THURSDAY, MAY 2, 1912.

CHEMICAL SPECTROSCOPY.

Introduction à l'Étude de la Spectrochimie. Par Prof. G. Urbain. Pp. iii+248+ix plates. (Paris: A. Hermann & Fils, 1911.) Price 10 francs.

PROF. URBAIN has written an exceedingly interesting and valuable introduction to spectroscopy treated more especially in relation to chemistry and chemical analysis. He has based this book upon his course of lectures delivered at the Sorbonne, and with undue modesty explains that it is mainly written for those younger chemists who, in their desire to enter a field full of promise, wish rapidly to acquire the fundamental ideas necessary for the theoretical and experimental study of the subject. Prof. Urbain is singularly happy in his preface, wherein he deals with the position of the spectroscope in relation to chemistry. Quite truly he points out the very valuable services that spectroscopy has rendered to chemistry and to astronomy. As for the former, it was a very long time before the subject formed more than a very restricted adjunct to chemical analysis. In truth, spectroscopy now deals with numerous facts which have but a dim connection with chemical analysis, and it deserves to rank as one of the principal branches of physical chemistry along with electrochemistry and thermochemistry.

The discoveries that chemistry owes to spectroscopy are many. To all is familiar the detection of rubidium and cæsium by Bunsen and Kirchhoff, followed by the isolation of indium, thallium, and gallium. The spectroscope, however, has also proved itself to be the only guide in that apparently insoluble labyrinth of elements, the rare earths. To the spectroscope we owe the discovery of samarium and dysprosium by Lecoq de Boisbaudran, of holmium and thulium by Soret, of neodymium and praseodymium by Auer von Welsbach, and of europium by Crookes and by Demarçay. Finally there is the brilliant work of Prof. Urbain himself, which has resulted in the separation of ytterbium into neoytterbium and lutecium, and the discovery of the new element celtium. Again, the value of the spectroscope in Ramsay's work on the rare gases is within the common knowledge of all. Modern chemistry would have been in debt to the spectroscope for its most beautiful discoveries had not M. and Mme. Curie found in radioactivity a method of investigation which, although less general in its application, is certainly more sensitive in certain cases.

When Bunsen and Kirchhoff published their method of investigation by flame spectra, chemists naturally welcomed this with enthusiasm. Ever since that time the textbooks of analysis have religiously incorporated their methods. Very few, if any, of these books describe the modern methods of investigation, although the value of these has clearly been proved. These modern methods are only to be found in specialised books which students have not the leisure to read and the skilled chemist rarely consults.

Prof. Urbain shows how the confidence felt by chemists in spectroscopy received a severe blow when the plurality of spectra was enunciated by Plücker and Hittorf. It was felt that spectrum analysis no longer possessed that rigour and infallibility at first attributed to it; nothing, after all, was so sound as the good old methods of pure chemistry; spectrum analysis was a complex subject, and it was abandoned to the specialist. In spite of this attitude of the pure chemist, the advance of spectro-chemistry has been enormous, and the variety of the modern methods is extraordinary. Flame spectra, spark spectra, spectra of gases and of solutions, arc spectra, absorption spectra, phosphorescent spectra, and infra-red emission and absorption spectra—all have their value in particular cases. The time has surely come for this subject to take the rank which it deserves in the chemical laboratory. At present the students of chemistry have a poor idea of the part played by the spectroscope in analytical research. The faint-hearted ones hesitate to take risks in so unknown a field, while the bolder ones perhaps try a few experiments, but are soon discouraged owing to their ignorance of the technique.

With the view of removing this ignorance, Prof. Urbain has written this book, and he treats in a most admirable way all the modern methods of work. In the first four chapters he describes the character and nature of spectra and the methods of illumination. Without going fully into the spectroscope itself, he gives in detail a most excellent account of the modern methods of illumination. The fifth and sixth chapters deal with phosphorescence and absorption, to the literature of which the author himself has contributed so largely. In the seventh chapter is to be found a concise description of series of lines and their relationships.

In fine it may be said that this book forms a most admirable introduction to chemical spectroscopy, and it is to be cordially recommended

to every chemist, student, and expert alike, for it should go far to dispel that somewhat doubtful confidence which the author quite rightly complains is still felt by the pure chemist as regards this important and fascinating branch of science.

E. C. C. BALY.

THE CONSTITUTION OF THE SILICATES.

Die Silicate in chemischer und technischer Beziehung: unter Zugrundelegung der seitens der philosophischen Fakultät der Universität Göttingen preisgekrönten Hexitpentit-Theorie nebst Umwandlung derselben in eine allgemeine stereochemische Theorie. By Dr. W. Asch and Dr. D. Asch. Pp. xv+409. (Berlin: Julius Springer, 1911.) Price 16 marks.

THE present work, which is an expansion of an essay originally submitted for a prize offered by the philosophical faculty of Göttingen, is a bold and original attempt to grapple with the difficult problem of the chemistry of the silicates and related compounds. The authors have sought to give a structural explanation of the behaviour of such compounds consistent with the doctrine of valency. The "Hexite-Pentite" hypothesis, which forms the basis of the work, assumes that silicates and alumino-silicates are not, in general, derived from the simpler hydroxides, such as $Si(OH)_4$ and $Al(OH)_3$, but from compounds formed by the condensation of six such molecules, with elimination of water, to form a closed ring. Less frequently, five-membered rings may be produced, and complex molecules are built up by the union, according to certain definite principles, of two or more such "hexite" or "pentite" groups. By the replacement of hydroxylic hydrogen by metals, of hydroxyl by fluorine, &c., formulæ are constructed which are capable of expressing with remarkable completeness the properties and reactions of many silicates and aluminosilicates.

The formulæ, especially in the contracted notation chiefly employed in the text, strongly recall the Kekulé theory of aromatic carbon compounds, but the analogy is not a real one, as the linking is never from silicon to silicon or aluminium, but always through an intervening oxygen atom. Praise is due to the authors for the ingenuity with which the hypothesis is applied, and for the labour expended in recalculating the enormous number of analyses given, and expressing them in terms of the new structural theory. A certain arbitrariness in the choice of many of the formulæ is unavoidable, in the absence of experimental investigations specially designed to test the points in question.

The most serious defect of the work is its disregard of physical considerations, owing to the exclusively chemical viewpoint adopted. This one-sidedness is well seen in the lengthy and detailed treatment of Portland cement and blast-furnace slag. Definite hexite-pentite formulæ are assigned to a great variety of these artificial products on the evidence of ultimate analyses only, and the microscopical proof that such materials are heterogeneous is brushed aside in a single sentence. Thermal analysis, by means of which such great advances are being made, including the brilliant work of the Geophysical Laboratory in Washington, is not considered, and the names of Day, Shepherd, and their collaborators do not even appear in the bibliography, although this includes some 1500 references. Again, the great additions made in recent years to our knowledge of colloids and of the part played by them in the chemistry of silicates are passed over in silence or with a brief allusion, in spite of the intimate bearing of such work on the weathering of felspars, the setting of cements, the hydration of zeolites, and similar questions, all of which are discussed from a purely structural point of view. Even to glasses and porcelain definite structural formulæ are assigned.

By replacing silicon and aluminium atoms by other elements, and by introducing stereochemical considerations, the hypothesis is extended to complex salts, metal-ammonia compounds, and salts with water of crystallisation. Some shorter chapters are devoted to further and more hazardous speculations, the hexite-pentite arrangement being applied to aliphatic organic compounds, and even to the structure of the atom and the explanation of radioactivity. These extravagances, however, do not detract from the value of the main thesis, which certainly deserves the attention of inorganic chemists and mineralogists, as possibly affording assistance in the further study of a complex and difficult subject.

C. H. DESCH.

BRITISH VEGETATION.

Types of British Vegetation. By members of the Central Committee for the Survey and Study of British Vegetation. Edited by A. G. Tansley. Pp. xx+416+36 plates. (Cambridge: University Press, 1911.) Price 6s. net.

THE great impetus that has been given during recent years to the study of the British flora is largely owing to the development of that branch of botany known as ecology. This subject—the study of plants in connection with their habitat—has raised many questions, and amongst them that of plant-communities has received foremost attention, and has been zealously investigated. The committee which was formed in 1904 to

organise and carry out a systematic survey of the vegetation of the British Isles has worked hard. Much surveying and mapping has been done, and several memoirs dealing with widely separated areas have been published. Though further work is required before a complete account could be presented, yet enough has been accomplished to obtain a general idea of the principal types occurring.

The volume now issued summarises in a clear and useful manner the results that have so far been obtained, and provides the student with a sketch of the British vegetation from an entirely new point of view. The book is based on the work of the committee referred to. Mr. A. G. Tansley has acted as editor, chapters being furnished by different workers, he himself, moreover, being responsible for a large proportion of the whole. The joint authorship works well, and results in a certain freshness of style, owing to each writer being specially familiar with the region he describes.

A short section in the first part of the book deals with the general conditions obtaining in the British Isles, the whole of part ii. being devoted to the description of the various formations and associations recognised. The plant-formations of clays and loams, of sandy soils, and of heaths are first described by the editor, and a chapter follows, by C. E. Moss, on the plant-formation of the older siliceous rocks. The vegetation of calcareous soils is next taken up, Tansley and Rankin dealing with the sub-formation of chalk, and Moss with that of the older limestones. A short chapter on general aquatic vegetation is inserted, though information on this subject is scanty. The fen and aquatic formations of East Norfolk are, however, dealt with in detail by Miss Pallis; and G. S. West gives a short account of the Phytoplankton of the lakes of the British Isles. The moor formation receives considerable attention, the lowland and upland moors being described by Rankin, and by Lewis and Moss respectively. A very interesting section on the Arctic-alpine vegetation is contributed by W. G. Smith, who deals chiefly with the slopes and corries of Ben Lawers, though here again much further work is required. The final chapter concerns the vegetation of the sea-coast, and contains, amongst others, an account by Oliver of the maritime communities of the Blakeney Harbour district.

The principal formations are in many cases divided into three associations, representing woodland, scrub, and grassland, and these, if need be, are subdivided into a number of smaller communities (sub-associations and societies). Progressive and retrogressive associations receive due attention, and the serious amount of degenerating woodland that exists in England is repeatedly emphasised.

Although many areas in Great Britain and Ireland remain to be investigated, Mr. Tansley's "Types of British Vegetation" forms a most welcome addition to ecological literature, and one which will be indispensable to every student of the subject in this country. Well arranged, and illustrated by a number of excellent photographs, the book will not only be valuable to botanists, but should attract and stimulate inquiry amongst all who take interest in the vegetation of our islands.

A. D. C.

RECENT BOTANICAL PUBLICATIONS.

(1) *Plant Life: a Text-book of Botany for Schools and Colleges.* By Prof. Eug. Warming. Translated from the fourth edition of the Danish (Eug. Warming and C. Raunkiær) by Metta M. Rehling and Elizabeth M. Thomas. Pp. viii + 244. (London: G. Allen and Co., Ltd., 1911.) Price 4*s.* 6*d.* net.

(2) *Wild Flowers as they Grow: Photographed in Colour Direct from Nature.* By H. Essenhigh Corke. With descriptive text by G. Clarke Nuttall. Second series. Pp. vii + 197. (London: Cassell and Co., Ltd., 1911.) Price 5*s.* net.

(3) *Plant Life and Evolution.* By Prof. D. H. Campbell. Pp. iv + 360. American Nature Series. (New York: Henry Holt and Co., 1911.) Price 1.60 dollars net.

(4) *An Intermediate Text-book of Botany.* By Ernest Evans. Pp. viii + 394. (London: Longmans, Green and Co., 1911.) Price 6*s.*

IN the first of these volumes the treatment of the subject matter is excellent, and follows a plan which is considerably different from that generally adopted in most of the English elementary text-books. The whole book bespeaks of the wide range of knowledge possessed by its illustrious author, and is written with a terseness and accuracy which is the outcome of a deep and extensive store of fact. A good feature of the book is the reference to so many plants with which the student has a common and almost every-day acquaintance.

The illustrations are for the most part very good, and not only are they more varied than is usually the case in such a small volume, but they are likewise considerably different in character from those found in most of the English text-books. The illustration of *Atropa belladonna* (on p. 178) is poor, and that of Sphagnum (on p. 210) presents a peculiar appearance owing to

being inverted. On p. 214 the name "*Algæ*" should be in clarendon type so as to be in conformity with the other groups, such as fungi, lichens, &c.; and on p. 218 the spore-bearing plants with stem and leaves might be well termed Archegoniates, but not "Bryophyta."

The translators are to be congratulated upon putting before the English public a most interesting elementary work on botany, and one which cannot fail to be stimulating to the junior student.

The second work treats of the flowers of twenty-five species of British plants, each one of which is illustrated by a photograph in colours and small text-illustrations of various parts of the flower. The text is very well written, and is full of folk-lore and legends concerning the plants dealt with. One useful feature of the book is the description of the pollination of the various flowers, but it must be mentioned that throughout the book the author makes the technical error of using the word "fertilisation" for pollination. This is the only flaw in a book which is an excellent one of its kind, and which would make a charming gift to any person interested in wild flowers. The majority of the plates are good, the best of them being the illustrations of *Arum maculatum*, the crab-apple, the cowslip, and the toothwort. The colouring of the gorse, and especially that of *Orchis mascula*, is scarcely true to life.

In the third publication there are ten chapters dealing with "Plant Life and Evolution." All are good, from the admirable introductory chapter to the concluding one on the "Origin of Species." The chapters dealing with the factors in evolution, with environment and adaptation, are excellent, but perhaps the best section of the book is that on the "Problems of Plant Distribution." Prof. Campbell's account of the "Origin of Land-plants" is just such a brief summary as so many students require, but it should be remarked that in it the author inclines to Bower's antithetic view of alternation of generations. The chapter on "Seed-plants" is a good *résumé* on the evolution of Gymnosperms.

There is some doubt whether diatoms are so recent in origin as suggested by the author, and not everyone would agree that Euglena "is structurally more like an animal than a plant."

The book must be considered as a valuable addition to the smaller text-books on botany, and exactly suited to the student who has mastered the elements of botany, and requires an insight into the principles of evolution.

The intermediate text-book by Mr. Evans is an attempt by the author to condense a rather large amount of fact into a relatively small space. It is pervaded throughout by a looseness of expression, and the mistakes in the earlier part of the book are almost too numerous to mention. Some of these errors are serious from the point of view of the student. The treatment of the Spermatophytes is much better, but even here the author's account of photosynthesis would be much improved by careful revision. On the whole, one could not recommend this book to an "Intermediate" student unless considerably revised.

OUR BOOKSHELF.

Hydro-Electric Practice. A Practical Manual of the Development of Water Power, its Conversion to Electric Energy, and its Distant Transmission. By H. A. E. C. von Schon. Second edition. Pp. xvii + 383. (Philadelphia and London: J. B. Lippincott Company, 1911.) Price 25*s.* net.

We heartily welcome this second edition of Mr. von Schon's admirable treatise on "Hydro-Electric Practice." Although only four years have elapsed since the first edition appeared, general interest in hydro-electric schemes has greatly increased, partly, no doubt, due to the way in which the public imagination has been fired by the possibilities of electrochemical and electrometallurgical processes, particularly as applied to the manufacture of iron and steel, and to the fixation of atmospheric nitrogen. It is on this, if on no other, account to be regretted that the book deals solely with conditions as they exist in America, and that no illustrations are drawn from the vast water-power schemes now in course of construction or operation in Norway, for example.

