in my experiments on such small quantities of gold as I can purchase, when, disintegrating at the same rate, if disintegrating at all, tons of gold are lying useless in the national bank, their secret—possibly one that it much concerns the race to know—guarded from knowledge by every cunning invention that the art of man may devise. I confess to a sense of indignation that I should have to purchase for my experiments coins and other objects of known antiquity when within the walls of the National Museum lie—mere dead relics as they at present are—one of the finest collections in existence, capable of affording evidence perhaps of a longer history than any dreamed of by the antiquarian, and guarded by those who cannot interpret the cypher, and who, officially at least, are unaware of its existence. I confess to a feeling of misgiving in starting experiments where, on the scale possible to the individual, the chances are all against their yielding a positive result in a lifetime. Surely considerations of this character, the availability of the national resources and antiquities for the purpose of scientific investigations under due safeguards, and the provision for and care of experiments of long period with great quantities demanded by this new subject, are worthy of the attention of the nation, and of the British Science Guild as its newly formed adviser. FREDERICK SODDY.

The University, Glasgow, December 9.

THE suggestion which Mr. Murray has put forward (p. 125) in explanation of the constancy of association of lead and silver has occurred to me also, and is indicated in an article which will probably appear shortly in the "Jahrbuch der Radioactivitat und Elektronik"; some calculations are contained therein which may be of sufficient interest to justify reproduction here.

Some recent experiments [1] have afforded evidence that the activity of the ordinary metals is caused by the emission of α particles. On the assumption that these α particles have an ionising power similar to that of those from radioactive elements, it appears that lead should emit less than one such particle per second. In order to find the maximum rate of change that we can attribute to this metal, we will assume that the emission of one such particle involves the breaking up of one atom of lead and the formation of one atom of silver; thus one atom breaks up per second. Now a gram of lead contains about 4×10^{21} atoms, and therefore to transform one ten-millionth part of the lead would require 4×10^{14} seconds or more than ten million years. Since it would be impossible to detect a smaller proportion than this by chemical tests, I fear that the experiment which Mr. Murray suggests is impracticable. The earth would probably have ceased to be a habitable globe by the time that the lead was ripe for examination; perhaps we may trust posterity to settle the matter with greater expedition!

But the slowness of the change in lead presents serious difficulties to the theory that the silver in galena is a disintegration product. Even so small a proportion as one in ten thousand ($3\frac{1}{2}$ ounces to the ton) would mean that the silver had been accumulating for a thousand million years—a period longer than that usually assigned as the age of the earth. But until we know more of the processes by which deposits of ore were formed, it is impossible to say whether the lead could have retained its silver through all the vicissitudes of its career. I believe that the silver cannot be separated from galena by any physical means; it may be so intimately associated that geological processes cannot affect it; but against this we have to set the fact that cerussite often contains much less silver than the galena from which it is obviously derived. But here chemical separation may have taken place involving the passage of the metals into solution.

There are problems connected with the "traces of impurity" constantly associated with certain minerals which await solution by some laborious chemist; it would be interesting to see whether there is any tendency to proportionality like that which holds between uranium and radium. But the absence of such a relation might be explained on the grounds that radio-active equilibrium had not yet been attained.

There is one other point to which attention may be directed. Rutherford has shown that the loss of heat from the earth by conduction would be compensated by the energy evolved by radium distributed throughout the mass of the earth in the ratio of 1 to 2×10^{13}; it appears that this amount of energy might be supplied by the disintegration of the actual constituents of the earth even if no radium were present. It is becoming clear that the older estimates of the age of the earth, based on physical data, are wholly erroneous; but if the radio-activity of all elements can be established rigidly, and the time constants of their decay measured with sufficient accuracy, it may be possible to use the evidence to which Mr. Murray has directed attention to gain some information as to the period that has elapsed since the solidification of the earth's crust. NORMAN R. CAMPBELL.

Trinity College, Cambridge, December 10.

IN NATURE, December 7, p. 125, Mr. Donald Murray suggests that the constant association of different elements arises from the slow transmutation of one into the other. The idea is certainly a reasonable one, and I presume has long been in the minds of all who have followed recent work. The writer discussed this question last year (*Chem. News*, 1904, lxxxix., 47, 58, 118), and arrived at Mr. Murray's opinion.

Now interest in the matter is reviving, perhaps I may be allowed to direct attention to this discussion.

Kiel, December 10. GEOFFREY MARTIN.

Action of Wood on a Photographic Plate.

I HAVE recently seen some photographic plates used at the last eclipse which have on them, not only pictures of the sun, but also pictures of the wood forming the dark-slides in which they had been placed.

At a former eclipse I understand a similar disaster occurred. It may, therefore, be well for me again to state that wood in contact with, or in near proximity to, a photographic plate, even in the dark, can impress upon the plate a clear picture of itself.[1] This action is much stimulated by high temperature and brilliant sunshine. It can, however, be stopped in several ways; probably the simplest one would be to make the slides of copper in place of wood. WILLIAM J. RUSSELL.

Davy-Faraday Laboratory.

Magnetic Storms and Auroræ.

THE interesting paper by Dr. Chas. Chree in your issue of November 30 (p. 101) is inaccurate in one particular. He states that the storm of November 12 was not accompanied by auroræ. My friend Mr. John McHarg, of Lisburn, writes me that "it was fairly prominent, to be seen easily above the moonlight, the usual type, a steady glow brighter than the Milky Way, extending half round the horizon and fading off upwards at an altitude of 20°, or 30° in the west."

From that station auroræ were also observed on November 14, 15, 16, 17, 20, 21, 22, 23, 26, 27, and 30, and it is reported also that a bright crimson arch was seen on the early morning of December 1.

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[1] The accounts of these should be included in an early number of the *Philosophical Magazine*.

[1] *Phil. Trans.*, vol. cxcvii. p. 281; *Proc. Roy. Soc.*, vol. lxxiv. p. 131.

NOTES ON STONEHENGE.[1]

IX.—FOLKLORE AND TRADITIONS.

SO far in these notes I have dealt chiefly with stones, as I hold, associated with, or themselves composing, sanctuaries. We have become acquainted with circles, menhirs, dolmens, altars, viæ sacræ, various structures built up of stones. Barrows and earthen banks generally came afterwards.

The view which I have been led to bring forward so far is that these structures had in one way or another to do with the worship of the sun and stars; that they had for the most part an astronomical use in connection with religious ceremonials.

The next question which concerns us in an attempt to get at the bottom of the matter is to see whether there are any concomitant phenomena, and, if there be any, to classify them and study the combined results.

Tradition and folklore, which give dim references to the ancient uses of the stones, show in most unmistakable fashion that the stones were not alone; associated with them almost universally were many practices such as the lighting of single or double fires in the neighbourhood of the stones, passing through them and dancing round them; there were also other practices involving sacred trees and sacred wells or streams.

Folklore and tradition not only thus may help us, but I think they will be helped by such a general survey, brief though it must be. So far as my reading has gone each special tradition has been considered by itself; there has been no general inquiry having for its object the study of the possible origin and *connection* of many of the ancient practices and ideas which have so dimly come down to us in many cases and which we can only completely reconstruct by piecing together the information from various sources.

I now propose to refer to all these matters with the view of seeing whether there be any relation between practices apparently disconnected in so many cases if we follow the literature in which they are chronicled. We must not blame the literature since the facts which remain to be recorded now here, now there, are but a small fraction of those that have been forgotten. Fortunately, the facts forgotten in one locality have been remembered in another, so that it is possible the picture can be restored more completely than one might have thought at first.

It will be noted at once that from the point of view with which we are at present concerned, one of the chief relations we must look for is that of time, seeing that my chief affirmation with regard to the stone monuments is that they were used for ceremonial purposes at certain seasons, those seasons being based first upon the agricultural, and later upon the astronomical divisions of the year.

But in a matter of this kind it will not do to depend upon isolated cases; the general trend of all the facts available along several lines of inquiry must be found and studied, first separately and then *inter se*, if any final conclusion is to be reached.

This is what I now propose to do in a very summary manner. It is not my task to arrange the facts of folklore and tradition, but simply to cull from the available sources precise statements which bear upon the questions before us. These statements, I think, may be accepted as trustworthy, and all the more so as many of the various recorders have had no idea either of the existence of a May year at all or of the connection between the different classes of the phenomena which ought to exist if my theory of their common origin in connection with ancient worship and the monuments is anywhere near the truth.

This question of time relations is surrounded by difficulties.

I give in Fig. 23 the Gregorian dates of the beginning of the quarters of the May year, if nothing but the sun's declination of 16° 20′ N. or S., four times in its yearly path, be considered. These were:—

	May Year	Greek Calendar	Roman Calendar
End of Winter ... ... } Beginning of Spring ... }	Feb. 4	Feb. 7	Feb. 7
,, Summer ...	May 6	May 6	May 9
End of Summer ... ... } Beginning of Autumn ... }	Aug. 8	Aug. 11	Aug. 8
,, Winter ...	Nov. 8	Nov. 10	Nov. 9

In the table I also give, for comparison, the dates in the Greek and Roman calendars (p. 20).

There is no question that on or about the above days festivals were anciently celebrated in these islands, possibly not all at all holy places, but some at one and some at another; this, perhaps, may help to explain the variation in the local traditions and even some of the groupings of orientations.

The earliest information on this point comes from Ireland.

Cormac, Archbishop of Cashel in the tenth century, states, according to Vallancey, that "in his time four

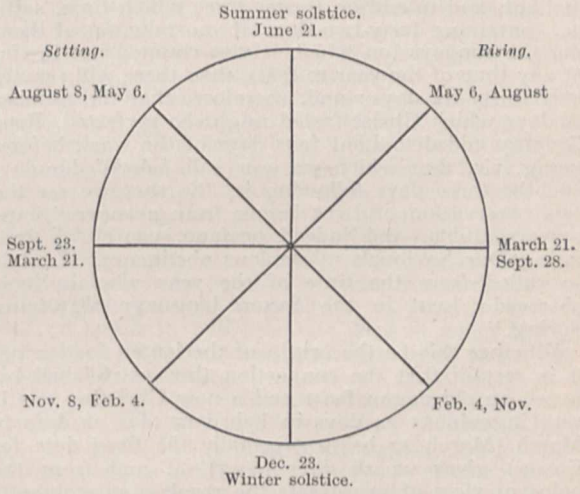

FIG. 23.—The farmers' and astronomical years.

great fires were lighted up on the four great festivals of the Druids, viz., in February, May, August, and November."[1]

I am not aware of any such general statement as early as this in relation to the four festivals of the May year in any part of Britain, but in spite of its absence the fact is undoubted that festivals were held, and many various forms of celebration used, during those months.

From the introduction of Christianity attempts of different kinds were made to destroy this ancient time system and to abolish the so-called "pagan" worships and practices connected with it. Efforts were made to change the date and so obliterate gradually the old traditions; another way, and this turned out to be the more efficacious, was to change the venue of the festival, so to speak, in favour of some Christian celebration or saint's day. The old festivals took no

[1] Continued from vol. lxxii. p. 272.

[1] Hazlitt, "Dictionary of Faiths and Folklore," under Gule of August.

account of week-days, so it was ruled that the festivals were to take place on the first day of the week; later on some of them were ruled to begin on the first day of the month.

When Easter became a movable feast, the efforts of the priests were greatly facilitated, and indeed it would seem as if this result of such a change was not absent from the minds of those who favoured it.

The change of style was, as I have before stated, a fruitful source of confusion, and this was still further complicated by another difficulty. Piers[1] tells us that consequent upon the change "the Roman Catholics light their fires by the new style, as the correction originated from a pope; and for that very same reason the Protestants adhere to the old."

I will refer to each of the festivals and their changes of date.

February 4.

Before the movable Easter the February festival had been transformed into Ash Wednesday (February 4). The eve of the festival was Shrove Tuesday, and it is quite possible that the ashes used by the priests on Wednesday were connected with the bonfires of the previous night.

It would seem that initially the festival, with its accompanying bonfire, was transferred to the first Sunday in Lent, February 8.

I quote the following from Hazlitt[2]:—

"Durandus, in his 'Rationale,' tells us, Lent was counted to begin on that which is now the first Sunday in Lent, and to end on Easter Eve; which time, saith he, containing forty-two days, if you take out of them the six Sundays (on which it was counted not lawful at any time of the year to fast), then there will remain only thirty-six days: and, therefore, that the number of days which Christ fasted might be perfected, Pope Gregory added to Lent four days of the week beforegoing, viz. that which we now call Ash Wednesday, and the three days following it. So that we see the first observation of Lent began from a superstitious, unwarrantable, and indeed profane, conceit of imitating Our Saviour's miraculous abstinence. Lent is so called from the time of the year wherein it is observed: Lent in the Saxon language signifying Spring."

