THURSDAY, APRIL 25, 1912.

IN NATURE'S BYWAYS.

Die Pflanzengallen (Cecidien) Mittel- und Nordeuropas, ihre Erreger und Biologie und Bestimmungstabellen. By Dr. H. Ross. Pp. ix+350+x plates. (Jena: Gustav Fischer, 1911.) Price 9 marks.

Die Gallen der Pflanzen. Ein Lehrbuch für Botaniker und Entomologen. By Prof. E. Küster. Pp. x+437. (Leipzig: S. Hirzel, 1911.) Price 16 marks.

AMONG the byways that lie in the borderland between botany and zoology and appeal to the students of both sciences, few, if any, offer more attractions than the study of galls. That certain organisms can change the modes of action of the living substance in some other, and can make it produce new structures to benefit themselves, is an intervention of a kind to arouse interest. But that power is shared by plants and animals of widely different types, and so related to others that do not possess the power as to indicate that it has often been independently acquired. The effects produced by some amount to little more than sufficient to heal wounds, while at the other extreme we find growths unlike any uninjured structure of the host; and between these are galls of varied forms and structure, each true to its type. The wide diffusion of the power to influence the work of the protoplasm seems to point to the readiness of that substance to respond to certain kinds of stimuli, and to give some warrant for the hope that means to regulate its activities may be discovered. As yet, however, the attempts to produce galls artificially have failed.

The literature on galls is already very extensive, though comparatively recent; but much of it is scattered in periodical literature, or forms large and costly works. The two before us are among the latest contributions to the mass, and though comprehensive in treatment are among the less expensive books. They treat the subject from different points of view.

"Die Pflanzengallen Mittel- und Nordeuropas," by Dr. Ross, is intended to supply a descriptive catalogue of the galls recorded from Central Europe and Scandinavia, including those caused by plants as well as those of animals. The descriptions are limited to the briefest possible statement of the distinctive features, in keys of tabular form, of all the galls in each genus. The characters have been carefully selected, though sometimes too brief; but contractions are freely used for the organs of the hosts, and the tables have not the clearness of those in Houard's "Zoocécidies des Plantes d'Europe." Somewhat above a hundred of the galls caused by animals are figured, often with details of structure, on the ten plates. All the galls in each genus are treated in a single table, the species of the hosts being named after the description of each gall, except under Quercus, where *Cerris* receives distinct treatment from the other oaks, owing to the multitude of galls on these trees. For ease of reference the genera are arranged alphabetically, but the gain is more than balanced by the loss in the separation of nearly allied host-plants, and the consequent obscuring of the relationships between the galls on them.

The tables are preceded by eighty pages of general discussion. The author defines "gall," in the widest sense of the word, as any deviation of structure due to growth produced (usually by a chemical stimulus) on a plant by an organism living parasitically or symbiotically on the plant. He treats of the forms and structure of galls, the various types of animals and plants that give rise to them, the effects on the host-plants, the distinction of galls into "organoid" (which allow recognition of the parts of which they are modifications) and "histoid" (not evidently comparable with parts present in the plant naturally), the limitation of the gall-forming response to the meristem, the nature of the stimuli employed by different gall-makers and of the response to each, the formation of "procecidia" (growths abandoned by the larvæ very early), and other topics of great biological interest, such as the different relations to production of galls exhibited within the limits of certain species of gall-makers. Some of these in alternate generations produce galls of different structure on the same host; or they pass from one host to another, producing galls on both, or on one host but not on the other; or the galls may be formed by some individuals (*e.g.* of certain weevils), and occupied by their larvæ, while other larvæ of the same species may live healthily on the same host without a gall being formed. The "ambrosia" galls, in which fungi grow, to serve as food for the larvæ, also find mention.

Brief directions are given for collecting and preserving galls, and for rearing the makers to maturity. Within the limits set, the book will be found a helpful and suggestive guide to the determination of the galls of Central and North Europe, and a good introduction to their study.

Dr. Küster's "Die Gallen der Pflanzen" does not attempt to give an exhaustive list of the galls of any one region or country, its aims being to afford a comprehensive and trustworthy introduction to the study of galls, illustrated by series of selected types, to indicate the progress already

made, and to point out and direct attention to some of the many problems that suggest themselves more or less urgently at each step forward.

The term "gall" is employed in almost the same sense as by Dr. Ross, and the subjects treated of by him are also met with in this work; but the whole subject is discussed far more thoroughly, and from other points of view, with very copious notes and bibliographical references.

The introduction gives a historical outline of the investigation of galls from the earliest records onwards. Some of the earlier beliefs as to their origin are similar in kind with the strange explanations of the origin of fungi at the same period; and they form a striking contrast to the views expressed by Malpighi, the founder of the scientific study of galls, in his treatises, "De gallis" and "De variis plantarum tumoribus et excrescentiis." But for a long period after Malpighi, little interest was shown in them except by Réaumur, and a catalogue of galls due to animals (zoocecidia) published in 1858 included only about 300. How rapidly knowledge has advanced since then is evident from the catalogue by Houard, issued in 1909, enumerating more than 6000 from Europe and the Mediterranean area of Africa and Asia, while numerous records have recently appeared on the galls of many other regions.

Dr. Küster divides his book into comprehensive chapters devoted to the great divisions of his subject, beginning with one on the gall-producing animals and plants considered class by class. The second consists of a review of the gall-bearing plants, also treated systematically. The situations of galls on their hosts and their morphology receive very full consideration, as do also their internal structures and their relations to the healthy tissues of the host-plants. Then follows a brief account of the chemistry of galls, including the physiological processes that go on in them. The two last chapters are the most important and suggestive of all, the one being devoted to the etiology and the other to the biology of galls. Under etiology are considered the prerequisites for their formation, the varying degrees of ability shown by the gall-makers to originate and to develop them, general questions as to means employed by their makers, the formation of galls as affected by absorption, nutrition, and wounds, their connection with alterations of correlation in the members and tissues of the host, their tendency to induce permanent variations (very slight, as tested by cases where the growth extends beyond a gall), abnormal galls, and the information that they yield as to their etiology, and as to the effect on their growth of the death of the maker or its early abandonment of the gall. The great need of further efforts to produce galls experimentally is dwelt on, while the small result from the experiments of the past is fully recognised, and makes still more evident the need to observe very carefully the actual course of things in the development of galls, both normal and abnormal. Many show themselves to result from stoppages of advance in complexity, while increase goes on in mass of tissues.

Under the biology are included a number of most interesting topics, such as the grade of restriction to certain host-plants, alternation of generations, with or without alternation of hosts, tendency to produce "physiological species" or races restricted to certain hosts, though scarcely differing morphologically, relative frequency in various habitats (*e.g.* water plants, dry moor and mountain floras, deciduous trees, &c.), methods of distribution in space, palæontology, relations between galls and their makers (duration of life, sexual dimorphism of galls, methods of emergence of makers), effects of galls on welfare of host, and relations to other organisms (feeders on galls, inquilines, "ambrosia," and parasitic fungi, &c.).

A brief account is given in an appendix of the relatively few galls ("thylacia") upon the bodies of animals.

Space will not allow of quoting any of the remarks on the numerous problems to which the reader's attention is directed as in need of investigation. For these, as for much else, we must refer those interested in galls to the work itself, assured that they will find no better or more trustworthy guide. Its value will be most fully felt by those who have already gained some knowledge of galls in the field. As already stated, it does not aim at being a descriptive catalogue. Numerous good figures in the text (not always correctly referred to, however), and a sufficient index add to the value of this excellent work.

SOIL STRUCTURE AND PLANT GROWTH.

Boden und Klima auf kleinstem Raum. Versuch einer exakten Behandlung des Standorts auf dem Wellenkalk. By Prof. G. Kraus. Pp. vi + 184 + Taf. vii. (Jena: Gustav Fischer, 1911.) Price 8 marks.

NO one can pass from a sand to a chalk formation without being struck by the very sharp changes in vegetation, even where similar climatic conditions persist, changes which clearly indicate marked or even fundamental differences in soil conditions. But so far as we know no one has taken the trouble to investigate a particular case with anything like the completeness it de-

serves. The author of the present volume set out to remedy this deficiency by making adequate study of a little region near Karlstadt-on-the-Main, where the sandstone with its green woods and red, moist soil gives place to limestone and a dry, glistening white soil.

In similar instances it has been the practice to attribute the difference of flora to the presence of calcium carbonate in the limestone soil and its absence from the sandy soil, and the author began with this hypothesis in view by making numerous determinations of calcium carbonate in the soil. But he was soon driven to the conclusion that calcium carbonate is an exceedingly variable quantity; indeed, he doubts whether any estimate can be obtained of the amount in the layers of the soil immediately in contact with the plant root. Making the determination in the accepted way, however, and comparing the analytical results with the vegetation, he failed to find any plant that occurred exclusively on soils of even approximately the same calcium carbonate content; there were always variations within very wide limits. A vague relationship only could be traced: some plants showed a clear preference for soils containing a high amount of calcium carbonate, whilst others were found on soils containing only small quantities. Thus *Festuca glauca* occurred on soils containing 28 to 64 per cent., *Teucrium montanum* on soils containing 11 to 73 per cent.—more generally, however, when more than 35 per cent. was present—and *Melica ciliata* where 24 to 60 per cent. occurred. Against these the limits for *Brachypodium pinnatum* were 2 to 43 per cent., for *Koeleria cristata* 1·4 to 27 per cent., and for *Hieracium pilosella* 16 to 56 per cent.

A mixed flora was found where the limestone merged into the sandstone. True chalk plants like *Pulsatilla* and *Hippocrepis* grew in spots where calcium carbonate was absent, while calcifugous plants like *Calluna* and *Vaccinium* were found in places where more than 3 per cent. of calcium carbonate occurred, and alongside *Anemone sylvestris* flourished. With the exception of a few plants that require large amounts of calcium carbonate the author seems to have found most of the local calcicolous plants on soils entirely free from calcium carbonate. He has completely lost faith in the lime content of the soil as a true basis of discrimination, and looks forward to the time when every calcicolous plant shall have been found on chalk-free soils.

The wandering of plants for which calcium carbonate is supposed to be essential on to chalk-free soils has been already observed, but never accounted for. When exceptions to a rule begin to crop up, there is a strong temptation to invent a new name to describe the exceptional case and after a while to take the name as an explanation of the phenomenon, and the cynic might argue that something of the sort has happened with the word invented in this instance—heterotopism. The present author, however, goes further; since the calcium carbonate hypothesis fails, he turns to a second hypothesis, the view that the physical properties of the soil and not the calcium carbonate really determine the distribution of plants. The particular set of properties best suited to calcicolous plants are usually found in soils rich in calcium carbonate, while those suited to calcifugous plants are associated with soils poor in calcium carbonate; but the carbonate itself does not play the controlling part in the matter. The author is not prepared to say that calcium carbonate exerts no specific action on the plant, but he knows of no proof that it does. Even small quantities of calcium carbonate are known to affect markedly the properties of the soil; he therefore made mechanical analyses, determined water-contents and temperatures of the soils, and also noted their aspects and general relation to their surroundings. Working over very small areas in great detail, he finds distinct similarity in general physical conditions on spots where the same plants are growing. In the last instance the physical properties of the soil are some function of the soil structure, which therefore he considers to be the determining factor.

Whether the author's conclusions are wholly justified can only be ascertained by further experiments, but he certainly makes out a strong case for his main thesis that the botanist must pay more attention to the properties of the soil if he wishes to account for the distribution of plants. The book will be found of much interest to ecologists as a piece of painstaking and methodical work, and it emphasises the important fact that careful investigation over a limited area is likely to prove very fruitful in the study of ecology.

E. J. RUSSELL.

THE ADVANCE OF PHOTOGRAPHY.

The Advance of Photography: its History and Modern Applications. By A. E. Garrett. Pp. xiii + 382. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1911.) Price 12*s.* 6*d.* net.

IT is about forty years since Dr. Hermann Vogel wrote his volume entitled "The Chemistry of Light and Photography in their Application to Art, Science, and Industry" for the "International Scientific Series," so well known by their red covers. The copy before us is a "new and revised" edition issued in 1876, and about two-fifths of its contents are devoted to historical

facts and processes, two-fifths to the applications of photography, including photo-mechanical methods, while the remaining fifth is devoted to the action of light, the correctness of photographs, perspective, &c., with a final chapter on "Photography as a subject to be taught in art and industrial schools." In this last chapter Dr. Vogel makes an earnest plea for the inclusion of photography in the courses of study of technical institutions, not "to train professional photographers . . . but so far as it is of importance for art and science." He bases his plea, not only on the opinions of others, but also on his nine years' experience as professor of photography in the Royal Industrial Academy of Berlin.

This is the book that Mr. Garrett has sought to modernise, or "bring up to date," as the saying is. The present author has given the volume a new title, transferred Vogel's name from the title-page to the preface, and states that "although the present book is of necessity practically a new work, it is based upon the lines laid down in the original publication." The only noteworthy omission of the substance of the original volume that we observe is the last chapter, that is the plea for the consideration of photography as a subject to be included in the curriculum of colleges, because of the importance and the universality of its applications. Perhaps the author is justified, for, in this country at least, there is little "advance" to record with regard to this matter. The study of photography, even by those who need its aid, too often means no more than working from the instructions issued by manufacturers, with perhaps an occasional question across the dealer's counter.

The remainder of the volume is rearranged somewhat and added to. The chief additions are on gelatino-bromide dry plates (which, of course, were not in use when Vogel wrote), photography in natural colours, Röntgen-ray photography, photo-telegraphy, and animated photography. These final chapters are interesting, instructive, and well illustrated, though they sometimes wander rather far from photography, as, for example, in the consideration of the apparatus used in Röntgen ray work. When a matter such as this is treated and illustrated so fully, we naturally expect that the more purely photographic subjects will have received at least as much attention, but here we are disappointed. Within the space of four pages there is all that we can find with regard to carbon printing, the gum bichromate process, ozobrome (ozotype is not mentioned), printing-out papers, toning and fixing, phosphate papers, bromide printing, gas-light papers, and platinum printing!

Lenses are classified into (1) rapid rectilinears, (2) portrait lenses, (3) wide angle lenses, and, as a kind of supplement, telephoto lenses. All that we can find about Abbé and Schott, and the optical work they carried out which has revolutionised the construction of photographic lenses, is that when they "undertook to construct a lens suitable for this work," that is, exact work, "they had the very great advantage of having a definite aim in view."

The author's style is generally clear, but there are some sentences which need a little expansion or explanation, because as they stand they are liable to mislead the reader. For example, at p. 323 we are told that

"the superiority of apochromatic lenses in micro-photographic work is only very apparent when the preparation to be photographed is unstained, and extremely minute details are required such as can only be resolved with light of short wave-length. Hence it is that the cheaper achromatic lenses are much more frequently used in conjunction with stained preparations, autochrome plates, or orthochromatic plates and colour screens."

The unqualified statement that it is "essential" to have a stand of "a large type and provided with a rotating and centering stage" for the purposes of photomicrography, appears to us to be contrary to general experience. When such matters as these are elucidated, the volume will be an interesting and useful treatise, though it can scarcely claim to be comprehensive.

C. J.

THE GRAMMAR OF SCIENCE.

The Grammar of Science. By Prof. Karl Pearson, F.R.S. Part i., Physical. Third edition, revised and enlarged. Pp. xx + 394. (London: A. and C. Black, 1911.) Price 6*s.* net.

THE notices formerly given of the first and second editions of Prof. Pearson's well-written "Grammar of Science" (see NATURE, vol. 46, pp. 97–99, 1892, and vol. 62, pp. 49–50, 1900) scarcely need to be added to in the way of a general review. The main feature of the new edition which differentiates it from the others is the addition of two new chapters: chapter v., on contingency and correlation, and chapter x., modern physical ideas. The former chapter is particularly noteworthy, presenting as it does in a wonderfully small compass the scientific significance of the two terms contingency and correlation. The general reader, whose mathematical symbolism is of the most elementary type, will probably find difficulty in appreciating the full scope of this chapter. A simple concrete example might not have proved amiss.

To keep the volume a reasonable size the addition of this new matter has compelled the author to reserve for a second volume the subjects which were formerly discussed in the last two chapters, namely, life and the classification of the sciences. In other respects there is singularly little change, the author being evidently convinced that the original statement could not be improved upon. It is a pity, perhaps, that some of the more polemical sections have not been modified so as to prevent misunderstanding as to the intention of some of the earlier writers who are attacked. Prof. Pearson himself speaks of "the acceleration of A due to B," but carefully adds a footnote to guard the reader against taking the phrase in its obvious meaning. Newton and others were guilty of similar anthropomorphism, for which they are denounced. They failed to add warning footnotes, partly because they had a grand faith in the common sense of their readers, partly because they were writing a constructive scientific treatise, and not a critical grammar of science. These attacks, however, add spice to the pages of a book which excels in the clearness with which the significance of natural law is discussed.

It should be mentioned in conclusion that chapter x., on modern physical ideas, is contributed by Prof. E. Cunningham. The scope of the chapter is sufficiently indicated by the titles of a few of the sections, such as: the electromagnetic constitution of the atom, electromagnetic mass, fluid or space distribution of electricity, and the theory of relativity. The expanded second volume of this interesting work will be looked forward to with great expectations.

A BIOLOGICAL DICTIONARY.

Wörterbuch der Biologie. By Dr. Heinrich Schmidt. Pp. viii+581. (Leipzig: Alfred Kröner, 1912.) Price 10 marks.