As in the first edition, the book consists essentially of two portions, the first a general survey of hydro-electric projects and possibilities, intended for the investor and capitalist rather than for the engineer, and the second portion a really valuable account of the design and construction of a water-power equipment which will be indispensable to engineers actually engaged in constructional work.

The sections dealing with the electrical equipment are somewhat meagre, and they should at least have been supplemented by a full bibliography of the extensive existing literature covering this branch of the subject.

It is a pity that the author should have disfigured his otherwise perfectly lucid descriptions by writing such a sentence as is to be found on p. 25, in which the terms "energy" and "power" are used indiscriminately in hopeless confusion. Again, why "cubic second feet" instead of "cubic feet per second"? These may seem, and no doubt are, small points, but a writer who uses scientific terms loosely is bound to arouse suspicion; in this instance at least

the suspicion would be quite unfounded, and the author is merely putting an easily avoidable obstacle in the way of a general acceptance of his treatise by responsible engineers.

Mendelism. By Prof. R. C. Punnett. Third edition. Pp. xiv+176. (London: Macmillan and Co., Ltd., 1911.) Price 5*s.* net.

ALL who knew Prof. Punnett's little book entitled "Mendelism" in its original form will welcome the greatly amplified edition of it which he has now published. This edition has been entirely rewritten, and is illustrated by five coloured plates. Prof. Punnett's book, in its original form, did so much to familiarise the public with Mendelian phenomena and hypotheses that the present work requires no recommendation from "the old shuffling bribed sots, called Reviewers," to use the words of William Cobbett.

The book is especially valuable because it is, in the words of the author, "in some measure a record of the work accomplished by the Cambridge School of Genetics." If the book were a complete record (which, of course, it is not), the work of that school would be an achievement of which a larger group of investigators working over a longer period of time might well be proud. The theories which have been put forward to explain the new facts may or may not survive the test of future experiment and criticism; they may be nearer the truth than the more cautious of us dare to hope. But whether they survive these tests or not, the new facts discovered constitute a solid advance in human knowledge which the carpings of those who criticise the theories put forward to explain these new facts cannot rob of one iota of its value.

The attempt to answer the question how far the Mendelian theory as held by Prof. Punnett approximates to the true explanation (if we may make the extravagant assumption that there can be such a thing) is a fascinating exercise for those who are more interested in the relation between the human mind and the so-called objective world than in the objective world itself. But this is neither the time nor the place to discuss the truth of the Mendelian hypothesis. It is enough, for the present, that the Cambridge School of Genetics has contributed handsomely to the capital of our knowledge of hereditary phenomena, and that the book before us is an admirable presentation of these contributions.

Boiler Draught. By H. Keay Pratt. Pp. vii+138. (London: Constable and Co., Ltd., 1911.) Price 4*s.* net.

IN this little book the author has endeavoured to assist those to whom the efficient working of steam plant is of importance by explanations of methods of determining whether existing arrangements are satisfactory. The book opens with a number of elementary calculations regarding the pressure, volume, weight, and temperature of air, and the resistance to flow. Calculations in relation to chimney, forced, and induced draught follow. There are also sections dealing with the construction of chimneys, the applications of mechanical draught for land and marine purposes, and the chemistry of combustion. The treatment of the subject is designed to suit those practical men whose knowledge of mathematics and science may be scanty. Indeed, the author states in his preface that while mathematical investigation is well appreciated, the results are likely to be greatly misleading if relied on too completely to the exclusion of practical experience. "It is for this reason that men of high scientific attainments are sometimes at fault when they have to tackle a problem in practical work."

That there may be another side to this question is also rendered very clear in the book. Thus in chapter vi. are given methods of calculating the approximate over-all dimensions of a fan. The methods employed can give rough results only, yet we find data stated to five significant figures and worked into the calculations, including one case of the weight of a cubic foot of water taken as 62·418 lb. While many valuable results and suggestions occur here and there, obtained from the author's practical experience, there is very little reference to recent experimental work, such as that conducted at the Manchester School of Technology and elsewhere.

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.*]

Burdon Sanderson and Vitalism.

IN his interesting and sympathetic notice, in NATURE of March 21, of the Memoir of Burdon Sanderson, your reviewer discusses Burdon Sanderson's attitude towards "vitalism," and thinks that the editors of the Memoir (my sister and myself) have scarcely represented this attitude satisfactorily. Our task in this connection was a somewhat difficult one, and we may have failed in it; but the grounds of the difficulty are of so much general scientific interest that it may perhaps be worth while to refer to them more fully. We quoted in the Memoir from the following letter, written by Burdon Sanderson from Algiers in 1904 to Miss Florence Buchanan, D.Sc. (who was then assisting him), with reference to a general paper which he was endeavouring, in the face of ill-health, to prepare on the general results of his electro-physiological work.

"From your pencil notes on my MS. I take it that you regard as the *result* of an investigation of the excitatory process the complex of data relating to localisation, time-relations, and intensity of electrical change—all of these being measurements. To me it appears that when you have got by measurement a complete knowledge of what happens electrically (intensity, localisation, and time-relations), this knowledge, however exact it may be, is of no value unless it enables you to conjecture the nature of the *excitatory process* of which these phenomena are the concomitants.

"The excitatory process can best be defined as a sudden transition from less functional activity (the

so-called rest state) to greater. It is not a measurable physical change, but a vital one which cannot be measured, and which *therefore* lies outside the scope of scientific knowledge. The two acts which seem to constitute the excitatory process, viz. excitation and response, are not continuous, but are joined together by a non-measurable link. This link is a subject of scientific conjecture, not of scientific knowledge; for nothing that is not measurable is known. It is, in short, something which is involved in *organism*, for which the most proper designation is *organismal*.

"The point to be emphasised is that the organismal link or nexus is the *essential* part of the excitatory process; for neither the physical effect of the stimulus nor that of the response is effectual by itself. It is only when these two are coupled by the organismal nexus that the excitatory process is constituted.

"The propagation of the excitatory process thus constituted takes place, not through or by any measurable process, but is wholly and solely organismal, and therefore not measurable. The electrical machinulæ are acted on by the organismal stuff, and not by their neighbours. Propagation is a vital process, not a physical one.

"The purpose of the paper will be (in case it is ever written) to show (1) that the mere statement of measurable data stops short of its purpose because it misses the essential fact in the excitatory process; (2) that every electrical change accompanying excitation which is cyclical corresponds to a single organismal change; (3) that the organismal change is modified by (*a*) exhaustion and (*b*) injury, these being localised (*a*) at the proximal contact and (*b*) at the distal, and having opposite signs." (Here, of course, the ligatured muscle preparation is referred to.)

While your reviewer is certainly right in emphasising, as, indeed, we have done in the Memoir, Burdon Sanderson's strong objections to vitalism, it seems to me that in this letter he also lays his finger, deliberately and accurately, on the weak spot in the physico-chemical theory of life. It is the connection between "physical" or "chemical" stimulus and "physiological" response that is unintelligible from the point of view of the physico-chemical theory of life. Burdon Sanderson concluded that this connection lies outside the scope of scientific knowledge, and in this way he avoided the many scientific difficulties and defects of traditional vitalism. But we felt bound to point out the gap which is left if no attempt is made to deal scientifically with what he calls (the italics are his own) "the *essential* part of the excitatory process." In every department of physiology there is the same gap; and what remains for exact physical and chemical investigation would seem to be only the outer fringe of the real phenomena.

J. S. HALDANE.

Oxford, April 16.

A Peculiarity in the Shadows Observed during a Partial Eclipse of the Sun.

DURING the recent partial eclipse of the sun, I observed a peculiarity in the shadows cast by the sun's rays which may be worth recording. If eclipses occurred more frequently, this peculiarity would be familiar to everyone; as it is, I am not aware that it has been noticed, which is probably due to the fact that the attention of most observers was concentrated on the appearance of the sun itself.

While the eclipse was progressing I was walking along a country road white with dust. Along the edge of the road were young trees about 15 ft. high, decked with small, undeveloped leaves. The shadows of these trees, cast on the road, presented a peculiar appearance. What first attracted my attention was the number of salient angles in the shadows: these angles were not due to the shapes of the leaves, which were practically oval. A closer scrutiny revealed the fact that, where a leaf was isolated, its shadow took the form of a crescent; in fact, each such shadow was *a negative image of the visible portion of the sun's disc*.

This observation recalled to my mind a phenomenon to which my attention was directed some years ago by Mr. L. H. Winn. Mr. Winn observed that if a white screen be placed at some distance from a window which looks towards the sky, and a pencil be placed between the window and the screen, the shadow of the pencil takes the form of a faint negative image of the window, the vertical sashes being represented by bright lines, while the clear panes are represented by dark rectangles. Mr. Winn explained this phenomenon correctly by tracing the paths of individual rays; he also performed a number of other experiments which confirmed his reasoning. The explanation which will be given in this communication is of a somewhat more general character, and is a particular instance of Babinet's principle. The following laboratory experiments illustrate the phenomenon to be explained in a striking manner, and, at the same time, suggest its explanation.

Let a magic lantern (preferably illuminated with an arc lamp) be directed towards a white screen at a distance of 15 to 20 ft. Remove the focussing lens and cover the condenser with tissue paper. Next, let the circular illuminated area of the tissue paper be partly covered with an opaque disc, so that a brightly illuminated crescent remains visible. Place a sheet of cardboard, in which a hole about a centimetre in diameter has been bored, between the lantern and the screen. An inverted positive image of the illuminated crescent is formed on the screen: this image is produced in accordance with the principles which are exemplified by the pinhole camera. When the perforated sheet of cardboard is removed, the illumination of the screen is approximately uniform; and if a small ball about a centimetre in diameter, suspended by a fine thread, is placed in the position previously occupied by the perforation in the screen, it will cut off those rays which, by themselves, would form a positive inverted image on the screen. The part of the screen which was previously rendered bright by the rays which passed through the perforation in the card is now rendered dark by the interception of these rays, and the shadow of the ball takes the form of a dark crescent, which is a negative inverted image of the bright crescent from which the rays emanate. The ball must be placed so far from the screen that the umbra of the shadow is not formed; for the rest, there is considerable latitude as to the position in which the ball is placed. A body of about the same size, but with a shape differing considerably from the ball, casts an identical shadow. If a larger body is used, its shadow still has the form of an inverted negative image of the extended source of light, but the definition is less perfect.

If the disc which partly covers the illuminated tissue paper be removed, and a sheet of card, in which a stencil letter has been cut, is substituted for it, an inverted negative image of the stencil letter is obtained on the screen. Instead of the stencil letter, we may use a letter painted in transparent red on the tissue paper, the remainder of the illuminated area being painted blue; in this case the shadow of the ball thrown on the screen takes the form of an inverted image of the letter in blue, on a reddish ground.

These experiments show that *when light from an*

extended source throws the shadow of a small object on a screen, under such conditions that the umbra of the shadow is not formed, then the shadow is the negative inverted image of the source of light.

Another shadow phenomenon observed during the partial eclipse may be mentioned here, although its explanation is obvious. In cases where the leaves of trees were so far advanced that most of the sun's rays were intercepted by them, the rays which passed through the small apertures between the leaves formed on the ground positive inverted images of the visible part of the sun's disc. The oval patches of light seen on the ground beneath thick trees under ordinary conditions of sunlight are due to the same cause. During the eclipse, the rays of the sun reflected from the free surface of water in a small glass formed a positive inverted image of the visible crescent of the sun on the walls or ceiling of the room in which the glass was placed.

EDWIN EDSER.

Halo during the Solar Eclipse of April 17.

AS NATURE contains no mention of the circular halo that appeared for about half an hour during the solar eclipse on April 17, the following facts may be of interest, for possibly the appearance was very local.

I was in the south of the Isle of Wight, at sea-level, and noticed, just as the air began perceptibly to cool, that a faint and very gauzy film of cloud collected round the sun. This was transparent enough for the sun to appear through it unmasked, but just dense enough somewhat to relieve the glare and make it possible to take hasty glances at the sun itself with the naked eye. After the clouds drifted into position, they remained through the whole time of the eclipse, but disappeared when the sun's warmth returned. Shortly after their accumulation I saw a perfectly circular halo; this was coloured, but the bands of colour were only red, yellow, and greenish. The halo gradually increased in apparent diameter until it faded, as the eclipse waned.

MARIE C. STOPES.

University College, London, April 27.

The Smoke Problem.

UNDER this head an anonymous notice appeared in NATURE of April 11 of a little volume by Mr. Ruston and myself, in which the reviewer refers to certain "weaknesses in what is otherwise so excellent a work." As the "weaknesses" form the bulk of the review, I have permission to try to explain them.

The first "weakness" is in reference to the origin of soot, which we ascribe partly to mechanical removal of dust and partly to incomplete combustion. The reviewer denies that coal-dust is a product of incomplete combustion, and also that tar and free carbon are formed in the destructive distillation of coal. I had imagined that tar and coke were among the principal by-products of the gas industry.

The next criticism occurs in the paragraph that follows, and refers to the amount of tar (we call "tar" the oil extracted by ether from soot and coal) in the original coals. The reviewer concludes, after citing some of our analyses, "surely the authors do not believe that a ton of these coals contains about a couple of gallons of ready-made tar." But suppose the authors have the weakness to accept the results of their analyses, what then? The reviewer offers no suggestion.

In the next paragraph the reviewer finds fault with the statement: "The chimney gases were drawn off at the rate of about a litre a minute (*i.e.* through a narrow brass tube), which would approach the speed of the gases passing up the flue." Although he is good enough to interpret the passage for us in the only way in which it could possibly be interpreted, he concludes with the remarkable *non sequitur* that "if the flue draught was a litre a minute, it is no wonder their figures are abnormal." Of course, there is no such suggestion that the flue draught was a litre a minute (which has no meaning, unless the area of the flue is known), nor is it so stated. Having made this gratuitous assumption, on what grounds does he conclude that our figures are abnormal? What are the normal figures? I believe that the figures of the late Sir W. Roberts-Austen and our own are the only records of the kind, and they substantially agree.

In the next paragraph, among other remarkable items of information, is the statement that "the percentage of soot to carbon burnt is of no practical importance. It is the percentage loss on the fuel used that is the important factor." The reviewer apparently fails to see that (1) the entire object of the experiments was to ascertain the amount of soot emitted, and (2) the percentage of soot on carbon burnt can be easily calculated on the fuel used if the amount of carbon in the fuel is known (as it was in every case).

I do not wish to extend this reply by referring to our other "weaknesses," which are of the same gross order. I can only thank the editor for his courtesy in giving me his permission to show how and where some of them, at least, may have had their origin.

J. B. COHEN.

IN the above remarks by Prof. J. B. Cohen on the review of "Smoke: a Study of Town Air," which appeared in NATURE of April 11, the reviewer is first taken to task for denying that "coal-dust is a product of incomplete combustion, and also that tar and free carbon are formed in the destructive distillation of coal." The passage in the review was: "Dust is not, as a rule, a product of incomplete combustion, nor is the tar and free carbon formed in the destructive distillation of coal." The reviewer is still of opinion that coal-dust is not a product of incomplete combustion; by a strong chimney draught some coal-dust may be drawn up the flue, but it has certainly not been produced by combustion (unless Prof. Cohen looks upon the natural formation of coal as a process of incomplete combustion). Prof. Cohen elects to read the second part of the sentence as a denial that tar and coke are formed during gas manufacture, but it is doubtful if anyone else will do so; the reviewer's statement is that the tar and free carbon formed in the destructive distillation of coal are not products of incomplete combustion.