Whether this be the origin of the lenten fast or not it is certain that the connection thus established between an old pagan feast and a new Christian one is very ingenious: 24 days in February plus 22 days in March (March 22 being originally the fixed date for Easter) gives us 46 days $(6\times7)+4$, and from the point of view of priestcraft the result was eminently satisfactory, for thousands of people still light fires on Shrove Tuesday or on the first Sunday of Lent, whether those days occur in February or March. They are under the impression that they are doing homage to a church festival, and the pagan origin is entirely forgotten not only by them but even by those who chronicle the practices as "Lent customs."[3]

Finally, after the introduction of the movable Easter, the priests at Rome, instead of using the "pagan" ashes produced on the eve of the first Sunday in Lent or Ash Wednesday in each year, utilised those derived from the burning of the palms used on Palm Sunday of the year before.

Further steps were taken to conceal from future generations the origin of the "pagan" custom due on February 4. February 3 was dedicated to St. "Blaze." How well this answered is shown by the following quotation from Percy.[4] "The anniversary of St. Blazeus is the 3rd February, when it is still the custom in many parts of England to light up fires on the hills on St. Blayse night: *a custom antiently taken up perhaps for no better reason than the jingling resemblance of his name to the word Blaze.*"

This even did not suffice. A great candle church festival was established on February 2. This was called "Candlemas," and Candlemas is still the common name of the beginning of the Scotch legal year. In the Cathedral of Durham when Cosens was bishop he "busied himself from two of the clocke in the afternoone till foure, in climbing long ladders to stick up wax candles in the said Cathedral Church; the number of all the candles burnt that evening was 220, besides 16 torches; 60 of those burning tapers and torches standing upon and near the high altar."[1]

There is evidence that the pagan fires at other times of the year were also gradually replaced by candles in the churches.

May 6.

The May festival has been treated by the Church in the same way as the February one. With Easter fixed on March 22, 46 days after Easter brought us to a Thursday (May 7), hence Holy Thursday[2] and Ascension Day. With Easter movable there of course was more confusion. Whit Sunday, the Feast of Pentecost, was only nine days after Holy Thursday, and it occurred, in some years, on the same day of the month as Ascension Day in others. In Scotland the festival now is ascribed to Whit Sunday.

It is possibly in consequence of this that the festival before even the change of style was held on the 1st of the month.

In Cornwall, where the celebrations still survive, the day chosen is May 8.

August 8.

For the migrations of the dates of the "pagan" festival in the beginning of August from the 1st to the 12th, migrations complicated by the old and new style, I refer to Prof. Rhys' Hibbert lectures, p. 418, in which work a full account of the former practices in Ireland and Wales is given.

The old festival in Ireland was associated with Lug, a form of sun-god. The most celebrated one was held at Tailltin. This feast—Lugnassad—was changed into the Church celebration Lammas—from A. S. hláfmaesse—that is loaf-mass, or bread-mass, so named as a mass or feast of thanksgiving for the first fruits of the corn harvest. The old customs in Wales and the Isle of Man included the ascent of hills in the early morning, but so far I have come across no record of fires in connection with this date.

November 8.

The fact that November 11 is quarter day in Scotland, that mayors are elected on or about that date, shows, I think, clearly that we are here dealing with the old "pagan" date.

The fact that the Church anticipated it by the feast of All Souls' on November 1 reminds us of what happened in the case of the February celebration, later I give a reference to the change of date; and perhaps this change was also determined by the natural gravitation to the first of the month as in the case of May, and because it marked at one time the beginning of the Celtic year.

1 "Survey of the South of Ireland," p. 232.
2 Under Ash Wednesday.
3 Frazer, "Golden Bough," ii., 247 *et seq.*
4 "Notes to Northumberland Household Book," 1770, p. 333.

1 Quoted by Hazlitt.
2 Much confusion has arisen with regard to the Holy Thursday in Rogation week because there is another Holy or Maundy Thursday in Easter week. Archæologists have also been often misled by the practice of many writers of describing the May festivals as midsummer festivals. The first of May, of course, marked the *beginning* of summer.

But what seems quite certain is that the feast which should have been held on November 8 on astronomical grounds was first converted by the Church into the feast of St. Martin on November 11. The "Encyclopædia Britannica" tells us

"The feast of St. Martin (Martinmas) took the place of an old pagan festival, and inherited some of its usages (such as the Martinsmännchen, Martinsfeuer, Martinshorn, and the like, in various parts of Germany."

St. Martin lived about A.D. 300. As the number of saints increased, it became impossible to dedicate a feast-day to each. Hence it was found expedient to have an annual aggregate commemoration of such as had not special days for themselves. So a church festival "All Hallows," or "Hallowmass," was instituted about A.D. 610 in memory of the martyrs, and it was to take place on May 1. For some reason or another this was changed in A.D. 834. May was given up, and the date fixed on November 1. This was a commemoration of all the saints, so we get the new name "All Saints' Day."

There can be little doubt that the intention of the Church was to anticipate and therefore gradually to obliterate the pagan festival still held at Martinmas, and it has been successful in many places, in Ireland, for instance; at Samhain,[1] November 1 "the proper time for prophecy and the unveiling of mysteries; . . . it was then that fire was lighted at a place called after Mog Ruith's daughter Tlachtga. From Tlachtga all the hearths in Ireland are said to have been annually supplied, just as the Lemnians had once a year to put their fires out and light them anew from that brought in the sacred ship from Delos. The habit of celebrating *Nos Galan-galaf* in Wales by lighting bonfires on the hills is possibly not yet quite extinct."

Here, then, we find the pagan fires transferred from the 8th to the 1st of November in Ireland, but in the Isle of Man this is not so. I will anticipate another reference to Rhys by stating that Martinmas had progressed from the 11th to the 24th before the change of style had brought it back, "old Martinmas," November 24, being one of the best recognised "old English holidays," "old Candlemas" being another, at the other end of the May year, which had slipped from February 2 to February 15 before it was put back again.

With regard to the Isle of Man Rhys writes[2] that the feast is there called Hollantide, and is kept on November 12, a reckoning which he states "is according to the old style." The question is, are we not dealing here with the Martinmas festival *not* antedated to November 1? He adds, "that is the day when the tenure of land terminates, and when serving men go to their places. In other words it is the beginning of a new year." This is exactly what happens in Scotland, and the day is still called Martinmas.

There is a custom in mid-England which strikingly reminds us of the importance of Martinmas in relation to old tenures, if even the custom does not carry us still farther back. This is the curious and interesting ceremony of collecting the wroth silver, due and payable to his Grace the Duke of Buccleuch and Queensbury, on "Martinmas Eve." The payment is made on an ancient mound on the summit of Knightlow Hill, about five miles out of Coventry, and in the parish of Ryton-on-Dunsmore. One feature about this singular ceremonial is that it must be observed before sun-rising. The money is now paid as a sort of high-way rate for the privilege of using certain roads in the Hundred of Knightlow, and, according to the ancient charter, the penalty is a fine of twenty shillings for every penny not forthcoming, or the forfeiture of a white bull with red nose and ears. There are no defaulters nowadays, and if there were it would certainly be difficult, if not impossible, to find a beast answering the above description, as this breed of cattle has become extinct. When the short ceremony is over, those taking part adjourn to a wayside inn, and there with glasses charged with hot rum and milk they toast the Duke's health.

NORMAN LOCKYER.

[1] Rhys, "Hibbert Lectures," p. 514.
[2] "Celtic Folklore," p. 315.

AN AUSTRALIAN STORY BOOK.[1]

SHOULD any reader of NATURE desire to give a Christmas present to a boy or girl he might do much worse than buy Mrs. Jeanie Gunn's little book, but before parting with it he should himself look through it. The author has a great sense of humour, and seizes on salient features of native life and describes them in a few words; these gifts, combined with a real sympathy with the blackfellow, have enabled her to write a little book that is full of human interest. This is not an ethnographical treatise, and no matters are gone into in detail, yet the reader will learn somewhat of the life of Australian aborigines and of their relations with the white man, and if he should not acquire any deep knowledge he will have nothing to unlearn, and that is something to be thankful for.

A few examples culled at random will give a good idea of this most excellent little book.

"The blacks' sign language is very perfect. They have a sign for every bird, beast, fish, person, place and action. They have long talks without uttering a word. There are many times when a blackfellow must not speak, unless by signs. For instance, if he is mourning for a near relative, or has just come from a very special corrobboree. Often he must keep silent for weeks, and occasionally for months, and it is because of this and many other reasons that the sign language is so perfect. Everyone can speak it, and everyone does so when hiding in the bush from enemies, and then there is no fear of voices being heard."

"It is very wonderful, but then the blacks *are* wonderful. To have any idea of how wonderful they are, you must live among them, going in and out of their camps, and having every one of them for a friend. Just living in a house that happens to be in a blackfellow's country is not living among blacks, although some people think it is."

"I had plenty of Eau de Cologne, and used it freely. One day when Bett-Bett smelt it, as I was sprinkling it over my dress, she screwed up her little black nose, and after half-a-dozen very audible sniffs, said—'My word, Missus! That one goodfellow stink all right!'"

"Anyone can 'sing magic,' even lubras, but of course the wise old magic men do it best. It never fails with them, particularly if they 'sing' and point one of the special Death-bones or Sacred stones of the tribe. Generally a blackfellow goes away quite by himself when he is 'singing magic,' but very occasionally a few men join together, as they did in the case of Goggle Eye. . . . Of course the man who has been 'sung' must be told somehow, or he will not get a fright and die. There are many ways

[1] "The Little Black Princess: A True Tale of Life in the Never-never Land." By Jeanie Gunn. Pp. vii+107; illustrated. (London: The De La More Press, 1905.) Price 5s. net.

of telling him, without letting him know who has 'sung' him; but the man who leaves the bone about must, of course, be very careful to destroy his own tracks. Have you ever heard of faith-healing? Well, dying from bone-pointing is faith-dying! Goggle Eye, after he had found the bones lying about, knew exactly what was going to happen to him—and of course it did."

"You cannot change a blackfellow into a white man, if you try; you only make a bad, cunning, sly old blackfellow. I don't mean you can't make a blackfellow into a better blackfellow. I know that can be done, if he is kept a blackfellow, true to his blackfellow instincts." A. C. H.

FIG. 1.—Tree-burial, south of the Roper River. From "The Little Black Princess."

NOTES.

THE Nobel prizes in science have this year been awarded as follows:—The prize for physics to Prof. P. Lenard, of the University of Kiel, for his investigations on kathode rays; the prize for chemistry to Prof. Adolf von Bäyer, of the University of Munich, for the development in organic chemistry and chemical industry resulting from his works on organic colouring matters and hydro-aromatic compounds; the medical prize to Dr. Robert Koch, for his discoveries in connection with tuberculosis. The prizes, consisting of a sum of about 7700*l.*, an illuminated diploma, and a gold medal with an appropriate inscription, were presented by King Oscar on December 10 at the annual ceremony in commemoration of the founder of the institution.

THE following note appeared in the *Times* of December 7:—Sir William Thiselton-Dyer, whose resignation of the post of director of the Royal Botanic Gardens at Kew is announced, has held that appointment since 1885, and for ten years—1875–1885—before his promotion he was assistant director. His successor, Lieut.-Colonel David Prain, had a distinguished university career at Aberdeen and Edinburgh before he entered the Indian Medical Service in 1884. Three years after his arrival in India he was nominated curator of Calcutta Herbarium; in 1895 he became professor of botany at the Medical College, Calcutta, and superintendent of the Royal Botanic Garden there, and in 1898 he was appointed director of the Botanical Survey of India. He is forty-eight years of age.

THE German Anatomical Society has decided to erect a memorial of its honorary president, the late Prof. Albert von Kölliker. The memorial will be erected in Würzburg, with which the famous teacher and investigator was intimately associated.

PROF. E. RIECKE, professor of experimental physics and applied electricity in the University of Göttingen, and also director of the Physical Institute, celebrated his sixtieth birthday on December 1; whilst Prof. R. Fittig, emeritus professor of chemistry of the University of Strassburg, celebrated his seventieth birthday on December 6.

THE committee appointed to carry the proposal of a memorial to the late Prof. Virchow into execution has now, we learn from the *British Medical Journal*, a sum of 4000*l.* at its disposal. Of this amount, 1800*l.* has been contributed by subscribers and 2200*l.* by the city of Berlin. Three prizes, of the value respectively of 150*l.*, 100*l.*, and 50*l.*, are offered for the best design of a memorial. Drawings must be sent in before April, 1906.

THERE is a movement on foot in German chemical and technical circles to erect a statue in Freiburg, Saxony, to the memory of the late Prof. Dr. Clemens Winkler, who was professor in the Royal Mining Academy at Freiburg, and died in Dresden last year. The proposed memorial is to take the form of a large block of granite decorated with a medallion picture of the deceased investigator and a short account of his life's work.

THE French Académie des Inscriptions et Belles Lettres has elected Dr. Arthur Evans, keeper of the Ashmolean Museum, and Mr. Barclay, head keeper of the department of coins and medals in the British Museum, corresponding members of the academy.

THE thirteenth meeting of the International Congress of Prehistoric Anthropology and Archæology will be held at Monaco, under the patronage of Prince Albert the First, on April 16–21, 1906. Particulars as to the congress may be obtained from the general secretary, Dr. Verneau, 61 Rue de Buffon, Paris.