WRITERS on biological subjects have always used a rich vocabulary, but with the growth of information and knowledge there has arisen such a wealth of technical terms and of classificatory nomenclature that readers, and even writers themselves, are often at a loss, and it is difficult to refer an inquirer to any handy work containing an adequate glossary of terms used in anthropology, botany, and geology. Ziegler's "Zoologisches Wörterbuch" supplies the want for zoologists, and supplies it well, but there is undoubtedly room for such a dictionary as this which Dr. Schmidt has written. At a rough estimate it contains 10,000 definitions, and the labour of compiling it must have been very great, for not only are descriptive words explained but there are also many generic terms and expressions that appeal only to the advanced systematist. The derivations of the words are not given.

Use, and use alone, can test the value of this dictionary. So far as we have been able to determine its accuracy and inclusiveness, the work has stood the test very well. As an example of the unexpectedly interesting information afforded in dealing with arid or forbidding names, we select "Lebensdauer." Under this heading a most interesting summary is given of the relative longevity of plants and animals. We are told on the authority of Hesse's work, "Tierbau und Tierleben," that an earthworm lives ten years, a leech twenty or even twenty-seven years, a pond mussel twelve years, a (fresh-water) pearl mussel fifty to a hundred years. Most of the definitions we have examined seem well arranged, though here and there a little inaccuracy has crept in. For example, under "body-cavity" we are told that a true coelom is well-developed in limulus, spiders, millipedes, and insects, whereas, of course, the well-developed cavity in these animals is not a true coelom at all.

The terms used in classification seem needlessly numerous, and are sometimes very unhappily expressed. Protozoa, for example, are divided into "Cytomorphæ" and "Cytoideæ," a new and abominable classification. Certain cases of omission have occurred in the course of a few days' use. The term "lipoids," about which so much is heard just at present, might have been included. The class of pigments known as lipochromes is left out, whilst the melanins are included. But these considerations are of small account in comparison with the mass of successful definitions which testify to the author's tireless researches. A few illustrations are given, and a geological table is added as an appendix.

OUR BOOKSHELF.

Links with the Past in the Plant World. By Prof. A. C. Seward, F.R.S. Pp. ix+142. (Cambridge: University Press, 1911.) Price 1s. net.

THE object of this neat little volume is best explained in the author's words. "I hope," he says, "that I may succeed in attracting some of my readers who are already interested in living plants to the study of plants of former ages." The book is likely to fulfil its purpose. Without attempting any serious discussion of evolutionary theories, the author brings home to the reader the deep interest of a number of problems in the history of plants and their distribution.

The introductory chapter begins with the always attractive subject of the longevity of trees, and explains very clearly how a tree grows

and the nature of the so-called annual rings. From the age of individuals we are led on to archæological evidence of antiquity. "From the period claimed by archæologists we pass by gradual stages into the domain of the geologist."

Before entering on this field, a chapter on geographical distribution, a subject of which the importance has not always been realised by modern students, is appropriately introduced. Darwin's high appreciation of the study of distribution, which he called "that almost keystone of the laws of creation," is emphasised. Quite recently, interest in distribution, stimulated by the kindred study of ecology, has much revived.

In his sketch of the geological record, Prof. Seward points out that the history of the world's flora must go back immensely farther than our records show. "The relics of plant-life furnished by the Devonian and succeeding formations represent the upper branching-systems of a deeply rooted and spreading tree, the lowest portions of which have been destroyed or have left no sign of their existence" (p. 44).

The preservation of plants as fossils is the subject of chapter iv. A particularly striking picture of the flood-plain of the Rio Colorado, with drift-wood stretching over a tract 25 miles across, gives a vivid idea of how a fossil "pine-raft" may have been formed.

The four succeeding chapters illustrate the general theme by special examples of "links with the past," taken from the ferns, the big trees of California, the Araucaria family, and the maiden-hair tree.

The illustrations throughout are remarkably good. Mr. Tansley's photographs of Malayan ferns are of exceptional beauty. The book concludes with a full bibliography and a useful index.

D. H. S.

How to Attract and Protect Wild Birds. By M. Hiesemann. Translated by Emma S. Buchheim. With an introduction by Her Grace the Duchess of Bedford. Second edition, with many revisions. Pp. 101. (London: Witherby and Co., 1911.) Price 1*s.* 6*d.* net.

WE have already directed attention (NATURE, July 22, 1909) to the first edition of the useful little work by Martin Hiesemann on the practical preservation and protection of birds by the provision or creation of opportunities for their breeding, winter feeding, and by fighting the enemies of birds, and little remains to be said of the second edition except that it has been revised and enlarged in many essential points. This excellent little book was written for Germany, where the birds' natural conditions of life differ somewhat from those prevailing in this country. For instance, our winters are less severe, and so less systematic feeding at that season may be necessary; our country is, generally speaking, less open and more wooded (hedgerows, gardens, and ornamental grounds and plantations being taken as woodlands in this connection), so that the provision of special breeding plantations may not be desirable here. Our birds of prey have been closely killed down, and there seems to be no way (permitted by law) of dealing with the domestic cat, the birds' worst enemy in this country.

But the portion of the book dealing with the provision of nesting places for birds which breed in holes deserves the closest consideration by those who wish to encourage the different species which fall under this category; for the difficulty experienced by these birds in finding nesting places has greatly increased, since by the rules of modern forestry nearly every old tree is felled, without regard to the fact that the holes it contains serve as shelters and nesting places. Those men who care only for what is of practical use grudge the old, decayed trees the little space on which they stand, and prefer to convert them into firewood. The remedy for this is the provision of nesting boxes, and we are told here what is the right sort of box, and the right—and the wrong—way of hanging them up. The illustrations are numerous and very useful.

Applied Biology. An Elementary Textbook and Laboratory Guide. By Prof. M. A. Bigelow and Anna N. Bigelow. Pp. xi+583. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1911.) Price 6*s.* net.

THIS volume has been prepared for use in higher schools during a year's course of five hours per week. The frog and the bean-plant are taken as types for the study of animal- and plant-structure and biology. The succeeding part of the book contains an account of the structure and life-histories of "seed-plants" and "spore plants" (ferns, mosses, algæ, fungi, and bacteria). The chief phyla of the animal kingdom are traversed in the third part of the book; but the authors have attempted to compress too much material into these 140 pages, with the result that many subjects are necessarily considered so briefly that only imperfect ideas of them are conveyed. For instance, "Paramecia reach a state when they are unable to continue to divide. Two such individuals come into contact, and through their delicate cell-walls some of the nucleus of each one passes over to join the nucleus of the other,"—is surely an incorrect and inadequate account of the conjugation phenomena. There are a few slips in this part of the work, *e.g.*, the sword-fish is placed among the cartilaginous fishes. The succeeding part of the work deals in an interesting manner with the structure of the human alimentary canal, digestion, food-values, blood, respiration, excretion, and nervous activity, and leads up to an application of biological principles to personal hygiene.

The book contains much information on biological subjects of public interest, *e.g.*, toxins and anti-toxins, mosquitoes and flies in relation to disease, the bacterial treatment of sewage, parasites in meat, and shows clearly the important bearing of a knowledge of biological science on many aspects of human life.

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.]*

Insect Parasites on Trees.

THE note in NATURE of April 11 (p. 144) about the ravages of insect parasites upon the chir pine (*Pinus longifolia*) in the Himalayas suggests a consideration which, I think, is not enough present to foresters and planters in this country. I am too destitute of biological or physiological knowledge to venture an opinion upon the causes which lead to the excessive multiplication of parasites, whether animal or fungoid, upon animals and plants whereof the vitality has been impaired by some other agency; but the phenomenon must be familiar to most people, though it is generally wrongly interpreted. Normally vigorous organisms may, and do, entertain a reasonable number of parasitic guests without appreciable loss of vigour; but these guests seem to bide their time until the host is weakened by accident or disease, when they display a surprising amount of latent fecundity. In the case of the chir pine, the opportunity occurs when the vitality of the tree is lowered by tapping for resin; in other words, when it is depleted of its protective juices, the diminution of which gives easy access to the Platypus larvæ.

To an analogous process may be traced the prevalence of larch canker, which, during the last fifty years, has brought such heavy loss upon owners of woodland, having previously attracted no attention whatever from foresters. It has now become the most widely destructive tree disease in Britain. The hostile agent in this case is a pesizoid fungus, *Dasycypha calycina*, the ravages of which generally manifest themselves on poles from seven to fifteen years old. Many of these die or become hopelessly deformed, and all attempts to arrest the evil have hitherto proved futile, although recent works on forestry bristle with recommendations on the subject. Yet I am convinced that planters have the remedy in their own hands—at least as regards planting in the future.

The fungus Dasycypha is no new creation; it has always found a home on the larch. Dr. Hartig found traces of it in Swiss larch of 100 years' standing. I have found it also on Corsican and Scots pines, where it is quite innocuous. The European larch has succumbed to its attack in Great Britain because, under the conditions to which foresters too often expose them, the young plants receive a severe check at the critical time of planting, and do not recover strength before the mycelium has penetrated the tissues so far as to hinder or prevent recovery.

This check is the result of the drying of the roots during transport from a distant nursery. There is Dasycypha in the noble larch woods of Dunkeld, but no cankered larches. The parasite has never had a chance of overcoming its host, because these trees were all reared from seed in home nurseries and planted out straight away.

The Japanese larch (*Larix leptolepis*) is very nearly akin to the European species, but is distinguished by its immensely superior vigour in youth. Hence, although the characteristic larch parasites—Dasycypha, Chermes, and the large larch sawfly—may all be found in a plantation of Japanese larch here, the trees are none the worse for their presence.

The lesson to be learnt by our foresters seems to be that although the native climate of the European larch is very different from that of the British Isles, it adapts itself readily to British conditions, provided that care be taken to protect it from any check to its vitality, and that they may treat with indifference prescriptions against this and other tree diseases for exterminating parasites or checking their attacks, such as hand-picking, smoking, spraying, &c., all of which are childish in their futility and prohibitive in expense when applied to large woodland areas.

Monreith, April 15. HERBERT MAXWELL.

The Propagation of Long Electric Waves during the Solar Eclipse.

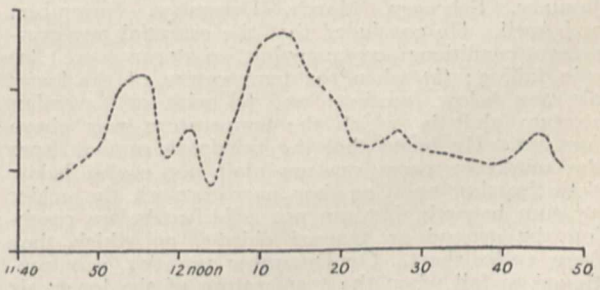
IT is now common knowledge that the long electric waves employed in wireless telegraphy over great distances appear to travel better during the hours of darkness than in the daytime. It is known besides that the natural electric waves produced by atmospheric electrical discharges—which are heard in the telephones of receiving stations as clicks or scratching noises, and are called "strays" or "X's" by those engaged in wireless telegraphy—are also propagated better in darkness than in light.

These differences between day and night propagation suggested to me that observations of the strength and number of strays, and of the strength of signals, during the solar eclipse of April 17, might prove to be of interest. Accordingly a record of strays and signals was made at my laboratory in London during the progress of the eclipse. The apparatus was set so as to receive signals of wave-length 5500 metres, which is approximately the wave-length of the signals emitted from the Marconi Transatlantic station in Ireland.

About the time of the eclipse strays were fairly numerous. The table below is a convenient summary of them. The number entered under each of the times was obtained by making a sort of rough time-integral of the number and intensity of the strays heard from half a minute before to half a minute after the beginning of the minute indicated.

Time 11.46 a.m.	47	48	49	50	51	52	53	54	55				
Strays 10	10	11	12	13	17	21	20	21	22				
Time 11.56 a.m.	57	58	59	12 noon	1	2	3	4	5	6	7	8	
Strays 22	17	12	12	13	15	14	9	8	12	14	17	23	
Time 12.0	10	11	12	13	14	15	16	17	18	19	20	21	
Strays 25	24	26	27	27	27	24	22	21	20	19	17	14	
Time 12.22	23	24	25	26	27	28	29	30	31	32	33	34	35
Strays 13	13	13	13	14	15	14	13	12	12	13	13	11	12
Time 12 36	37	38	39	40	41	42	43	44	45	46	47		
Strays 12	11	11	10	10	10	12	14	14	14	12	10		

These results are exhibited in the curve, with the times as abscissæ.



The message-bearing waves from Clifden were brief and irregular, so no measurements of their intensity were obtained; but it was very noticeable that they were loud when the strays were loud, and *vice versa*.

The observations show that on the whole the dark-

ness has its usual effect of facilitating the propagation of electric waves over great distances, but that there are portions of time during the period of greatest darkness at the receiving station when propagation is hindered. This minimum is not an accident, and was, in fact, not unexpected by me. It can be explained in some measure by a hypothesis which I have embodied in a paper and submitted to a learned society; but until the paper is published I feel precluded from discussing the phenomenon, and am writing to you merely to put the results of the observations on record.

I may add that Mr. Lempfert, of the Meteorological Office, has kindly informed me that there was not any trace of thunderstorm during the eclipse shown on the Daily Weather Reports of April 17 and 18. The distribution of pressure was not favourable for thunderstorms over the continent of Europe, though electric disturbances may have occurred in the low-pressure systems over the Spanish peninsula and the north of Norway. W. H. ECCLES.

37 Chelsea Gardens, S.W., April 19.

Glazed Frost.

JUDGING from the letters recently published under this heading (NATURE, pp. 414, 447, 484, 516, and 550), the phenomena known in New England as "ice storms" are of rare occurrence in Old England. They are of frequent occurrence along the Atlantic coast of North America, and the conditions which produce them are well understood.

In W. M. Davis's "Elementary Meteorology" (1893), p. 294, they are described as follows:—"Regions of strongly variable temperatures are subject to occasional winter storms in which the precipitation occurs as rain, but freezes as soon as it touches any solid body, such as the branches of trees, or telegraph wires, or the ground. This happens when the ground and the lower air have been made excessively cold during a spell of clear anticyclonic weather, when a moist upper current in advance of an approaching cyclone brings clouds and rain. Serious damage is caused by breaking down over-weighted wires and branches at such times. Wires may be increased in weight ten to twentyfold, and twigs even more than a hundredfold." Hann describes the phenomenon under the term "Glatteis" in his "Lehrbuch der Meteorologie" (1906), p. 190.

In a recent study of New England ice storms made under the direction of Prof. A. Lawrence Rotch by Mr. Charles F. Brooks in a research course in Harvard University, he found that twelve such storms occurred each year in the average for the period 1886 to 1911, inclusive. For the various months the frequency of occurrence was in the following order: January, February, March, December, November, and April. He concluded that the essential and ever-present conditions accompanying ice storms were: (*a*) rain falling; (*b*) when the temperature of the lower air was below freezing; and (*c*) with an inversion stratum aloft in which the temperature was above freezing. He found that the raindrops coming from the relatively warm stratum aloft are cooled below their freezing point as they pass through the colder stratum beneath, but are not solidified before reaching the ground or exposed objects, on which they form an ice sheet. On December 13, 1895, rain continued to fall when the temperature of the lower air was but 9° F.

Data obtained in kite flights during ice storms at Blue Hill Observatory verify the presence of this inversion stratum aloft. On February 9, 1905 (see Annals of the Astronomical Observatory of Harvard College, vol. lviii., part iii., p. 168), the temperature decreased with height from 29·3° F. at the observatory, 195 metres above sea-level, to 27·6° F. at 702 metres, the wind being uniformly E.S.E. in direction, and the air saturated. At 885 metres, however, the temperature was 32·9° F., the wind direction S.E., and the humidity 100 per cent. The base of the relatively warm stratum from which the moisture came in the form of raindrops was apparently between the last two heights quoted. The drops were undercooled as they descended through the colder stratum beneath, but did not change to ice until striking the ground. A somewhat similar condition was observed in the last international kite flight, that of March 7 last. On that occasion the auxiliary kites added to lift the line became so heavily coated with ice that they pulled the leading kite down instead of aiding its ascent, thereby rendering the maximum height reached during the flight considerably lower than usual. On that occasion the air was practically isothermal from the summit of Blue Hill to 625 metres above sea-level, the temperature being about 30·8° F. Above the latter level, however, the temperature increased steadily with height, and was 36·8° F. at 874 metres, the maximum height reached by the leading kite. Rain falling from this relatively warm stratum was undercooled by its passage through the colder air below, and changed to ice upon reaching solid objects.

In the vicinity of the observatory, after the occurrence of recent ice storms, it is not uncommon for the ice to accumulate to a depth of an inch on all exposed objects, and on one occasion, February 14–16, 1909, ice formed to a thickness of three inches, and did not disappear until February 20. During such storms we are able to keep the anemometer in operation only by frequently dashing hot water over the revolving cups and the other exposed parts.

Blue Hill Observatory, ANDREW H. PALMER.
Hyde Park, Mass., April 2.

Animal Intelligence.

THE following incident may be of interest to readers of NATURE.

We have a black retriever dog, very well trained. She is kept chained in a kennel in the yard, to which a number of fowls have access. During the last few days a black hen nearly every day lays an egg in the kennel, the dog meanwhile sitting outside. Unless someone takes the egg out directly afterwards, the dog takes possession of it and eats it.