The authors give analyses of the original coal used in some of their experiments, and amongst the constituents of the coal figure certain percentages of tar, in one case amounting to 1·64 per cent.; and the reviewer says: "Surely the authors do not believe that a ton of these coals contains about a couple of gallons of ready-made tar." To this Prof. Cohen replies: "But suppose the authors have the weakness to accept the results of their analyses, what then? The reviewer offers no suggestion." If the authors do believe it, I am afraid they would take any suggestion the reviewer could make as an impertinence.

In replying to the criticism with regard to the rate of flow of the chimney gases in the flue, Prof. Cohen quotes from the book, and inserts five words which make the meaning clear, but which were not in the original paragraph.

Prof. Cohen claims that his figures for soot formation agree substantially with those obtained by the late Sir W. Roberts-Austen; but do they? Sir W. Roberts-Austen's figure was 6 per cent. of soot on the coal burned, whilst Prof. Cohen's figure is 6·5 per cent. of soot on the carbon burnt to carbon dioxide—carbon dioxide being the product of complete combustion, whilst soot has been defined by the authors as a product of incomplete combustion.

As pointed out in the review, no such method as that employed by the authors can give even approximately accurate results unless the carbon escaping as carbon monoxide and hydrocarbons is also estimated; and when Prof. Cohen says that the reviewer fails to see that the percentage of soot on carbon burnt can be easily calculated on the fuel used if the amounts of carbon in the fuel and carbon dioxide in the flue gases are known, he is truly stating the case.

In conclusion, I can only say that my opinion of the book is unchanged by Prof. Cohen's reply, and that it is a pity that so excellent a work has been marred by the points to which attention was directed in the review.

THE REVIEWER.

Remains of Prehistoric Horse in the Stort Basin.

WITHIN the last few weeks a metatarsal and an astragalus identical in type with those previously found at Bishop's Stortford (see Report B.A., Portsmouth meeting, 1911, p. 521) have been exhumed from beneath 3 ft. of native peat and 2 ft. of an overlying pond-silt of probably outwash from the Boulder Clay capping of the Essex Plateau. The site is about 300 ft. O.D. at Pledgdon Hall Farm, in the parish of Henham, on the left bank of the brook which flows through Stansted Mountfichet into the Stort. I am contemplating further excavation, with the kind permission of Sir Walter Gilbey, the proprietor. I may say that the shallow cutting for the new light railway to Thaxted makes the stratigraphy of the high ground to the north of this minor upland valley quite clear; and there again we have evidence of the "rubble-drift" movement on the hill-slope, of which I have already recorded a good number of examples in the Stort Valley. I reserve details until the excavation has been carried further.

Meanwhile, it may be interesting to note here the exhumation of a fairly complete skeleton of probably a mediæval ox (a "stray," perhaps, of the time of the ancient Essex "forest-laws"). The characteristic structural features of the skull rank it very closely with the type furnished by the remains of Bos from Newstead, as described by Prof. J. C. Ewart, F.R.S. ("On Skulls of Oxen from the Roman Military Station at Newstead, Melrose," Proceedings of the Zoological Society of London, 1911, text-figure 74), while the lower jaw and its dentition present us with but a slight modification of those of the *Bos primigenius* of the glacial shingle of the Stort Valley, at the same time differing strongly from those of *B. longifrons* (see B.A. Report, *loc. cit.*). This Essex ox-skeleton was cut through by Mr. H. G. Featherby, of Bishop's Stortford, in sinking an iron cylinder on the site of a spring for water supply to the farm. It was found in what is probably interglacial gravelly sand, and beneath some 3 ft. of *remanié* boulder clay stuff, which had worked down ("rubble-drift" again) from the Boulder Clay capping of the plateau above. It was evidently one of a number of landslides, which have furrowed the sloping meadows on both sides of the brook at Collier Street Farm, on the Barrington Hall Estate, in the parish of Hatfield Broad Oak.

Bishop's Stortford, April 27. A. IRVING.

An Anode Dark Space in the Discharge in Oxygen.

IT may be of interest to readers of NATURE to know that I have recently obtained unmistakable evidence of an anode dark space in the discharge in oxygen at low pressures. The anode which exhibited this remarkable phenomenon was an aluminium plate which had been used as an anode during an extended series of measurements of the Crookes dark space with kathodes of different metals. As these were continued for some months, and as the phenomenon was not noticed when the anode was fresh, one is inclined to connect the occurrence with the excessive fatigue of the metal surface.

The anode dark space is a region of comparative darkness just in front of the anode, and can only be seen when the latter is immersed in the bright negative glow. Its thickness is small, but as its edge is exceedingly sharp, it can be measured with fair accuracy. The rough values already obtained are very interesting, as they show it to be entirely unaffected by changes of pressure and to vary inversely as the square root of the current density; with the latter at one-tenth of a milliampere per sq. cm., its value is about 1·2 mm. in pure oxygen.

The same anode showed it, though faintly, in air and nitrogen, but no trace of it could be observed in hydrogen. F. W. ASTON.

Cavendish Laboratory, Cambridge, April 25.

May Meteor-showers.

THE following meteor-showers become due during the period May 1–24, their arrangement being according to the times of the principal maxima:—

Epoch May 3, 0h. 30m. (G.M.T.), approximately tenth order of magnitude. Principal maximum, May 3, 22h. 50m.; secondary maxima, May 3, 18h. 50m., and May 5, 19h. 40m.

Epoch May 4, 5h., third order of magnitude. Principal maximum, May 4, 5h. 10m.; secondary maximum, May 4, 17h. 50m.

Epoch May 8, 11h., twelfth order of magnitude. Principal maxima, May 5, 13h. 25m., and May 7, 10h. 10m.; secondary maximum, May 7, 12h. 20m.

Epoch May 8, 14h. 30m., approximately fifteenth order of magnitude. Principal maximum, May 9, 13h. 10m.; secondary maximum, May 9, 0h. 40m.

Epoch May 12, 23h. 30m., twenty-fifth order of magnitude. Principal maximum, May 11, 16h. 15m.; secondary maxima, May 9, 19h. 30m., and May 12, 5h.

Epoch May 13, 10h., approximately twenty-fifth order of magnitude. Principal maximum, May 13, 15h. 55m., May 14, 23h. 25m., and May 16, 11h. 45m.

Epoch May 19, 6h., fifteenth order of magnitude. Principal maximum, May 18, 17h.; secondary maximum, May 18, 9h. 55m.

Epoch May 19, 18h., fourteenth order of magnitude. Principal maximum, May 18, 5h. 30m.; secondary maxima, May 19, 13h. 55m. and 16h. 5m.

Epoch May 19, 18h., thirteenth order of magnitude. Principal maxima, May 19, 20h. 55m., and May 21, 16h. 55m.; secondary maxima, May 21, 5h. 45m. and 12h. 50m.

Epoch May 21, 22h., second order of magnitude. Principal maximum, May 23, 13h. 45m.; secondary maxima, May 22, 10h. 30m., and May 23, 7h. 30m.

The intensity of an epoch being inversely as its order of magnitude, the greatest meteoric activity occurs on May 4 and May 23. The epoch of May 21, 22h., apart from its high intensity, is a very interesting epoch, and this remark applies also to the double epoch of May 19, 18h.

April 29. JOHN R. HENRY.

THE SOLAR ECLIPSE OF APRIL 17.

The Annular Eclipse as Observed near Chavenay, France.

THE recent eclipse of the sun was of interest from several points of view, but chiefly in the opportunity it afforded of determining the exact path of the moon's shadow and the duration of totality. It was well known that there existed a great deal of uncertainty as to both these items, the calculations depending on the different values employed.

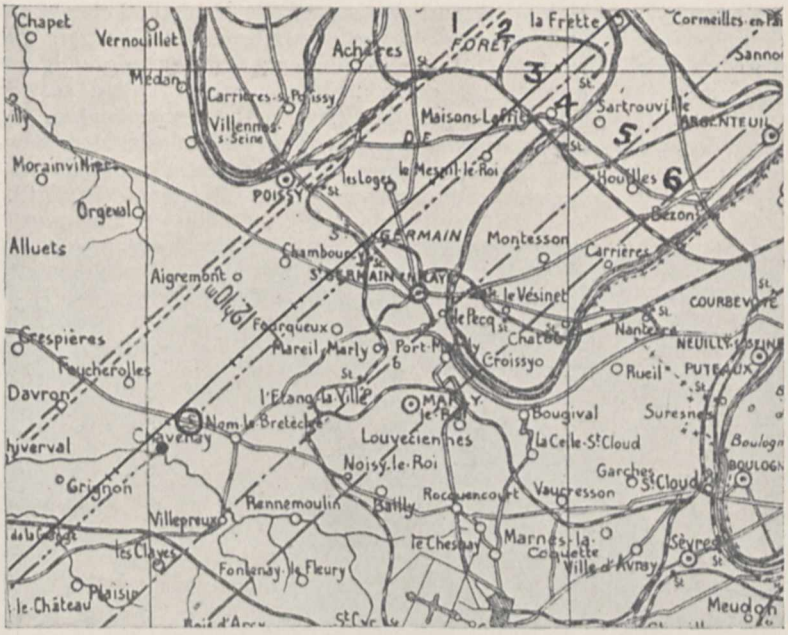


FIG. 1.—The region to the north-west of Paris, showing the several computed lines for the central eclipse from (1) "Berliner Jahrbuch," (2) "Nautical Almanac," (3) Dr. Crommelin, (4) "American Ephemeris," (5) "Connaissance des Temps," (6) "Carte du Bureau des Longitudes."

It was generally considered fairly certain that the total phase would be observed from stations near the north of Portugal and Spain, and that totality would only last for a second or two at most if the correct position were selected.

It was my intention to have proceeded on April 5 to Ovar, in Portugal, and place myself as near the centre of the track as possible, relying on the calculations of Dr. Crommelin, but unfortunately unforeseen circumstances rendered it impossible for me to undertake the journey. I was enabled, however, at a later date (16th) to go to Paris and observe the annular phase from a station some miles outside that capital.

The present communication deals with the observations made by my companions, Mr. Frank McClean and Mr. W. N. McClean, and myself, for it is possible that these observations, combined with those made by other observers, may help to locate the exact path of the moon's shadow as it swept across the country, and so determine the differences between the observed and the numerous calculated tracks.

We arrived at Paris in the early morning of the eclipse day (17th), and decided to take up our position on a portion of the track which would possibly be less frequented by other observers. We had heard that the region about Saint Germain-en-Laye, a point easily reached by train from Paris, would be fully occupied, so we determined to intercept the track more to the south-westward.

The accompanying chart (Fig. 1) shows the region to the north-west of Paris, with Saint Germain-en-Laye near the centre. The several lines lying in the direction south-west to north-east are the positions of the tracks of the shadow in that region as given by the various authorities. Thus, commencing with the upper one and working downwards, they represent the positions as given by (1) the "Berliner Jahrbuch," (2) "Nautical Almanac," (3) Dr. Crommelin, (4) "American Ephemeris," (5) "Connaissance des Temps," and (6) "Carte du Bureau des Longitudes." This chart is a portion of a much larger chart published recently in *L'Astronomie*, but here the track calculated by Dr. Crommelin has been indicated.

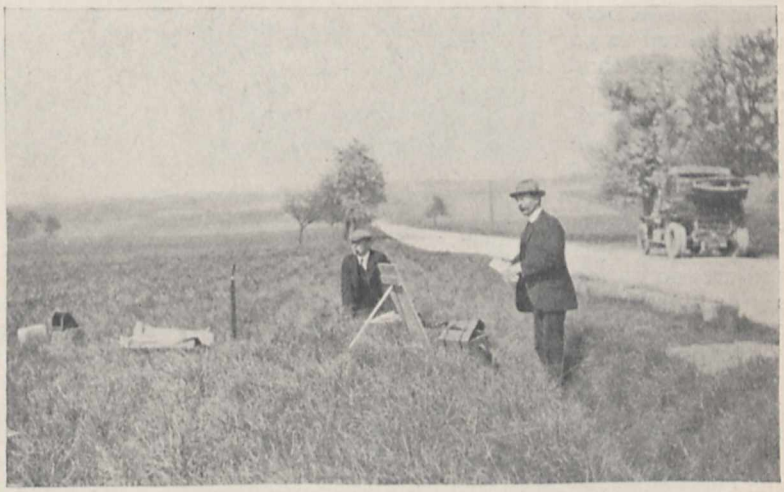


FIG. 2.—The main road (looking westward) from which we made our observations.

Being unaware of the position of Dr. Crommelin's line, we decided to place ourselves on that

indicated by the "American Ephemeris." A motor-car made it possible easily to reach the spot we selected, which lay on a part of a main road about three-quarters of a mile to the north-east of the village of Chavenay. This village is marked with a black disc in Fig. 1, and our camp is shown by a black circle near it.

The locality in which we settled was rather high, in slightly undulating country and very open, so that we had a good view for miles in all directions. The accompanying photograph (Fig. 2) shows the country looking westward along the main road.

We had this region all to ourselves, for only four other persons were within a quarter of a mile of us on either side of our position.

The weather was all that could be desired, only very small patches of cloud moving lazily in the sky.

After first contact had taken place at about 10h. 48m. (the times mentioned are only approximate), we gave ourselves up to noting any peculiarities that might be worth recording. There was scarcely a breath of wind, and a balloon which was silently making captive ascents at about a mile from us appeared to go vertically up and down. A little later we experienced some small intermittent breezes from the south.

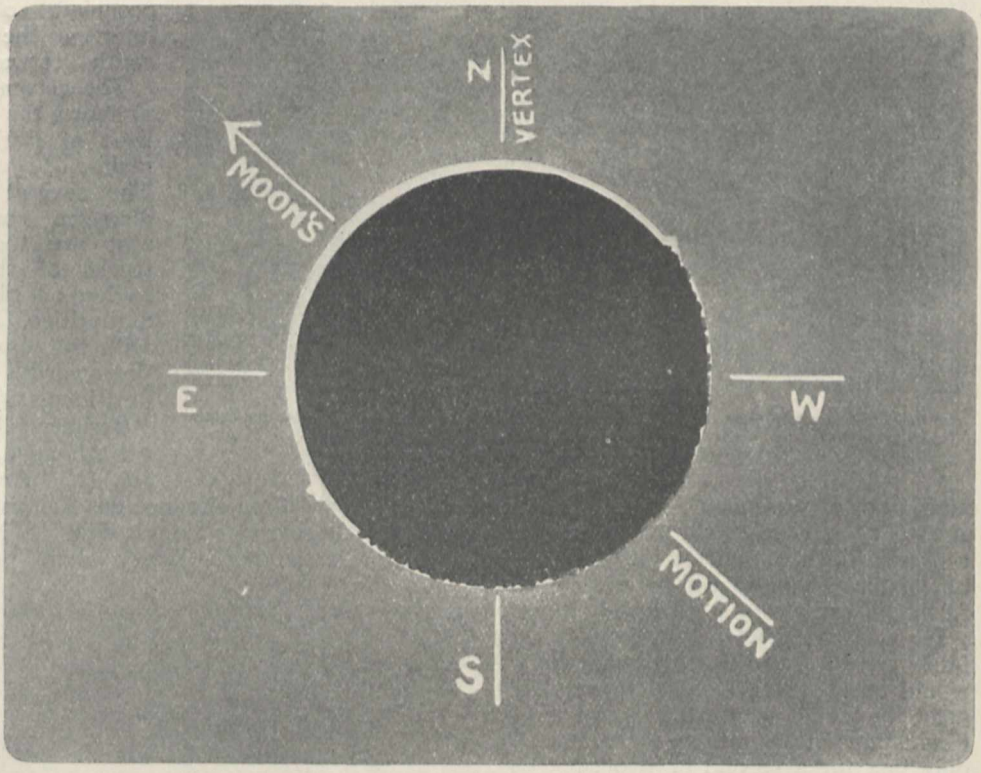


FIG. 3.—The eclipse as observed just before the beginning of the annular phase.