AT a meeting of the British committee for the Marseilles International Exhibition of Oceanography and Sea

Fisheries held last Friday, a central committee was nominated, consisting of Sir John Murray, K.C.B., the honorary president, Captain D. Wilson-Barker, Mr. W. E. Archer, Dr. H. O. Forbes, Mr. E. W. L. Holt, Dr. H. R. Mill, Dr. P. C. Mitchell, Prof. D'Arcy W. Thompson, C.B., Mr. J. W. Towse, and Dr. G. H. Fowler as honorary secretary.

A CONFERENCE on smoke abatement and an exhibition of smoke-preventive appliances, arranged by the Royal Sanitary Institute and the Coal-Smoke Abatement Society, were opened at the large hall of the Horticultural Society on Tuesday. At the conference parts of an address by Sir Oliver Lodge, who was prevented by illness from being present, were read by Sir William Richmond; and at the conclusion of the reading a paper entitled "Is London Fog Inevitable?" was contributed by Dr. W. N. Shaw.

THE dinner of the Institute of Chemistry was held on Monday at the Hotel Metropole, the president, Mr. David Howard, being in the chair. Responding to the toast of the institute, the president said that they had a very high ideal when they founded the institute; they wished to raise the standard of the chemist to something like the same level as that of the other learned professions. The position of the professional chemist was higher in England than it was anywhere else, and why? Because there was that independence of thought, that individual excellence and individual devotion to duty which was required in a true professional spirit.

THE seventeenth annual dinner of the Institution of Electrical Engineers took place on December 8 at the Hotel Cecil. A distinguished gathering assembled. Short speeches, in proposing and responding to the various toasts, were delivered by Mr. Babington Smith, the president (Mr. John Gavey), Sir Alexander Kennedy, F.R.S., Mr. E. Cunliffe Owen, Mr. Alexander Siemens, Mr. John G. Maydon, Mr. W. M. Mordey, Sir Alexander Binnie, and Dr. Budde, president of the Verband Deutscher Elektrotechniker of Berlin. Dr. Budde remarked that, speaking on behalf of his fellow electricians in Germany, he gratefully acknowledged the thought and the spirit expressed in the invitation to himself to be their representative as guest of the institution. Contact, he said, between the scientific and technical men of all countries cannot be too close. There are matters enough tending to separate nations, and therefore it cannot be too strongly pressed that research and intellectual labour form a tie which will always draw together the best spirits of the world, and must tend to promote international solidarity.

ON Saturday, December 9, a very interesting ceremony took place at the Royal Forest Hotel, Chingford, when a presentation was made to Mr. Wm. Cole, the founder of the Essex Field Club, in honour of the completion of his twenty-five years of service as hon. secretary, editor of the publications, and curator of the two museums founded by the club. At the instigation of the president, Mr. Miller Christy, a "recognition fund" was started a few months ago with Prof. Meldola as chairman, Mr. David Howard as treasurer, Mr. Christy as secretary, and a committee. The invitations issued on behalf of the movement were most cordially responded to, and the fund asked for was exceeded long before the subscription list was closed. At the dinner at Chingford Prof. Meldola presided and made the presentation on behalf of the subscribers, Mr. Cole and his brothers and sisters, all of whom had cooperated with him in carrying out the work of the club during the whole period of its existence, being present as the guests of the evening. The presentation took the form of an illuminated address and a purse. Among those who were present to support the chairman, and who bore testimony to the value of the work of the club and of the services of the hon. secretary and his family, were Mr. Victor Buxton, the High Sheriff of Essex, Mr. Christy and Mr. David Howard, the president and treasurer of the club, Mr. T. V. Holmes and Prof. Boulger, past-presidents, Mr. Gellatly, representing the verderers of Epping Forest, Messrs. W. Whitaker and Horace B. Woodward, hon. members of the club, Mr. W. M. Webb, representing the Selborne Society, and others. A very large number of appreciatory letters had also been sent, and were read from the chair, among the writers being the Countess of Warwick, Lord Rayleigh, Sir John Evans, Mr. E. N. Buxton, Profs. Ray Lankester, Marshall Ward, E. B. Poulton, and J. B. Farmer, Dr. Horace Brown, Mr. F. W. Rudler, Dr. J. C. Thresh, the chairman of the Essex County Council, the chairman of the Epping Forest committee, and all the past-presidents of the club other than those who were present. After the reading and presentation of the address by the chairman, and the handing of the purse by the treasurer, Mr. Cole returned thanks on behalf of himself and family. In the course of his remarks he laid emphasis on the services which the chairman of the evening had specially rendered to the club as their first and eighth president, and who had ever taken the keenest interest in their work. He produced a copy of the original inaugural address delivered by Prof. Meldola in 1880, and pointed out that the general policy of the club had been sketched out therein, and that it, with subsequent addresses, had been to them as models laying down the lines on which the work of their own and of all kindred societies ought to be conducted. In concluding, Mr. Cole also directed attention to several branches of work which he hoped to see the club take up in the future, among these being the establishment of a marine biological station, and the preservation, in connection with the photographic survey, of Essex folklore and dialects by means of phonographic records.

AT a meeting of the Institution of Civil Engineers on December 5, the Hon. Charles A. Parsons, C.B., F.R.S., and Mr. G. G. Stoney, in a paper read before the institution, traced the evolution of the steam-turbine from the time of Hero of Alexandria, following the chief steps in development that have led to the types in present use. After describing and discussing the chief characteristics of the three types of steam-turbine, which practically cover the whole field of useful turbine inventions, viz. the Parsons turbine, introduced in 1884, the De Laval turbine in 1888, and the Curtis turbine in 1902, the development of the Parsons turbine was dealt with. A good vacuum is required for the economical working of steam-turbines, and certain special conditions and arrangements must be observed in order to obtain a vacuum of 27½ inches to 28 inches. An apparatus called a vacuum-augmenter has been designed by the authors, and consists of a steam jet placed in a contracted pipe between the condenser and the air-pump. With this apparatus, a total net reduction of steam-consumption of about 8 per cent. at full load has been obtained. Experience gained from cross-Channel steamers and yachts shows that the propellers of turbine vessels do not race in a heavy seaway, that the vessels maintain their smooth-water speed to a remarkable extent in heavy seaway, and that they start, stop, and manœuvre promptly.

IN a recent issue of *Scientific Investigations* (*Irish Fisheries*), 1904, Prof. G. H. Carpenter describes the

Pycnogonida, or sea-spiders, of the Irish seas, naming two new representatives of the group, each of which is figured.

"VOLITION IN MICRO-ORGANISMS" is the translation of the title of a paper by Mr. R. B. Mesén, published at San José, Costa Rica, apparently as the first part of a serial entitled *Publicaciones Nuevas por Contribucion de Amigos*. While admitting that the activity of such organisms is automatic, and due in the first instance to external stimulants, the author considers that such "automatomism" constitutes the basis of the human will, and that there is a complete gradation from the former to the very highest developments of the latter.

PERHAPS the most generally interesting article in the November number of the *American Naturalist* is one in which Mr. F. B. Loomis attributes the phenomenon in animals commonly known as "over specialisation" to "momentum." As examples of structures coming under the designation of over specialisation, the author cites the tusks of the sabre-toothed tigers, the radiolarian shell, the sutures of ammonites, sponge-spicules, and the horns of wild sheep, wapiti, and elk. A variation started in one particular line tends, in the author's opinion, to develop in that one direction; if the feature be harmful the development dies, otherwise it may continue *ad infinitum*. This theory of momentum, it is added, has not been credited with the importance to which it is entitled. Whether we are very much more forward for this supposed explanation of a very obvious feature in development may perhaps be open to doubt.

FROM the entomological division of the U.S. Department of Agriculture we have received a copy of a catalogue of exhibits of economic entomology at the recent St. Louis Exhibition, forming Bulletin No. 47. The whole exhibit was intended to bring into prominence the general scope of the work of the entomological division. Intimately connected with this is a memoir on the Mexican cotton-boll weevil, by Messrs. Hunter and Hinds, forming Bulletin No. 45 of the entomological division of the U.S. Agricultural Department. This weevil (*Anthonomus grandis*) has the evil distinction of having developed during the last twenty years from an insignificant into a notorious insect. In 1885 it was ascertained for the first time that this weevil attacked cotton in Mexico, and between that date and 1902 it crossed the Rio Grande into Texas, where it has since spread with extraordinary rapidity, and inflicted enormous losses on cotton-growers. After spreading for the first few years very quickly, it was checked for a time by unfavourable seasons, but meeting with suitable conditions in 1898 it soon colonised the greater part of the State. It was hoped that in ten years' time Texas would double its output of more than ten million bales of cotton, but this is now regarded as impossible.

IN the course of an article on western explorations for fossil vertebrates, published in the October number of the *Popular Science Monthly*, Prof. H. F. Osborn states that "it is an extremely slow and difficult matter to prepare a fossil, however carefully collected, for exhibition. It takes two years or more to work out the collections of a single season; the result is that most of our museums are collecting materials more rapidly than they can be worked. . . . With larger endowments or with special gifts these treasures could be more rapidly brought to light." It will not fail to be noticed that public exhibition of these wondrous fossils, when properly mounted, is regarded by American museum officials as a matter of prime importance. Those who pay for these institutions do not like the treasures hidden away for the sole benefit of the student.

A CHARACTERISTIC of modern American museums is formed by the restored models of extinct animals, of which there are scarcely any in the corresponding institutions of this country. A considerable number of such models were used by Prof. Osborn to illustrate his discourse on progress in mammalian palæontology during the last decade in America, delivered before the International Zoological Congress at Berne last year. The report of this lecture, published in the *Comptes rendus* of the congress, contains photographs of these models, one of the most spirited of which is herewith reproduced. In this instance, the restoration has been a comparatively easy task, as the animal belongs to an existing genus, but the workers under the author's direction have not hesitated to attempt to reproduce the external form of the Tertiary titanotheres and uintatheres, and even of the giant reptiles of the Jurassic and Cretaceous. It may be hoped that we shall ere long see some of these excellent restorations in our own museums. The author points out that there are three fossil elephants in America, viz. the mammoth (*Elephas primigenius*) in the far north, *E. columbi* (akin to *E. antiquus*) chiefly in the central States, and *E. imperator* (allied to *E. meridionalis*) in the south. Taken as a whole, Prof. Osborn's record of progress is little short of marvellous, and ought to make European palæontologists jealous, if jealousy could be supposed to exist in matters scientific.

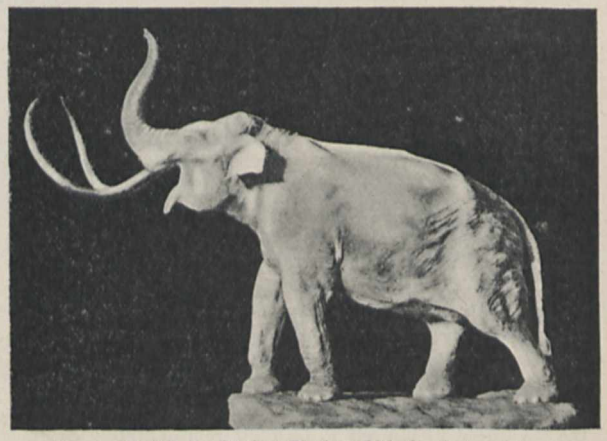

FIG. 1.—Model of an Extinct Elephant (*Elephas imperator*).

THE report by Dr. Ashburton Thompson on the fourth outbreak of plague at Sydney in 1904 adduces further evidence on the part played by rats in the communication of plague to man. During the three last plague epidemics in this city, an epizootic among the rats was always found to precede the epidemic in man.

THE *Bulletin of the Johns Hopkins Hospital* for November (xvi., No. 176) contains the first of the Herter lectures on the contributions of pharmacology to physiology by Prof. Hans Meyer, the second part of the paper by Mr. Martin on the cause of the heart beat, and articles of considerable anatomical and medical interest.

THE October number of *Naturen*, published at the Museum, Bergen, contains an article by Prof. L. Kny on the sensitivity of plants, and a historical summary of the researches on the nature of alcoholic fermentation written by Mr. P. R. Sollied.

THE American gooseberry mildew, *Sphaerotheca mors-uvae*, which was reported from Ireland in 1900, and from Russia in the succeeding year, has also appeared in Sweden. Dr. J. Eriksson, writing in Bulletin No. 87 of the experimental station of the Royal Agricultural College, traces the disease that developed in Karlshamm, in the south of Sweden, to bushes that had been imported from Denmark.

THE monthly journal *Tropical Life* deals chiefly with tropical agriculture and commerce. Reference is made in the November number to two American machines recently brought out, the one a sugar-cane harvester, the other an auto-cottonpicker. The latter machine is provided with two long mechanical arms moving lightly in a universal joint; along each arm runs an endless belt studded with hooks. The arms are tilted to come in contact with the bolls, when the hooks pull away the whole mass, and the cotton passes along the belt to a receptacle. The possibility of utilising banana stems and trash for the manufacture of paper is discussed in view of the large amount of material that is produced in the cultivation of the fruit.