This curious proceeding raises the question whether the hen lays the egg in the kennel for the dog's benefit, and whether the dog for her own advantage allows the hen to enter the kennel without molestation. M. N. W.

Frankland, St. Leonards, near Tring, April 19.

THE ECLIPSE OF THE SUN ON APRIL 17.

THE solar eclipse which occurred on April 17 appears to have been observed under ideal conditions all along the available track, and the question as to whether a *total* eclipse would occur is settled in the affirmative, for a totality of one-half to one second was witnessed in Portugal near Ovar.

No astronomical phenomenon of recent years appears to have attracted more general popular attention. Even the Lords Justices temporarily adjourned their sittings at the Law Courts in order to witness the unusual event.

A large number of well-known astronomers

journeyed to various environs of Paris in order to locate themselves on the central line, and were rewarded by a magnificent view of an annular eclipse which was so near total as to present vividly the phenomenon of Baily's beads.

Among these was a party including Dr. W. J. S. Lockyer and Mr. Frank McClean, whose telegram we published last week. Dr. Lockyer states that at Chavenay they were located exactly on the line given by the American ephemeris, which corresponded with the amended path given by Dr. Crommelin. There is no doubt that the eclipse there was central; the phenomenon of Baily's beads, starting symmetrically from both ends of the diameter, made a glorious spectacle. No corona was seen, but there were two large prominences. Referring to the latter phenomena, Mr. A. A. Buss states that he observed two prominences, spectroscopically, in position angles 116°-120° and 182°-206°. The former was very bright, and agrees in position with one of those reported by Dr. Lockyer, and shown on a "disc" spectroheliogram taken at South Kensington at 12h. 6m. 18s. p.m.; but the position of the other is not in agreement. Unfortunately, Mr. Buss does not give the time of his observations, but they indicate that considerable changes were taking place among the prominence structures about eclipse time. We learn from Dr. Lockyer that some such changes are indicated on the excellent series of photographs secured by M. Deslandres, with the various forms of spectroheliographs, during the eclipse period.

Another party, located at St. Germain, also close to the central line, included Prof. Turner, Mr. Howard Payn, M. Antoniadi, Mr. Whitmell, and others. According to the *Times* correspondent, the eclipse commenced at 10h. 48m. 51s. G.M.T., and as the moon advanced three lunar peaks were plainly visible at the satellite's limb. Prof. Turner saw a narrow ring of corona round the southern limb of the sun, Mr. Whitmell, with a slitless binocular spectroscope, could discern numerous Fraunhofer lines at 11h. 52m., and Mr. Payn succeeded in catching sight of Mercury. The thermometric observations made by M. Antoniadi indicated a distinct fall of temperature nearly concurrent with the passage of the lunar shadow; at 11h. 25m. the shade temperature was 57° F., and gradually decreased to a minimum of 49° F. at 12h. 18m., *i.e.*, about 8m. after the maximum phase.

The reports from Portugal show that the party of British astronomers organised by the British Astronomical Association enjoyed ideal conditions at Milhiondos, near Oporto, and saw the whole sun covered except for two luminous points, probably prominences.

In a cablegram to Dr. Lockyer, Mr. Worthington—who was fortunate enough to be able to secure good photographs at Vavau last year—reports a totality of about one second, during which he obtained a photograph of the corona. This shows a corona of the "wind vane" type, such as one naturally expects at such an epoch as the present, when we appear to be in the trough of a minimum of solar activity. Mr. Butler, of the Solar Physics Observatory, was also in Portugal, and in a communication to the *Daily Express* reports that Mr. Dean and himself made observations from Olhomarinho, four and a half kilometres north of Ovar. Totality appears to have been certainly less than one second, and a glare around the dark moon was thought to be the lower corona, but no streamers were seen: nor were any large prominences detected. A portrait-lens camera of large aperture was employed to photograph the corona, and photographs of the chromosphere at the moment of the reversal of the dark lines were attempted. The visual observations showed bright chromospheric rings corresponding to the radiations of hydrogen, helium, &c. Both Mercury and Venus, but no stars, were visible.

Reports from Brussels show that the central line passed over Waremme, between Liége and Brussels, where an annular eclipse, with the apparent diameters of the sun and moon very nearly equal, endured for a few seconds.

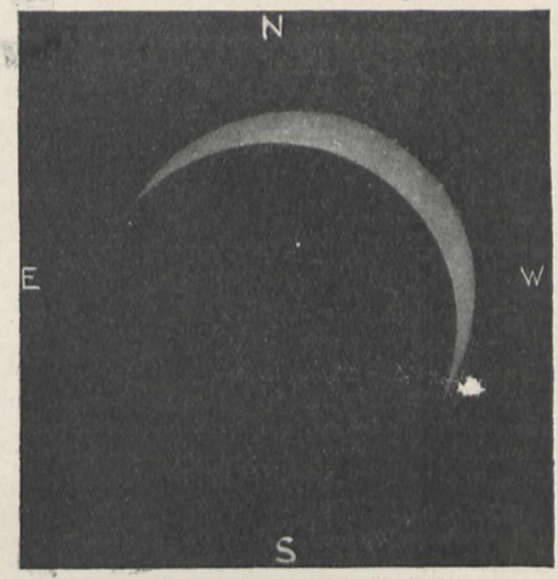


FIG. 1.—Spectroheliogram taken at the Solar Physics Observatory on April 17, 12h. 6m.

At Berlin the conditions for observations were remarkably good, and Prof. Schwarzschild, director of the Potsdam Observatory, watched the eclipse from the Zeppelin airship, which ascended from Frankfurt-on-Main. At Gedser, Denmark, where the magnitude of the eclipse was 0·98, the air temperature fell 9° F. between the beginning and end of the eclipse.

At Cambridge, Prof. Newall secured photographs of the spectrum of the sun's limb near the cusps, which showed bright lines superimposed upon the ordinary dark lines of the Fraunhofer spectrum.

At the Solar Physics Observatory, South Kensington, a series of photographs was secured with the spectroheliograph throughout the various phases, and the "limb" photographs taken after the eclipse showed two small prominences. We reproduce here one of the "disc" photographs

taken near mid-eclipse (Fig. 1), showing the thin crescent of the sun as photographed in the calcium radiation *K*. For visual observations the crescent was projected, by a 3¼-inch telescope, on to a white screen, the 4-inch image thus obtained showing exceedingly well the mountain peaks on the moon's limb. A noticeable feature was the ease with which one could produce crescent images through small apertures. The spaces between the fingers of an extended hand produced several, while thousands were seen projected on to a door by the uneven and dusty glass of a south window. The peculiar gloom which overspread everything near the maximum phase was very striking, being similar to that which precedes a dark thunderstorm.

The charts exhibited at the Meteorological Office show the thermometric effects of the solar obscuration very markedly. For the usual daily sheets, "quick-run" sheets were substituted on the various recording instruments for the eclipse period. The minimum air temperature during the run was recorded at 12h. 21m., 10·4 minutes after the maximum phase; during the eclipse the temperature ranged from 56° to 54° F., the maximum for the whole day being 59·3° at 2h. 45m. p.m. The Callendar radiation recorder showed an average rate of radiation received on a horizontal surface, during the eclipse time, of 0·030 watt per sq. cm., the maximum being 0·054 watt at 1h. 30m. p.m. and the minimum rate being 0·007 watt from 12h. 11m. to 12h. 15m., just after the maximum phase of the eclipse; the maximum rate of radiation for the day was 0·057 watt per sq. cm. at 1h. 50m. (1 cal. per minute = 0·07 watt).

The fall in temperature was very perceptible, but the actual readings are somewhat complicated, in their possible interpretation, by a breeze which sprung up about 11 a.m. and lulled at about 1h. 30m. p.m. At Balham Mr. Creeze recorded shade temperatures of 56° F. at the beginning, 52° at maximum phase, 51° at 12h. 30m. p.m., and 55·5° at 1h. 55m. p.m.

SARDINES.

A CASE recently decided at the London Guildhall by Alderman Sir George Woodman, in which a large part of both the evidence and the arguments turned on the question of the true meaning of the word "sardine," has excited considerable interest. On one side it was contended that sardines were the young of the pilchard (*Clupea pilchardus*) preserved in a particular way in oil and put up in tins, according to the methods employed on the west coast of France. On the other side, an attempt was made to show that the name "sardine" had in practice been extended, so that it included any small fish preserved in oil and put up in tins. Although the defendant, who was being prosecuted for selling Norwegian sprats or brisling put up in oil in tins as "sardines," won his case (without costs) on the ground that he had acted innocently, the decision on the question of the meaning of the name "sardine" followed closely the evidence given by the majority of the scientific experts. The Alderman's decision on this point was:—

"My decision is that the term 'sardine' is of French origin. It is the French name for the pilchard, the fish scientifically known as *Clupea pilchardus*. The industry of packing the immature pilchard in tins was started in France in 1882, and the fish so packed and imported into this country were universally known as 'sardines.' The word 'sardine' has now become anglicised, and I hold that the meaning of the term is 'the immature pilchard prepared and packed in oil in tins.' This is not what the defendant sold. The 'Skipper Sardines' sold by him were the Norwegian fish known as 'brisling.' The 'brisling' is the *Clupea sprattus* of the same family, but of a different species from the *Clupea pilchardus*, and it is the same fish, allowing for differences caused by local environment, as the English sprat."

The most interesting and complete account of the name "sardine" which we have seen was not, however, given in the evidence presented to the court, in so far as that evidence was published, but occurs under the signature "Quibbon," which we believe conceals the identity of a well-known and trustworthy authority on fishery questions, who writes in the *Fish Trades Gazette* (March 30, 1912) as follows:—

"The name 'Sardine.' This name is very widely applied either to the young of the pilchard, as with us, or to the pilchard itself. Thus the species *Clupea pilchardus*, our pilchard, is called *sardina* in Italy, *sardinha* in Portugal, *sardina* in Spain (where it seems also to apply to the anchovy), *sardine* in France and in Germany, *sardin* in Norway and Sweden (also *pilchard* in Swedish), *pelser* in Holland, and *pilchard* in Denmark; in Russia it is called *Ssardinka*. It is interesting to learn that it was the first of the Latin names to be used among the Anglo-Saxons for the herring. Eleven hundred years ago the Italian priests who endeavoured to instil a little learning into the Anglo-Saxon mind gave the name *sardinas* as the equivalent to the word *heringas*, but later on this gave way to the name *allec*. The smelt (Anglo-Saxon *smeltas*) was called *sardus*. The word is derived from the island Sardinia (Greek Σαρδώ), and the fish was known to the Greeks as *sardine* (σαρδίνη or σαρδῖνος). It is curious that to this day the term *sardyn* or *schardyn* is applied all along the Dutch coast to the sprat, and the usual net for catching sprats is called *sardynkuil*. A Dutch fisherman confines the term *sprott* to the smoked sprat; the fresh sprat, or the sprat fishing, is always referred to as above stated. This has been the case for a very long time, as is evident from an old work, 'Nieuwe Cronyk van Zeeland,' published in 1696. Centuries ago Dutch trade with the Mediterranean was very great, and no doubt the mariners brought back the term 'sardine' as applied in that sea, and used it in Holland for the small *clupeoids*, the sprats."

It is an easy matter to distinguish the sprat either from the young herring or from the young pilchard by the very much greater development of the spines along the ventral edge of the body in the sprat. The distinction can be made by the sense of touch alone, as is well known to many fishermen, for if the finger be passed along the belly of the fish from the tail towards the head,

the sharp spines of the sprat are distinctly felt, whereas the pilchard and the herring both feel comparatively smooth. To distinguish between young pilchards and young herrings, especially after they have been preserved in oil, is a more difficult matter, the size of the scales, which are relatively much larger in the pilchard, being the best guide.

PROF. A. LAWRENCE ROTCH.

PROF. ABBOTT LAWRENCE ROTCH, whose death we recorded with regret last week, was born on June 6, 1861. He received his education at the Massachusetts Institute of Technology, whence he graduated in the department of mechanical engineering in 1884. He became interested in meteorological investigation, and in 1885 founded a meteorological observatory at Blue Hill, Massachusetts, at a height of 635 feet above sea-level, for the purposes of observation, research, and local prediction. He showed characteristic independence in refusing at the outset to accept official help in maintaining the observatory at the expense of fettering it with official control. His main work was done in connection with this observatory, which he maintained and directed throughout. The results obtained were published from time to time in separate parts of the Annals of the Astronomical Observatory of Harvard College. For the first ten years the work consisted principally of the routine of an ordinary first-order observatory with reduction and analysis of the records, and special investigations of certain problems.

In 1894 the exploration of the free atmosphere by means of kites was begun at the observatory, and continued through succeeding years, steel piano wire (first used by E. D. Archibald in the early 'eighties) and a winding gear driven by a steam engine being adopted as the work developed, until a complete series of records up to a height of three miles had been obtained. In this work Rotch was a pioneer, and his methods were adopted at a later date in this country and on the Continent and by the United States Weather Bureau at the Mount Weather Observatory. In 1904 and the three following years seventy-six balloons carrying self-recording instruments were sent up under his direction at St. Louis, and of these seventy-two were recovered. Some of these reached heights exceeding ten miles, and temperatures below $-70°$ C. were recorded. Our knowledge of the higher parts of the free atmosphere in the United States is almost entirely due to the results obtained in this series of ascents.

But Rotch's efforts were by no means confined to his own country. He was a constant visitor to meteorological meetings in Europe, and he was ever alert and ready to help in meteorological enterprise. With M. L. Teisserenc de Bort he fitted out expeditions in three successive years to explore the atmosphere over the tropical Atlantic, and the results obtained have exceeded in interest nearly all other contributions to meteorological discovery in recent years. Our knowledge of the variation of the height of the stratosphere with latitude rests almost entirely on the evidence obtained in these expeditions. His most recent work was an atlas of charts of the atmosphere for aeronauts and aviators, in which he included a chart showing the best aerial routes in summer for a dirigible balloon travelling across the Atlantic between Europe and America.

The importance of his work was recognised by scientific societies both in Europe and America, and the Governments of France and Germany conferred honours upon him.

He was generous in his recognition of the work of others, and gave kindly encouragement to younger men engaged in research. His death, which occurred suddenly on April 7, 1912, at his Observatory at Blue Hill, will be regretted by meteorologists of all lands. E. G.

NOTES.

WE are informed that the provisional programme of arrangements for the forthcoming celebration of the 250th anniversary of the Royal Society are as follows:—Monday, July 15—An evening reception of delegates at the rooms of the Royal Society. Tuesday, July 16—In the morning a commemorative service in Westminster Abbey; in the afternoon the official reception of delegates at the Royal Society and presentation of addresses; in the evening a commemorative dinner at the Guildhall. Wednesday, July 17—In the morning visits to places of interest in London; in the afternoon the Duke of Northumberland gives a garden-party at Sion House; in the evening a conversazione in the rooms of the Royal Society. Thursday, July 18—In the morning visits to places of interest in London; in the afternoon H.M. the King gives a garden-party at Windsor, to which the delegates and fellows of the society will be invited. Friday, July 19—The delegates will visit Oxford and Cambridge Universities.

IN *The Times* of April 17, and in *The Morning Post* of the following day, reference is made to the drift of a sealed bottle which was thrown overboard from the steamship *Indraghira* on November 17, 1908, in lat. 51° 38′ S., long. 96° 15′ E., by a passenger during a voyage from London to Melbourne. The bottle contained a note of the ship's position with a request that the finder would notify the sender, Mr. H. P. Adams, of Carshalton, Surrey, of the facts of the discovery. The bottle was picked up early last winter, it is thought, on the eastern coast of Wellington Island, south of Chili, in lat. 49° 42′ S., long. 74° 25′ W., having drifted eastward a distance of at least 7100 nautical miles, presumably in 1100 days or less, at a minimum rate of six miles per day. This drift, though remarkable, is by no means the longest on record. The late Mr. H. C. Russell, when Government astronomer at Sydney, contributed several papers to the Royal Society of New South Wales on "Current Papers," in which he recorded the drift of numerous bottle messages, ranging from 50 to 5000 nautical miles, and several from 8000 to more than 9800 miles. The ostensible reason for launching these

bottles is to gain knowledge relating to ocean currents. It is difficult, however, and generally impossible, to obtain trustworthy information in this connection from the drift of bottles, because when a bottle is sufficiently weighted to present little surface to the wind, it sinks when covered with barnacles, and if not so weighted is influenced by winds as much as or more than by currents. Moreover, it is the resultant drift during a period of unknown length, not the direction and velocity of the various currents a bottle encounters, that can be estimated. Bottle messages might, however, be utilised with advantage to shipping were the drifts charted of even half those that have been recovered—their name is legion. Such charts would be useful for tracing the probable tracks of disabled steamers and thus locating them.

MR. R. N. LYNE, director of agriculture in Portuguese East Africa, has been appointed the director of the new agricultural department of Ceylon.

THE following have been nominated president and vice-presidents of the Institution of Electrical Engineers:—*President*, Mr. W. Duddell, F.R.S.; *vice-presidents*, Mr. W. Judd, Mr. C. H. Merz, Major W. A. J. O'Meara, C.M.G., and Mr. J. F. C. Snell.

AN official announcement from Mr. C. E. Adams, Government astronomer for New Zealand, states that the adopted position of the transit instrument at the Hector Observatory, Wellington, is latitude 41° 17′ 3·76″ south, longitude 11h. 39m. 4·27s. east of Greenwich; height above 1909 mean sea-level, 418 ft.