Numerous skylarks were singing merrily above and around us, and twice the whirr of the Gnome engine was heard when a biplane and monoplane came over in our direction from the south. Two hawks were soaring leisurely in the sky in our vicinity, and one went off south-eastward and seemed to try to outvie the captive balloon, which was then quite still at its greatest altitude.

As the sunlight grew appreciably more feeble and everything began to take on that weird, ashen hue so typical of eclipses, the skylarks were hushed and a few birds flew by as if homeward bound. This was at about five minutes past twelve, or about five minutes before the maximum phase.

Observing with a pair of binoculars (magnifying 2·5 times) shielded with dark glasses fixed to the front of the objectives, I watched the progress of the moon over the sun.

At first the crescent sun had been growing less and less in length, but at a later stage, as second contact was approaching, the thin remaining crescent began to lengthen out, at first slowly and then more rapidly.

Just beyond the end of the horn of the crescent in the south-eastern quadrant I observed the summit of a prominence (orientation about 8 o'clock), quite isolated, and I called to the others to notice it. The further movement of the moon allowed more of it to be brought into view, and the well-known "Baily's beads" had already begun to be clearly observed along the limb, successively forming in an anti-clockwise direction.

Almost simultaneously with the above appearance a like phenomenon was happening in the north-western quadrant. The "beads" were forming there in a clockwise direction, and a prominence also became visible (orientation about 2 o'clock), though of smaller dimensions (radially) than that seen in the other quadrant.

The successive formation of the "beads" in *both quadrants* reminded me vividly of the electric night sky-signs in London, when numerous nearly adjacent small incandescent lamps are successively lighted up.

So far as I could see, the phenomenon was symmetrical in both quadrants, neither quadrant

predominating in intensity. Both these sets of strings of "beads" travelled, or rather were successively formed, until they almost met in the middle of the limb in the south-west quadrant.

Unfortunately I could not observe any longer, as I had previously arranged at this stage to move a lever on my Thorp grating camera to expose a plate for one second; thus my attention had to be turned to the instrument. When I looked up again, about two seconds afterwards, the sunlight had just begun to break out in the south-western quadrant.

The accompanying sketch (Fig. 3) illustrates approximately the conditions I observed just previous to the beginning of the annular phase. The impression I gained was that the eclipse, from our point of observation, *must have been very nearly if not actually central.*

Mr. Frank McClean, who was likewise observing, also concluded that the eclipse was central; he recorded prominences at about 9, 1, and 7.30 o'clock, and estimated the duration as two or three seconds.

Mr. W. N. McClean observed two prominences, one at 8 o'clock and the other at half-past one, and both were visible, according to him, "some time before Baily's beads flashed out round the dark arc." The eclipse "appeared to be quite central, and the duration of darkness about two seconds."

Our attention being fixed on the immediate region of the sun, no observations were made of stars, planets, shadow-bands, or such like phenomena.

Since my return to London, Dr. Crommelin kindly communicated to me the position of his predicted line of central eclipse, and this I have inserted in Fig. 1. This line, it will be seen, lies a little to the north of that representing the American prediction. Dr. Crommelin saw the eclipse well from a station on the road from St. Germain-en-Laye, just north-west of the railway crossing, and in the above mentioned communication he says, "But from the actual result I think that the true line was nearer the 'American Ephemeris' line than my line."

WILLIAM J. S. LOCKYER.

French Observations of the Eclipse.

In the *Comptes rendus* for April 22 (No. 17) there are seventeen papers giving accounts of the observations made, chiefly by French observers, during the eclipse of the sun which took place on April 17, but in the following notes we can only refer to some of the more important results.

M. Deslandres organised a very complete set of observations at Meudon, and also despatched observers to Grignon, where M. Bernard used a large spectrograph with a circular slit fed by a cœlostat, and other members of the expedition took direct photographs of the sun through red screens. At both stations excellent results were secured.

At Meudon M. Perot's attempt to measure the rotational velocity of the corona was frustrated by the fact that he could only be sure of measuring the wave-length of the green corona line on the west side of the sun, 1′ from the limb just before the maximum phase. By a rapid setting he found the wave-length to be 5303·7, the value published by Sir Norman Lockyer.

The spectroheliograms secured show that, although there were no spots or faculæ on the disc, there was considerable activity, in the form of prominences and dark filaments, in the upper layers of the solar atmosphere, especially near the poles. M. Deslandres suggests that at sun-spot minimum the activity is transferred from the lower to the higher layers and latitudes.

The positions, dimensions, and intensities of the chief prominences shown on the photographs in "K" (calcium) light, taken with the smaller spectroheliograph at 8h. 56m., are shown in the following table:—

Latitude	E. or W.	Breadth	Height	Intensity (1–5)
°		°	″	
22 N.	E.	1	40	1
47 N.	E.	3	75	4
17 N.	W.	2	10	2
53 S.	E.	2·5	50	5
47 S.	W.	15	60	5
28 S.	W.	7	30	3
12 S.	W.	2	25	2

It will be seen that the largest prominence (47° S.) was duplicated by one diametrically opposite, and it will be interesting to see the coronal extensions in these localities if such have been photographed. Photographs taken with the *spectroheliographe polychrome* show that the congeries of particles were more intense thereabouts than in the neighbouring regions, and a similar intensification is shown on the plates taken with the large spectroheliograph, using the green coronal line.

At Grignon the red-screen photographs show the larger prominences, but no details attributable solely to the corona. The photographs with the large photoheliograph are 10 in. in diameter, and should furnish exact measures of position; the central line was obviously south of the observing station at Grignon.

M. Bigourdan gives a chart of the positions of his several instruments at Cormeilles-en-Parisis, and finds that he was very near the central line; this was in longitude 0° 7′ 20″ W. of Paris, and latitude 48° 58′ 55″ N., the altitude being 163 m. Baily's beads were very fine, and frequently the horns of the decreasing solar crescent were completely detached by the interposition of irregularities on the moon's limb.

A little before second contact M. Bigourdan believed he saw the exterior edge of the dark moon projected against the lower corona or the upper chromosphere. M. Eyssèric, who successfully observed shadow bands at the 1905 eclipse, was unable to detect any on this occasion.

In addition to those actually observing at the observatory itself, the Paris Observatory had several parties located at various points along the eclipse path, and the results secured were so numerous and various in character that but a small part of them may be briefly mentioned here. It appears certain, however, that nowhere in Europe was the eclipse definitely total. Even in Portugal, M. Salet reports, Baily's beads were to be seen around the moon throughout the whole of the maximum phase, and no one at Ovar saw the corona; he was located near the Bay of Aveiro. Messrs. Slater and Worthington, located about 1·5 km. north of Ovar, saw it for the fraction of a second, and thus it would appear that the "Connaissance des Temps" line was too far south. M. Salet's report would place the central line

about half-way between it and that given by the "American Ephemeris." This was confirmed by observations made from a dirigible, and a captive, balloon, by MM. Fournier and Bourgeois near St. Nom-de-Bretèche, where the respective observers quite independently registered the passing of the shadow at the same moment.

M. Giacobini saw Baily's beads form a chaplet of brilliant points, three or four seconds after maximum phase, which rotated about the lunar circle 180° in eight or ten seconds.

Many bright chromospheric arcs are shown on M. Millochau's plates, taken with the large spectroscope at the Paris Observatory, but the attempt to photograph the green coronal radiation was not successful.

At his station near St. Nom-de-Bretèche, M. Puiseux saw the bright annulus complete, except for the breaks caused by lunar mountains, for about two seconds, and estimates that he was but slightly north of the true central line.

MM. Esclangon and Stephan, at the Château de Talmont (Vendée), recorded that the eclipse was neither total nor annular; Baily's beads appeared almost instantaneously. They, also, conclude that they were very slightly north of the true central line, and to an observer 4 km. further north the eclipse was palpably not central.

Interesting observations were made at the Lyons Observatory, where some 6000 kinematograph pictures were made of a screen on which the images of the sun and moon were projected, and on which a carefully rated watch was also hung. On an average, ten photographs were taken per second, and it is hoped to derive very exact times for the contacts from the results.

Encouraged by the fact that at Vavau last year he was able to see, faintly, the green coronal line two minutes after totality, M. Stéfanik prepared to photograph the corona at Cormeilles-en-Parisis, using Wratten green-sensitive plates and suitable screens. But only the inner corona, as a very thin ring, is shown on his plate, and is easily distinguishable from the halation effect.

Prof. Iñiguez, at Madrid, found his observations seriously hampered by clouds, but succeeded in seeing, as very intense and long lines, the bright chromospheric radiations of H, Na, He, and Mg. Although the magnitude of the eclipse was only 0·9, he was able to observe the bright lines for some thirty minutes.

M. Eginitis, at Athens, observed the times of the contacts, and compares them with the predicted times as follows :—

	Observed	Calculated from the data of the Conn. des Temps	Nautical Almanac
	h. m. s.	h. m. s.	h. m. s.
First contact ...	0 54 17	... 0 54 33·6	... 0 54 48·0
Last ,, ...	3 20 23	... 3 20 53·4	... 3 20 51·6

As in 1905, the observed are seen to be in advance of the calculated times.

An important series of observations was made by L'École Polytechnique at the suggestion of M. Hamy, and under the supervision of M. E. Carvallo. Equipped with field-glasses (×8), the students were echeloned in twos across the eclipse track along a line 12 km. long on the route between Trappes and Neauphle; successive pairs were separated by a distance of 1 hectometre, the idea being to locate exactly the central line and to compare the relative sizes of the lunar and solar discs. At the extremities and at the middle of the echelon photographic and kinematographic observations were made. The results show that the central line was situated 35·5 km. along Route No. 12 from Paris to Brest, and lay between the lines predicted by the "Connaissance des Temps" and the "American Ephemeris," 500 m. from the former and 2400 m. from the latter. They also showed that the minimum diameter of the moon —between the valleys—was about 1·2″ less than that of the sun, while the maximum diameter—including lunar peaks—was about 0·8″ greater.

[In the article on the eclipse of the sun, in NATURE of April 25, for "disc" in line 23 of column 1 on p. 193 the author should have written "limb," and for 12h. 6m. 18s on the next line he should have given 1h. 31m.]

COLONIAL SURVEYS.[1]

THE report of the Surveyor-General of New Zealand for the year ending March 31, 1911, has recently been published, and shows both a larger outturn and a decreased cost under most headings. Topographical survey shows the largest output of more than two and a quarter million acres, while nearly half a million acres were covered by the triangulation. The previous report referred to the urgent need for an effective major triangulation as a control for the very extensive network of minor triangles, and the present report shows work on triangulation of the second order as being done in the Wellington district, but apparently not elsewhere, except a new base-line in Taranaki district.

This base-line was almost ten miles long, and formed one of the sides of a polygon of the major triangulation. It was measured twice with each of two standard 100-link steel tapes belonging to the survey, thus giving four values for the length. The tape was supported and strained to a tension of 25 lb. in the same manner as a previously measured base which was described in the report of last year, and satisfactory results were obtained; the mean values of the two measurements with each of the two tapes differ only by 0·0445 link on a length of 79,605 links, and the probable error derived from the measurement of the sections of the base is given as being 1 in 5,142,370; the probable error of the base when temperature, standardisation, and such other sources of error are taken into account is not given. Three months were occupied in preparing the line, and forty-five days were occupied in the measurement which gave such good results. At the present time, when base measurement has been so much simplified and cheapened by the use of wires, this base seems long, and the time it required was considerable, but no doubt local reasons were against the use of a shorter base and a base extension network of triangles. Surveyors will regret the absence of technical details in this report, for they would be most interesting and instructive. The accuracy of the triangulation, the density of the points, and the rate of its execution in different districts could be easily included, and would give a far clearer idea of the work described, and the same may be

[1] Report on the Survey Operations for the year 1910–11. New Zealand Department of Lands. By J. Strauchon, Surveyor-General. (Wellington, 1911.)

Colonial Report No. 685. Annual. The Surveys of British Africa, Ceylon, Cyprus, Fiji, Jamaica, Trinidad, and British Honduras for the year 1909–10. Price 1s. 6d.

said of the standard traverses. The regulations of the department (1908) admit the same closure error, 20″ for the triangles of both the major and minor triangulation; but doubtless in the new second order work the average error is much less.

Magnetic and seismographic records were regularly obtained at the observatory at Christchurch, and progress was made with the reduction of the observations of the magnetic survey, though no mention is made of an extension of the field work. The most important seismograph traces are reproduced.

Tide gauges are in operation at ten ports, and the methods of reducing the observations are discussed. To economise time and labour mechanical computation is largely employed, and mechanical plotting of coordinates with the aid of a co-ordinatograph is about to be introduced. In this connection we note the commencement of precise levelling at Wellington, but neither the instruments nor the permissible differences in the work are mentioned

The report of the Colonial Survey Committee for the year 1910–11, dealing with the surveying work which is being carried out in the Crown colonies and in Ceylon, contains much interesting information, and shows a steady improvement in the quality of the work. The expenditure on land measurement and work connected with it in ten colonies amounted to about 65,000*l*., besides about 80,000*l*. which was expended by Ceylon.

Everywhere the need for accurate surveys is felt, and in every colony where work has been done cadastral (landed property) surveys are in progress. For these a higher accuracy for control is needed than for topographical surveys, which are on smaller scales and do not deal with so sharply defined boundaries. The employment of trustworthy triangulation is steadily increasing, but still it is in progress in five only of the nine colonies which report that cadastral surveys are being carried on. For some colonies the accuracy of the work is stated, and triangular closing errors of 2″ to 5″ for second order triangulation and of 8″ to 12″ for third order triangles speak of excellent work done under conditions which are frequently most trying. There are some survey departments which do not report on the accuracy of their work in this way, and the value and interest of the report would be greatly increased if not only the angular precision were stated but generally the accuracy, the rate, and the cost of the different classes of work.

The number of control points available for the detail survey is also a matter of great interest to surveyors, and the interchange of such information on a systematic plan, as is done in the reports of the survey of Indian and of most foreign surveys, would be of much value. In Fiji a base-line 19,320 ft. in length was measured with a probable error of field observation of 1 in 4,000,000, but including errors arising from coefficient of error and temperature of the tape and of standardisation, the probable error of the base is put at 1 in 260,000. The stereophotographic method of survey is being employed here for plotting on the scale of 1 : 31,250 with 100-foot contours.

Cyprus appears in the report for the first time, and here a cadastral survey of the landed property in the island has been commenced, as required by the law passed in 1909 for the revaluation and registration of property in the land; it is based on a triangulation originally executed for topographical purposes, and will therefore need some revision to make it adequate as a control of the registration of small holdings. H. G. L.

NOTES.

THE first conversazione of the Royal Society for this year will be held in the rooms of the society at Burlington House on May 8.

DR. C. H. READ has been elected president of the Society of Antiquaries for the ensuing year.

WE regret to see the announcement of the death, on April 28, of Mr. J. Gray, honorary treasurer of the Royal Anthropological Institute and examiner at the Patent Office.