THE cultivation of tomatoes under glass, with special reference to the value of pruning, is discussed in Bulletin No. 105 issued from the Hatch Experimental Station of the Massachusetts Agricultural College. The writer, Mr. G. E. Stone, advocates planting in beds rather than in pots, although the root restriction in pots favours early maturity. Pruning is said to promote early ripening and to produce increased size of fruit. There is some difference of opinion whether it is better to prune to one or three stems, but there is a general consensus in favour of cutting out the leader.

THE report of the chief of the United States Weather Bureau for the fiscal year 1903–4 (pp. xxxix+381) contains, in addition to tables of observations and summaries at some 1650 stations, an interesting account of the very useful operations of that organisation. Weather forecasts for thirty-six and forty-eight hours in advance are issued for each State, besides special warnings of gales, cold waves, floods, &c. To mention one case only of the utility of the storm warnings—a hurricane which advanced from the West Indies destroyed property to the value of 100,000 dollars during its progress over Florida, but, owing to timely notice, comparatively little damage was done to vessels, as they remained in port in consequence of the warnings. Prof. W. L. Moore reiterates the hope that the time will come when it will be possible to forecast the weather for coming seasons, but that time has not yet arrived, and the officials of the Weather Bureau have been instructed to warn the public against imposition by long-range forecasters. A course of lectures on meteorology has been delivered by Prof. Abbe to students frequenting the Bureau, and we understand that this useful practice is now being carried out at our own Meteorological Office. The lectures present the results of work done by some of the ablest meteorologists in various parts of the world, and undoubtedly tend to excite greater interest in the science generally.

IN the *Transactions of the American Mathematical Society* for October Mr. F. R. Sharpe discusses the stability of motion of viscous liquids. It was found by Reynolds in 1895 that for a liquid of density ρ and viscosity μ moving between two planes at distance $2b$ apart, the motion was unstable when $2b\rho U/\mu > 517$, while for a cylindrical pipe of radius a the critical velocity was given by $2ba/\mu = 1034$. Mr. Sharpe now obtains for the first case the constant 167 instead of 517, and for the second 470 instead of 1034.

IN the *Smithsonian Miscellaneous Collections*, vol. xlvii., Prof. E. W. Scripture gives a first report of his studies on the construction of a vowel organ. The first experiments were made with reeds, but it was soon found necessary to replace these by rubber membranes held in various frames, and representing more closely the action of the human glottis. It is now possible to imitate all the vowels and their variations, and the remaining problem is to replace the rubber glottis by something that changes its form of vibration for different vowels and does not alter with time. When this can be done it will be possible to construct either a complete organ or a vowel register such as could be effectively used in church music. A register of one octave would require 124 vowel pipes.

IN a note contributed to the *Journal of the Royal Microscopical Society* (first read before the New York Microscopical Society in April last) Mr. Daniel D. Jackson advances the view that the movements of diatoms are caused by the evolution of gas. This idea was first suggested to the author by noticing the behaviour of a lithia tablet in a glass of water. The bubbles of carbonic acid gas given off set up the exact motions in the tablet that have been so often described for the movements of diatoms —"a sudden advance in a straight line, a little hesitation, then other rectilinear movements, and, after a short pause, a return upon nearly the same path by similar movements." Mr. Jackson next made small models of diatoms of aluminium, 2 mm. thick, having longitudinal grooves resembling those of the diatoms. When placed in caustic soda these models not only reproduced the actual movements of the diatoms, but also gave rise to currents in the matter closely resembling those described by Prof. H. L. Smith as the result of observations made by placing indigo in the water.

WE have received the *Transactions of the English Ceramic Society*, including the papers and discussions for the season 1904–5. It is satisfactory to note that the president, in the course of his address, considered that the scorn for technical instruction affected by pottery manufacturers in the past appeared to be dying out. Allusion was also made to the steps taken by the Joint Committee of Manufacturers of Staffordshire to foster research in pottery by offering prizes for original work bearing on certain subjects. The society appears to be in a prosperous condition, and its efforts are becoming more and more appreciated both at home and abroad. Amongst the various papers we notice an interesting contribution by the pottery instructor, Dr. J. W. Mellor, on crystallisation in pottery.

IN No. 7 of the Bulletin of the Royal Academy of Belgium Prof. W. Spring describes experiments extending his well known work on the colour of natural waters. He comes to the conclusion that the calcium compounds present in natural waters have no colour peculiar to themselves, and hence are not responsible for the green tint of many waters containing them. This is probably due to the diffraction produced by minute solid particles, the presence of which can be demonstrated by an intensely luminous ray of light. Calcium salts really tend to conserve the pure blue colour of water by causing the elimination of ferric salts and humic materials. When a highly calcareous water is of a greenish hue it generally indicates that there is an equilibrium between the influx of brownish water containing humic material and ferric salts, and the purifying action of the calcium salts. In No. 8 of the same Bulletin Prof. Louis Henry discusses in a theoretical paper the properties of water and their relation to the formula H_2O. The physical properties point to a polymerisation of

the molecule, whilst a consideration of the chemical properties leads to the conclusion that the two atoms of hydrogen are functionally different, and that in reality water has a disymmetric formula.

A VERY interesting paper by M. T. Godlewski on certain radio-active properties of uranium is contained in No. 5 of the *Bulletin International* of the Cracow Academy of Sciences. A re-investigation has been made of the anomalous phenomena encountered by Meyer and Schweidler in studying the activity of uranium X. These authors had concluded that the decay curve of uranium X is not complementary to the recovery curve of uranium, but M. Godlewski considers that this only holds when the uranium nitrate containing the UrX is separated from its solution by crystallisation; when it is separated by evaporation to dryness at a temperature sufficiently high to remove the water of crystallisation, an abnormally high rate of decay is not observed. In fractionally crystallising uranium nitrate, uranium X, which is easily soluble in water, accumulates in the mother liquors; several crystallisations will completely deprive uranium nitrate of UrX. The author explains the increase of activity observed in the crystallisation of uranium nitrate as being due to an accumulation of UrX in the upper surfaces of the crystals; this appears to be confirmed by the observation that the activity of a crystal when turned over was found to be only one-third of the activity measured from the upper side. Experiments are brought forward to show that the first rapid decay of activity after crystallisation, which causes an uneven distribution of UrX throughout the plate, is due to the diffusion of UrX from the upper layers of the crystal, where it is more concentrated, to the lower, where the concentration is smaller. The view is held that the uranium X is dissolved in the crystals and the total mass of uranium in the form of a solid solution.

A SECOND and revised edition of the section of the report issued by the Engineering Standards Committee dealing with standard locomotives for Indian Railways has been published by Messrs. Crosby Lockwood and Son at 10*s*. 6*d*. net.

WE have received from Messrs. John J. Griffin and Sons, Ltd., a copy of their "H" list dealing with apparatus for use in the teaching of hydrostatics and pneumatics. The excellence of the illustrations and the lucidity of the brief descriptions make the catalogue a very serviceable one.

A CIRCULAR from the bio-chemical department of the University of Liverpool announces that the first number of a new periodical—the *Bio-Chemical Journal*—will be issued in January. Contributions are invited, dealing with all portions of the subject of bio-chemistry in its widest sense. The journal will be issued monthly, in so far as material is available.

THE University of Chicago Press has published a second edition of Dr. C. J. Chamberlain's "Methods in Plant Histology." The first edition of the book was reviewed in our issue for November 28, 1901 (vol. lxv. p. 75). The new issue contains both alterations and additions; and some of the improvements suggested in the review referred to have been made.

IN noticing the illustrated catalogues of makers of scientific apparatus in this country from time to time, we have directed attention to the excellence of the illustrations accompanying the descriptions of the different instruments. A revised price-list of microscopes and accessories which has been received from the Bausch and Lomb Optical Co., Rochester, N.Y., is another instance of a carefully arranged and admirably illustrated catalogue. The catalogue provides information concerning microscopes made by this firm suitable for general laboratory work, advanced work, bacteriology, photomicrography, and a physician's needs. The necessary accessories are detailed fully, and clear descriptions make their special characteristics easily understood. The sole representatives of the company in this country and the colonies are Messrs. A. E. Staley and Co., 19 Thavies Inn, Holborn Circus, E.C.

OUR ASTRONOMICAL COLUMN.

ANOTHER NEW COMET, 1905*c*.—A telegram from the Kiel Centralstelle announces the discovery of a new comet, by Prof. Giacobini, of the Nice Observatory, on December 6·080.

At 16h. 53·7m. (Nice M.T.) the comet's position was

R.A. = 14h. 21m. 39·4s., dec. = +20° 59′ 29″,

and subsequent observations showed that its daily movement in R.A. amounted to +1° 08′ (=+4m. 32s.) and in dec. to −0° 26′.

From the above it is seen that, when discovered, the comet was about 10m. east and 1° 15′ north of Arcturus, and that it is apparently travelling slowly towards the constellation Serpens.

A second telegram from Kiel announces that the comet was observed at the Lick Observatory on December 8. The position at 17h. 16·5m. (Lick M.T.) was determined as R.A. = 14h. 32m. 58s., dec. = +19° 55′ 36″.

Circular No. 82 from Kiel states that the following elements and ephemeris have been computed by Mr. Morgan (Glasgow, Mo.) from observations made on December 6, 7, and 8, and communicated to the Centralstelle by Prof. E. C. Pickering:—

Elements.

T = 1906 January 16·20 (G.M.T.).

$$\left.\begin{array}{ll} \infty = & 213\ 56' \\ \Omega = & 93\ 21 \\ i = & 44\ 23 \end{array}\right\} 1905{\cdot}0$$

$$q = 0{\cdot}0928$$

Ephemeris 12h. G.M.T.

1905	α	δ	Brightness
	h. m. s.	° ′	
Dec. 14 ...	15 1 28 ...	+17 1	
18 ...	15 24 56 ...	+14 22	
22 ...	15 50 48 ...	+11 13 ...	4·22

The computed brightness for December 10 was 1·66, the brightness at time of discovery being taken as 1·0.

COMET 1905*b*.—A number of observations of comet 1905*b* (Schaer's) are recorded in No. 4057 of the *Astronomische Nachrichten*.

Using the Bruce telescope, and exposing for fifty-five minutes, Prof. Wolf photographed the comet on November 21, and obtained an image which showed the object to be unsymmetrical. A fine, faint tail was seen to issue from the coma in a position angle of 92°, reckoning from the direction of the comet's path. This tail was curved, with the concave side preceding, and at a distance of 22′ from the nucleus it was broken, the second part having a slightly different direction to the first.

On November 20 Prof. Wolf was able to see the comet with the naked eye, and estimated its magnitude to be about 5·5. On November 21 he found it to be about 6·3m., and on November 24 observed that it had decreased to 7·0.

The ephemeris calculated by Herr M. Ebell gives the position of this comet on December 15 as

α = 23h. 32m. 16s., δ = −10° 30′·5,

and its brightness as about 0·04 of that at the time of discovery.

ORBITAL ELEMENTS OF TWO METEORS.—From a number of observations of a meteor which was seen on August 3 Dr. P. Moschick, of Heidelberg, has calculated the radiant point, the earth point, the velocity, and the height of the meteor, and also the elements of its orbit. For the apparent radiant he obtained $\alpha = 317^\circ\ 56'$, $\delta = -11^\circ\ 54'$, and for the mean velocity $47{\cdot}93 \pm 8{\cdot}37$ km. per second, the probable value for the absolute velocity being 52·74 km. per sec. The elements show the orbit to be hyperbolic, and the meteor's motion in the orbit to be direct.

A second meteor was seen by numerous German observers on September 28, and Dr. Moschick has treated the observational results similarly. For the position of the radiant point he obtained $\alpha = 354^\circ\ 54'$, $\delta = +22^\circ\ 40'$, and therefore concluded that the object observed was a Pegasid. The relative and absolute velocities were respectively 21·51 and 36·4 km. per second, and the calculated elements show that the meteor moved, with a direct motion, in an elliptical orbit (*Astronomische Nachrichten*, No. 4057).

MAGNETIC DISTURBANCE DURING THE RECENT AURORAL DISPLAY.—In a paper communicated to the Paris Academy of Sciences, M. Th. Moureaux states that a strong magnetic disturbance took place about 9 o'clock on November 15, coinciding, in point of time, with the exceptionally fine auroral display which was so generally observed. From 8h. 59m. to 9h. 9m. (Paris M.T.) the declination, which was already below the normal, diminished by 34′, and then quickly recovered, increasing 42′ between 9h. 9m. and 9h. 24m. The horizontal and vertical components were simultaneously affected in the opposite direction. Similar disturbances took place on November 12. Numerous small groups of sun-spots were on the solar disc during this period, and the first large group seen in October, now much scattered and diminished, was due to cross the central meridian on the evening of November 13, during its second rotation (*Comptes rendus*, No. 21).