MR. GUSTAV POLLAK, who is preparing a biography of Michael Heilprin and his sons, will be glad to receive any letters by the late Prof. Angelo Heilprin. They may be sent to Mr. Pollak at No. 21 West Eighty-fifth Street, New York, and will be returned to the senders promptly if required.

REUTER'S AGENCY has received the first letters which have reached this country from Dr. Mawson's Australian Antarctic Expedition. It is stated that, although in the earliest stages of its work, the expedition has disproved the existence of Clairie Land, confirmed the existence of Termination Land, discovered by Wilkes, but not seen either by the *Challenger* or the *Gauss*, discovered numerous islets along the Great Barrier, and charted a great deal of previously unknown coast-line.

THE death is reported, at the age of fifty-one, of Dr. Perry L. Hobbs, professor of chemistry at the Western Reserve University, Cleveland, Ohio. He was one of the first men in America to specialise as a chemical engineer, and was widely known through his experiments in the manufacture of concrete.

MR. E. C. HAWKINS, the chief engineer of the Morgan-Guggenheim properties in Alaska, has died in the New York Hospital after an operation. In his construction of the White Pass and Yukon and the Copper River and Northern railways he met and overcame several problems of engineering that were new to the profession. In building the Childs Glacier bridge across the Copper River, for example, he had to evade the Miles glacier on one hand and the Childs glacier on the other. Mr. Williams was born in 1860, and was educated at the Rensselaer Institute, Troy, New York State.

ON Tuesday next, April 30, Mr. F. Balfour Browne will begin a course of two lectures at the Royal Institution on "Insect Distribution, with Special Reference to the British Islands," and on Thursday, May 2, Prof. J. Norman Collie will give the first of two lectures on "Recent Explorations in the Canadian Rocky Mountains." The Friday evening discourse on May 3 will be delivered by Mr. W. C. Dampier Whetham on "The Use of Pedigrees," and on May 10 by Prof. W. Stirling on "The Gaumont Speaking Kinematograph Films" (illustrated by the aid of M. Gaumont).

THE Home Secretary has appointed a committee to inquire and report whether the following diseases can properly be added to those enumerated in the third schedule of the Workmen's Compensation Act, 1906, namely—(1) cowpox; (2) Dupuytren's contraction; (3) clonic spasm of the eyelids, apart from nystagmus. The following are the members of the committee:—Mr. Ellis J. Griffith, K.C., M.P., Sir T. Clifford Allbutt, K.C.B., F.R.S., his Honour Judge A. Ruegg, K.C., and Dr. T. M. Legge. The secretary of the committee is Mr. Alexander Maxwell, of the Home Office, to whom all correspondence on the subject of the inquiry should be addressed.

IN *The Times* of April 22 appears a description by a correspondent of the archæological work of the Egyptian Research Account, directed by Prof. Petrie, during the past season. From this it appears that Prof. Petrie and his coadjutors have made very interesting discoveries of antiquities of the time of King Narmer, of the First Dynasty, which show that the crocodile worship in the Fayyûm was already established in his time. These finds were made in a necropolis at Kafr Ammar, in Middle Egypt. "Surprising discoveries" were made also at Heliopolis, where excavation has not hitherto met with any success whatever. These are to be described later. At Memphis an alabaster sphinx weighing 80 tons has been found.

THE Manchester Oriental Society was recently started by that well-known scholar Prof. Hope W. Hogg, whose premature death was a serious loss to science and a subject of general regret. The first part of the Proceedings of the society, prepared under his supervision, has just appeared. The most interesting contribution takes the shape of a symposium of well-known scholars with the object of solving a problem suggested by Prof. Elliot Smith. In examining Egyptian mummies, he noticed that it was a general habit to leave the heart *in situ*, while this was not apparently the case with other internal organs. The psychological explanation of this differentiation of treatment is still uncertain, though it is suggested by Prof. Rhys Davids, on evidence from India, that the heart was regarded as the seat of the soul. Prof. J. G. Frazer remarks that among

savage races little attention seems to be paid to the kidneys, save among some of the Australian tribes, and further evidence on this point from observers of savage life is much to be desired.

IN the third part of the Journal of the Gypsy Lore Society for the current year Miss E. Lyster gives an interesting account of the custom of marriage over the broomstick which prevails among some branches of the tribe in this country and other parts of Europe. The editor suggests that as in many places the besom is supposed to be an efficient instrument for scaring ghosts from the house, the stepping over it is probably a method of getting rid of their undesirable attentions. Others, again, are inclined to believe that, being specially used by women, its employment at marriage points to a stage of belief when mother-right was in force. Others suggest that the object of the bride stepping over it at marriage is to promote her fertility by associating her with the productive spirit of the tree from the branches of which it is made. Prof. Frazer in the second part of the new edition of "The Golden Bough" describes the belief that harm is done to a person or thing by stepping over him or it. This, however, seems to depend on a train of thought different from that on which the Gypsy custom rests, and the exact explanation of the latter is still obscure.

WE have been favoured with a copy of the first part of an illustrated account, in Spanish, of the "microfauna," that is to say, the fresh-water plankton fauna, of the Argentine Republic, by Dr. J. M. de la Rua, published under the auspices of the National University of Buenos Aires by J. H. Kidd and Co. of that city. This part is devoted to protozoans.

ONE remarkable result of the collecting cruise of the *Siboga* in the Indo-Malay Archipelago was the extraordinary number of new forms of free crinoids discovered. These were handed over to Mr. A. H. Clark, of the museum at Washington, by whom no fewer than twenty new species—one of which is referred to a new genus—belonging to the families Antedonidæ and Atelecrinidæ are described in vol. xxxiv., No. 2, of Notes from the Leyden Museum.

ARTICLES on the proposed new library and art gallery at Manchester, and the London Museum in Kensington Palace, form the leading features of the April number of *The Museums Journal*. From the former it appears that the original intention was to erect the new building on the site of the old infirmary in Piccadilly, Manchester, and the article contains reproductions of the designs which have been accepted on that understanding. An alternative site has, however, been suggested, which would seem to require a building of a different type; and until the question of site is definitely decided, no further progress in the matter can be made. The estimated cost of the building approved for the Piccadilly site is 250,000*l*.

BULLETIN No. 91 of the U.S. Bureau of Entomology (U.S. Department of Agriculture) contains a detailed account by Messrs. L. O. Howard and W. F. Fiske of the attempts made to check the increase of the gipsy moth (*Porthetria dispar*) and the brown-tail moth (*Euproctis chrysorrhoea*) by importation into the United States of their parasites and natural enemies from Europe. The task was much more arduous than was anticipated at the beginning, and a great deal of original research upon the enemies of the two moths had to be undertaken in order to deal with the problem intelligently. It was found that the rapid dispersion of the introduced species necessitated the liberation of larger and stronger colonies than had been contemplated. It is hoped, however, that an efficient and automatic control of the gipsy moth in the United States will be obtained by 1916. The report is fully illustrated, and is a valuable contribution to the bionomics of insects as well as an object-lesson in methods of dealing with a serious economic problem.

IN 1895 Prof. Milne published his great catalogue of 8331 earthquakes recorded in Japan during the years 1885–92, the analysis of which has thrown considerable light on the distribution of earthquakes both in space and time. He has now further increased the debt of seismologists to him by compiling, at the cost of several years' labour, a "Catalogue of Destructive Earthquakes from A.D. 7 to A.D. 1899," a memoir of nearly a hundred pages issued under the auspices of the Seismological Committee of the British Association. Though containing only half as many entries as the earlier volume, its value, it may be anticipated, will be even greater. Being confined to shocks of an intensity sufficient to damage buildings, it deals with those movements which are of chief consequence in the moulding of the earth's crust. An analysis of the catalogue for different epochs should reveal to us some of the laws which govern the distribution of seismic energy within extensive regions, such, for instance, as the Pacific coast of the American continent.

HERR FRITZ KLUTE contributes to the *Berichte der naturforschender Gesellschaft* (Freiberg in Breisgau, Band xix., Heft i., 1911) a paper on "Die Schneereste der Schwarzwalder im Frühsommer und die Beziehungen ihrer Lage zu den Stellen ehemaliger Vergletscherung." After the heavy snows which fell on the Schwarzwald during the winter of 1906–7, it occurred to Prof. L. Neumann to send round inquiries as to the times and places where it lingered longest. These brought him 182 forms duly filled up, which he placed in Herr Klute's hands to work out. He obtained others for the winter of 1910, which brought the number up to 230. In this paper he gives a sketch of the geology and physical structure of the Schwarzwald, with a separate discussion of each district in which observations were taken. The duration of the snow depends chiefly on height and meteorological conditions (sunshine, warm winds, and rain being favourable to removal), and a useful map shows the contour lines, stations, and traces of former glaciers in the southern Schwarzwald. Here, out of 128 places of observation, only 21 have no connection with these traces; in the central region as many as 49 out of 62, and in the northern 14 out of 40. In the last the snowfall appears to be heavier than in

the first at the same elevation. The results, however, do not at present lead to any definite conclusion, which, indeed, was hardly to be expected, but they were worth undertaking, and it is to be hoped they will be continued, for they may enable more precise estimates to be made of the change of temperature that would bring back an ice age, and the meteorological conditions most favourable to it. The small glaciers in the Alps tell us the conditions under which they can exist at the present day, so that we may infer from the relics of similar glaciers in the Jura, Schwarzwald, and similar ranges that like conditions prevailed in them during the Ice age.

THE Italian Ministry of Foreign Affairs has issued a useful report on the climatology of Tripoli and Benghazi, prepared at the Central Meteorological Office by Dr. Eredia, with an interesting preface by Prof. Palazzo. Some of the observations used have already been published in the Annals of the French and Italian Meteorological Offices and other publications, but the recent occupation of those parts by Italy has made it desirable to issue a separate publication, brought, so far as practicable, up to date. All the principal meteorological elements are dealt with in considerable detail; we have extracted the following notes:—*Tripoli* (July, 1892, to May, 1911): Mean temperature, January, 12·1° C.; July, 25·8°; year, 19·7°; absolute maximum, 43·0°, in June and September; minimum, 1·4°, in January. Mean annual rainfall, 420·4 mm.; wettest month, December, 113·7 mm.; driest, July, 0·5 mm. Average number of rain-days, 51·1. *Benghazi* (January, 1891, to May, 1905): Mean temperature, January, 13·2°; July, 25·6°; year, 20·3°. From another series (August, 1886, to February, 1891) the absolute maximum was 40·0°, in June; minimum, 6·6°, in February. Rainfall (1886–1905): year, 276·3 mm.; wettest month, 77·4 mm., in January; driest, 0·0, in August. The rain-days were 55·1 in the yearly average. June–August were practically rainless.

IN *The Times* of April 16, and in *Symons's Meteorological Magazine* for April, Dr. H. R. Mill discusses the rainfall of the winter six months, October, 1911–March, 1912, in the British Isles. In this period the excessive rainfall was as remarkable as the drought of the summer of 1911. He shows in a very interesting manner, by selecting representative stations from the mass of materials at his disposal, that although as a whole excessive, the distribution of the rainfall was very irregular, and he remarks:—"It is very common, perhaps we might say usual, to find the rainfall at the opposite ends of Great Britain swinging to opposite sides of the average and the same divergence is also apparent in Ireland." The rainfall was below the average in Scotland, north and west of the Great Glen, but above the average everywhere else. In the eastern mountain mass between Perthshire and Aberdeenshire the excess was 40 per cent. and upwards. Most of South Wales and the south of England had an excess of more than 50 per cent., and Sussex 70 per cent. and upwards. In the extreme north-west of Ireland the excess was less than 10 per cent., while in the south-east a considerable area had an excess of more than 50 per cent. Expressed in percentages of the average, England and Wales as a whole had a mean of 141, Scotland 111, Ireland 136 per cent. For the Thames Valley above Teddington, an area of about 3800 square miles, the rainfall of the winter six months, 1911–12, was greater than the annual amount in seven years out of the last twenty-nine.

MANY of our readers will remember that the management of the Kew Observatory (Surrey) and the Eskdalemuir Observatory (Dumfriesshire) was recently transferred to the Meteorological Committee. The meteorological and geophysical elements observed at these stations, together with those made at Valencia Observatory (Kerry), and the wind components for four representative stations are, from January, 1911, published monthly in *The Geophysical Journal*. This work forms a very useful addition to the "British Meteorological and Magnetic Yearbook." All the units employed are based on the C.G.S. system, and although these have to some extent been used in the "Weekly Weather Report" they are not necessarily obvious to ordinary observers; their meaning is, however, lucidly explained by Dr. Shaw in the preface. The following examples illustrate some of the changes from the usual notation: atmospheric pressure is expressed in "bars," one bar being approximately equivalent to the pressure of 750 mm. of mercury; temperature is given in degrees absolute measured from a zero of 273° C. below freezing point; solar radiation is expressed in "watts" per cm.^{2}, instead of the usual gram-calorie; the latter unit is equivalent to 0·07 watt.

THE annual summary of the *Indian Weather Review* for 1910 contains abstracts of observations taken at a large number of stations, and special reports from the Kodaikanal and Bombay Observatories. One of the most notable features of the year observed at the former station was the rapid decrease in sun-spot activity. In 1909 the mean daily number was 3·9; in 1910 1·8. The sun's disc was free from spots on fifty-six days. In the valuable discussion of the meteorological elements the year is divided, as heretofore, into four seasons: cold and hot weather, south-west monsoon and retreating south-west monsoon periods, while the rainfall is illustrated by maps for each of the four periods. On the whole, 1910 was the coldest year on record since 1894. Only February and May had an excess of temperature. April, November, and December were much colder than usual. On the general average of all stations in the plains, 1910 had the heaviest rainfall since the above date, notwithstanding that the winter and spring seasons were drier than usual.

THE remarkably fine weather recently has had decided effects upon plant and animal life. A correspondent states that he saw a cabbage butterfly, *Papilio brassicae*, flying in his garden in the Hampstead Garden Suburb on Wednesday, April 17, and on April 21 several were seen in the course of an hour. The earliest date given by Gilbert White is April 28. Cabbage whites were seen at Appledram, near Chichester, on April 13, and the cuckoo was heard

for several minutes about 5 p.m. of the same day. White's earliest date for the cuckoo is April 7. The first Sulphur butterfly and a Peacock butterfly were seen at the same place on April 6. As is well known, the brimstone or sulphur butterfly is one of the earliest to make its appearance, and may sometimes be seen on a fine day in winter months; while Peacock butterflies which have hibernated are not infrequently seen in early spring.

THERE exists in France a technical committee the object of which is to study and extend the knowledge of the means of prevention and of extinction of fire, and of averting accidents. It is a voluntary organisation supported by public bodies, and includes amongst its members many well-known French officials. We have received from the committee two bulletins, one relating to the precautions to be taken against fire and accidents at exhibitions, the other to precautions against fire in villages. Both documents bear evidence of the thoroughness of the work done by the committee, and can be obtained for a few pence. We notice that in neither case does the committee advise the provision of "extinguishers" or "grenades," but insists on simple buckets of water. The headquarters of the committee are at 45 Avenue Trudaine, Paris.

THE magnetic survey of Egypt, commenced in 1908, has been completed, and the results obtained at eighty-one stations are summarised in a pamphlet issued by the Survey Department. The field work has been carried out by Messrs. H. E. Hurst and C. B. Middleton with instruments standardised at the Helwân Observatory. In the delta the declination varies from 3° west in the west to 2° 30′ west in the east, the dip from 43° in the north to 40° 30′ in the south, and the horizontal intensity from 0·294 in the north to 0·302 in the south. In Upper Egypt the limits are nearly the same for the declination, but the dip decreases to 30° 36′ and the horizontal intensity increases to 0·325 in the south. In Nubia the declination is 4° in the west and 2° 42′ in the east; the dip decreases to 26° 32′ at Wadi Halfa, where the horizontal intensity is 0·328. Values for the western desert are also given, and when the present survey of the Sudan is completed a full report covering the whole country is to be issued.

MR. STEPHEN PAGET, secretary of the Research Defence Association, has written a book summarising in ten chapters the evidence given before the Royal Commission on Vivisection, as well as the Inspector's Report for 1910, and giving in a final chapter a brief account of the commission's report. The volume will be published by Mr. H. K. Lewis.

MESSRS. WITHERBY AND CO. will shortly publish "A Hand-list of British Birds," giving a detailed account of the distribution of each bird in the British Isles and a general account of its range abroad, together with details of the occurrences of rarities. The hand-list is the joint work of Messrs. E. Hartert, F. C. R. Jourdain, N. F. Ticehurst, and H. F. Witherby.

MESSRS. JACK announce that among the volumes to be included in the second dozen of "The People's Books," which are to be issued on May 15, will be "The Foundations of Science," by Mr. W. C. D. Whetham, F.R.S.; "Inorganic Chemistry," by Prof. E. C. C. Baly, F.R.S.; "Radiation," by Dr. P. Phillips; "Lord Kelvin," by Dr. A. Russell; "Huxley," by Prof. G. Leighton; and "Francis Bacon," by Prof. A. R. Skemp.

OUR ASTRONOMICAL COLUMN.

COMETARY STATISTICS.—Some interesting figures concerning comets have been educed by M. Borrelly, and appear in Nos. 51–52 of the *Gazette Astronomique*. For 376 comets discovered since the sixteenth century he gives the place of discovery, Marseilles heading the list with 64, Paris coming second with 46, and Geneva, Florence, Lick, Nice, and Berlin following with 16, 15, 14, 12, and 12 respectively. It is noteworthy that of British observatories, Slough is top with seven discoveries, and Bristol, twenty-second in the complete list, has four to its credit. Nearly two-thirds of the comets discussed were discovered in the morning before sunrise, and the second half of the year has proved more prolific in cometary discoveries than the first. Of these 376 comets, 106 were periodic and 19 have been observed at more than one return; only 56 have been visible to the naked eye, and seven could be seen during full daylight.