IT is stated in *Science* that the late Prof. Abbott L. Rotch has bequeathed to Harvard University the Blue Hill Meteorological Observatory, which he established in 1885 and directed up to the time of his death. He has further provided an endowment fund of 10,000*l*.

ON Friday, May 10, the third May lecture of the Institute of Metals will be delivered by Sir J. Alfred Ewing, K.C.B., F.R.S., on "The Inner Structure of Simple Metals." Cards of invitation admitting to the lecture can be obtained on application to Mr. G. Shaw Scott, secretary of the Institute of Metals, Caxton House, Westminster, S.W.

THE annual dinner of the Society of Engineers (Incorporated) will be held at the Criterion Restaurant, Piccadilly Circus, W., on Saturday, May 11, when Mr. John Kennedy, the president, will take the chair. Among those who have promised to attend are Sir Wm. H. M. Christie, K.C.B., F.R.S., Sir David Gill, K.C.B., F.R.S., Sir Maurice Fitzmaurice, chief engineer to the London County Council, Mr. Alexander Siemens, past-president Inst.C.E., and Mr. H. P. Boulnois, chairman of the Royal Sanitary Institute.

THE Royal Meteorological Society will meet at Southport at the end of next week, by invitation of the Mayor and Corporation. On Saturday, May 11, a popular lantern lecture, "A Chat about the Weather," will be given by Mr. W. Marriott, and on Monday, May 13, there will be visits to the Marshside Anemograph Station and the Fernley Observatory, Hesketh Park, succeeded by a meeting of the society, at which the papers to be read are :—Results of hourly wind and rainfall records at Southport, 1902–11, by Mr. J. Baxendell; the south-east trade wind at St. Helena, by Mr. J. S. Dines.

DR. IRA REMSEN has sent in his resignation of the presidency of Johns Hopkins University, Baltimore,

to take effect at the end of the present academic year. He succeeded the late Dr. Daniel Coit Gilman, the first president of the University, in 1902. Dr. Remsen will retain the chair of chemistry, which he has held since 1876, and hopes to find time to return to research work. In his letter to the board of trustees, he points out that the University is confronted by new problems, and urges that the policies to deal with them should be entrusted to someone who has "a reasonable expectation of a long term of service."

THE death is reported, at Beguio, in the Philippines, of Dr. Paul Caspar Freer, at the age of fifty. He was a graduate in medicine of the Rush Medical College, Chicago, and took the Ph.D. of Munich in 1887. After spending a short time as assistant to Dr. Perkin, at Owens College, Manchester, he joined the staff of Tufts College, Massachusetts. From 1889 to 1903 he was professor of general chemistry at the University of Michigan. He then went to Manila as superintendent of the Government laboratories there, and in 1905 was appointed director of the Bureau of Science for the Philippine Islands. He was the editor of *The Philippine Journal of Science*, and the author of various chemical textbooks and monographs. He had been mentioned recently as a possible successor to Dr. Wiley as chief of the Bureau of Chemistry at Washington.

THE council of the Association des Ingénieurs électriciens sortis de l'Institut électrotechnique Montefiore has circulated the conditions of award of the prize known as the Fondation George Montefiore. The prize represents the accumulated interest at 3 per cent. on a capital of 6000*l.*, and is awarded every three years for the best original work on the scientific advancement and progress in the technical applications of electricity in all its branches. The prize was awarded for the first time in 1911, and will be offered again in 1914. The last date for receiving competing works is March 31, 1914, and they should be addressed to M. le Secrétaire-archiviste de la Fondation George Montefiore, l'hôtel de l'Association, rue St-Gilles, 31, Liége, Belgium.

A VERY promising career has been ended prematurely by the accidental death of Mr. George Borup, who was drowned in Long Island Sound a few days ago through the upsetting of a canoe. As announced in last week's NATURE, Mr. Borup was to be one of the leaders of the expedition which will shortly set out to reach and map Crocker Land, in the north polar seas. He was assistant curator of geology in the American Museum of Natural History, and was well known by his work with Admiral Peary in the expedition to the north pole, and his book "A Tenderfoot with Peary." During the past two and a half years he had been devoting his whole attention to studies in the field and at Yale to fit him thoroughly for scientific geological and geographical exploration. He took up geographical work seriously and from a scientific point of view; and it is with regret that we have to announce the loss of a life from which many years of valuable work were anticipated.

APRIL was almost rainless over the south-east of England, and without doubt in a few isolated positions there was absolutely no rain throughout the month. At Greenwich the only rain measured is 0·02 in. on April 9, and with the exception of 0·07 in. on March 31, this is the only rain since March 23. The monthly records of rain at Greenwich from 1815 fail to show any month with so small an amount of rain. The previous smallest amounts are in July, 1821, 0·04 in., and in February, 1891, 0·05 in. The total rainfall in April has only twice fallen below 0·1 in., these being in 1817, 0·06 in., and in 1855, 0·09 in. In the memorable spring drought of 1893 the rainfall for April was 0·12 in. The duration of bright sunshine at Greenwich for April was 225 hours, which is 85 hours more than the average of the past thirty years, but it is 25 hours less than the duration of sunshine in April, 1909. The mean temperature for April was 49·7°, which is 1·6° in excess of the average; and on three days, from April 19 to 21, the sheltered thermometer rose to 70° or above. The temperature was generally lower towards the end of the month, due to the setting in of a northerly and north-easterly wind. The aggregate rainfall for April was only 0·02 in. at Oxford, 0·14 in. at both Dover and Shields, 0·19 in. at Clacton-on-Sea, 0·20 in. at Nottingham, and 0·25 in. at Bath. The most recent summary of the weather issued by the Meteorological Office shows that for the eight weeks of spring ending April 27 the aggregate rainfall is in excess of the average in all districts, except in the east of Scotland and in the east and north-east of England, whilst the rainfall since the commencement of the year is everywhere in excess of the average, except in the north and east of Scotland.

A CONFERENCE of members of the Museums Association and others interested in the work of museums was held at Stockport on Thursday, April 25. Besides members of the committee of the Stockport Municipal Museum and local visitors, representatives attended from some twenty public museums in Lancashire, Cheshire, and Yorkshire, including those at Manchester, Liverpool, Sheffield, Hull, Salford, Ralton, Bootle, Rochdale, and Warrington. The conference assembled at the Vernon Park Museum, which was duly inspected. After tea, to which the members were invited by the museum committee, a meeting was held in the Town Hall, under the presidency of Alderman Briggs, Mayor of Stockport, and chairman of the Education Committee, who welcomed the conference on behalf of the Corporation, adding a few words on the value of museums as factors in the education problem of which insufficient use was made. Mr. T. Sheppard (Hull) in a humorous paper gave an interesting account of the development of the Museum of Fisheries and Shipping which was recently opened as a department of the Hull Municipal Museum. The paper contained many practical suggestions and a moral for other curators. Mr. R. Butterfield (Keighley) read a short paper advocating the use of three-ply board as a backing

for cases and other purposes, which led to considerable discussion; he also exhibited and described a relief model of the district surrounding the Keighley Museum, which could be used as a basis for the elementary teaching of geology, natural history, and history, as well as for geography. Mr. Hewitt (Stockport) read an account of the history of the Stockport Museum, pointing out the difficulties under which it labours, and foreshadowing the lines on which it might profitably be developed.

MUCH new light is thrown on the possibility of the production of symmetrically formed prehistoric pottery without the use of the wheel or a regularly constructed kiln by the researches of the Rev. J. W. Hayes, recorded in the Journal of the Royal Anthropological Institute for July-December, 1911. At one small factory at Verwood, near Wimborne, he found most primitive methods in operation for the production of milk and water pans, the clay being worked up in a tank by barefooted boys, as Italian peasants tread the grapes in a wine-vat, the only tool used, besides a piece of string to cut the finished article off the wheel when finished, being a piece of hoop iron to smooth the edges of the pot. It is interesting to note that the process of building up the jar by the junction of separate pieces, the joinings being closed by tapping with a mallet, is still apparent in many prehistoric pots in the British Museum.

IN the issue of the Journal of the Royal Anthropological Institute for July-December, 1911, Major A. O'Brien gives a graphic and interesting account of the difficulties experienced by a district officer in dealing with the guardians of the multitudinous shrines of Mohammedan saints which abound in the valley of the Indus. Devotion to these worthies constitutes the working faith of the majority of the population, and the appeal to Allah or the Prophet is forgotten in the reverence paid to their local viceregents. All sorts of miracle-working powers are attributed to these holy men, and pilgrimages to their shrines are undertaken to provide for all the ordinary wants and hopes of the peasantry. The permanence of primitive animistic beliefs of this kind is shown in the fact that sanctity clings to certain sites from prehistoric times. Thus at the shrine now occupied by the saint Sakhi Sarwar, in the Dera Ghazi Khan district, men, women and children, Sikhs, Hindus, and Mohammedans alike resort to make vows and present offerings to the officiating guardians, including a company of old women representing the wife of the holy man, who devote themselves to the collection of dues from female votaries.

A SEVENTH report on research work, by Dr. Houston, director of water examinations, has been issued by the Metropolitan Water Board. The search for pathogenic microbes in raw river water, with special reference to the typhoid bacillus, has been continued. Taking all the results together, the study of 20,771 *specially selected* organisms derived from 215 samples of raw river water has resulted in the discovery of only two typhoid-like microbes. Typhoid bacilli derived directly from the patient, and without cultivation on artificial media, are found to be less resistant and to die out quicker in water than the same organisms after artificial cultivation. The temperature of the water influences the rate of disappearance of typhoid bacilli from water; the effect of low temperature (41° F. to 32° F.) is to delay considerably the diminution in numbers of typhoid bacilli. In a previous report, storage of the raw river water was shown to improve materially the condition of the water. Experiments are detailed on the use of a precipitation method (with "alumino-ferric") antecedent to storage as an additional means of purification. This is found to possess considerable advantage, but it materially increases the cost of purification.

THE April number of *The American Naturalist* contains the first part of a Harvey lecture delivered by Prof. H. F. Osborn on January 20 on the continuous origin of certain unit characters as observed by a palæontologist. Comment may be reserved until the completion of the report.

EELS, new and otherwise, from all parts of the world, form the subject of a long article by Dr. H. W. Fowler in the February issue of the Proceedings of the Philadelphia Academy. The forms described as new are nine in number, and two new subgeneric terms are also proposed. It may be noted that the name *Leptocephalus conger* is adopted for the conger, and that Echidna is employed for another genus, the latter usage barring the application of that term, in a generic sense, to the spiny anteater of Australasia.

FOSSIL whales akin to the modern finners form the subject of an article by Prof. F. W. True, published as vol. lix., No. 6, of Smithsonian Miscellaneous Contributions, which mainly consists of a summary of a paper in Danish by Dr. H. Winge. Both writers consider that among a multitude of extinct generic divisions which have been proposed, four are undoubtedly valid, namely, Aulocetus, Cetotherium, Herpetocetus, and Plesiocetus, and of these, as well as of the two allied existing genera, diagnoses based on osteological characters are appended.

As the first portion of a work entitled "The Fishes of the Indo-Australian Archipelago," Drs. Max Weber and L. F. de Beaufort have compiled an index to the ichthyological papers of Pieter Bleeker, published, as a volume of 410 pp., by E. J. Brill, Ltd., Leyden. Bleeker's papers are not only very numerous —the more important comprising no fewer than 432— but much scattered; and this index, not only of the articles themselves, but of the genera and species mentioned in them, will prove of great value to ichthyologists. The volume commences with a portrait and biography of Bleeker, who was born at Zaandam in 1819 and trained as an apothecary. In 1840 he qualified, however, as a surgeon and general practitioner, and in the following year was appointed surgeon in the Dutch East Indian Army. He arrived at Batavia in the spring of 1842, where he spent the greater portion of the next sixteen years, the intervals including sojourns at other stations and a trip to Celebes and the Moluccas. Here he soon commenced the study of the local fish-fauna, which culminated in

the issue of the "Atlas Ichthyologique des Indes Orientales," the completion of which was prevented by the death of the author in 1878.

IN *The Kew Bulletin* (1912, No. 3), J. H. Holland gives a useful review of the sources whence alcohol is obtained, these sources being treated under the heads of fruits, grain, roots, rhizomes, stems, leaves, inflorescences, wood, and peat. Interesting statistics are given with reference to the distillation of industrial alcohol from the potato in Germany and Poland, from the beet in France, and from maize and wood in the United States. There appears to be no bar, apart from fiscal and transport difficulties (which could readily be overcome), to the development of flourishing industries of this kind in our own country. The statements available at present regarding the production of alcohol on a commercial scale from peat are, unfortunately, meagre and contradictory; success has been reported from Sweden, failure from France. The Swedish experimenters claim that alcohol made from peat can be sold at less than one-half the present price of alcohol, and lower than the present price of petroleum.

PROF. R. PEPPERT, in a memoir issued by the Ministry of Agriculture in the Argentine Republic, deals with the world's supply of citric acid, which comes chiefly from Sicily, and gives interesting details concerning the species and varieties of Citrus, chemical analyses of the fruits used in the industry, and the methods of extraction on the commercial scale. Mention is made of Wehmer's discovery that citric acid can be made from artificial glucose by fermentation by various micro-organisms (*Citromyces pfefferianus*, *Penicillium lutem*, *Mucor pyriformia*), but it seems that this process yields only 2 or 3 per cent. of citric acid instead of the 50 per cent. promised by the laboratory experiments. The author points out that the climate and soil in the fertile Tucuman province of Argentina are admirably suited for the growing of lemons, that the fruits grown locally are in no way inferior to those of the Mediterranean region in their yield of citric acid, and that with capital and enterprise a flourishing citrate industry may well be established in Argentina.

MR. P. MACNAIR, whose useful "Introduction to the Study of Rocks" has been already noticed (NATURE, April 13, 1911), now issues an "Introduction to the Study of Fossils and Guide to the Palæontological Collections in Kelvingrove Museum," Glasgow, price 3*d*., with some forty illustrations. The Silurian eurypterids and fishes of Lesmahagow are well referred to, and Scottish fossils are properly emphasised throughout. The book will no doubt soon reach another edition, and certain misprints in generic names can then be rectified.

THE prehistoric human remains near Cuzco, in Peru, which occur low down in the face of a high gravel cliff, are dealt with in considerable detail in three papers by H. Bingham, T. Bowman, and G. F. Eaton in *The American Journal of Science* (vol. xxxiii., pp. 297–333, April). The bones described appear to be contemporaneous with the bedded gravels, which are regarded as a glacial series, an approximate age being assigned to them of 20,000 to 40,000 years ago. The valley of Ayahuaycco quebrada, or "dead man's gulch," in which they occur, has been used in modern times as a burial ground, and great caution is shown by the explorers in making the above suggestion.

Symons's Meteorological Magazine for April contains an account of the meteorological service of the Argentine Republic, by Sr. W. G. Davis (director), which is of much interest, owing to geographical position and large extent of country, as well as to the activity with which the science has been pursued. The service was established by Dr. B. A. Gould in 1872, and the results of the observations made up to the time of his retirement in 1884 were printed in four large quarto volumes. The service was continued on the same lines by the present director until the year 1900. The first daily weather chart was published in 1902, and forecasts are now issued for thirty-six hours in advance. The charts show the conditions existing from Para (Brazil) to the southernmost limits of the Republic, extending over 55° of latitude. In addition to the central office at Buenos Aires, there are two principal observatories at Cordova and Chacarita where special researches are carried on; and a fully equipped meteorological and magnetic station is maintained at South Orkney, in 61° S. latitude. The work of the meteorological office includes a seismological service, which will shortly embrace a line of stations along practically the whole of the north-to-south extent of the Republic.