THE ZODIACAL LIGHT TO THE NORTH OF THE SUN.—Whilst in Switzerland recently, Prof. Newcomb ascended the Brienzer Rothorn in order to observe, if possible, the extension of the zodiacal light in the north and south direction. He found that the light was bright enough to be seen at a distance of 35° from the sun in the direction of the solar axis, and he assumes that it extends equally on both sides. Prof. Newcomb therefore suggests that the zodiacal light shall in future be described "as a luminosity surrounding the Sun on all sides, of which the boundary is nowhere less than 35° from the Sun, and which is greatly elongated in the direction of the ecliptic" (*Astrophysical Journal*, No. 3, vol. xxii.).

CANADIAN ELECTRIC POWER STATIONS AT NIAGARA.

ON January 2 of this year, in the power house of the Canadian Niagara Power Company, on the Canadian side at Niagara, the largest units used in the development of water-power were started. This great power house is situated in Victoria Park, and all the work of development is done under consent from the Government of the Province of Ontario and the commissioners of the park.

Fourteen years ago ground was broken on the New York side at Niagara for a power development by means of a wheel-pit and tunnel. The 105,000 horse-power thus developed has been a great inspiration to the growth of the American city, and Canadians looked forward to the time when they should profit by a similar development. Now their hopes are being realised, for three strong companies are actively at work on the Canadian side developing power from the water that speeds toward the Horseshoe or Canadian Fall. It was in 1892 that the Canadian Niagara Power Company secured its first rights to develop power in Canada, and since then it has paid the park commissioners more than 225,000 dollars in the retention of its privileges, while its first horse-power was developed on the date above mentioned.

The Canadian Niagara Power Company is allied to the Niagara Falls Power Company of the New York side of the river, but in its Canadian development it has given men of science and electrical engineers the most wonderful installation to study yet known in the field of any water power development. In the big power houses on the New York side the unit of development is 5000 horse-power, but on the Canadian side the unit is 10,000 horse-power. It was in 1890, at a meeting of the International Niagara Commission, held in London, that a unit of 5000 horse-power was adopted for the development on the American side at Niagara.

Ten years have elapsed since Rudolph Baumann, a Swiss engineer, turned the wheel that started the first 5000 unit on April 4, 1895, and since that day the installation has been doubled in size and output capacity, and is in every way a success. Now comes Canadian Niagara with its units of 10,000 horse-power, the largest in the world. Mr. William H. Beatty, of Toronto, Ontario, who is president of the Canadian Niagara Power Company, turned the small wheel that controls the flow of water from the penstocks to the turbines, and as he admitted the flood of water the monster generator began to revolve, and within a few minutes was making 250 revolutions a minute, the speed at which it is to be steadily operated. Unit No. 2 was also started, making 20,000 horse-power available in the

FIG. 1.—Site of the Power House of the Ontario Power Co., showing its nearness to the Horseshoe Fall.

station, and by May 1 three additional units of the same size were ready to run, giving off a total of 50,000 horse-power from the five machines. In all, eleven units will be installed in this station, so that its final output will be 110,000 horse-power, or 5000 horse-power more than is available from the twenty-one machines in the two power houses of the Niagara Falls Power Company on the American side of the river.

In the wheel-pit and tunnel method of developing power at Niagara, a great slot, several hundred feet long, is excavated in the earth to a depth of about 180 feet and 21 feet wide. From the bottom of the wheel-pit a tail race or tunnel is driven through solid rock a distance of 2200 feet to the lower river or gorge. This tunnel is built in the form of a horseshoe, and is about 20 feet wide by 25 feet high. It is lined from end to end with vitrified brick and concrete, while the wheel-pit is also carefully lined. From the upper river a canal of short length diverts water from the main stream to a forebay at one side of the big power house. Near the bottom of the wheel-pit the turbines are installed, and these are connected to the generators in the power station over the wheel-pit by vertical shafts or tubes. From the forebay to the turbines penstocks 10 feet in diameter run to the turbines, and as

the gates are raised the water pours from these penstocks into the wheels that give motion and life to the big generators. As the water passes through, or is discharged from, the turbines, it falls into the tunnel, and then flows through this tail race to the lower river and gorge. It is diverted from the main stream but a very few minutes, but in that time it serves to aid man in gaining control of thousands of electrical horse-power.

It is agreed between the power companies and the commissioners of Victoria Park that all power generated in the park limits must be transmitted outside the park boundaries for application and use, and so the electric current from the station referred to will pass to a transformer station not far distant, where, for transmission purposes, it will have its voltage raised to 40,000 or 60,000 volts, in order that it may successfully and economically be sent to Toronto and other distant places to meet the demand for electric power from Niagara. Toronto has long been anxious to be connected by a transmission line with the power development at the falls, and now a line for transmission purposes has been about completed, so that electric current from the generators in the station of the Canadian Niagara Power Company may be used in the

FIG. 2.—Power House of Canadian Niagara Power Co., being erected over the wheel-pit.

operation of the trolley cars and lighting systems of the Canadian city nearly 90 miles away from Niagara.

The Electrical Development Company of Ontario, Ltd., is also constructing a wheel-pit and tunnel power development in Victoria Park. The works of this company will be a short distance above the site of the development of the Canadian Niagara Power Company, but, for all this, the tunnel it is building will be slightly shorter than the tunnel of the company last named, because it will run right under the river-bed, over which the upper rapids toss, to a point behind the falling sheet of water of the Horseshoe Fall, where it will empty into the lower river. From the bottom of this wheel-pit there will be two short lateral tunnels that will carry the water from the pit to the main tunnel at a point 165 feet from the bottom of the slot. This company projects a development of about 125,000 horse-power, and the machinery it will instal will command general attention.

The Ontario Power Company is another concern that has secured a franchise for the development of power in Victoria Park. Its method of development will be quite different from that of the other two companies referred to. Its power house, a concrete and iron structure, has been built at the water's edge, in the gorge, a short distance below the Horseshoe Fall, and water will be carried to it by penstocks concealed from view in tunnels that have been driven through the rocky bank from a spillway or open relief on top of the bank. From this spillway great steel flumes will extend to the forebays, which are situated far up the river. There will be three of these steel flumes, each 18 feet in diameter and more than 6000 feet long. Each will divert 3900 cubic feet of water every second, which is an amount estimated to be sufficient to develop 60,000 electrical horse-power in the station at the water's edge. Thus from the three steel flumes and the water supply thus afforded, no less than 180,000 horse-power is to be developed. This power will pass from the generators to a transformer station located on the bluff in the rear of Victoria Park more than 250 feet above the power house, and more than 550 feet back from it.

ORRIN. E. DUNLAP.

INVESTIGATION OF THE UPPER AIR.

THE subjoined announcement has been received from the director of the Meteorological Office.

In response to representations from various quarters, the Meteorological Committee has assigned from the Parliamentary grant under its control a sum for promoting the investigation of the upper air by kites and other means.

The immediate objects in view are:—(1) To establish an experimental station where kite ascents and other experimental investigations can be carried out, especially on the days selected for international cooperation. (2) To develop and extend the instrumental equipment, so that facilities may be afforded for the cooperation of other observers upon sea or land. (3) To provide for the publication of the observations in combination with those of other countries, by a contribution to the cost of the international publication undertaken by the president of the International Commission for Scientific Aërostation, Prof. H. Hergesell, of Strassburg.

Mr. W. H. Dines, F.R.S., has undertaken the direction of the operations for the Meteorological Office. His experiments for the office are carried on at his house at Oxshott.

An endeavour will be made, with fair prospect of success, to enlist the cooperation of marine observers in correspondence with the office. Captain A. Simpson, of the S.S. *Moravian*, has already expressed his willingness to make a trial of this method of extending our knowledge of marine meteorology as soon as the necessary gear and instruments can be supplied.

It is hoped that through the assistance of others who are interested in such investigations, and have at their disposal the means of carrying them out, an effective scheme for the investigation of the upper air may be set on foot. Lieut.-Colonel J. E. Capper, C.B., R.E., of the Aldershot Balloon Companies, has already facilities for such purposes, and will take part; Mr. G. C. Simpson, lecturer in meteorology in the University of Manchester, is making arrangements for occasional observations on the Derbyshire hills; Mr. C. J. P. Cave, who has already made some interesting kite ascents in Barbados, has provided himself with the necessary equipment for experiments at Ditcham Park; and Mr. S. H. R. Salmon has arranged a station on the Downs near Brighton, and carries out ascents on the international days.

There is, accordingly, a prospect of an effective investigation being commenced.

BOTANY AT THE BRITISH ASSOCIATION.

THE president, Mr. Harold Wager, F.R.S., dealt in his address, which was delivered at Johannesburg, with some problems of cell structure and physiology. The text of this address has already appeared (September 21) in NATURE.

As was to be expected, there were fewer papers than usual this year in Section K, and of these relatively few were of a purely technical nature, the majority being either general accounts of recent work or else papers which possessed some special local interest.

General Papers.—Prof. R. W. Phillips opened the pro-

ceedings at Cape Town by delivering a semi-popular lecture on recent advances in our knowledge of seaweeds. Dealing first with the attached shore vegetation, the lecturer pointed out that, with the exception of a very few phanerogams, this consists entirely of blue-green, green, red, and brown algæ. In the red algæ the most important recent work is that of Oltmanns, who has shown, in opposition to the view maintained by Schmitz, that no real nuclear fusion takes place in the auxiliary cells. In the brown algæ Williams's work on the Dictyotaceæ has considerably modified the views previously held regarding them. Not only has he discovered motile antherozoids in this group, but his work on their cytology points to the existence of a definite alternation of generations. Farmer and Williams had shown that in the Fucaceæ the reduction of chromosomes takes place at the origin of the oogonium. In Dictyota, however, as originally shown by Mottier, and since confirmed by Williams, the reduction division occurs in the mother-cells of the tetraspores. There would thus appear to be in this plant two generations, precisely similar in their external morphology, but fundamentally distinct in respect of the number of chromosomes in the dividing nucleus. Our knowledge of the floating oceanic vegetation has been greatly extended by the members of the German plankton expedition, and other workers. The lecturer dealt with the distribution of this floating vegetation in the surface waters of the globe, and described some of the adaptations which prevent rapid sinking of the minute forms composing it.

Mr. R. P. Gregory discussed some of the problems of heredity. He first gave a general account of Mendel's principles of heredity, referring to some of the more recent work on Mendelian lines. He then dealt particularly with some new experiments conducted by Mr. Bateson and himself, on the inheritance of heterostyly in Primula. Although certain irregularities were observed, on the whole the characters of long and short style were inherited in the usual Mendelian ratio, the short style being dominant, the long recessive. Further experiments, conducted in the hope of throwing light on the fact, observed by Darwin, of the relative infertility in "illegitimate" as compared with "legitimate" crosses in Primula, were inconclusive.

Prof. F. E. Weiss contributed a paper on the value of botanical photographs. He pointed out that the mapping of the plant-associations of any given district, and the detailed study of the ecological factors concerned, can be most usefully supplemented by good photographs showing the general aspect and distribution of the vegetation. It is important to have, not only general photographs of various plant-associations, but also photographs of the different members of such associations. Plant photography can also be usefully employed in morphological, pathological, and other studies. The truth of the author's remarks was forcibly illustrated by a series of beautiful lantern slides. Two committees are now at work collecting botanical photographs and rendering them available for teaching and other purposes. One, recently established for the survey of British vegetation, is concerning itself with British ecological photographs; the other, the British Association committee for the registration of photographs of botanical interest, has adopted a wider scheme, and is anxious to receive help from scientific photographers in all parts of the world.

An interesting discussion took place on educational methods in the teaching of botany. The president (Mr. Harold Wager, F.R.S.), who opened the discussion, was of opinion that the methods usually employed, both in universities and schools, neither develop real interest in the subject nor afford an adequate training in scientific method. He emphasised the importance of basing all courses of botanical teaching on practical work, both observational and experimental, such work to be carried out by the students themselves. Lectures should be rather of the nature of discussions upon the facts learned during practical work than merely informational. A good deal of faulty educational method is due to the domination of examinations. It is almost impossible for satisfactory work to be done if teachers are compelled to follow set syllabuses, which are generally so extensive as to leave little room for originality on the part of the teacher.

Several speakers agreed with the general conclusions of the president, but Mr. A. C. Seward, F.R.S., and Prof. Douglas Campbell were inclined to lay more stress on the importance of lectures, particularly where advanced students are concerned.

Miss Lilian Clarke contributed to the discussion a most interesting account of her methods of teaching botany in the James Allen School for Girls at Dulwich. She gives no set lectures, but the girls make observations and conduct experiments, not only in the school garden, where each girl has charge of a plot, but also in the laboratory. The latter has been designed so as to admit as much light as possible; it can also be kept at a constant temperature, so that practical work on living plants can be carried on at all seasons of the year.