THE BEST VALUE OF THE SOLAR CONSTANT.—In the current number of the *Astrophysical Journal* (vol. xxxv., No. 2, March) Messrs. Abbot and Fowle traverse Prof. Very's criticism of their determination of the solar constant noted in this column on January 18. Among other things they deprecate the deduction of a value for the constant from such unknown and fragmentary data as the reflection and emission of the earth, the moon, and Mars, the temperatures of the two latter, and the dependence of terrestrial temperature on insolation. They maintain that many other variables beside the insolation, *e.g.* cloudiness, distribution of land and water, mountains, &c., considerably complicate terrestrial temperatures, and show that they have not departed from Langley's methods except in so far as they are improved by thirty years' extra experience.

OBSERVATIONS OF SATURN AND ITS RINGS.—To No. 4566 of the *Astronomische Nachrichten* Dr. H. E. Lau contributes a note describing his observations of Saturn, with the 10-inch refractor of the Urania Observatory, during the years 1908–1910. He found the colour of the south pole to be bluish-green changing to a brownish-green at a little distance from the actual polar region. For the various rifts he records various shades of colour and also places on record the appearance of whitish cloud masses in the equatorial zones in December, 1909, and September, 1910. Measures of the rings on seven evenings in 1909 and 1910 gave 40·03″ for the outer diameter of the A ring, 34·59″ for the Cassini division, 26·48″ for the inner diameter of the B ring, and 21·34″ for the inner diameter of the C ring; the breadth of the Cassini division was found to be 0·71″. Differences of colour between the different parts of the various rings are also recorded.

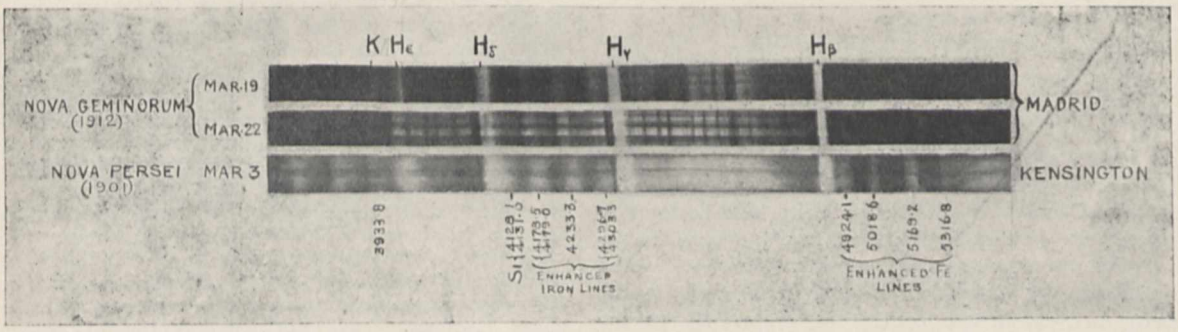
THE CAÑON DIABLO CRATER.—An interesting paper by Mr. Elihu Thomson appears in No. 19, vol. xlvii., of the Proceedings of the American Academy of Arts and Sciences, in which the author, having visited the famous Coon Butte or "Meteor Crater," speculates as to the probability of the crater having been produced by the impact of an enormous meteor. He states that the amount of rock blown out of the cavity could not have been less than two or three

hundred million tons, and, on a moderate estimate, this would require some ten million tons of meteoric iron to be accounted for. Mr. Thomson advances many arguments, and evidently concludes that the crater was produced by a meteoric fall. To account for the non-discovery of the main mass, he suggests that, as the meteor would probably not fall vertically, bore-holes should be made under the southern and south-western walls of the crater where the strata are peculiarly disturbed; the twenty-eight bore-holes already made have all been near the centre and have revealed undisturbed sandstone at a depth of 850 ft. below the crater bottom.

NOVA GEMINORUM NO. 2.

THE brightness of Nova Geminorum would appear to have reached that stage when further diminution is very slow but steady. On Friday last at 8.45 p.m. an observation made in a 4-inch finder showed the nova to be but a shade brighter than the neighbouring star 984, of which the magnitude is given variously between 6·8 and 7·2.

By the courtesy of Father Iñiguez we have been permitted to examine four excellent spectrograms of the nova, secured by him at the Madrid Observatory on March 17, 19, 22, and 24 respectively, and transmitted to NATURE.



Father Iñiguez reports that between March 16 and April 10 the spectrum underwent important modifications, of which he especially mentions the changes in the structure of the hydrogen lines, the almost total disappearance of the bright calcium radiation, K, since March 20, and the marked diminution of the ultra-violet part of the spectrum. The principal radiations are those of hydrogen, each bright band being accompanied by the usual well-marked dark band on its more refrangible edge; during the last days of March the more refrangible bright hydrogen bands became relatively weaker, Hε becoming much weaker, relatively, than Hβ and Hγ, while the bright Hζ nearly disappeared.

In addition to the bright lines there are numerous dark lines, especially between Hβ and Hγ, which Father Iñiguez describes as absorption bands, and among which he recognises the helium lines at λλ4026, 4144, 4388, and 4472, and the spark line of magnesium at λ4481. He also directs attention to the apparent separation of the bright and dark hydrogen lines which attained its maximum between March 22 and 24; the apparition of a bright line traversing the dark companions gave the hydrogen pairs an appearance of duplication which, we believe, has also been recorded at the Cambridge Observatory.

Father Iñiguez states that considerable variation in the number, intensity, and definition of the numerous bright and dark lines has been very noticeable. From March 22, when a magnificent spectrum was photographed, the lines became more prominent and also became more uniform *inter se*, more particularly between Hβ and Hγ; generally speaking, the dark lines are relatively diffuse and ill-defined.

A recrudescence of activity in the star was observed on March 23–25, since when the nova has gradually decreased in brightness. The increase of redness contemporaneous with the decrease in the intensity of the ultra-violet spectrum is remarked upon by Father Iñiguez, who further discusses his spectra in No. 16 of the *Comptes rendus*.

For the purpose of comparison we reproduce two of Father Iñiguez's spectrograms, taken on March 19 and 22 respectively, alongside a spectrum of Nova Persei photographed at South Kensington on March 3, 1901. It will readily be recognised that although there are important differences in the minor details, the two spectra are, in general, very similar; consequently the explanations of the chemical origins of the lines in Nova Persei given by Sir Norman Lockyer in 1901 hold good, generally, for those in the spectra of Nova Geminorum. In that paper it was shown that the chief bright lines other than hydrogen could be adequately represented by the principal enhanced lines of iron, and, in a less degree, of other metals.

Comparing the Madrid spectra. the abnormal decrease of the bright calcium radiation, K, between March 19 and 22 is very readily discerned. Attention should also be directed to the apparent reversal of the dark hydrogen lines, especially noticeable in Hγ on March 22, which is evidence in favour of these dark bands, at least, being true absorption phenomena.

While the comparison shows that the spectra of the two novæ are in general very similar, there are differences in the details, as is shown in the subjoined description by Mr. F. E. Baxandall, based upon a careful examination and discussion of the several photographs at the Solar Physics Observatory:—

Spectra of Nova Geminorum.

A comparison of the excellent spectra of Nova Geminorum obtained on March 19 and 22, by Father Iñiguez, of the Madrid Observatory, with that of Nova Persei photographed at Kensington on March 3, 1901, shows that in the main features the spectra of the two novæ are the same. The well-marked bright hydrogen lines in Nova Geminorum are accompanied by strong absorption lines on the more refrangible side, and the isolated bright bands between Hγ and Hδ typical of novæ spectra are present. The Nova Persei band at λ4130, probably due to protosilicum $\left\{\begin{matrix}\lambda 4128{\cdot}2 \\ \lambda 4131{\cdot}0\end{matrix}\right.$ and identical with the conspicuous double line in such stars as α Cygni, Rigel, and Sirius, is either lacking in Nova Geminorum or occurs only very faintly.

Between Hγ and Hβ the spectra show the usual complex set of bright lines seen in previous novæ.

Amongst these are what appear to be absorption lines, but, judging from other regions of the spectrum, the *bright* lines are the authentic ones, and the apparent absorption lines are more likely to be interspaces between bright lines, and have little or no significance as spectrum *lines*.

The well-known series of bright nova lines on the less refrangible side of Hβ at λλ4924, 5018, 5169, 5276, 5317, seen in Nova Persei and Nova Aurigæ, are not well shown in the Madrid spectra, only the first two of these being faintly seen. This is probably due to the plates used by Iñiguez being not very sensitive to this part of the spectrum, and not due to any real lack of lines in the spectrum.

These bright lines and those previously mentioned between Hγ and Hδ (λλ4176, 4233, 4300) were recorded by Sir Norman Lockyer in a series of Royal Society papers on Nova Persei in 1902, as being due to the enhanced lines of iron λλ $\left\{\begin{matrix}4173\cdot5\\4179\cdot0\end{matrix}\right\}$, 4233·3, $\left\{\begin{matrix}4296\cdot7\\4303\cdot3\end{matrix}\right\}$, 4924·1, 5018·6, 5169·2, 5276·2, 5316·9. These are the only enhanced lines of iron in the two regions mentioned, and they are *all* represented by strongly marked lines in α Cygni. A direct comparison of the α Cygni spectrum with that of Nova Persei will show that these isolated strong lines of α Cygni fall exactly on the middles of the broad, bright nova lines.

Some of the lines mentioned have, in previous publications on novæ spectra, been ascribed to various origins. The λ4924 and λ5018 lines have often been referred to as helium lines, although much stronger lines of the same element have been lacking. The line λ5018 is also sometimes identified with the chief nebular line. The line λ5169 is often referred to as being probably the "*b*" group of magnesium, and the line λ5316·9 as being probably the chief corona line. The fact that all these lines occur together as strong lines in the spectrum of a normal star—α Cygni—and that they can all be adequately accounted for by specially behaved lines of one chemical element—and those the *only* special lines of that element in the region discussed—must surely be taken as convincing evidence that the identity is a real one.

In the region between Hγ and Hβ, the nova spectrum is far more complex, but so also is that of α Cygni, and here again the chief lines in the nova spectrum agree in position with lines or groups of lines in α Cygni. In this part of the α Cygni spectrum there are enhanced lines of iron, magnesium, chromium, and titanium, but there is little or no doubt that in the nova spectrum the chief lines, other than those of hydrogen and calcium, are due to iron.

The most striking changes between the spectrum of March 19 and that of March 22 are: (1) the occurrence of what seems to be a fine bright reversal in the middles of the dark Hγ and Hδ bands (more particularly the former), and (2) the appearance of a bright band, the centre of which is at about λ4440, superposed on what was a broad, dark band on March 19. One of the strongest lines in Wolf Rayet spectra occurs at or near this position (4442), and the two lines may possibly be identical. Unless, however, some of the other strong Wolf Rayet bands, such as λλ4652, 5692, 5813, are also found in the spectra, little weight can be attached to the suggested identification.

F. E. BAXANDALL.

Magnitude observations of the nova are published in Nos. 4566–67 of the *Astronomische Nachrichten*, and Dr. Rosenberg describes his observations of the spectrum at the Tübingen Observatory. On March 19 a red-sensitive plate showed well-marked radiations corresponding to Hα, Hβ, and Hγ. Their breadth was about 30 A.U., of which 9 A.U. was shifted towards the red, and 21 A.U. towards the violet from the normal positions. Hγ presented three maxima at λλ4348, 4339, and 4332 respectively, and an examination of the spectrum for polarisation effects gave a negative result.

In a report to the Harvard College Observatory Prof. Frost states that a spectrogram taken on March 15 shows the H and K lines bright, at about their normal positions; they are strong and broad and crossed by very sharp, dark lines. The lines at λ4923 and λ5016, which Prof. Frost ascribes to helium, are strong, both bright and dark, but the line at λ4472 is not conspicuous, although probably present.

WILLIAM E. ROLSTON.

THE LOSS OF THE "TITANIC."

THE terrible loss of life on account of the disaster to the *Titanic* has directed emphatic attention to various aspects of the employment of wireless telegraphy in times of crisis at sea. The point which is at the moment attracting most of the public attention is that of the erroneous messages, or alleged messages, which appeared in the newspapers in the day or two following the disaster. Possibly some of these messages may have been invented by imaginative reporters, but others seem to have been perversions of messages which had actually passed between vessels at sea, but which were not concerned with the accident. This kind of mistake is well illustrated by the transformation undergone by a message containing the words, "Am towing oil-tank to Halifax." Such mistakes as these are possible in all kinds of telegraphy, but they probably arose in the present case at the hands of some of the amateur wireless telegraphists that swarm on the American coast. Some of these amateurs, it is widely believed, may indeed have originated of set purpose a number of the early reassuring messages, and it is clear that the possibility of rigging the insurance market by such messages affords motive enough for their concoction. It is most unlikely that intelligence of this character should have been sent in irresponsible moments by operators on liners, for the operators are under the direct control of the captains, the service discipline is strict, and every message has to be recorded.

All this raises more prominently than ever the chaotic condition of wireless telegraphy in the United States. For years the legitimate users of wireless telegraphy have complained of the unbounded freedom enjoyed and abused by the American amateur; perhaps they may now look forward to the imposition of some salutary restrictions. But besides that aspect of the matter just discussed, there is another which this catastrophe has brought into prominence. It is now impressed on us that the most urgent call for help will pass unheeded if none of the operators on the ships within hail are on duty. In fact, it seems to have been a mere chance that the *Carpathia* operator was at his apparatus at the time the *Titanic* called. On ships that carry only one operator—and very few carry more—the man cannot always be on the look-out. For this deadly contingency one obvious remedy is for each ship to carry more operators; another remedy lies in the provision of an apparatus that will ring up the telegraphist when a message reaches it. This latter desideratum is, unhappily, as yet unattained.

Engineering aspects of the disaster are discussed in the leading article in *Engineering* for April 19. As but little definite information is available as yet, the drawing of conclusions is premature, but several questions present themselves as ripe for discussion and settlement. The effect of centre-line or longitudinal wing bulkheads is one of these Such have

advantages in confining any water admitted to a part of the width, but have disadvantages even from the point of view of stability under disastrous conditions. The effect of impact on the superstructure of very large ships will have to be considered. In such ships it has become a practice to have two or three decks above the moulded structure. Would inertia have effects somewhat similar to those experienced in railway collisions, in which the body of the carriage is driven from the under-frame? As the boats and launching gear are carried on these decks, there is a possibility of damage to them under such conditions. The position of the Board of Trade in relation to lifeboat accommodation in large ships is regarded with considerable anxiety by the general public. The law, as at present laid down by this department, called for 8250 cubic feet only in the case of the *Titanic*, which would provide for 825 passengers. The American law requires, for vessels of 20,000 gross tons, that the boats carried should have a capacity of 12,420 cubic feet, and an additional 225 cubic feet for each successive 500 tons above 20,000 tons. The *Titanic* accommodation exceeded that required by British law, but was less than the American law lays down. The engineers of the ship have all been lost—their claim to recognition is the simplest and best; they did their duty to the end.

The leading article in *The Engineer* is also devoted to the loss of the *Titanic*, and raises other urgent questions besides those mentioned above: the arrangements adopted for securing water-tight subdivision, comprising not only the number and disposition of bulkheads, but also the height to which they extend and the watertightness of the deck at their upper extremity; the construction of transverse and longitudinal bulkheads, in connection with which it will not be found that any consistent standard of strength is observable under conditions implied by the existence of the bulkhead. The time is ripe for the revision of Table 2, Appendix B, of the bulkhead committee's report—a report which is taken as a standard by the Board of Trade. Prof. J. H. Biles contributes a separate article to *The Engineer* in which the effects of flooding compartments are fully dealt with. His conclusions are:—(1) the transverse bulkheads should in all cases be carried as high as possible; (2) the decks should be made effectively water-tight. If, however, the whole bow be smashed by hitting a vertical wall of ice, the value of watertightness of the decks would be reduced.

REPORTS UPON METEOROLOGICAL OBSERVATIONS.

CANADA, METEOROLOGICAL SERVICE (1907).—This report, which extends to xx+748 quarto pages, is considerably belated, owing probably to the immense amount of data included in this extensive system. It should be borne in mind, however, that the results for about 300 stations, with synopses of the weather, are published one month after date in the *Monthly Weather Review*, and also that a map is issued three days after the close of each month. The present volume is divided into seven parts, which may be summarised as (1) observations at ordinary stations of various classes, mostly taken at local time; (2) observations at telegraphic reporting stations, taken at 75th meridian time; and (3) magnetic observations made at Agincourt Observatory. The tables, with monthly and yearly means, are very complete, but in the absence of maps it is difficult to obtain a general view of the annual distribution of the different elements. The outstanding feature of the year was the exceedingly cold weather experienced in the western provinces in January. In some of these it was the coldest January on record, the mean temperature being 6·22° below the average. At some stations in Alberta minimum temperatures as low as 56° F. below zero were registered. (On January 11, 1911, we note that a temperature of −76° was recorded at Fort Vermilion, Alberta.) The weather forecasts issued for all districts were very successful, the average of complete and partial success being 85·6 per cent.