A REPORT on the daily sunshine in Russia was presented to the Imperial Academy of Science in January (*Bulletin*, February 15). The duration of sunshine in European Russia increases on the whole from north to south and from west to east, being, however, somewhat longer on the coast than in the interior. In the yearly means the lowest maximum is recorded at St. Petersburg, where it occurs between noon and one o'clock, and attains to 11·9 hours (this figure being obtained from the means of thirty days in each month). The highest maximum in European Russia is 19·8 hours in Uralsk; in Bairam-Ali it is 23·9 hours, and 23·6 hours in Chita. The monthly maximum occurs at Bairam-Ali in August, and amounts to 30·8 hours, *i.e.* during thirty-one hours of observation the sun is on an average obscured by clouds for only twelve minutes. In St. Petersburg the maximum is reached in July, and is 18·8 hours. Sunshine is more frequent in winter during the afternoon and in summer in the forenoon. Only in St. Petersburg is sunshine more prevalent after noon in all months, attaining 60 per cent. of the possible in December and 50·4 in October. In January sunshine is more frequent at all stations in the afternoon, and in May in the forenoon, except in St. Petersburg, but the difference between the morning and afternoon is much less in summer than in winter. The greatest difference occurs in Irkutsk, where the sunshine in

the afternoon amounts in December to 65 per cent. of the possible. From twenty-five years' observations in Pavlovsk, it appears that in winter the maximum occurred later, and the afternoon sunshine was greater, in the clear months, that is, those in which the sunshine was above the average during the period; whereas in the summer months the reverse was the case.

THE Journal of the Washington Academy of Sciences for April 4 contains a summary of the results obtained by Messrs. Day and Sosman, of the Geophysical Laboratory of the Carnegie Institution, in their recent determination of standard melting and boiling points on the constant volume nitrogen thermometer and in terms of the thermodynamic scale. In some cases the determination was made directly, in others by the intervention of platinum-platinum-rhodium or copper-constantan thermocouples. The following melting points were found:—cadmium 320·8°, zinc 419·3°, antimony 629·8°; and the following boiling points at normal pressure:—benzophenone 305·85°, sulphur 444·4°, on the constant volume nitrogen thermometer. These become on the thermodynamic scale 320·9°, 419·4°, 630·0°, 305·9°, and 444·55° respectively.

TWO sets of measurements of the electric charge on rain made during last year are already available. The first, covering the short period March to June, were made in Dublin by Prof. McClelland and Mr. Nolan, and are published in the February Proceedings of the Royal Irish Academy; the second, from May to December, made at Puy-en-Velay, central France, by M. Baldit, appear in the March number of *Le Radium*. Both sets agree in giving an excess of positive over negative electricity brought down by rain, and the Dublin observations show that large drops are nearly always positively charged. At Puy-en-Velay the charge per cubic centimetre of rain is greater for negatively charged than for positively charged, while the reverse is true for Dublin. The mean electric current to earth per square centimetre of surface during rain, according to the Puy-en-Velay observations, is between 3 and 5×10^{-14} ampere.

DR. HANS STRECKER finds that if strong aqueous solutions of gelatine and gum arabic are shaken together they do not mix, but form an emulsion. On standing there is much agitation of the droplets of the one that is in the smaller proportion, they coalesce to a certain extent, and there results an even distribution of spherical globules of an approximately equal size, the size depending upon various conditions. He describes in the last number (April 15) of the *Revue générale des Sciences* the use of such an emulsion in various photomechanical processes. It will take the place of the asphalt grain in photogravure, and it will serve instead of the lined screen in the making of half-tone blocks. For these purposes the gelatine is in excess, and the particles of gum in the dried film are less easily penetrated by the etching liquid than the gelatine in which they have been formed. The making of half-tone blocks is much simplified by this process, which has the further advantage that solid or continuous lines in the original are not broken up as they are when reproduced by means of a lined screen. The author calls this process "stagmatypie," and gives two illustrations of it which certainly show that the process has the advantages claimed for it.

IN vol. iv., part i., of the Transactions and Notes of the Concrete Institute is contained an interesting photograph of a rag bolt found last summer embedded in a slab of concrete composed of Portland cement, ballast, and broken bricks. The concrete formed part of the foundations of the 1862 exhibition buildings at South Kensington, and had not been disturbed up to the time of its removal. The bolt was found when cutting through the concrete slab for some alteration in connection with the Imperial Institute, and was at ground-level. Both concrete and bolt were under cover. Only the top end of the bolt where exposed to the atmosphere, and the bottom end where embedded in the soil, were corroded; the remainder was quite clean, with the original blue scale thereon. This may be regarded as another proof that the reinforcement bars in ferro-concrete work will be preserved for an indefinite time provided that the concrete is maintained free from cracks.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR MAY:

May 3. 14h. 9m. Jupiter in conjunction with the Moon (Jupiter 5° 2′ N.).
4. 2h. 0m. Mars at greatest heliocentric latitude N.
7. 13h. 36m. Uranus in conjunction with the Moon (Uranus 4° 41′ N.).
„ 23h. 0m. Uranus stationary.
12. 15h. 10m. Mars in conjunction with Neptune (Mars 2° 9′ N.).
„ 21h. 0m. Mercury at greatest elongation W.
14. 6h. 0m. Saturn in conjunction with the Sun.
15. 10h 45m. Venus in conjunction with the Moon (Venus 3° 11′ S.).
16. 9h. 11m. Saturn in conjunction with the Moon (Saturn 4° 58′ S.).
20. 5h. 1m. Neptune in conjunction with the Moon. (Neptune 5° 46′ S.).
„ 12h. 4m. Mars in conjunction with the Moon (Mars 3° 42′ S.).
27. 8h. 47m. Venus in conjunction with Saturn (Venus 1° 7′ N.).
30. 15h. 49m. Jupiter in conjunction with the Moon (Jupiter 4° 48′ N.).
31. 22h. 0m. Jupiter at opposition to the Sun.

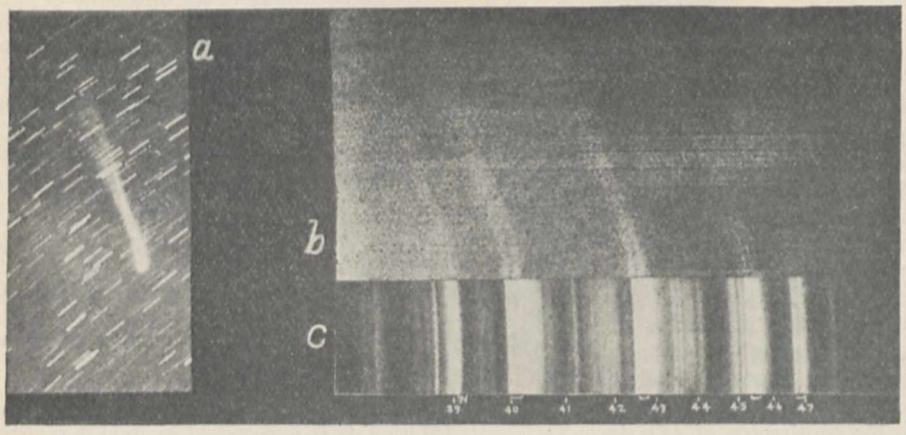
COMETARY SPECTRA.—In an article recently noted in these columns, MM. Pluvinel and Baldet, while agreeing as to the identity of certain doublets in the spectra of Morehouse's comet with similar doublets in Prof. Fowler's spectrum of carbon monoxide at very low pressure, pointed out that only twelve of their twenty-one cometary bands were represented in the published laboratory spectrum, and of these twelve there were serious discrepancies of wave-length in two cases.

Prof. Fowler now points out (*Astrophysical Journal*, vol. xxxv., No. 2) that there are probably

far more doublets in the CO spectrum than he published, but, owing to the difficulty of producing the spectrum bright enough to photograph, and the admixture of other lines, he could not be absolutely certain of them. As the comet spectrum seems to be of nearly pure origin, it will probably serve as a key in the problem of recognising the CO doublets in the laboratory spectrum. The discrepancies in wave-length are probably produced by the difficulty of determining the wave-lengths accurately in the cometary spectrum. Prof. Fowler thinks the identification of their λ 4846 doublet with his "indication of a faint band" at λ 4887, 4916 is a mistake on the part of MM. Pluvinel and Baldet, and shows, by computation from his observed data, that in a brighter laboratory spectrum there should be a CO band at λ 4843.

He also suggests that the less refrangible doublets included by MM. Pluvinel and Baldet in their brighter series (A) should be placed in a distinct series by themselves, and, on this assumption, calculates wave-lengths which fit their observations equally well, while representing the blue bands with much greater accuracy.

We reproduce a photograph from which it will readily be seen how conclusive is the agreement between the CO doublets and those photographed in the spectrum of Morehouse's comet by Dr. H. D. Curtis at Santiago, Chile, on March 20, 1909. The strong band on the left of the laboratory spectrum is due to an impurity of nitrogen, and is suitably represented by a single band in the cometary spectrum, whereas those due to CO are double. As will be seen, the latter are represented, in this comet, both in the head and the tail, but in several other comets they occur in the tail only, and should be regarded as characteristic of that part of the comet.



Morehouse's comet (1908*c*). *a*, Direct photograph, 4 hrs.; *b*, Objective-prism spectrogram, 7 hrs.: H. D. Curtis, Santiago, March 20, 1909. *c*, Spectrum of carbon-monoxide at 0·01 mm. pressure: Prof. A. Fowler, South Kensington.

THE SPIRAL NEBULÆ.—An interesting article on spiral nebulæ is published by M. Puiseux in No. 14 of the *Revue Scientifique*. In it the author reviews, popularly, the history of the observations of these important structures, and shows how our knowledge of them has steadily increased since Marius directed attention to the great Andromeda nebula in 1612. But there are many questions, as to their structure and their position in sidereal evolution, still outstanding, and it is with reserve that M. Puiseux advances the opinion that they are huge agglomerations of stars, set at enormous distances from us in space, from which the condensations are moving outwards.

LEEDS UNIVERSITY: NEW TEXTILE EXTENSION.

THE Leeds University has gained in reputation by the work of its technological departments. One of the principal and earliest of these is that of textile industries, founded in 1874 as part of the Yorkshire College of Science, the institution which has developed into the Leeds University. Textile teaching was then regarded by literary and scientific men, and also by manufacturers and those associated with the weaving industries, as a doubtful educational experiment. It had to be proved in what way a course of textile study could be formulated which would contribute to industrial progress. Such has been, however, the growth of this department, the widening of the curriculum of study, and the success of the students trained, that the late Vice-Chancellor of the University (Sir Nathan Bodington) asserted that the expansion of the University as a whole has been largely influenced by the prosperity of the textile industries department.

A recent important extension of the spinning section was formally opened on April 26 by the Master of the Clothworkers' Company (Mr. F. G. Fitch, J.P.), and presented to the University. On behalf of the University, the buildings were accepted by the Chancellor (his Grace the Duke of Devonshire). Provision has been made in the equipment for experimental instruction in the methods of producing worsted yarns on the Continental system, and also for research in the use of wool and other fibres in manufacturing. Machinery and apparatus have been designed and arranged primarily in regard to educational utility, but the practical character of the operations of yarn construction has also been attained. Hitherto it has been possible in the department to treat wool and other fibres by the woollen system of machinery and by two standard English systems of worsted yarn manufacture. The various grades of cross-bred and Merino wools may be treated from the raw condition to the manufactured fabric.

The new addition affords facilities for experiment in a method of worsted yarn making not extensively practised by British spinners. One feature is that in the processes only a small percentage of oil is applied, and that removed after the processes of combing. This necessitates the employment of apparatus for humidifying the atmosphere, to minimise the electrification of the fibres, and to impart a quality of adhesiveness which is essential in the preparation of the material and in the spinning of the yarn on this principle.

Equipment has been provided for various operations of yarn production, and humidifying plant, a section for carbonising, garnetting, and other machines, and also class-rooms for colour-matching, testing, and machine drawing.

The building has been erected at a cost of 5000*l*. The Clothworkers' Company of London has now contributed for buildings and for equipment at the

Leeds University a sum of 75,000*l.*, which has been augmented by donations from leading textile firms and machinists. The company's total contributions amount to 160,000*l.* for educational purposes in relation to the textile industries.

MEMOIRS OF THE GEOLOGICAL SURVEY.

THE "Summaries of Progress" issued by the Geological Survey of Great Britain are not by any means dry official reports, but contain a number of results, available for general use, which otherwise might remain unknown for several years. One of the chief features of the Summary for 1910, issued in June, 1911 (price 1*s.* 6*d.*), is W. B. Wright's account of the district round Loch Ba in Mull. This is accompanied by a map and sections, one of the latter (p. 36) showing the immense number of inclined intrusive sheets of basic rock that penetrate the "hybrid" mass of gabbro invaded by granophyre on the slope of Glen Forsa. On p. 39 it is mentioned that G. W. Lee's work in Morvern has led to the detection of two new localities for Cainozoic sediments among the basalts. The thin Cainozoic coals of southern Mull are discussed on p. 40. Carboniferous strata have received attention in Denbighshire and Warwickshire, where the observations are certain to have a considerable economic bearing, since these areas have not previously been mapped on the six-inch scale. In Appendix iii. (p. 80), R. G. Carruthers describes a mass of Lower Cretaceous sandstone, associated with fossiliferous Cainozoic clay and Boulder-clay, which rests on Old Red Sandstone in the heart of Caithness. This huge block, in which a quarry 160 yards long has been opened, has been investigated with the aid of borings, for the expense of which a grant was made by the Royal Society—whether of London or Edinburgh is not stated. The results show that the mass is an erratic brought in by the North Sea ice, and we become impressed by this further evidence of the wide extension of marine Cretaceous strata between Scandinavia and Britain in former times.

A second edition of the Explanation of Sheets 326 and 340 of the English map appeared in 1911 (price 1*s.* 6*d.*). The joint colour-printed map was published (price 1*s.* 6*d.*) in 1906. On this, the Clay with Flints is shown, covering with great regularity the plateaus of Cretaceous rocks. The district includes the famous landslip between Lyme Regis and Axmouth, which occurred in 1839, and was described by W. D. Conybeare, then vicar of Axminster, and speedily illustrated in Lyell's "Principles of Geology." It is pleasant to find that active author A. J. Jukes-Browne still associated with H. B. Woodward and W. A. E. Ussher in the preparation of the present memoir. We are interestingly reminded on p. 4 that W. Buckland was born at Axminster, while H. De la Beche lived at Lyme Regis from 1817 to 1821.

The long-continued borings into the concealed Coal Measures in Kent have added to our knowledge of the overlying Mesozoic rocks, and the results are now described by G. W. Lamplugh and F. L. Kitchin ("On the Mesozoic Rocks in some of the Coal Explorations in Kent," 1911, price 3*s.* 6*d.*). Lower Lias rests on the Carboniferous at Dover, and the upward succession of Jurassic and Cretaceous strata is practically complete, with a break between the Kimmeridge Clay and the base of the Hastings Sand. At Brabourne, however, between Folkestone and Ashford, even Portland beds are represented, with Purbeck beds above them, while Triassic marl and conglomerate occur below the Lower Lias. The Palæozoic rocks, here of doubtful age, are reached at 1921 ft. from the surface, while the boring begins in Gault. Correlating the two sections, G. W. Lamplugh states (p. 35) that they are, so far as he knows, "unparalleled in Britain—or . . . in any other part of the world—in the geological range and continuity of formations proved by them to exist in actual superposition in a single small area." The shorthand habit of recording horizons merely by a specific name leads to the anomaly of frequent references to the "Mammillatus zone," as a familiar term, while the zone-fossil is called in the same pages *Douvilleiceras mammillatum*. The crypts bored by Pholadidea from the Sandgate beds at Dover down into the Atherfield Clay still retain the shells in them, and are interestingly illustrated in the frontispiece. This occurrence is described on pp. 12 and 102.