South African Botany.—Mr. A. C. Seward, F.R.S., in discussing the fossil floras of South Africa, gave a general account of the plants characteristic of the Lower Karroo, Stormberg, and Uitenhage series. He laid stress on the need for further field work, as more material, particularly petrified specimens for microscopical examination, is badly needed to render our knowledge of these floras more complete.

Prof. A. Engler and Dr. R. Marloth presented important papers on the floras of tropical Africa and South Africa respectively.

Prof. Engler dealt with his subject largely from the ecological point of view. Discussing first the meteorological conditions of tropical Africa, he pointed out that in every tropical country, where the altitude of the land surface varies from sea-level to high mountains, practically the same plant-formations can be distinguished, though, of course, their systematic composition may be very different in different cases. The author then enumerated the various halophilous, hygrophilous, xerophilous and other formations, with their subdivisions, finally discussing the affinities of the flora as a whole. The dominant element of the flora is one peculiar to tropical Africa, the plants composing which are more nearly related to those of India and Madagascar than they are to those of tropical America. But besides this native element, we find in tropical Africa other elements. Thus in the hygrophilous formations of East Africa, Indian and Madagascan elements abound, while in those of West Africa a distinct tropical American element is found. A South African element is present, particularly in the shrub-formations of Angola and East Africa; a Mediterranean element in the north-east, especially in Somaliland; and lastly, in the high mountains, many species belonging to a boreal element are found. From the entire absence on these mountains of many groups characteristic of northern regions, Prof. Engler concludes that such northern forms as are here found have entered by immigration, and are not the remnants of a once widely spread Old World flora.

The botanical regions proposed by Dr. Marloth in his paper on the phyto-geographical subdivisions of South Africa are somewhat similar to those suggested by Bolus, Engler, and others, though differing in detail. The two main divisions, very unequal in size, are A, the Cape province, characterised by many endemic plants of more or less south temperate affinities, and B, the palæo-tropical province. The latter is again subdivided, according to ecological conditions and floral constituents, into (1) the grass-steppe regions, including the Bush-veld, High-veld, Kalahari, and the Caffrarian countries; (2) the central districts of Cape Colony, including the Karroo, the Karroid plateau and Little Namaqualand; (3) the western littoral; (4) the forests of the south coast; (5) the south-eastern coast belt.

Mr. J. Burtt-Davy contributed a paper on the climate and life zones of the Transvaal. He divides the Transvaal, according to altitude and climate, into three zones, which he terms the High, Middle, and Low Veld respectively. Each is characterised, not only by its native vegetation, but also by the crops it is capable of producing.

Mr. F. B. Parkinson gave an interesting account of irrigation farming as carried on at the Orange River farm at Baviaankrantz. To raise the water, chain and bucket pumps are employed, working in shafts sunk at a sufficient distance from the river to be above flood-level. The shafts are supplied with water from the river by means of 10-inch syphons. By judicious watering, winter cereal crops, and

summer crops of potatoes, peas, &c., can be profitably grown.

Mr. T. R. Sim discussed the distribution of South African ferns, and pointed out that the recent opening up of the Orange River Colony, the Transvaal, and Rhodesia has resulted in the filling up of many gaps in our knowledge of this subject.

Dr. Schönland gave a survey of our knowledge of South African succulent plants, chiefly from the historical and systematic points of view.

A paper was also contributed by Mr. J. Medley Wood on the indigenous plants of Natal.

Technical Papers.—Among these may be mentioned an interesting note by Dr. Horace T. Brown, F.R.S., on the dissipation of absorbed solar radiation by xerophilous plants. He pointed out that in ordinary foliage leaves the amount of heat necessary to vaporise the water of transpiration is so considerable that such a leaf may be subjected to intense solar radiation without acquiring a temperature of more than a very few degrees above that of the surrounding air. In xerophilous plants, however, transpiration is at a minimum, and therefore some other method of guarding against the risk of dangerously high temperatures is necessary. According to the author, this is to be found in the loss of heat due to thermal emission. Experiments have been conducted by him (in collaboration with Dr. W. E. Wilson) which show that a powerful cooling effect is produced by the high thermal emissivity of a leaf surface, even when transpiration is completely in abeyance.

Prof. H. H. W. Pearson communicated an interesting account of his investigations into the development and germination of the spores of Welwitschia. The results obtained show that some of the current views of the relationship of this extraordinary plant to the other genera of the Gnetaceæ must be considerably modified.

Prof. Douglas Campbell described the prothallium and reproductive organs of *Gleichenia pectinata*, and directed attention to the similarity that exists between them and those of Osmunda.

Prof. M. C. Potter presented two papers. In the first an account was given of some experiments which showed that amorphous carbon can be slowly decomposed by the agency of a soil bacterium, with the evolution of carbon dioxide.

The second dealt with the healing of parenchymatous tissues in plants. According to the author, the first step in this process (prior to the formation of cork) is the closing of the intercellular spaces by the formation of a "wound-gum" similar to that described by Temme in wounded xylem vessels. Thus the increased rate of gaseous interchange caused by the wound is very soon checked.

Mr. I. B. P. Evans, in a paper on infection phenomena in the Uredineæ, said that it is quite possible to identify different species of Puccinia by the shape of their infection vesicles.

Dr. G. Potts contributed a paper on the action of calcium compounds on *Plasmodiophora Brassicae* ("finger and toe"). Experiments show that an acid soil encourages the growth of the parasite, while alkaline substances inhibit it.

A most interesting feature of the Cape Town meeting was afforded by a fine collection of native plants, brought together with considerable trouble by Dr. Marloth. These included a number of the more striking succulents from the Karroo region, and also a great many plants from the south-west district of Cape Colony. The latter were, for the most part, in flower, the heaths and the Iridaceæ in particular presenting a beautiful blaze of colour. Dr. Marloth also exhibited a number of ecological photographs taken in various parts of Cape Colony.

But, apart from the meetings themselves, the over-sea botanists found considerable opportunities of observing the vegetation of the various districts passed through during the tour. It is true that much of the travelling was hurried, but even when passing rapidly through a new country a botanist is able to gather valuable impressions of the general facies, &c., of the vegetation.

At the Cape, though the season was still early spring, a considerable number of plants were in flower. Table Mountain and the slopes of the Lion's Head were explored so far as time permitted, and many plants characteristic of the Cape Peninsula flora were observed. Some of the most striking of these were plants belonging to the families Ericaceæ, Proteaceæ, and Restiaceæ.

Several members of Section K visited the Karroo, and spent some days in examining the many curious xerophilous desert plants to be found there.

In the Transvaal and elsewhere little or no rain had fallen for some five months before the visit of the association, and in consequence the country presented a very parched and brown appearance, except where irrigation had resulted in vivid patches of green crops, or groves of Eucalyptus trees had been planted. The latter, as well as other Australian plants, have been extensively imported, and promise to become of considerable economic importance in South Africa.

A very striking feature of the bush vegetation in various parts of the Transvaal was the extraordinary prevalence of parasitic Loranthaceæ, many of the acacia and other trees being loaded with the parasites.

At Pretoria the Government experimental grounds were visited, the visitors being received by Mr. Smith, the Director of Agriculture, and Mr. Burtt-Davy. Extensive experiments are being at present carried on here with a view to the introduction of new grasses to improve the pasturage of the Transvaal. Other useful introduced plants include several species of Atriplex (the Australian "salt-bush"). As these plants are markedly xerophilous, and at the same time good fodder plants, they will probably prove very useful in a climate such as that of the Transvaal.

The agricultural department in Pretoria had also arranged an exhibition illustrative of the vegetable products of the Transvaal.

Mr. Burtt-Davy arranged a special botanical excursion to the Magaliesberg, where the "Wonderboom," an exceedingly fine specimen of *Ficus cordata*, was visited.

Other areas of botanical interest passed through included the High Veld, the Bush Veld, the teak forest of Rhodesia, and the luxuriant so-called rain-forest immediately surrounding the Victoria Falls.

PRIZE SUBJECTS OF THE INDUSTRIAL SOCIETY OF MULHOUSE.

THE Industrial Society of Mulhouse has issued its programme of the prizes to be awarded by the society during the year 1906; excluding the subjects which are of a purely local or technical character, the following are the principal prizes open to competition to all nations.

In the section of chemistry medals of honour are offered for a memoir on the theory and manufacture of alizarin-red by the rapid process, for a synthesis of the colouring matter of cochineal, for a research on cochineal carmine, for an investigation of the colouring matter of cotton, of the transformation of cotton into oxycellulose, or of the composition of aniline blacks; also for a research on the chemical changes of wool under the action of hypochlorites or chlorine, for a synthesis of a natural dye, for a theory of the manner of formation in nature of any organic substance, or for a chemical study of the fat of Turkey-red. Several medals will also be awarded for special chemical studies of mordants and their action, for the production by artificial means of certain dyes, and for practical methods of fixing certain dyes to the fibre. A method of manufacturing carbon tetrachloride at a price such as will enable it to compete with carbon bisulphide and benzene is also required. A sum of 500 francs to 1000 francs will be allotted to the best compilation of the densities of inorganic and organic substances in the solid state and in cold saturated solution. Medals will be given for the production of substances capable of taking the place of certain named chemicals which have an industrial use, and for the solution of a number of specified problems in the bleaching, dyeing, and printing of textiles.

In the section of mechanical arts a prize of 500 francs with a silver medal is offered for a new method of construction of buildings suitable for cotton spinning, wool combing, or calico printing. The following subjects will receive medals:—a new type of steam boiler; an indicator of the total work done in a steam engine; new forms of

gas generators for gas engines; new types of gas engines; a new method of heating boilers; new methods of spinning, weaving, and dyeing textile fabrics; a simple cut-out for electrical installations.

The following subjects in natural history and agriculture will be awarded medals:—a geological or mineralogical description of part of Alsace; a detailed catalogue of plants in the neighbourhood of Mulhouse, Thann, Altkirch, and Guebwiller; a treatise on the fauna of Alsace; a treatise on the plants and insects inimical to agriculture in Alsace and the methods of destroying them.

In commerce and statistics the prize subjects are:—a study of methods of insurance against risks of transport; a treatise on insurance against fire, with especial reference to the factories of Alsace; a memoir on the variation in the price of coal in Alsace during the last thirty years; a study of the effect of taxation on industrial development.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Vice-Chancellor has announced to the Senate the munificent gift of 1750*l.*, made by Dr. Ludwig Mond towards the fund for increasing the stipends of the Stokes and Cayley university lecturers in mathematics.

The detailed proposals put for the diploma in forestry were to be discussed on Thursday last. Apparently they satisfied the members of the university, for there was no criticism made on them.

The degree of Master of Arts, *honoris causa*, is to be conferred upon Mr. R. I. Lynch, curator of the botanic garden. Mr. Lynch is well known as a writer on horticultural subjects.

On the nomination of the board of geographical studies, Dr. Guillemard and Sir G. D. T. Goldie, K.C.M.G., F.R.S., and on the nomination of the council of the Royal Geographical Society, Sir Clements R. Markham, K.C.B., F.R.S., and Dr. J. Scott Keltie, have been appointed members of the board of geographical studies for the year beginning January 1, 1906.

Mr. J. B. Peace has been appointed chairman of the examiners for the mechanical sciences tripos, 1906.

The general board of studies has approved Mr. H. J. H. Fenton, of Christ's College, for the degree of Doctor in Science.

The following notice of the next award of the Walsingham medal has been issued:—The medal is to be awarded for a monograph or essay giving evidence of original research on any botanical, geological, or zoological subject. The competition is open to graduates of the university who at the time fixed for sending in the essays are under the standing of Master of Arts. The essays for the ensuing year are to be sent to the chairman of the special board for biology and geology (Prof. Langley, The Museums) not later than October 10, 1906.

The special board for biology and geology give notice that the Gedge prize will be offered for competition in the Michaelmas term, 1906. The prize will be awarded for the best original observations in physiology, but a candidate who has received a certificate of research from the university will not be entitled to submit an essay which is substantially the same as the dissertation for which such certificate of research was granted. Candidates need not necessarily be graduates of the university. Essays are to be sent to the professor of physiology not later than October 1, 1906.

DR. A. J. EWART, special lecturer in vegetable physiology, Birmingham University, has been appointed professor of botany in the University of Melbourne in succession to the late Baron von Müller.

THE will of the late Mr. John Edward Taylor, part proprietor and a former editor of the *Manchester Guardian*, on which probate was granted in London on December 9, among numerous bequests, leaves, on the decease of the widow, 20,000*l.* to the Victoria University of Manchester.

AT a meeting of the council of the University of Birmingham held on December 6, the Chancellor announced that the family of the late Mr. Harding had offered 10,000*l.* to the Birmingham University for the erection of a library. The offer has been gratefully accepted by the council.