Western Australia, Meteorological Observations (1907).—This volume, only recently received, and apparently published in 1910, contains results of observations made at Perth Observatory and other places. At the observatory the mean annual temperature was 64·7°; highest mean monthly maximum, 87·5° (February); lowest mean minimum 49·6° (June); absolute maximum, 103·6°; minimum, 39·5°; maximum solar radiation, 164·2° (January 30); bright sunshine, 2803 hours; rainfall, 40·12 inches; rain days, 132. Some very high shade temperatures at the outstations were recorded, especially on the north and north-west coast, and inland; at Onslow and Marble Bar readings of 116·1° and 116·8° respectively were reached. Morning and afternoon weather forecasts formed an important part of the work at the central observatory. The volume includes a useful rainfall map, with isohyets for 1907, and tinted areas showing where the fall was above the average.

Transvaal Meteorological Department (1910).—The results for the fiscal year ended June 30, 1910, are arranged as in previous reports. In some cases only the means of hourly or daily observations are given, but the original data are carefully preserved and are available if wanted. The observers for the year numbered 663, an increase of 64 since the last report; all those appointed by the observatory are volunteers or are attached to other departments. The year was generally mild and of a normal character, with the exception of a heavy snowfall in August and an unseasonable frost at the end of September. The rainfall was in most parts satisfactory, being equal to or more than the average; it was very deficient along the western border and in the northern Zoutpansberg. The average rainfall for the whole State for six complete seasons (1904–5 to 1909–10) was 29·5 inches on seventy-three days; this value is subject to some uncertainty, perhaps to the extent of 0·5 inch, owing to the want of observations in some localities. Weather reports and forecasts are drawn up daily, and the latter are transmitted to all postal telegraph offices for exhibition. The synoptic charts on which the forecasts are based are not published, because of the expense.

Christiania Meteorological Institute (1910–11).—The administration report for the fiscal year ended June 30, 1911, exhibits a large amount of useful activity. Observations were received during the year from 506 stations, dealing chiefly with rain and snow; the results are included in the publications, "Meteorological Year Book" and "Rainfall Observations," to which we have before referred. Among other important matters we may mention the installation of a station of the first order in Spitsbergen in connection with the radio-telegraphic station there. Meteorological data are regularly supplied to various institutions, including the International Solar Commission in London. The ordinary weather forecasts average a success of 87·1 per cent.; special forecasts are also issued at certain seasons for agriculturists and for fishermen. Storm warnings are issued from Bergen. Observations of the movements of the upper air by means of balloons and the drift of clouds are communicated to Prof. Hergesell at Strassburg.

THE ORIGIN OF RADIUM.[1]

THE theory of atomic disintegration, which affords a philosophical explanation of radio-activity, was based on simple chemical observations of the regeneration of radio-active constituents in substances from which they had been chemically separated, and not, as has sometimes been asserted, upon any physical or chemical theories as to the nature of the atoms of matter. Only two of the large number of new problems originally suggested by this theory remain at present unanswered. One had to do with the nature of the ultimate product or products of the distintegration of the atoms of the two primary elements, uranium and thorium. This problem may be likened to the task of trying to find a meteor after its flight, when its energy is spent and nothing but the matter remains. Much indirect evidence points to lead as the final product of uranium, although no direct proof has been obtained, whereas for the case of thorium there is still no hint of the answer. The other had reference to the origin of radium. This element in the intensity of its activity, and therefore in the rapidity of its disintegration, resembles the short-lived active constituents uranium X and thorium X, whilst in the apparent permanence of its activity it resembles the primary radio-elements. Even the first rough estimates indicated that the period of average life of radium was not greater than a few thousand years. The present estimate, due to Rutherford, is 2500 years. A few thousand years hence the radium in existence to-day will for the most part have disintegrated. Very little of the radium in existence at the time the Pyramids were being built can still exist. Hence arose one of the most interesting and crucial of the problems of atomic disintegration. Does the regeneration of radio-active constituents, observed in the cases where the period is short compared to the span of human life, apply also to radium —to an element, that is, with a definite spectrum, atomic weight and chemical character, filling a vacant place in the periodic system, and forming one of a family of common elements? After the separation of radium from a mineral does the non-radium part of the mineral grow a fresh crop with lapse of time, the quantity present before separation being the balance or equilibrium quantity when the rate of production is equal to the rate of supply? A somewhat similar prediction made with reference to the production of another well-defined element, helium, in the radio-active process had only to be tested, as it was first in 1903 by Sir William Ramsay and myself, to be proved correct. The question, however, of the origin of radium is still, in spite of many discoveries, not entirely solved.

At first sight the experimental trial of the view appeared easy. This problem is not analogous to the finding of a meteor after its flight is spent. The quantities of radium which can be detected and recognised unequivocally by radio-active methods are thousands of times smaller than can be detected even by the spectroscope, sensitive as the spectroscopic test of radium is. The first product of the disintegration of radium is a gas, the radium emanation, and the test for radium consists in sealing up a solution of the substance for a month, then boiling the solution in a current of air, and introducing this air into the electroscope. For the instrument employed and shown, a millionth of a milligram of radium would be rather an undesirably large quantity, whilst a few hundredths of this amount is the best suited for accurate measurement. The volume of radium emanation, measured at N.T.P., obtainable from one gram of radium is only 0·6 cubic millimetre, a volume comparable to that of a pin's head. If a thousandth part of this quantity were distributed uniformly through the air of this room, estimated as 50,000 cubic feet, or about 1⅞ tons by weight, and the electroscope were then filled with the air of the room, it would produce an effect much greater than any dealt with in the work to be described. (The effect of breaking a tube containing the emanation in equilibrium with 3 mg. of radium, outside in front of the fan supplying air to the building, was demonstrated by the electroscope, through which a slow current of air from the room was aspirated.)

Since radium is found in uranium minerals and since uranium and thorium are the only elements known of atomic weight greater than that of radium, it was natural to suppose that uranium was the primary parent, in the disintegration of which radium results. Preliminary experiments nine years ago on a kilogram of uranyl nitrate, purified from radium by precipitating barium sulphate in the solution, proved that uranium could not be the direct parent of radium. For in this case, from 100 grams of uranium, the growth of radium should be readily detectable after the lapse of only a few hours. Whereas from a kilogram after 500 days, although a distinct increase of the quantity of radium was observed, it was at most only 1/1000 part of what should have been formed. In the meantime, indirect, though conclusive, evidence that uranium was the primary parent of radium was obtained by McCoy, Strutt, and Boltwood, who showed that in all unaltered minerals there is a constant ratio between the quantities of the two elements, and this is what is to be expected if they are genetically connected. Unfortunately, this is still the only evidence available of the connection between the two elements. To account for the excessively slow growth of radium in the first uranium preparations studied it was necessary to suppose that between the uranium and radium an intermediate product existed of period of life great by comparison with the time of the experiment. Such a product would enormously retard the initial growth of radium. Its existence complicates what first appeared as a very simple problem in many other ways. It is no longer a question of simply detecting a growth of radium. It is necessary to measure the form of the growth-curve accurately.

In the first place this intermediate parent must be present in uranium minerals, and therefore, to greater or less extent, in commercial uranium salts. The mere separation of radium therefrom initially, as in the first experiment, is not sufficient purification. In addition every trace of the intermediate parent must also be separated, or a growth of radium will not prove that uranium is the parent. On this account, in conjunction with Mr. T. D. Mackenzie, a fresh series of experiments was begun in Glasgow in 1905, in a new laboratory uncontaminated by radium. Three separate quantities, each initially of 1 kilogram of uranyl nitrate, were purified by repeated extraction with ether, which was considered to be the method most likely to separate all the impurities, not merely the radium. Observations on these preparations have now been in progress for six or seven years. At the same time a portion of the impure fraction separated from the original material was sealed up, freed from initial radium by the barium sulphate method, and tested for radium from time to time along with the pure uranium preparations. The diagram (Fig. 1) shows the growth of radium in this impure fraction. The unit used for expressing the quantity of radium is 10^{-12} gram. It confirms unequivocally the original

[1] From a discourse delivered at the Royal Institution on Friday, March 15, by Mr. Frederick Soddy, F.R.S.

observation that a substance is present in commercial uranium salts capable of generating radium and not removed from it by the barium sulphate method used first for separating the radium, but separated, at least mainly, by the ether method.

In the meantime a cognate discovery of first importance was made by Boltwood, in America, who

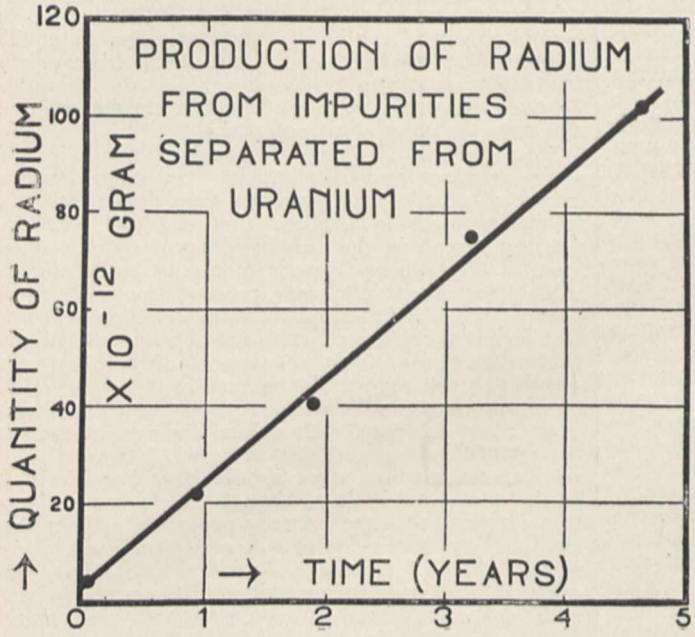


FIG. 1.

proved that actinium preparations obtained from uranium minerals, and initially free from radium, grow a fresh crop of radium with lapse of time. The growth is not by any means a very minute one as in my experiments, in which the growth can only be put beyond all doubt after the lapse of years. The growth of radium from constituents separated from minerals can be readily detected and measured in a relatively short space of time. The curve shown (Fig. 2) is taken from a paper by Keetman (*Jahr. Radioact. Elektronik*, 1909, vi., 270), who has worked upon this parent of radium in Germany. Although the total quantity of radium represented by this curve is only nine millionths of a milligram, it is enormous compared with that shown by the other diagram (Fig. 1), in which the quantity of radium produced in a period about eight times longer is nearly a hundred times less. Further work on this parent of radium proved that it was not actinium, but a new radio-element admixed with it, which Boltwood called ionium. It is radio-active, and its radiation consists entirely of α-rays of very low range. The chemical nature of this ionium is absolutely identical, so far as is known, with that of thorium, and it cannot be separated from it. On the other hand, it is easily separated from any mixture, however complex, by adding a trace of thorium and separating and purifying the latter. It is interesting to note that no fewer than three at least of the known radio-elements—ionium, radio-thorium, and uranium X—are absolutely identical in chemical properties with thorium. This complete similarity with known elements is one of the features of the chemistry of radio-elements.

Returning to the experiments with the uranium solutions purified by ether, Fig. 3 shows the growth of radium therein. The three curves labelled I., II., III. refer to these preparations. No. III. was the last prepared, after experience with the others, and contained both the greatest quantity of uranium and the least radium initially. No. IV. refers to a much later experiment with no less than 6 kilograms of uranyl nitrate, purified by repeated crystallisation in the course of other work. In all, there has been a distinct growth of radium, but it is so small, and the period over which the measurements extend is so prolonged, that the errors of the individual measurements are relatively great. The general scope of the curves, as indicated in the figure, is, however, probably not far wrong. A conservative view to take is that in all cases the curves are straight lines. There is some indication in No. I. of an increasing slope, but it is negatived by the evidence of Nos. II. and III.

The quantity of uranium in the four preparations differs widely. In Fig. 4 the curves are replotted in a different way to eliminate this difference. The ordinates represent the quantities of radium formed in terms of the amounts of radium in equilibrium with the uranium. The equilibrium amount is the amount that theoretically should be formed after the lapse of sufficient time, if uranium is the ultimate parent of radium. It will be seen that the slopes of the four curves are all different and diminish in order, the growth in the first being the greatest, and in the last, after all the experience in methods of purification, the least. This is additional evidence that, so far, the radium formed is derived, not from the uranium, but from varying infinitesimal quantities of ionium still unremoved by the purification processes.

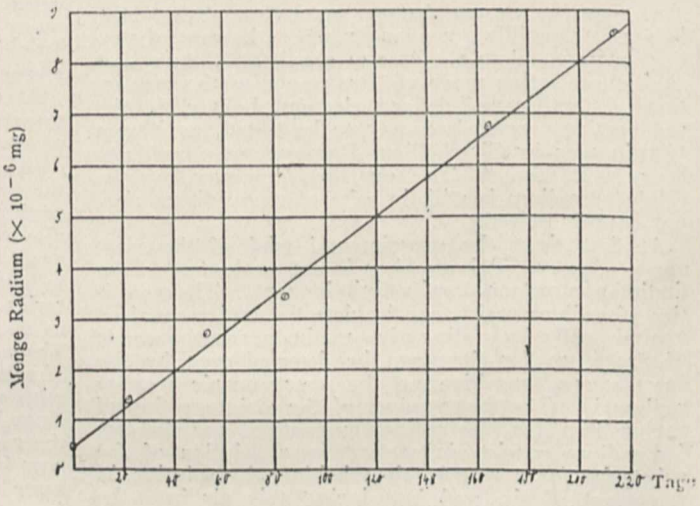


FIG. 2.

Taking No. III. as the best of the first batch of preparations, the growth of radium therein is only about 1/30,000 part of what would have occurred if uranium were the direct parent of radium. Some idea of the minuteness of the quantities of radium

indicated by these curves can be got by the following consideration. Radium bromide at its present price costs about 16*l.* per milligram. For the element, radium, this is at the rate of 750,000*l.* per ounce. Fig. 3 represents a diagram 2 ft. high. To represent

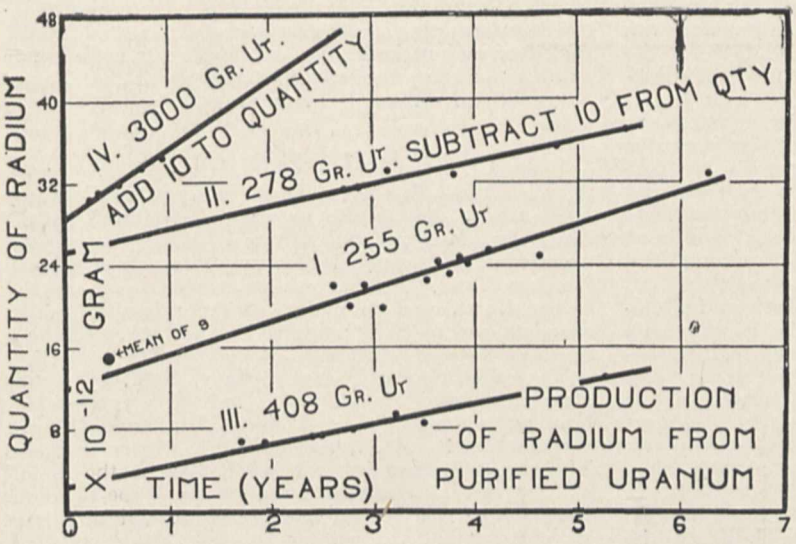


FIG. 3.

a pennyworth of radium on this scale would require a diagram more than 6000 ft. high, whereas to represent Keetman's curve (Fig. 2) would require one as high as St. Paul's Cathedral.

These results, therefore, confirm absolutely the view that uranium does not produce radium directly. As Rutherford first showed, if ionium is the only long-lived radio-element between uranium and radium, the growth of radium from uranium must initially be proportional to the square of the time, and should be represented by the equation $R = 6 \times 10^{-8} \lambda T^2$, where R is the radium formed per kilogram of uranium, T is the time in years, and $1/\lambda$ is the period of ionium. Hence, if uranium is the primary parent of radium, it is to be expected that the rate of growth of radium from the preparations will increase as time goes on according to some power of the time higher than unity. As Fig. 3 shows, there is still no evidence of this increase of slope in any of the preparations. This indicates, either that the period of ionium must be enormously long, or that several intermediate long-lived members intervene. If ionium is the only intervening member a *minimum* possible limit to its period may be arrived at by applying the above equation to the results. If it is assumed that the growth observed is due to uranium and that no ionium was initially present, the minimum periods calculated in the several experiments are as follow:—No. I., 28,000 years; No. II., 41,400 years; No. III., 80,000 years; and No. IV., 69,200 years. Since, in all, certainly some of the growth is due to ionium initially present, the period of ionium must certainly be greater than the longest of these periods. We may safely conclude, if ionium is the only intermediate member, that its period is *at least* 100,000 *years*. This is forty times longer than the period of radium itself.

Entirely independent confirmation of this conclusion was obtained in another way. The gap in our knowledge is, strictly speaking, not between uranium and ionium, for the direct product of uranium is well known, and is called uranium X. It gives β-rays alone in disintegrating and has a period of only 35·5 days, so that in all the preceding work it has not been necessary to take it into account. It would retard the growth of radium inappreciably. But, if the view is right, the product of uranium X must be ionium, which gives α-rays. Concomitantly with the rapid decay of the intense β-rays of uranium X there should occur a growth of α-rays due to the ionium produced. Whether these α-rays can be actually detected will depend on the period of ionium. From experiments on the uranium X separated from 50 kilograms of uranium nitrate no growth of α-radiation, concomitant with or subsequent to the decay of the β-radiation, could be detected, and from these negative results the minimum period ionium can possess, if it is the only long-lived intermediate product, is 30,000 years.