Clement Reid, George Barrow, and others of the staff write on "The Geology of the Country around Tavistock and Launceston" (1911, price 3*s.*). The accompanying colour-printed map, Sheet 337 (price 1*s.* 6*d.*), shows that for "around" we should read "between," and that those who visit Tavistock for its comfortable proximity to Dartmoor must consult Sheet 338. The section at the foot of the map is a pleasing illustration of the possibility of working without an exaggerated vertical scale, and would have pleased the master, De la Beche. The interesting lavas at Brent Tor—the memoir preserves this spelling, though the map does not—are shown (p. 52) to possess pillow-structure and to be of the albitic "spilite" type. We should like to know the author of the charming sketch on p. 53. Dr. Flett remarks that Rutley's memoir on Brent Tor was "the first to contain the results of microscopic investigation of rock sections." Clifton Ward, however, was probably the pioneer in his Lake District memoir of 1876, while the Brent Tor memoir appeared in 1878, not 1876, as is here stated. The radiolarian cherts of Carboniferous age form a considerable feature on the map, and the new boundaries introduced show the importance of revision in this historic area. D. A. Macalister describes the tin and copper mines in detail, including those of Calstock and of the granite land of Bodmin Moor.

An important memoir on "The Geology of the Glasgow District" (1911, price 4*s.* 6*d.*) has been prepared by almost the entire staff of the Scottish branch of the Survey. It is accompanied by a composite colour-printed map of the district, with vertical and longitudinal sections (price 2*s.*), and it seems almost unfortunate that either of these works should be procurable without the other. The numerous and energetic attendants at geological classes in Glasgow will welcome these publications, equally with the members of the well-known local Geological Society. The elaborate subdivision of the igneous rocks may be a phase of the present epoch; but it comes naturally from a land where mineral studies have been developed with a traditional aptitude for classification. By means of letters on the map, as well as by more general colours, five types of basalt of Calciferous Sandstone age are distinguished, and also four others intrusive in the strata of the district. The separation on a map of intrusive from clearly contemporaneous rocks of the same composition is easily defensible, since the forms of the outcrops may convey no information. The coloured vertical sections on the margins of the map serve admirably to illustrate the contrast between the coal-bearing beds of the Clyde Basin and those of central England or South Wales. The memoir takes its place at once among our textbooks as a work to which all interested in European stratigraphy will refer. It will equally be the authority on the economic geology of a district where

mines and quarries are of high importance. Among the many places where modern research has been aptly utilised, we may mention E. B. Bailey's preference (p. 9) for ascribing a continental origin to the Old Red Sandstone, and his comparison of the "cornstones" with the kankar of tropical Africa—the original Indian examples might well have received mention. The alleged unconformity between the Barren Measures and the productive Coal Measures is regarded (p. 61) as improbable, owing to C. T. Clough's observations, published in 1910. G. W. Lee contributes a chapter of sixteen pages on the palæontology of the Carboniferous rocks of the district, from which it is pleasant to see how much we owe to members of the Geological Society of Glasgow. The interesting paragraphs (p. 94, &c.) on the life-zones of the system show how difficult it is to define, to the satisfaction of palæobotanists and palæozoologists alike, the lower limit of the Upper Carboniferous series. The base of the upper, or Visean, division of the Avonian, or Lower Carboniferous, lies somewhere below the Hollybush Limestone in the Calciferous Sandstone stage. All the "Carboniferous Limestone" stage near Glasgow is thus correlated with beds high up in the "Carboniferous Limestone" of southern England.

E. B. Bailey (pp. 124–50) treats of the petrology of the igneous rocks with enthusiastic thoroughness. We are glad to note the use of "alkali" as an adjective, rather than "alkaline," for types of rocks rich in sodium or potassium. Nepheline has now been found in several of these in the Glasgow district, notably in the "alkali gabbro" of Lennoxtown. The influence of Rosenbusch in establishing rock-species has spread to the Central Valley of Scotland, since a rock, already described as a theralite, becomes thus qualified (p. 135):—"In these characters it approaches much more closely the bekinkinites of Madagascar, which are a highly melanocratic type of ijolite." We regret to read that several other ultrabasic rocks of the area "have a composition which places them near to the bekinkinites," so that the way lies open for at least one new name, indicating, as must so often happen, nearness rather than identity. May we quarrel also with the word "macroporphyritic," which does not quite represent the author's meaning? It is interesting to find Abich's term "trachydolerite"—a very bad one from the point of view of rock-structure—revived for rocks that might surely be styled trachytic andesites. Harker's "mugearites," those interesting fine-grained types with orthoclase, oligoclase, augite, and often olivine, are recognised in the Carboniferous rocks near Glasgow. The discussion and diagram of the composition of the quartz-dolerites (p. 146) are of especial interest.

The chapters on the origin of local topographic features, including details of recession and river-capture on the escarpment of the Campsie Fells, bear further witness to the thoroughness of the Geological Survey work. These pages could be read with appreciation by persons who have never seen the district, and they will tempt many from the smoke of the great city into the gaps in the highland border that open up another world.

The Scottish branch also issues a memoir, by E. H. Cunningham Craig, W. B. Wright, and E. B. Bailey, on the "Geology of Colonsay and Oronsay, with Part of the Ross of Mull" (1911, price 2*s.* 3*d.*) The one-inch geological map issued in connection with it (Sheet 35, price 2*s.* 6*d.*) is mainly concerned with the Atlantic Ocean, and Oronsay lies beyond it on the south. Plate i. of the memoir, however, completes the island group. Most of the sedimentary rocks are believed to be representatives of the Torridon Sandstone. There is a considerable range of igneous rocks, and W. B. Wright and E. B. Bailey describe and illustrate an attractive example of the interaction of an ultrabasic hornblende-rock with included blocks of quartzite (p. 29). The quartzite, during solution, has led to a local concentration of alkalies. Many of the blocks, "surrounded by a magma which is overwhelmingly hornblendic, are actually replaced by alkali felspars and quartz." Tectonic features are described in detail, and we wish that James Hutton could again come to life to see how, in this and other instances, physical geology holds its own in Scotland. The glaciation of Colonsay took place from the east, and a map (p. 61) shows the course of boulders over the island from the mainland beyond Loch Awe. A pre-glacial rock-shelf, due to marine erosion, with accompanying cliffs, is traceable as high as 135 ft. above high-water mark (p. 62). E. H. Cunningham Craig in part ii. describes part of the Ross of Mull, and supports Judd's view that the great mass of granite is of later Palæozoic age. Both in this memoir and in that on the Glasgow district the petrographic details owe much to the advice and notes of J. S. Flett.

A third Scottish memoir, by ten authors, deals with Knapdale, Jura, and North Kintyre (1911, price 3*s.*). The immense part played by quartzite in Jura is well brought out on the accompanying map, Sheet 28. The term "vitreous quartzite" (p. 99) seems a little misleading, like the "glassy felspar" of older writers. This series in Jura may be 15,000 ft. in thickness (p. 106). A pleasant feature of the memoir is the introduction by J. B. Hill, where the geological structure and the raised beaches are concisely brought into relation with the human interests of the district.

G. A. J. C.

DISCUSSIONS OF CLIMATOLOGY.

A DISCUSSION by Dr. A. B. Rosenstein of the conditions of temperature in central and southern Spain is published in vol. xxxiv. (part iii., 1911) of *Aus dem Archiv der deutschen Seewarte,* based on observations of the last twenty years of the last century, and including a longer series for Lisbon, San Fernando, Coimbra, and Madrid. The last four stations represent essentially different climatological types, as previously pointed out by Hellmann. The author deals with the observations in considerable detail (twenty-seven tables), but we can only very briefly refer here to one or two of the results. The amplitude of the daily range, being chiefly dependent upon the season, is smallest in winter (December) at the above-mentioned stations (at San Fernando in April), and greatest in summer (August); in the latter season the mean daily range at Madrid is 13·8° C., twice that at Lisbon and San Fernando. With reference to the yearly range, one of the tables shows the deviations of the monthly from the yearly means, the sum of the greatest *plus* or *minus* monthly departures being given as the expression of the mean yearly oscillation. The stations are divided into three groups: (1) coastal, where the aggregate mean yearly oscillation is between 11·5° and 15·3° C.; (2) more inland, oscillation between 15·9° and 18·2°; and (3) central tableland and plateaux, oscillation between 18·9° and 20·1°. This useful paper closes with tables showing the interdiurnal variability of temperature at Madrid (yearly mean 1·5° C.) and San Fernando (1·0°).

A discussion of "The rainfall of Jamaica from about 1870 to end of 1909," with monthly and annual maps, has been published recently by Mr. Maxwell Hall, Government meteorologist. It includes means from a large number of stations, so far as observations were available, and general averages for each of the

several sections into which the island is divided for meteorological purposes. While the rainfall is fairly well distributed over the year, it is rather heavy in each division in May, June, September, and October; the north and north-east divisions have winter rains in November and December, and the north-east and west-central divisions have summer rains in July and August. The annual average for the whole island is 71·77 inches, maximum 90·61 inches in 1886, minimum 45·18 inches in 1872. The heaviest falls occur in the north-east division, where the aggregate average is 93·52 inches, the annual amounts exceeding 100 inches in many years. Some remarkable flood rains in twenty-four hours are reported during cyclonic disturbances, frequently exceeding 20 inches, and on one occasion (November 6, 1909) exceeding 30 inches on the Blue Mountain range. A table of the mean diurnal range at Kingston shows that the rainfall increases more or less regularly from the early morning until 3h. and 4h. p.m., after which it decreases to a minimum at midnight. The work is a valuable addition to our knowledge of the rainfall in the West Indies.

Dr. O. L. Fassig has sent us a useful paper on "The Climate of Porto Rico," chiefly based upon observations of the U.S. Weather Bureau during the years 1899–1909. The island, which is the most eastern of the Greater Antilles, and one of the most favoured regions within the tropics, has always been primarily devoted to the pursuit of agriculture. It has an equable and comfortable climate; the mean annual temperature at forty selected stations (combining all the records) is given as 76·4°, February 73·3°, August 79·1°, absolute maximum 103° in August, minimum 43° in February and March. The mean values naturally vary somewhat at individual coast and mountain stations; there is a fairly constant difference of 6° to 8° between the coast temperatures and those of the higher inland stations throughout the year. The average annual rainfall for the whole island is 77·30 inches; the amounts vary greatly from year to year, *e.g.* 93·72 inches in 1901, and only 64·18 inches in 1907, while in the Luquillo mountains, where rainfall is heaviest, the average annual amount exceeds 135 inches, and along portions of the south coast it is less than 40 inches. The average number of rainy days is 169 for the island as a whole; there are no well-defined wet and dry seasons. Porto Rico is comparatively free from storms of all kinds; the centre of a hurricane has only passed over the island three times in forty years, all in the month of August.

BIRD NOTES.

THE Agricultural Research Institute at Pusa, Bengal, has taken up the subject of the food of Indian birds, and issued a preliminary report (Mem. Dept. Agric. India, Entomology, vol. iii., January, 1912) by Mr. C. W. Mason, edited and supplemented by Mr. H. Maxwell Lefroy. To a great extent the report is a compilation of extracts from the writings of Indian ornithologists relating to the food of birds, but it also includes an analysis of the contents of the stomachs of a considerable number of specimens (1325) which have been examined in the laboratory. It is very largely a confession of ignorance, as at present little is known with certainty as to the economic utility or harmfulness of Indian birds, and it is consequently impossible in most cases to make definite statements. Mr. Mason is, however, of opinion that as weed-killers—by consuming seeds—birds are of no value at all in India. Such birds "may keep weeds down to a certain extent, but this is of minor importance in a country where labour is cheap and where farming is not practised on such intensive lines as elsewhere. Even in intensive cultivation we cannot rely on weeds being kept down by birds, and the expense of cultivation to eliminate weeds is, I believe, not reduced in the slightest by the action of birds."

It is noteworthy that although hawks and owls are regarded, in the main, as beneficial, yet they are considered to be undoubtedly harmful on account of destroying insectivorous shrewmice, toads, frogs, and lizards.

In the February number of Witherby's *British Birds* Mr. Ogilvie Grant points out that the partridge possesses two seasonal plumage-changes—one in the male and the other in the female—which have been hitherto overlooked. During the autumnal moult, lasting from July to September, the cock develops on the sides of the head and neck light umber-brown feathers marked by narrow buff, black-bordered shaft-stripes; this so-called eclipse-plumage replacing for about two months the normal black-waved grey feathers. In the hen during May the ordinary plumage of the same parts, as well as of the back, is replaced by sandy-brown feathers mottled or barred with black, and having buff shaft-stripes, and usually a terminal spot of the same hue. This breeding plumage, which is retained until September, produces a mottled appearance, especially round the neck, which is held to be protective to the sitting bird.

The April number of the same journal contains a supplementary record by the editor of the dispersal of little auks over the inland districts of England due to the stormy weather which prevailed in the early part of January. The birds seem to have struck the coast in greatest numbers between Norfolk and the Firth of Forth, those reported from the western and midland counties having probably travelled from the east. Although the number of birds appears to have been fewer than in the visitation of 1895, they seem to have been spread over a wider area of country.

Notes on the breeding of the white-headed stilt in a swamp near Melbourne are contributed by Mr. C. French to the January numbers of *The Emu* and *The Victorian Naturalist*. This is believed to be the first record of the breeding of these beautiful birds in Victoria. Unfortunately, the swamp dried up before the nesting was completed, thus causing many of the eggs and young to be deserted. The nests, which were from 10 to 15 ft. apart, and were made of dried water-plants, were constructed on tussocks of sea crab-grass (Salicornia); the first eggs were laid early in October.

In his review of Norfolk ornithology for 1911, published in *The Zoologist* for April, Mr. J. H. Gurney suggests that the breeding of a pair of bitterns in the county may have been due to the drying up of some of the Dutch swamps by the unusual heat and dryness of the summer. Another event was the nesting of a pair of curlews near King's Lynn.

We have received a copy of the second number of *The Austral Avian Record*, a new journal, edited by Mr. G. M. Mathews, and published by Messrs. Witherby and Co., primarily devoted to the study of Australian birds. This number contains a long list of new subspecies and other addenda to the Australian fauna, which from internal evidence is clearly from the pen of the editor, although there is no other indication of its authorship.

The birds of Lower Egypt form the subject of an article by Mr. C. B. Ticehurst in the February issue of *The Zoologist*; Mr. M. J. Nicoll is also writing on the same subject in *The Ibis*.

In a pamphlet published for Government at the National Printing Department, Cairo, Mr. Nicoll gives a list of the species of wild birds (other than those kept in captivity) observed in the Giza Zoological Gardens between the years 1898 and 1911 inclusive. The list includes 200 species, of which 187 are indigenous to Egypt, while the remaining 13 are foreign, and were doubtless represented by individuals escaped from captivity in Cairo. R. L.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LEEDS.—On the recommendation of the Livesey Memorial Committee, the University Council has appointed Mr. John William Cobb to be Livesey professor of coal gas and fuel industries from the end of the present academic year, when the chair will be vacated by Dr. W. A. Bone, F.R.S., who has accepted the professorship of fuel and refractory materials at the Imperial College of Science and Technology.