ON Tuesday, December 5, Sir W. Martin Conway distributed the prizes and certificates gained by the students at the Sir John Cass Technical Institute during the past session. Sir Owen Roberts, chairman of the governing body, presided. Mr. George Baker stated that the scope of the work of the institute and the number of students continued to progress steadily, and that a large proportion were studying subjects bearing directly upon the industries in which they were engaged. Sir Martin Conway, in the course of his address, pointed out that people in this country suffer from a confusion of ideas in respect to education, and that they do not believe sufficiently in the necessity of giving the highest possible education to the directing brains of industries, nor do they understand sufficiently the length of time and the experience that are required for skilful hands to receive their full equipment. He remarked that the real struggle with Germany in manufactures is due to the enormous number of highly educated men turned out at the German universities; it is not a question of technical education, but of scientific education. The German is not a whit more scientific or better than the Briton, but faith in science which exists in Germany is lacking in England, and this gives the Teutonic tortoise the advantage over the British hare.

THE following bequests and gifts for higher education in the United States are announced in *Science*. By the will of the late Mr. Stephen Salisbury, the Worcester Polytechnic Institute receives a bequest of 40,000*l.* This money comes without restrictions of any kind on the part of the testator. In addition to this bequest, Mr. Salisbury, at the time of his resignation a few weeks ago from the presidency of the board of trustees, made an additional gift to the institute of 20,000*l.*, to be paid immediately. Formal announcement of the 50,000*l.* legacy to the Sheffield Scientific School from the estate of the late Mr. M. D. Viets has been made by Prof. Russell H. Chittenden, director of the school. The bequest will be used for the physical, mathematical, and general scientific needs of the school. The late Mr. Frank Harvey Cilley, the engineer, has bequeathed the residue of his estate, which will probably amount to 14,000*l.*, to the Massachusetts Institute of Technology. Mr. T. P. Shonts, chairman of the Isthmian Canal Commission, has given to Monmouth College 2000*l.* as part of the 6000*l.* needed to obtain an additional 6000*l.* which Mr. Andrew Carnegie had promised to give the college for a library. The late Mr. Stephen Salisbury, of Worcester, Mass., has bequeathed 40,000*l.* to the Worcester Polytechnic Institute, 50,000*l.* to the American Antiquarian Society, and 1000*l.* and a site for a building for the Worcester Natural History Society.

PROF. W. J. ASHLEY, dean of the faculty of commerce in the University of Birmingham, distributed on December 6 the prizes gained by candidates at the examinations of the London Chamber of Commerce. During the course of a subsequent address, Prof. Ashley remarked that the science of commerce has yet to be made, but, in his opinion, a true science of commerce is capable of being created. At present, however, it does not exist. Its formulation should have been the task of the political economists; but hitherto English economists have been too content to pursue the results, the conclusions to be reached by a process of reasoning starting with certain assumptions. It is necessary that the problems which actually present themselves to a business man in the course of his operations should be realised and studied, and that the various ways in which they have been approached and faced ought to be brought together, grouped, criticised, and analysed. The function of the economist is not to arrive at general abstract conclusions and then look round in the world of business for examples or illustrations of the conclusions arrived at. He should condescend to a more concrete and a more patient survey of the actual facts of real life. Prof. Ashley considers it to be vitally important that the highest type of education shall be brought into close touch with the realities of economic life. If that is properly done it will not degrade education, but vivify it.

THE current number of the *Monthly Review* contains an article on public school education by Mr. A. C. Benson, in which some valuable testimony as to the inadequacy as a training for life of a purely classical education is given. The question as to what are the intellectual accomplishments of a boy of average intelligence who has been through a public school and a university is answered in the following words:—"He knows a very little Latin and Greek, and he endeavours to put them out of his mind as fast as he can; he knows a little science; perhaps a little history, mostly ancient. He cannot generally calculate correctly in arithmetic; he knows no modern languages to speak of; he cannot express himself in simple English, and his handwriting is often useless for commercial purposes." And later, we read, "he has learnt to think the processes of the mind dreary and unprofitable, to despise knowledge, to think intellectual things priggish and tiresome." Mr. Benson summarises his contentions in the following words:—"believing intensely, as I do, in the possibilities of intellectual education, I have tried to judge the classical system as fairly as I can by results, and I see that those results are in many cases so unsatisfactory and so negative that experiments are urgently needed. Simplification seems to me to be the one essential thing." If a writer who was formerly a master at our greatest public school finds it necessary to write in this plain manner, it is evidently high time that scientific methods were applied to obtain an answer to the question, what constitutes a suitable public school education, and how can it be secured?

A LARGE audience assembled at the Borough Polytechnic Institute on Monday evening, December 4, on the occasion of the thirteenth annual meeting and distribution of prizes and certificates. The chairman, Mr. Leonard Spicer, said the work of the institute was going forward with great strides, and he feared that, even allowing for the additions to the building which had recently been made, the governors would again be faced with the problem of knowing how to house the students. Although the word "polytechnic" is still associated in many minds with recreation and amusements, the chief work of institutes of this kind lies in an educational and technical direction, 15,000*l.* a year being the least sum upon which the work at the Borough can be carried on at present. Mr. C. T. Millis, the principal, read the annual report, which disclosed a very satisfactory state of progress of the institute. An experiment is being made in the direction of coordination with London County Council evening schools, and several new classes have been started. A satisfactory feature of the work of the institute is the readiness with which intending students ask for and follow advice given as to their courses of study, and the increasing number of students who attend for two, three, and four years. After the certificates, which numbered considerably more than five hundred, and the numerous prizes were distributed by Lady Lockyer, Sir Norman Lockyer, K.C.B., delivered an address. In a few remarks, Prof. Perry claimed for the polytechnic institutions of London that they were doing a work that was unprecedented, and which our colonies are now endeavouring to imitate. He had recently returned from South Africa, where he found the people following the lead which London was now giving in the matter of technical education. Votes of thanks were proposed and seconded by Sir Philip Magnus and Mr. W. F. Sheppard.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 16.—"The Electrical Conductivity of Dilute Solutions of Sulphuric Acid." By W. C. D. **Whetham**, F.R.S.

The equivalent conductivity of neutral salts when dissolved in water approaches a limiting value as the dilution is increased; with solutions of acids and alkalies, however, the equivalent conductivity reaches a maximum, and then falls rapidly as the dilution is pushed farther.

It has been supposed that this diminution of equivalent conductivity at extreme dilutions is due to interaction between the solute and the impurities which remain even in re-distilled water.

Kohlrausch has given evidence to show that the chief impurity in water carefully re-distilled is carbonic acid, and Goodwin and Haskell conclude that the diminution of equivalent conductivity of dilute acids is due to the presence of carbon dioxide.

In order to examine the real effect of carbonic acid and other impurities on the conductivity of an acid solution, the writer and his wife have carried out an investigation in which the amount of impurity was varied, and the result observed. The conductivity of dilute solutions of sulphuric acid and its variation with concentration was determined in four solvents:—(1) good quality re-distilled water; (2) the same water to which a trace of carbon dioxide had been added; (3) the same water with a trace of potassium chloride; (4) the same water which had been freed as far as possible from carbonic acid and other volatile impurities by repeated boiling under diminished pressure.

In each case the conductivity of the solvent was subtracted from that of the solution. The results may be summarised as follows:—

Within the limits of experimental error, the equivalent conductivity of a dilute acid is not affected by boiling the water under diminished pressure, though the conductivity of the solvent is thereby much diminished. The equivalent conductivity of the acid is also unaffected by the addition of a small quantity of potassium chloride to the water, though the conductivity of the solvent is thereby much increased. But, by the addition of a little carbonic acid, the equivalent conductivity of the sulphuric acid is diminished appreciably. It is natural to conclude that, while the presence of carbonic acid would produce a diminution of equivalent conductivity of the same character as that observed, it does not explain the total effect.

"The Accurate Measurement of Ionic Velocities." By Dr. R. B. **Denison** and Dr. B. D. **Steele**. Communicated by Sir William Ramsay, K.C.B., F.R.S.

The authors have succeeded in devising an apparatus with which it is possible to compare and measure the velocities of the ions of a given salt without using gelatin or other membrane during the actual experiment. This enables the method of direct measurement of ionic velocities to be extended to dilute solutions, and the results obtained are free from any error due to electric endosmose.

The transport number and the average absolute velocity of the ions of a number of salts have been measured at dilutions down to one-fiftieth normal, and at two temperatures, 18° C. and 25° C. It is easy to measure by this method the transport number of the ions of some salts which present great difficulty by the analytical method of Hittorf, *e.g.* $KClO_3$, $KClO_4$, $KBrO_3$. The following are some of the numbers obtained for the anion transport number:—KCl $n/10$, 0·508; NaCl $n/10$, 0·618; KCl $n/50$, 0·507; $CaCl_2$ $n/50$, 0·587. The corresponding numbers determined by the analytical method are 0·508, 0·617, 0·507, 0·59.

The values obtained by the authors for the average velocity of the ions in cm./sec. agree in a remarkable manner with those calculated by Kohlrausch from conductivity data, and form a striking confirmation of the ionic theory of solutions. The values of the ionic velocity of the potassium ion in KCl, KBr, and KI are, for example, found to be:—at $n/10$, 0·000563, 0·000562, 0·000564 cm./sec.; at $n/50$, 0·000606, 0·000598, 0·000599 cm./sec. at 18° C.

It is claimed that the method is at least as accurate as that of Hittorf, and an experiment can be performed in about one-tenth of the time. It also gives a means of comparing the degree of dissociation of salts containing a common ion.

Mineralogical Society, November 14.—Prof. H. A. Miers, F.R.S., president, in the chair.—The determination of the angle between the optic axes of a crystal in parallel polarised light: Dr. J. W. **Evans**. The crystal plate is rotated on the optic normal as axis, and the positions are determined in which the relative retardation is nil. This may be observed by using a gypsum plate or the double quartz wedge devised by the author. In the latter case the positions in question are marked by the coincidence of the bands in the two halves of the wedge. This gives a very exact reading if strictly parallel light be employed.—Mineralogical notes (diopside and albite): Prof. W. J. **Lewis**. A large tabular crystal of white diopside, a brown

diopside of unusual habit, and a Carlsbad twin of albite were described.—Note on the crystallisation of drops, especially of potash-alum: J. **Chevalier.** The president described observations made by Mr. Chevalier on the crystallisation of drops of solution of potash-alum. These generally yield in succession (*a*) birefringent spherulites; (*b*) octahedra; and (*c*) a fine rectangular network. (*a*) is probably a less hydrated alum, and it becomes isotropic on exposure to moist air by conversion into (*b*). (*c*) is ordinary alum which is in a state of strain, owing to its rapid crystallisation, and becomes white and opaque after a time owing to the development of cracks. Drops observed upon a slide under the microscope behave differently according as they are in the metastable or labile condition. A metastable drop inoculated with (*a*), (*b*), or (*c*) deposits octahedra. A labile drop inoculated with (*a*) deposits spherulites, but inoculated with (*b*) or (*c*) deposits the rectangular network. When a metastable drop containing either octahedra or spherulites, or both, passes into the labile condition (by cooling or by evaporation), they may continue to grow unchanged. If, however, a fragment or germ of octahedral alum be introduced into a labile drop the network (*c*) is immediately produced. An alum crystal growing in a labile solution is surrounded by a zone of metastable liquid which prevents it from starting the network (*c*) characteristic of a labile drop. Experiments were made upon the action of various mineral substances in inducing crystallisation in metastable and labile drops. Among these the holosymmetric cubic crystals, and especially galena, exercise a remarkable effect in producing the network (*c*) in labile drops.—Note on the formation of gypsum crystals in a disused well at chemical works: C. J. **Woodward.** Groups of gypsum crystals were exhibited which were found thirty years ago studding the walls of an old well at Messrs. Chance's chemical works at Oldbury.—Notes on minerals recently found in the Binnenthal: R. H. **Solly.** The minerals described were (1) Ilmenite, in brilliant crystals, displaying marked hemihedrism and showing five new forms. It is associated with quartz, adularia, magnetite and mica, on mica schist. (2) Seligmannite; an exceptionally large and well developed crystal in dolomite. Unlike any previously described, it is untwinned; altogether forty-five forms were observed, of which twenty-one are new. (3) Marrite; two more crystals of this rare mineral were found, one tabular and the other sharply pointed in habit. (4) Proustite; a minute crystal deposited on a crystal of rathite. (5) Trechmannite; a crystal of this rare mineral displaying asymmetric hemihedrism, deposited on a crystal of binnite. (6) Hyalophane; in crystals of an unusual green colour.