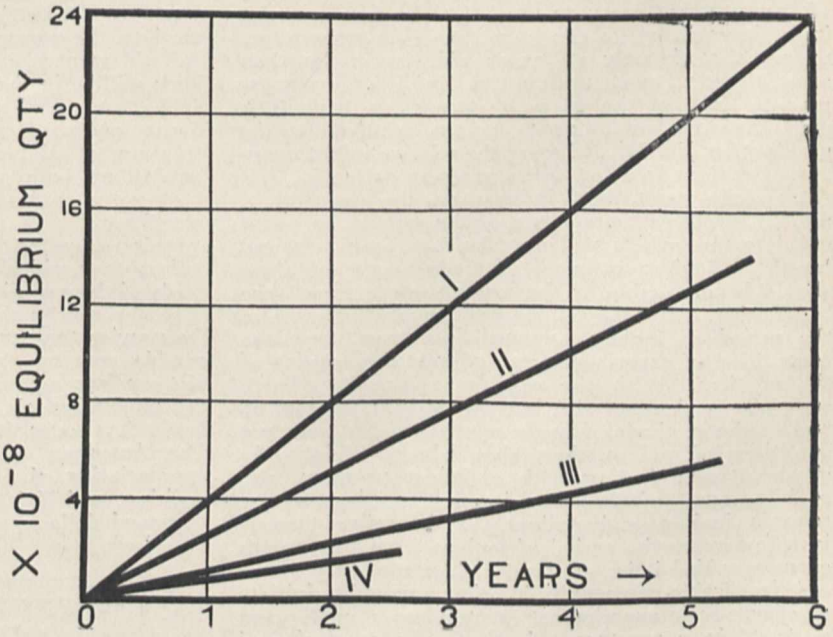


FIG. 4.

The question arose whether by any means an upper limit, or maximum value, for the period of ionium could be assigned. By the law already discussed there must be many times as much ionium as radium in uranium minerals, and if the actual ratio were known

the period of ionium could at once be found. For example, if the period were 100,000 years, there should be 12·5 grams of pure ionium per ton of uranium. Auer von Welsbach, in a masterly chemical separation of the rare-earth fraction from 30 tons of Joachimsthal pitchblende, separated a preparation, which he described as thorium oxide, containing ionium, the activity of which was measured by Meyer and von Schweidler. To obtain a maximum estimate for the period of ionium, I assumed that Welsbach's preparation was in reality pure ionium oxide (which it certainly was not, as it gave the thorium emanation), and so I obtained the period of a million years as the upper possible limit. In proportion as the percentage of ionium oxide present is less than 100 per cent., this period must be reduced.[2] Thus we have fixed the period of ionium as between 10^{-5} and 10^{-6} years, if ionium is the only intervening long-lived member.

Quite recently a method has been devised for calculating the period of ionium from the range of its α-particles, which is based upon an empirical mathematical relation holding between this range and the periods of the substances giving α-rays in the case of the other members of the series.[3] The most recent estimate by this method is about 200,000 years, which may be accepted provisionally as the most probable at the present time. If this is correct, there should be 25 grams of ionium per ton of uranium in minerals. A variety of evidence thus leads to the conclusion that to detect the growth of radium from uranium either still larger quantities of uranium or still longer time is necessary. Even after ten years, that is, at the end of 1916, if the period of ionium is as estimated, the uranium in No. III. preparation should only have produced 12×10^{-12} grams of radium, which is rather less than half the amount that will then have been formed by the ionium initially present. Nos. I. and II. preparations are very much less favourable. But it is interesting to consider No. IV. preparation, which, though only 2·6 years old, has more than seven times as much uranium as No. III. From the present slope of the curve it appears to have little more than one-half as much ionium, relatively to the uranium, as No. III., whereas the relative initial quantity of radium is about twice as great as in No. III. After eight years, that is in 1917, the quantity of radium produced from the uranium should be about equal to that which will have by then been produced from the ionium present. A distinct upward slope should be detectable in the growth curve some time before this. But this is the best, if the estimate of the period of ionium assumed is correct, that the present set of experiments can offer to the solution of the problem. With the experience already gained, especially in dealing with large quantities of uranium and in the methods of measurements of the minutest quantities of radium, there should be no difficulty in obtaining and dealing with sufficient uranium, say 20 kilograms, of the requisite degree of purity as regards ionium and radium, to determine directly in a few years the period of ionium from the growth curve provided it is not greater than 200,000 years.

A favourable opportunity is being awaited to initiate this large-scale experiment. It requires a small room to itself in a permanent institution uncontaminated with radium, and some guarantee that once installed the preparations will remain undisturbed for a reasonable term of years, and that the measurements will be continued in a comparable manner should the period of life of the original investigator prove insufficient. It is not enough to set aside a quantity of uranium for our successors to see if any radium has grown in it. It is essential that the exact form of the growth curve should be known before the problem in question can be fully answered. There *may* be more than one long-lived intermediate product between uranium and radium. However, such indirect information as has been acquired as to the life period of ionium indicates that it alone is sufficient to account for the present results as regards the absence of growth of radium from uranium.

[2] Soddy, *Le Radium*, 1910, vii., 207.
[3] Geiger & Nuttall, *Phil. Mag.*, 1911, xxiii., 613; 1912, xxiii., 439.

THE CROCKER LAND EXPEDITION.

REFERENCE was made in NATURE of February 22 (p. 560) to the expedition organised by the American Museum of Natural History and the American Geographical Society to reach and map Crocker Land, in the north polar seas north-west of Grant Land, and to make all the scientific studies *en route* and in other parts of the Arctic regions that circumstances may permit.

The expedition will leave Sydney, N.S., by special steamer about July 20, 1912, and it is proposed to land on the south side of Bache Peninsula (Flagler Bay), lat. 70° 10′ N., and establish winter quarters. The ship will then be sent home. About the middle of September, sledging supplies to Cape Thomas Hubbard will be begun, and the work will be carried on throughout the winter during the moonlight periods. Cape Thomas Hubbard will be left with the return of dawn in February, 1913, and the expedition will push across the ice to Crocker Land. Crocker Land will be left about May 1, and a return will be made to Cape Thomas Hubbard. Scientific work will be carried on in Grant Land and along the return route to winter quarters on Flagler Bay, where the expedition expects to arrive in July, 1913. In the spring and summer of 1914 there will be an expedition from Whale Sound (Inglefield Gulf) directly eastward to the summit of the ice-cap of Greenland, at the widest part of that island. The return to New York will be in the autumn of 1914 by special ship.

The leaders of the expedition will be Mr. George Borup, assistant curator of geology in the American Museum of Natural History, and Mr. Donald B. MacMillan, both of whom are well known by their work done under Admiral Peary in his last polar expedition.

It is estimated that not less than fifty thousand dollars (10,000*l.*) should be provided for the absolute needs of the expedition, in order to enable it to accomplish the results that have been outlined above. On the proviso that sufficient funds are contributed from outside sources, the American Museum of Natural History has agreed to appropriate in the course of the expedition six thousand dollars in money, and has taken over its organisation and management. The American Geographical Society has made an appropriation of six thousand dollars toward the expedition, and Yale University an appropriation of one thousand dollars, while other subscriptions have been promised.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

GLASGOW.—The degree of Doctor of Science was conferred upon the following on April 22:—Leonard Findlay: *Thesis*, "The Etiology and Condition of the Blood in Spontaneous and Experimental Rickets, with additional papers." David Robertson: *Thesis*, "The Mathematical Design of Transformers; Electrical Meters on Variable Loads; and other original

papers." George Duncan Campbell Stokes: *Thesis*, "A Critical Comparison of the Overlapping Section of the Oxford and Potsdam Astrographic Catalogues; An Original Solution of the Problem of Two Bodies; An Analytical Study of Plane Rolling Mechanisms."

Commemoration Day will be observed on June 25. A meeting will be held in the Bute Hall, when Prof. F. O. Bower, F.R.S., will deliver an oration on "Sir Joseph Hooker," and honorary degrees will be conferred. It is expected that a number of the delegates attending the Congress of the Universities of the Empire will be present.

THE resignation is announced of Prof. Arthur Searle, Phillips professor of astronomy at Harvard University. Prof. Searle, who graduated from Harvard in 1856, has taught in the University for forty-two years.

A COURSE of four lectures on "Heredity Considered from the Point of View of Physiology and Pathology" will be delivered by Dr. F. W. Mott, F.R.S., in the Physiological Laboratory, King's College, on Mondays, May 20 and 27, and June 3 and 10, at 4.30 p.m. The lectures are free to members of King's College, London, to internal students of the University, and to medical men.

AT the celebration of the 75th anniversary of the foundation of the University of Athens, on April 10, honorary degrees in medicine were conferred on Profs. von Behring (Marburg), Celli (Rome), Ehrlich (Frankfort), Exner (Vienna), Golgi (Pavia), Kronecker (Berne), Laudouzy (Paris), Richet (Paris), Sir Ronald Ross (Liverpool), Roux (Paris), Schulze (Würzburg), Weichselbaum (Vienna), and others. The degree of doctor of philosophy was conferred on Sir Donald MacAlister (Glasgow), Delbrück (Jena), Dörpfeld (Athens), Gubernatis (Rome), Harnack (Berlin), Kenyon (London), Mahaffy (Dublin), Wheeler (Berkeley), and others; and the degree of doctor of science on Profs. Depéret (Lyons), Halácsy (Vienna), Lacroix (Paris), Lepsius (Darmstadt), Partsch (Leipzig), and Philippson (Bonn).

THE programme of the annual conference of the Child-Study Society, to be held in the University of London on May 9–11 inclusive, is now available. The subject arranged for discussion is the health of the child in relation to its mental and physical development. The presidential address will be delivered on May 9 by Sir James Crichton Browne, F.R.S. Among papers to be read at the conference may be mentioned:—The influence of defects of hearing in relation to the mental and physical development of the child, by Dr. J. Kerr Love; the influence of defects of vision in relation to the mental and physical development of the child, by Mr. N. Bishop Harman; the tuberculous child, by Dr. Jane Walker; and mental hygiene in relation to the development of the child, by Dr. T. Hyslop. Fuller particulars of the meeting can be obtained from the secretary of the London Society, 90 Buckingham Palace Road, London, S.W.

THE Department of Agriculture and Technical Instruction for Ireland will conduct summer courses of instruction for teachers on July 2–26 next, and on August 6–31. Among the courses arranged for July we notice for teachers in day secondary schools and in technical schools a course in experimental science; for those in secondary schools only, one in domestic economy; and for domestic economy instructresses one in advanced cookery, housewifery, hygiene, and sick nursing. In August the courses will be concerned with practical mathematics and mechanics, handrailing, metal work, and rural science. Though most of the courses will be held in Dublin, some have been arranged for other important centres. Teachers desiring to take advantage of these courses must fill up and return the appropriate form of application so as to reach the offices of the department, Upper Merrion Street, Dublin, not later than April 30.

ATTENTION was directed, in our issue of April 4 (vol. lxxxix., p. 129) to the opening to-morrow of the spinning section of the textile department of the University of Leeds by the Master of the Cloth-workers' Company. The new extension is intended to afford facilities for instruction in the principles and theory of the manufacture of worsted yarns on the Continental system. To secure the most suitable equipment for this branch of technological teaching, textile institutes, spinning works, and conditioning laboratories in Belgium, France, Germany, and Switzerland were inspected, and a full inquiry was made as to the commercial value and technical nature of this system of worsted yarn construction. The extension has been designed by Mr. Paul Waterhouse, and erected at a cost of 5000*l.*, making a total amount of 75,000*l.* granted by the Clothworkers' Company for technical education in the textile industries and dyeing departments of the Leeds University.

SOCIETIES AND ACADEMIES.

LONDON.

Zoological Society, April 2.—Dr. A. Smith Woodward, F.R.S., vice-president, in the chair.—R. I. **Pocock**: A rare stag (*Cervus wallichii*) from Nepal, recently presented to the Zoological Society by his Majesty King George. The author pointed out the distinctive peculiarities of this species, which, on account of its great scarcity, had never been satisfactorily classified since it was described by G. Cuvier in 1825 from a coloured illustration of a specimen living at that time in the Barrackpoor Menagerie.—F. E. **Beddard**: Species of tapeworms of the genus Inermicapsifer obtained from the hyrax, with notes on the genera Zschokkeella and Thysanotænia. An account of the structure and characters of the species was given, together with the description of a new genus and two new species.—Dr. Bashford **Dean**: Living specimens of the Australian lung-fish (*Ceratodus forsteri*) in the society's collection. This paper contained some further observations made by the author in June, 1911, supplementary to his previous communication published in 1906, and dealt with the coloration, size, and age of the specimens. Details of the rate of growth of this species were also given, with notes on their method of breathing, their food, and an account of the regeneration of a portion of the left ventral fin which had suffered an injury.

Royal Astronomical Society, April 12.—Dr. Dyson, F.R.S., president, in the chair.—E. E. **Barnard**: Recent observations of Nova Cygni (1876). A series of measures of stars in the neighbourhood showed little evidence of motion; the nova seemed to have become stationary in brightness.—E. E. **Barnard**: Micrometrical measures and focal peculiarities of Nova Lacertæ (Espin). Photographs were shown, from which it appeared that the nova existed as a 13th mag. star in 1893.—H. F. **Newall**: Photographs of the spectrum of Nova Geminorum (Enebo) made

at Cambridge Observatory. The remarkable changes that had taken place in the spectrum of the nova were described, and Mr. Stratton further dealt with the Cambridge results, no fewer than 200 features having been measured upon the plates.—W. E. **Curtis**: The spectrum of the new star in Gemini. Prof. Fowler showed the photographs taken by Mr. Curtis.—**Royal Observatory, Greenwich**: Observations of Nova Geminorum. The President showed a series of photographs of the spectrum of the nova taken at the Royal Observatory, and described the changes that had taken place. Photometric observations were made by the aid of a grating, which was shown to the meeting. The grating was placed in front of the object glass, causing it to give a number of images of the star, and much facilitating the observations. Father Cortie described the observations of the nova made at Stonyhurst, the measurement of the spectra giving velocities similar to those shown by Nova Persei. Mr. Storey described the spectroscopic observations of Nova Geminorum made at the Royal Observatory, Edinburgh, and showed photographs taken. Dr. Duffield urged that the effects of pressure should be taken into consideration in our interpretation of the changes in the spectrum of the nova. The Rev. T. E. R. Phillips had made visual observations, and spoke of the great intensity of the Hα line. The star was an intense crimson at the end of March; its brightness had shown fluctuations.—Prof. H. H. **Turner**: A tentative explanation of the "two star streams" in terms of gravitation. Second paper: The position of the centre of our system. In his previous paper he had propounded a hypothetical constitution of our stellar system round a centre of attraction, on which view the centre should lie in the direction of one of the vertices. A number of entirely independent lines of investigation pointed to a vertex at 90°+11° It appeared that Boss's moving cluster in Taurus occupied a position near the centre of our system; the oscillation period of our sun would be about 400 million years, the sun having passed pericentron about a million years ago.

Royal Meteorological Society, April 17.—H. N. Dickson, president, in the chair.—J. E. **Clark** and R. H. **Hooker**: Report on the phenological observations for 1911. The outstanding features of the weather during the year were the severe cold of early April; the summer of abnormal dryness, heat and sunshine; and the continuous rainfall when once the drought thoroughly broke about mid-October. After referring to the flowering of plants, the appearance of insects and the song and migration of birds, the authors dealt with the yield of farm crops, and showed that potatoes and wheat were above the average, but most of the other crops were below the average, especially beans, roots, and hay. Throughout Great Britain harvest began generally a fortnight to three weeks earlier than usual, and the duration was very short, the result being that the termination of the harvest was fully a month earlier than the average..—R. G. K. **Lempfert** and H. W. **Braby**: A method of summarising anemograms. The tabulation of the hourly values of wind velocity and of wind direction as recorded by many anemometers in the British Isles forms part of the routine work of the Meteorological Office, but little has been done hitherto to summarise the tabulations. The authors have made a preliminary discussion of a few records, and in this paper they gave the results in the form of wind-roses for four stations, which had been selected as being typical of the extreme north, the extreme south, the east coast, and the west coast of Great Britain, viz., Deerness, Scilly, Yarmouth, and Holyhead.

CAMBRIDGE.