Entomological Society, November 15.—Mr. F. Merrifield, president, in the chair.—*Exhibitions.*—A flower-frequenting beetle from the Transvaal, illustrating a remarkable device for the cross-fertilisation of flowers, one of the front feet being tightly clasped by the curiously formed pollinia of an Asclepias: Mr. **Arrow.**—A remarkable specimen of *Agrotis tritici*, taken this year at Oxshott, bearing a close resemblance to *A. agathina*, with which it was flying over heather: W. J. **Kaye.** The specimen was a good example of syncryptic resemblance brought about by the common habit of resting on heather.—A specimen of *Forficula auricularia* taken by Mr. R. A. R. Priske at Deal in September, 1905, having the left cercus normal, while the right was that of var. *forcipata*: W. J. **Lucas.**—Forms of South African Pierine butterflies taken during the dry season of the present year, together with specimens of the same species for comparison taken in the same localities: Dr. F. A. **Dixey.** He said that his exhibit illustrated the fact, now widely recognised, that these forms varied in general correspondence with the meteorological conditions prevailing at the different seasons.—A long series of *Hemerophila abruptaria* bred by the exhibitor illustrating the proportion of light and melanic forms derived from a light male and a light female: E. **Harris.**—A ♂ specimen of *Tortrix pronubana*, Hüb., taken by Mr. Harold Cooper at Eastbourne, either at the end of September or the beginning of October last: S. **Image.** The insect is new to the British list.—*Paper.*—Hymenoptera-Aculeata, collected in Algeria, part iii., Diploptera, by E. Saunders, F.R.S.: Commander J. J. **Walker.**

Linnean Society, November 16.—Mr. C. B. Clarke, F.R.S., vice-president, in the chair.—*Exhibitions.*—Specimens of British water-Ranunculi, showing the modifications in the form of the leaves: H. and J. **Groves.** The authors pointed out that the species might be roughly grouped under three headings:—(1) those in which only broadly lobed aërial leaves were produced; (2) those in which submersed multifid leaves with capillary segments were also produced; and (3) those with multifid leaves only.—Photograph showing, of the natural size, the otoliths from thirty-five species of fishes, a collection made by the late Dr. David Robertson: Rev. T. R. R. **Stebbing.**—Leaf and seed of *Macrozamia spiralis* from Queensland, where the plant is stated to cause symptoms of paralysis of the hind-quarters of cattle eating the leaves: E. M. **Holmes.** The chemical nature of the constituents of the plant appears to be unknown.—*Papers.*—Contributions to the embryology of the Amentiferæ, part ii., *Carpinus Betulus*: Dr. Margaret **Benson,** Miss E. **Sanday,** and Miss E. **Berridge.** Material was collected early in July, 1902, and 1904, and more than 600 series of sections were obtained through ovules containing the earlier stages in the development of the embryo-sacs, until the first segmentation of the definitive nucleus had occurred. Former observations (see part i. in *Trans. Linn. Soc.*, ser. ii., bot. iii. (1894), pp. 409–424) were confirmed, and the following new facts obtained. The polar nuclei meet at the neck of the cæcum, descend together, and generally fuse near its base. The pollen-tube enters the sac in their vicinity, and emits one gamete into the cæcum, usually by means of a short spur. The gamete then makes its way to the definitive nucleus. The other gamete is carried up by the tube to the egg, with which it fuses. The egg then becomes clothed with a wall, and segmentation commences.—The membranous labyrinth of five sharks: Prof. C. **Stewart,** F.R.S.

PARIS.

Academy of Sciences, December 4.—M. Troost in the chair.—Contribution to the study of the distribution of the tsetse fly in French West Africa: A. **Laveran.** Since writing the earlier notes on the same subject, the author has accumulated additional material, details of which are now given.—On the deformation of quadrics: C. **Guichard.**—On Bode's law and the inclinations of the planetary equators to the ecliptic: E. **Belot.**—On the intrinsic brightness of the solar corona during the eclipse of August 30, 1905: Charles **Fabry.** The instrument used was a modified Mascart photometer. The intrinsic brightness found was, at a distance of 5′ from the edge of the sun, and in the direction of the equator, about 720 candles per square metre, or about 0·28 the intrinsic brightness of the lunar surface.—The inertia of the electrons: Marcel **Brillouin.**—On certain experiments relating to the ionisation of the atmosphere, executed in Algeria on the occasion of the total eclipse of August 30, 1905: Charles **Nordmann.** A continuous record of the positive ions present in the air was obtained, the instrument destined to measure the amount of negative ions being broken in transit. The curve given by the ionograph showed a marked minimum during the eclipse, thus agreeing with the views of Lenard, Elster and Geitel, who regard the solar radiation as one of the direct or indirect factors in atmospheric ionisation.—On the equilibrium diagram of the iron-carbon alloys: Georges **Charpy.** The influence of the rate of cooling on the composition of the casting has been neglected by the earlier workers on this subject. Details are given of a study of an alloy containing 2·90 per cent. of carbon, for which the Bakhuis-Roozeboom diagram is drawn.—The action of silicon on pure aluminium; its action on impure aluminium; silico-aluminides: Em. **Vigouroux.** Silicon does not form a definite compound with pure aluminium, but in presence of a third metal silicides of aluminium and this metal are formed, well defined crystallised substances, silico-aluminides.—On α-decahydronaphthol and the octahydride of naphthaline: Henri **Leroux.** α-Naphthol, treated with hydrogen by the method of Sabatier and Senderens, gives the decahydride, the details of the preparation and properties of which are given in the present note. Treated with a dehydrating agent it loses a molecule of water and gives an octahydride of naphthalene.—On victorium and the

ultra-violet phosphorescence of gadolinium: G. **Urbain.** The phosphorescence spectrum is given by one element when small quantities of a second element, called the excitor, are present. Either of these, in the pure state, gives no phosphorescent spectrum. These considerations have been applied to the examination of gadolinium, and the author regards the spectrum attributed to a new element, victorium, by Sir W. Crookes as due to a complex containing gadolinium.—On the existence of caoutchouc in a genus of Menispermaceæ: Jacques **Maheu.**—On prulaurasine, a crystallised cyanhydric glucoside extracted from the leaves of the cherry laurel: H. **Hérissey.** The method of obtaining this glucoside in a pure crystallised state from the leaves is given. Its formula appears to be $C_{14}H_{17}NO_6$, and under the action of emulsin it is hydrolysed to hydrocyanic acid, glucose, and benzoic aldehyde. It is an isomer of the amygdonitrile-glucoside of Fischer and the sambunigrin of Bourquelot and Danjou.—On the retrocerebral organ of certain rotifers: P. Marais **de Beauchamp.**—On phototropism of the larvæ of the lobster: G. **Bohn.**—On the geological structure of the eastern Pyrenees: Pierre **Termier.**—On the orientation which an elongated body will take when turning in a current of fluid: E. **Noël.**—On the Devonian fossils of the eastern Ahenet collected by M. Noël Villatte: Émile **Haug.** The collection of fossils made in the course of the Laperrine expedition is sufficient to prove the presence of the three principal subdivisions of the Devonian system, but the stratigraphical relations between the different terms cannot be exactly made out.—The influence of the summer rains on the yield of springs in the plains: M. **Houllier.**—The magnetic effects of lightning on volcanic rocks: Gaetano **Platania** and Giovanni **Platania.**

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 14.

ROYAL SOCIETY, at 4.30.—An Investigation into the Structure of the Lumbo-sacral coccygeal Cord of the Macaque Monkey (*Macacus sinicus*): Miss M. P. Fitzgerald.—On the Distribution of Chlorides in Nerve Cells and Fibres: Prof. A. B. Macallum and Miss M. L. Menten.—The Mammalian Cerebral Cortex, with Special Reference to its Comparative Histology. I. Order Insectivora: Dr. G. A. Watson.—Observations on the Development of Ornithorhynchus: Prof. J. T. Wilson and Dr. J. P. Hill.—Further Work on the Development of the Hepatomonas of Kala-Azar and Cachexial Fever from Leishman-Donovan Bodies: Dr. L. Rogers.—The Action of Anæsthetics on Living Tissues. Part I. The Action on Isolated Nerve: Dr. N. H. Alcock.—Report on the Psychology and Sociology of the Todas and other Indian Tribes: Dr. W. H. R. Rivers.—On the Sexuality and Development of the Ascocarp of *Humaria Granulata*, Quel.: V. H. Blackman and Miss H. C. I. Fraser.—On the Microsporangia of the Pteridospermeæ with Remarks on their Relationship to Existing Groups: R. Kidston, F.R.S.—The Araucarieæ, Recent and Extinct: A. C. Seward, F.R.S., and Miss S. O. Ford.—On the Spectrum of the Spontaneous Luminous Radiation of Radium. Part IV. Extension of the Glow: Sir William Huggins, K.C.B., O.M., F.R.S., and Lady Huggins.

MATHEMATICAL SOCIETY, at 5.30.—On Well-ordered Aggregates: Prof. A. C. Dixon.—Tables of Coefficients for Lagrange's Interpolation Formula: Col. R. L. Hippisley.—On the Representation of certain Asymptotic Series as Convergent Continued Fractions: Prof. L. J. Rogers.—On a New Cubic Connected with the Triangle: H. L. Trachtenberg.—Some Difficulties in the Theory of Transfinite Numbers and Order Types: Hon. B. A. W. Russell.—The Imaginary in Geometry: J. L. S. Hatton.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—*Adjourned Discussion*: The Charing Cross Company's City of London Works: W. H. Patchell.

FRIDAY, DECEMBER 15.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—*Adjourned Discussion*: The Seventh Report to the Alloys Research Committee: On the Properties of a Series of Iron-Nickel-Manganese-Carbon Alloys: Dr. H. C. H. Carpenter, and Messrs. R. A. Hadfield and Percy Longmuir.—*Paper*: Behaviour of Materials of Construction under Pure Shear: E. G. Izod.

PHYSICAL SOCIETY (at Royal College of Science, South Kensington), at 7.—Exhibition of Electrical, Optical and other Physical Apparatus.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Tests of Street Illumination in Westminster: E. E. Mann.

AËRONAUTICAL SOCIETY, at 8.—The Acoustical Experiments carried out in Balloons by the late Rev. J. M. Bacon: Miss Gertrude Bacon.—The Aëromobile: F. Webb.—A New Continuous Impulse Petrol Motor for Dynamic Flying Machines: W. Cochrane.

MONDAY, DECEMBER 18.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Anthropogeographical Investigations in British New Guinea: Dr. C. G. Seligmann and Dr. W. Mersh Strong.

SOCIETY OF ARTS, at 8.—The Measurement of High Frequency Currents and Electric Waves: Prof. J. A. Fleming, F.R.S.

INSTITUTE OF ACTUARIES, at 5.—Canadian Vital Statistics; with Particular Reference to the Province of Ontario: M. D. Grant.

TUESDAY, DECEMBER 19.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Economy in Factories: H. A. Mavor.

ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Origin of Eolithic Flints by Natural Causes: S. H. Warren.

ROYAL STATISTICAL SOCIETY, at 5.—The Decline of Human Fertility in the United Kingdom and other Countries as shown by Corrected Birth-Rates: Dr. Arthur Newsholme and Dr. T. H. C. Stevenson.—Changes in the Marriage- and Birth-Rates in England and Wales during the Past Half-century, with an Inquiry as to their Probable Causes: G. Udny Yule.

WEDNESDAY, DECEMBER 20.

GEOLOGICAL SOCIETY, at 8.—(1) The Clunian Series of the Ludlow District.—Miss G. L. Elles and Miss I. L. Slater; (2) The Carboniferous Rocks of Rush (County Dublin): Dr. C. A. Matley, with an Account of the Faunal Succession and Correlation by Dr. A. Vaughan.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Kite Observations from a Trawler in the North Sea: G. C. Simpson.—Investigation of the Upper Air in the West Indies by Means of Kites: C. J. P. Cave and W. H. Dines, F.R.S.—Temperature Observations during the Partial Solar Eclipse, August 30, 1905: W. H. Dines, F.R.S.—Comparison between Glaisher's Factors and Ferrel's Psychrometric Formula: J. R. Sutton.—A Rapid Method of finding the Elastic Force of Aqueous Vapour, &c., from Dry and Wet Bulb Thermometer Readings: Dr. J. Ball.

SOCIETY OF ARTS, at 8.—The Aërograph Method of Distributing Colour: Charles L. Burdick.

ROYAL MICROSCOPICAL SOCIETY, at 8.—A "Fern" Fructification from the Lower Coal-measures of Shore, Lancashire: D. M. S. Watson.—Exhibition of Balsam mounted Slides by the late Andrew Pritchard.

SOCIOLOGICAL SOCIETY, at 8.—The Russian Revolution and its Consequences: Dr. G. de Wesselitsky.

THURSDAY, DECEMBER 21.

LINNEAN SOCIETY, at 8.—Report on the Vienna Botanical Congress: Dr. A. B. Rendle.—*Cyrtandraceae malayanae novae*: Dr. Franz Kränzlin.—On Characæ from the Cape, collected by Major A. H. Wolley-Dod: H. and J. Groves.—Note on the Distribution of Shortia, Torr and Gray: B. Daydon Jackson.

CHEMICAL SOCIETY, at 8.30.—The Relation of Position Isomerism to Optical Activity. Part V. The Rotation of the Menthyl Esters of the Isomeric Dibromobenzoic Acids: J. B. Cohen and I. H. Zortman.—Azo-derivatives from α-Naphtho-methylcoumarin: J. T. Hewitt and H. V. Mitchell.—The Supposed Identity of Dihydrolaurolene and of Dihydro-*iso*laurolene with 1:1-Dimethylhexahydrobenzene: A. W. Crossley and N. Renouf.—The Slow Combustion of Carbon Disulphide: N. Smith.

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