Philosophical Society, March 11.—Sir George Darwin, president, in the chair.—Prof. **Pope** and C. S. **Gibson**: The resolution of racemic benzoylalanine. An account was given of the resolution of racemic benzoylalanine by the method of Pope and Peachey.—Prof. **Pope** and J. **Read**: The optically active hydroxyhydrindamines. The authors described the resolution of hydroxyhydrindamine into optically active components by means of α-bromocamphor-π-sulphonic acid and the preparation of salts and other derivatives of the racemic and active bases.—C. T. **Heycock** and F. E. E. **Lamplough**: The boiling points of zinc, cadmium, mercury, sodium, and potassium, and their alteration with change of pressure. An account was given of the more trustworthy previous determinations of these data, the wide differences being noted. The authors' experiments, in which platinum resistance thermometers were used, were described, and the results of many closely agreeing experiments were given. At 760 mm. pressure the boiling points were found to be as follows:—Zinc, 905·70°; cadmium, 765·93°; mercury, 357·70°; sodium, 882·6°; potassium, 762·2°.—F. E. E. **Lamplough**: The metastable condition of undercooling in metals. Investigations have been made to determine whether a metastable condition of undercooling before solidification exists in metals. In no case have positive results been obtained. Tin, which on solidifying exhibits superfusion in a notable degree, does not show a metastable undercooling greater than at most half a degree.—J. **Satterly**: The quantities of radium and thorium emanations contained in the air of soils. (1) The amounts of radium emanation in the air of different soils have been measured at intervals extending over a year. For depths of from 100 to 150 cms. in gravelly soil the amount of emanation is, on the average, equal to approximately 200×10^{-12} curie per litre or 2000 times as much as there is usually in atmospheric air. (2) Experiments showed that a litre of soil-air was in association with 14,000 gm. of damp soil (12,000 gm. when dry), whence the apparent radium content of the soil is $1\cdot7\times10^{-4}$ gm. per gm. of (dry) soil. As the actual radium content is more likely to be seventy times this it follows that little of the emanation generated in the solid particles of the soil can escape into the air around them. (3) The proportion of radium emanation to thorium emanation in soil-air has been measured for various depths and the ratio has been found to increase from 1600 near the surface to 26,000 at a depth of 400 cm. At a depth of 150 cm. it is 8600, whence, taking the radium content of the soil as $1\cdot1\times10^{-12}$ gm. per gm., the thorium content works out as $1\cdot4\times10^{-5}$ gm. per gm. This is of the right order.—J. A. **Crowther**: A theory of the dissymmetrical distribution of secondary Röntgen radiation.—A. E. **Oxley**: The variation of magnetic susceptibility with temperature. A criticism of the conclusions reached by Profs. du Bois and Honda concerning the invalidity of the Curie-Langevin laws.—H. H. **Paine**: The coagulation of colloidal copper. Rate of coagulation.—R. D. **Kleeman**: The different internal energies of a substance. The author showed that the internal energy of a substance can be divided into three parts, viz.: (1) the kinetic energy of the molecules due to their motion of translation; (2) their molecular internal energy; (3) the potential energy due to their attraction upon one another. It was proved that the kinetic energy of a molecule is equal to that it possesses in the gaseous state at the same temperature, that is, it is equal to $\frac{TR3}{2}$, where T is the absolute tempera-

ture and R is the gas constant. The internal energy of a substance is per molecule therefore $\left(U_1+u_1+\frac{3RT}{2}\right)$, where U_1 is the energy due to molecular attraction and u_1 the internal energy. Formulæ for the specific heat at constant volume and constant pressure, the Joule-Thomson effect, &c., were deduced and compared with the facts.

PARIS.

Academy of Sciences, April 15.—M. Lippmann in the chair.—J. **Boussinesq**: The geometric theory for a non-rigid body of continuous displacements, as well as the deformations and rotations of its particles.—Yves **Delage**: A self-recording bathyrheometer. A description of an instrument for measuring and recording surface currents. It has the advantage of being capable of total immersion, and measures both velocities and directions of the currents.—M. **Le Chatelier**: Remarks on a work by F. W. Taylor dealing with the principles of scientific organisation of works.—J. **Bosler** and P. **Idrac**: The spectrum of the new star in the Twins. Observations made at Meudon showed a complete series of the bright lines of hydrogen. The principal nebular line was also noted.—Fr. **Iniguez**: The new star in the Twins. From March 15 to 19 the lines Hβ, Hζ, and K were brilliant. The line K disappeared on March 20.—Etienne **Delassus**: The linkages of any order of material systems.—B. **Mayor**: The deformations of certain elastic systems.—Emile **Borel**: The geometric bases of statistical mechanics.—J. **Bergonié**: The phenomena of lightning. A description of some peculiarities caused by a lightning stroke on March 20 near La Flouquette.—C. **Dauzère**: The stability of cellular vortices.—M. **Deslandres**: Remarks on the preceding communication.—A. **Blondel**: An electro-chronograph with synchronised sparks. The vibrator of the secondary coil producing the sparks is controlled by a tuning-fork, not directly, but by the action of a current itself controlled by the tuning-fork. The necessary precautions are given in detail.—C. **Camichel**: The measurement of the differences of phase of two alternating currents.—B. **Szilard**: The radio-activity of the thermal springs of Saint Lucasbad (Hungary).—Albert **Bruno** and P. Turquand **d'Auzay**: The estimation of sulphates in solution by a physico-chemical volumetric method. The changes in electrical conductivity are measured when a solution of baryta is added to the sulphate solution. In the case of wine the method was found to be untrustworthy.—Georges **Dupont**: The oxidation of some ketohydrofuranes.—André **Meyer**: The action of oxyurea upon some β-ketonic esters.—MM. **Amouroux** and **Murat**: Some syntheses starting with butyrone. Butyrone can readily be obtained in quantity by the catalytic action of thoria upon butyric acid. Various derivatives obtained by the Grignard reaction from this ketone are described.—Paul **Gaubert**: The circular polarisation of liquid crystals.—Lucien **Daniel**: The transformation of a chrysanthemum as a result of repeated budding.—Henri **Piéron**: The variation of the sensation lag as a function of the intensity of stimulation.—Raphael **Dubois**: The physical properties of physiological light. Remarks on a recent note by M. Ozorio on this subject.—Edmond **Hue** and Marcel **Baudouin**: The atavic characters of certain lumbar vertebræ of men of the polished stone period. A study of the lumbar vertebræ of Neolithic men from Vendrest proves three atavic characters, showing that these skeletons must be classed between anthropomorphs and modern man.—A. **Marie** and Léon **Mac-Auliffe**: The physiognomy of assassins. Results of researches on this class of criminals.—Raoul **Dupuy**: Contribution to the study and treatment of children of arrested development.—Maurice **Letulle** and L. **Nattan-Larrier**: The epithelioma of the embryonic ectoderm. Embryonic ectodermic carcinoma is always secondary to a mixed tumour either of the placenta or of the completely developed organism.—Louis **Gentil**: The tectonic of the Haut Atlas in Morocco, and its relations with the Atlas of the Sahara.—Henri **Perrotin**: An attempt at the representation of terrestrial temperatures as a function of the cloud conditions.

BOOKS RECEIVED.

Cambridge Geographical Text Books—Intermediate. By A. J. Dicks. Pp. xi+362. (Cambridge: University Press.) 3*s*.

Beyond War: a Chapter in the Natural History of Man. By Prof. V. L. Kellogg. Pp. vii+172. (New York: H. Holt and Co.) 1 dollar net.

Lectures Delivered at the Celebration of the Twentieth Anniversary of the Foundation of Clark University under the Auspices of the Department of Physics. By V. Volterra, E. Rutherford, R. W. Wood, C. Barus. Pp. iv+161. (Worcester, Mass.: Clark University; New York and London: G. E. Stechert and Co.) 10*s*. net.

Post Mortems and Morbid Anatomy. By Dr. T. Shennan. Pp. xiv+496. (London: Constable and Co., Ltd.) 18*s*. net.

Individualism and the Land Question. By Sir R. K. Wilson, Bart., J. H. Levy, and others. (London: The Personal Rights Association.) 1*s*. net.

The Rational Arithmetic for Rural Schools. By G. Ricks. Scholar's Book. Sixth Year's Course. Pp. 71. (London: Macmillan and Co., Ltd.) 3*d*.

To the West of England by Canal. By R. J. Finch. Pp. 63. (London: J. M. Dent and Sons, Ltd.) 9*d*.

Catalogue of the Lepidoptera Phalænæ in the British Museum. Vol. xi.—Catalogue of the Noctuidæ in the Collection of the British Museum. By Sir G. F. Hampson, Bart. Pp. xvii+689; plates clxxvi.-cxci. (London: Printed by order of the Trustees. Sold by Longmans and Co., and others.) 20*s*. and 17*s*. 6*d*. respectively.

General Index to a Hand-list of the Genera and Species of Birds, Volumes i. to v. Edited by W. R. Ogilvie-Grant. Pp. v+199. (London: Printed by order of the Trustees. Sold by Longmans and Co., and others.) 10*s*.

Catalogue of the Chiroptera in the Collection of the British Museum. Second edition. By K. Andersen. Vol. i.—Megachiroptera. Pp. ci+854. (London: Printed by order of the Trustees. Sold by Longmans and Co., and others.) 2*l*. 10*s*.

National Antarctic Expedition, 1901–1904. Natural History. Vol. vi., Zoology and Botany. Pp. xvi+9+2 plates+pp. 32+3 plates+pp. 60+3 plates. (London: Printed by order of the Trustees. Sold by Longmans and Co., and others.) 16*s*.

Leitfaden zum Bestimmen der Vögel Mittel-Europas, ihrer Jugendkleider und ihrer Nester nach leicht und sicher erkennbaren Merkmalen. By Prof. F. Dahl. Pp. viii+162. (Berlin: Gebrüder Borntraeger.) 5.20 marks.

Die Blitzgefährdung der verschiedenen Baumarten. By Prof. E. Stahl. Pp. iii+75. (Jena: G. Fischer.) 1.80 marks.

Fortschritte der naturwissenschaftlichen Forschung. By Prof. E. Abderhalden. Fünfter Band. Pp. iii+320. (Berlin and Wien: Urban and Schwarzenberg.) 15 marks.

Witterung, Erdoberfläche und Leben: ihr Ineinander-

andergreifen und ihre astronomischen Ursprünge und Regulatoren. By C. Beckenhaupt. Pp. 104. (Brackwede i. W.: Dr. W. Breitenbach.) 2 marks.

The British Bird-Book. Edited by F. B. Kirkman. Section viii. Pp. 195 to 412+plates. (London and Edinburgh: T. C. and E. C. Jack.) 10*s.* 6*d.* net.

Annuals, Hardy and Half-hardy. By C. H. Curtis. Pp. 116. (London and Edinburgh: T. C. and E. C. Jack.) 1*s.* 6*d.* net.

Opere Matematiche del Marchese Giulio Carlo de' Toschi di Fagnano. Pubblicate sotto gli auspici della Società Italiana per il Progresso delle Scienze dai soci V. Volterra, G. Loria, D. Gambioli. Vol. Primo. Pp. *a*–*q*+474. Vol. Secondo. Pp. xi+471. Vol. Terzo. Pp. xi+227+ii plates. (Milano, Roma & Napoli: Albrighi, Segati e C.)

A Text-book of Rand Metallurgical Practice. By R. Stokes and others. In 2 vols. Vol i. Pp. xix+468. (London: C. Griffin and Co., Ltd.) 21*s.* net.

Methods of Air Analysis. By Dr. J. S. Haldane. Pp. x+130. (London: C. Griffin and Co., Ltd.) 5*s.* net.

The Prevention and Treatment of Disease in the Tropics. By E. S. Crispin. Pp. 95. (London: C. Griffin and Co., Ltd.) 1*s.* net.

Handwörterbuch der Naturwissenschaften. Edited by E. Korschelt and others. Sechste Lief. Pp. 481–640. Siebente Lief. Pp. 641–800. (Jena: G. Fischer.) 2.50 marks each.

Publications of the American Ethnological Society. Vol. iii.—Haida Songs. By J. R. Swanton. Tsimshian Texts (new series). By F. Boas. Pp. v+284. (Leyden: Late E. J. Brill.) 8*s.* 6*d.*

Meteorology: a Text-book on the Weather, the Causes of its Changes, and Weather Forecasting. By Prof. W. I. Milham. Pp. xvi+549+charts L. (London: Macmillan and Co., Ltd.) 19*s.* net.

Earth Features and their Meaning. By Prof. W. H. Hobbs. Pp. xxxix+506. (London: Macmillan and Co., Ltd.) 12*s.* 6*d.* net.

Essais de Synthèse Scientifique. By E. Rignano. Pp. xxxi+205. (Paris: F. Alcan.) 5 francs.

Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India. New series. No. 48—Investigations into the Jail Dietaries of the United Provinces, &c. By Major D. McCay. Pp. viii+200. New series. No. 49—Epidemic Dropsy in Calcutta. By Major E. D. W. Greig. (Calcutta: Superintendent, Government Printing.) 3*s.* and 2*s.* 6*d.*

Royal Botanic Gardens, Kew. Bulletin of Miscellaneous Information. Additional Series x.—Flora of Kwangtung and Hongkong (China). By S. T. Dunn and W. J. Tutcher. Pp. 370. (London: H.M.S.O.; Wyman and Sons, Ltd.) 4*s.* 6*d.*

DIARY OF SOCIETIES.

THURSDAY, APRIL 25.

ROYAL SOCIETY, at 4.30.—The Diffusion and Mobility of Ions in a Magnetic Field: Prof. J. S. Townsend, F.R.S.—On the Observed Variations in the Temperature Coefficients of a Precision Balance: J. J. Manley.—On the Torque produced by a Beam of Light in Oblique Refraction through a Glass Plate: Dr. Guy Barlow.—Contributions to the Study of Flicker. III: Dr. T. C. Porter.

ROYAL INSTITUTION, at 3.—Synthetic Ammonia and Nitric Acid from the Atmosphere: Prof. A. W. Crossley, F.R.S.

ROYAL SOCIETY OF ARTS, at 4.30.—The Central Provinces: Sir John O. Miller, K.C.S.I.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Third Kelvin Lecture: Prof. H. du Bois.

CONCRETE INSTITUTE, at 8.—Discussion on reports presented by the Tests Standing Committee, entitled (1) The Testing of Concrete, Reinforced Concrete, and Materials Employed therein; (2) The Testing of Reinforced Concrete Structures on Completion.

FRIDAY, APRIL 26.

ROYAL INSTITUTION, at 9.—Sir William Herschel: Sir George Darwin, K.C.B., F.R.S.

PHYSICAL SOCIETY, at 5.—*Adjourned Discussion:* The Coefficients of Expansion of Fused Silica and Mercury: H. Donaldson.—The Solution of Net-work Problems by Determinants: R. Appleyard.—A Method of Measuring Small Inductances: S. Butterworth.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Principles and Practice of Accountancy in Relation to Engineering Design and Work: T. Frame Thomson.

MONDAY, APRIL 29.

ROYAL SOCIETY OF ARTS, at 8.—Heavy Oil Engines: Captain H. R. Sankey.

INSTITUTE OF ACTUARIES, at 5.—On the Superannuation and Pension Funds of certain Metropolitan Borough Councils, their Establishment, Administration, and Actuarial Investigation: H. W. Manly and T. G. Ackland. With Tables of Progress of Typical Funds for Officers and Workmen and Examples: L. E. Clinton.

TUESDAY, APRIL 30.

ROYAL INSTITUTION, at 3.—Insect Distribution with Special Reference to the British Islands: F. Balfour Browne.

WEDNESDAY, MAY 1.

ROYAL INSTITUTION, at 5.—Annual Meeting.

ROYAL SOCIETY OF ARTS, at 8.—Ancient Egyptian Ceramics: William Burton.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Analysis of Lithopone: W. L. Austin and Dr. C. A. Keane.—The Effect of Calcium on the Ammonium Molybdate Lead Assay: C. O. Bannister and W. McNamara.—The Constituents of Oil of Savin: J. Watson Agnew and R. B. Croad.—The Detection of Heavy Petroleum in Paints and Vegetable Oils: W. B. Pollard.

ENTOMOLOGICAL SOCIETY, at 8.—The Colour-groups of the Hawaiian Wasps: Dr. R. C. L. Perkins.

GEOLOGICAL SOCIETY, at 8.—Insect Remains from the Midland and South-Eastern Coal-Measures: H. Bolton.—On the Geology of Mynydd Gader, Dolgelly, with an Account of the Petrology of the Area between Dolgelly and Cader Idris: P. Lake and Prof S. H. Reynolds.

THURSDAY, MAY 2.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Petrifications of the Earliest European Angiosperms: Marie C. Stopes.—The Distribution of Oxydases in Plants and their *rôle* in the Formation of Pigments: Dr. F. Keeble and Dr. E. F. Armstrong.—The Manifestation of Active Resistance to the Growth of Implanted Cancer: D. B. R. G. Russell.—The Nature of the Immune Reaction to Transplanted Cancer in the Rat: Dr. W. H. Woglam.—On the Instability of a Cortical Point: T. G. Brown and Prof. C. S. Sherrington, F.R.S.—The Measurement of *Trypanosoma rhodesiense*: Dr. J. W. W. Stephens and Dr. H. B. Fantham.

ROYAL INSTITUTION, at 3. Explorations in the Canadian Rocky Mountains: Prof. J. Norman Collie, F.R.S.

LINNEAN SOCIETY, at 8.—On the Structure of the Palæozoic seed *Lagenostoma ovoides*, Will: Miss T. L. Prankerd.—Additions to the Flora of Western and North-Western Australia: Dr. Karl Domin.—Freshwater Rhizopoda from the States of New York, New Jersey, and Georgia, U.S.A.; with a Supplement on the Collection from the Seychelles: G. H. Wailes.—*Ligidium hypnorum* a Woodlouse new to Britain: W. M. Webb.—New Light on the Linnean Herbarium: The General Secretary.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—*Adjourned Discussion:* The Causes Preventing the More General Use of Electricity for Domestic Purposes.

FRIDAY, MAY 3.

ROYAL INSTITUTION, at 9.—The Use of Pedigrees: W. C. D. Whetham, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—*Resumed discussion:* Tenth Report to the Alloys Research Committee: on the Alloys of Aluminium and Zinc: Prof. J. O. Arnold.

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