On the recommendation of the advisory committee on higher commercial education, the University Council has decided to develop the teaching of geography in connection with the department of economics, and has appointed Mr. Llewellyn Rodwell Jones as assistant university lecturer in geography.

MR. F. A. DUFFIELD has been appointed demonstrator in experimental physiology and pharmacology at the University of Sheffield.

THE annual meeting of the Parents' National Educational Union will be held at University College, London, on Tuesday, May 14, when an address on "Some Educational Ideals" will be delivered by the Rev. A. A. David, headmaster of Rugby School.

THE committee of University College, London, will shortly proceed to make an appointment to the post of senior assistant in the department of zoology and comparative anatomy, which has been rendered vacant by the election of Dr. W. N. F. Woodland to the professorship of zoology in the Muir Central College, Allahabad.

THE Maryland Legislature has, we learn from *Science*, voted the sum of 120,000*l*., to be followed by an annual grant of 10,000*l*., to establish a school of technology in connection with the Johns Hopkins University. Our contemporary also announces a gift of 60,000*l*. to Princeton University from Mr. W. C. Proctor, of Cincinnati, for the endowment of the Charlotte Elizabeth Proctor fellowships in the graduate school. Mr. Proctor has previously given 100,000*l*. to the graduate school.

A SCHOLARSHIP of 35*l*. for one year is offered at Bedford College for Women (University of London) for the course beginning in October next. The scholar, who must hold a degree, or an equivalent certificate, will be required either to take the full diploma course at Bedford College or to pursue some special line of investigation in cognate subjects under the supervision of the lecturer in hygiene. Names of intending candidates, with particulars of previous study, should be forwarded not later than July 1 to the Principal, Bedford College, from whom further particulars may be obtained.

A CONFERENCE on diet in public secondary and private schools will be held at the Guildhall on May 13, when the Lord Mayor will preside. A provisional programme has been circulated, and it is expected the following papers will be read and discussed:—Diet as a factor in physical, intellectual and moral efficiency, by Dr. Clement Dukes; existing methods and the main lines of reform, by Miss Robertson, Drs. Mumford and J. Sim Wallace, and Mr. Prosser; instruction in the elements of physiology and personal hygiene, by Mrs. Burn and Dr. Reddie; and problems in institutional feeding and training in institutional management, by Mrs. Stanley Hazell. Full particulars will be supplied to anyone sending a stamped addressed envelope to Mr. C. E. Hecht, National Food Reform Association, 178 St. Stephen's House, Westminster.

THE Australian Institute of Tropical Medicine is inviting applications in connection with the appointment of three new officers, one to be a laboratory expert capable of taking charge in the absence of the director, the second to be an expert in tropical hygiene and epidemiology, and the third to be a biochemist. This is the outcome of the large increase of endowment recently granted by the Commonwealth Government. Extensive new laboratories are in process of erection at Townsville, Queensland, and special wards have already been equipped in the Townsville Hospital. The first report of the director, Dr. Anton Breinl, is full of hopeful augury. An Australian diploma of tropical medicine is being established simultaneously by the Universities of Sydney, Melbourne, and Adelaide, the bulk of the teaching being entrusted to the institute. The affairs of the institute are supervised by a committee including representatives of the Governments of the Commonwealth and of Queensland, and the Universities of Sydney, Melbourne, Adelaide, and Brisbane.

THE second reading of the Education (School Attendance) Bill was agreed to in the House of Commons on April 26 by a substantial majority. The Bill provides that no child shall be allowed to leave a public elementary school below the age of thirteen, with the proviso that if a child leaves school between the age of thirteen and fourteen it shall only do so on condition that it is to enter into beneficial employment. The effect of the Bill would practically be to abolish half-time employment. It is generally admitted that the half-time system has little to recommend it so far as the great majority of districts are concerned. A recent departmental committee decided unanimously against it, and recommended its abolition. But, as the speeches in the House of Commons showed, some authorities wish to preserve the system in agricultural districts, though there has been a marked diminution of half-timers in country areas in recent years. The system is most in vogue in the textile districts of Lancashire and Yorkshire; but the debate served to demonstrate that its abolition would be greatly to the advantage of the children, and would result also in a marked improvement in the standard of the schools, where work has been retarded greatly by the regular absence from them of part of the children for a portion of the school day.

THE fourth annual report of the governing body of the Imperial College of Science and Technology, for the year ended August 31 last, has now been published (Cd. 6132). It provides interesting particulars of the progress already made in the provision of adequate accommodation for the extended work and activities of the college. The governing body has had under consideration its position as regards the Royal Commission on University Education in London, so far as it has reference to the work of the Imperial College, and has resolved that the autonomy of the Imperial College should be maintained and incorporation with the University of London should

not take place; also that some means should be found, either by the establishment of an independent department or faculty of technology or otherwise, by which students of the Imperial College who satisfactorily complete the associateship courses of the college, and students duly qualified by research, advanced study, or in other approved ways, may obtain degrees without further examination. To maintain the departments of applied science in the college, so that they may be of the greatest possible usefulness to their related industries, small committees of experts are being formed with the express object of keeping the college specially informed as to the needs of that industry. Throughout the report there are many instances of the strenuous endeavours of the governing body to equip and maintain the college in a manner worthy of its name.

IN a paper read before the Royal Colonial Institute on April 23, Mr. A. E. Shipley, Master of Christ's College, Cambridge, dealt with the problem of fitting men for their practical post-academic life. The Americans, he pointed out, set great store by the practical nature of education. Not infrequently boys who in the ordinary course of events would leave school at fourteen or so, go up to the high school, where they maintain themselves, altogether or partly. The path from the school to the university is a straight one. But the system in America is beset by many grave disadvantages. The teaching staffs of some of the great universities are far from adequate, and the priceless feature of individual instruction and attention is neglected. College degrees may, he said, be "crammed" for, and the system stifles originality. Several Americans have told Mr. Shipley that comparatively few things are actually invented in America—that most inventions come from abroad, but are eagerly taken up and exploited in the States. Where the American really shines is not as an inventor, but as a manufacturer. Originality is rare in America, and this must be accounted for by the educational system. The remedy is either a gigantic increase in the teaching staffs of the universities or else a rigorous elimination of the first-year students. At present, he continued, the older English universities are producing the best men, but the field from which they draw is small. By making slight reforms, America could be on the same footing as the English universities, with the added advantage of a universal field from which to select the raw material.

THE completion of another important addition to the many departments housed under the roof of the Battersea Polytechnic was inaugurated on Monday, April 22, when his Honour Judge Benson (Master of the Worshipful Company of Drapers) attended for the purpose of opening the new hygiene and physiology laboratories, presented by that body as a further step towards the thorough equipment of the polytechnic. The new laboratories with their classrooms are equipped and arranged on the latest principles for the study of hygiene, physiology, bacteriology, and geology. Dr. Rawson, principal of the polytechnic, presented an interesting report on the work of the past year, in the course of which he pointed out that the number of both day and evening students showed a gratifying increase. In the matter of examination results, thirty-eight scholarships and exhibitions (to the value of 211*l.*) had been gained during the year, together with nine medals and sixteen prizes, and other awards. The number of university students and their successes at the university examinations also showed a great increase over previous years. In conclusion, Dr. Rawson referred to the great help the new laboratories given to the polytechnic by the Drapers' Company would prove. In the past, so far as the study of hygiene and physiology was concerned, the work had been seriously hampered for want of accommodation, but that has now been remedied. Judge Benson then distributed the prizes and formally opened the new laboratories. Later he delivered an address, in which he contrasted the present educational system with the opportunities which existed in his youth, and urged the students in their efforts to perfect themselves in technical arts and crafts, not to neglect that general culture which is necessary to the proper development of the human intellect.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 25.—Sir Archibald Geikie, K.C.B., president, in the chair.—J. S. **Townsend**: The diffusion and mobility of ions in a magnetic field. The mobility and diffusion of ions in a magnetic field is investigated on the same principles as those employed in the ordinary kinetic theory by considering the motion of an ion along its free paths between collisions with molecules. If U and K be the mobility and coefficient of diffusion when the magnetic force is zero, U_h and K_h the corresponding quantities in directions at right angles to a magnetic force H, then

$$U_h = \frac{U}{1+\omega^2T^2} \text{ and } K_h = \frac{K}{1+\omega^2T^2},$$

where $\omega = He/m$ and T the mean interval between collisions. The magnetic deflection θ of a stream of ions moving with a constant velocity in an electric field is also investigated, and a method is indicated of determining the velocity U due to an electric force X. When θ is small, $\tan\theta = HU/X$, and when θ is large, $\tan\theta X/ = HU_h$.—J. J. **Manley**: The observed variations in the temperature coefficients of a precision balance. In this paper is given an account of experiments which supplement and extend an earlier research (Phil. Trans., A, ccx., p. 387) dealing with changes which may be observed in the resting points of precision balances. Attention is directed to the following:—(*a*) the possibility of the change from a positive to a negative value for the temperature coefficient of a balance; (*b*) the *critical temperature range* of a balance; (*c*) the various causes tending to give rise to a temperature coefficient; (*d*) the necessity for the "ageing" of a beam either naturally or artificially. In addition to the above, certain minute and temporary lateral displacements of the whole beam are investigated. A method for measuring these movements is given, and their origin disclosed.—Dr. Guy **Barlow**: The torque produced by a beam of light in oblique refraction through a glass plate. In accordance with the principle that light carries with it a stream of momentum, the passage of a beam of light through a refracting plate should give rise to a torque on the plate, it being supposed that the reaction is on the matter through which the beam is passing. In 1905 Prof. Poynting and the author made experiments which confirmed this result, but as disturbances, due to gas action, were not eliminated, more exact measurements appeared desirable. In the present experiment the original double-prism arrangement was abandoned in favour of a single cube. A glass cube, of 1 cm. edge, was suspended axially by a fine quartz fibre. A strong beam of light was sent obliquely through the cube, the angle of incidence having been so adjusted that the beam entered through one half of one face, and emerged through the half-face diagonally opposite. The torque was

determined from the observed angular deflection of the cube. Observations were made in hydrogen and air with pressures ranging from 0·1 to 76 cm. Hg. The disturbance due to radiometer action was found to be inversely proportional to the gas pressure, and could be eliminated. After allowing for the reflected beams, the observed torque (of the order 2×10^{-6} dyne cm.) was within 2 per cent. of that calculated from the energy of the beam.—Dr. T. C. **Porter**: Contributions to the study of flicker. Paper III. This paper is a continuation of two former papers: Proc. Roy. Soc., vol. lxiii., p. 347, and vol. lxx., p. 313. If n be the number of revolutions per second for a disc with white sector "w" and the rest black, just to appear flickerless under illumination "I," then

$$n = -27{\cdot}83 + (8{\cdot}57 + 2{\cdot}79 \log \mathrm{I}) \log w\,(360 - w);$$

this holds when I is greater than 3·98. If I be less than 3·98, then

$$n = -38{\cdot}6 + (12{\cdot}4 + 0{\cdot}77 \log \mathrm{I}) \log w\,(360 - w).$$

The existence of the remarkable break in the line connecting n and log I for $w = 180$ has been confirmed. The relation of n and I for perfectly symmetrical discs of four or more sectors is established, and application made to the measurement of high illuminations. Asymmetrical discs are considered, and it is proved that n is independent of the direction of their rotation. With the aid of a reasonable assumption there is deduced a curve expressing numerically the rise and fall of retinal excitation with time when the eye has presented to it suddenly a white surface, which is afterwards suddenly withdrawn. This curve is drawn to scale for a given illumination of the white surface.

Royal Microscopical Society, April 17.—Mr. H. G. Plimmer, F.R.S., president, in the chair.—J. D. **Siddall**: The life-history of some marine diatoms from Bournemouth. Living and mounted examples, drawings, photographs, and lantern slides were exhibited in illustration of the author's observations, the chief interest of which centred in a Coscinodiscus, about 1/400 in. in diameter, furnished with very numerous radiating pseudopodial filaments. The specimens shown demonstrated the certainty of this beyond any possibility of doubt, and thereby set at rest the old and much-debated controversy as to the possession and utilisation of pseudopodial appendages, at any rate in this particular diatom, which, for the sake of convenience, he proposed should receive the specific name *heliozoides*. The presence of pseudopodial appendages, much smaller, fewer, and still more difficult to discern, was also notified in Nelosira, Surirella, Biddulphia, and Triceratium. The cause of the peculiar movement of *Bacillaria paradoxa* was also briefly discussed in the paper, which concluded with the suggestion that further study of living diatoms with modern microscopical appliances would explain much of the meaning and purpose of the exquisite minutiæ of their siliceous skeletons.—E. B. **Stringer**: A modified form of the lever fine-adjustment, and a simple turn-out device for the substage condenser. The essential feature of the fine-adjustment was that the movement of the lever was carried to the top of the limb by means of a strong steel pin working through a guide, the opposing spring being at the bottom, and friction between the lever and the pin eliminated by means of a ball-bearing. Freedom from lateral movement and greater sensitiveness was thus secured. A simple two-speed movement was also provided. The turn-out device acted on the top lens of the condenser alone, thus affording illumination adapted to the power of the objective in use. A note was added on the value of the Bertrand lens in ordinary microscopical work.

Institution of Mining and Metallurgy, April 18.—Bedford McNeill, vice-president, in the chair.—E. **Hatschek** and A. L. **Simon**: Gels in relation to ore deposition. Actuated by the already known fact that dissolved substances will diffuse into and out of "gels," such as gelatine and silicic acid gels, the authors have made a series of experiments, from which it appears probable that many features of the occurrences of gold in quartz can be explained by the assumption that such occurrences originated in the reduction of gold salts in a medium of gelatinous silicic acid. In these experiments the agents employed for the reduction of gold chloride in the gels were various, and comprised two groups: in aqueous solution—oxalic acid, ferrous sulphate, formic acid with ammonia, and sodium sulphite; gaseous—sulphur dioxide, carbon monoxide, illuminating gas, and hydrogen. The reverse process of adding the reducing agent to the "gels," and afterwards pouring in the gold chloride solution, was also tried. The results of these experiments, as demonstrated in test-tubes, throw, in the authors' opinion, a new light on certain gold deposits, and afford a more satisfactory explanation of their genesis than has been hitherto suggested. This is a matter of some importance, as the finding of alluvial gold has frequently led to the expenditure of vast sums of money in the endeavour to locate the primary rock source, which is possibly non-existent if these experiments are interpreted aright. The authors are making further and more exhaustive investigations on the same lines which may lead to even more conclusive results.—J. I. **Hoffmann**: Recent practice in diamond drilling and borehole surveying. This paper may be regarded as supplementary to others on the same subject read previously before the institution, and described more recent practice, including a detailed account of the surveying instrument now exclusively employed on the Rand, the invention of Mr. Oehman, with improvements by Mr. A. Payne-Gallwey. In this instrument the survey is photographically recorded, two discs of sensitised paper being placed so that at a given moment they receive impressions from a small electric lamp, and the variation in the image transmitted to each enables a ready estimation to be made of both the dip and direction of the borehole at the point where the record is made. The paper contains folding plates giving diagrammatic views of two typical Rand boreholes surveyed by means of this instrument. A description of a deflecting wedge invented by Mr. Wm. Gallagher, used for the purpose of correcting the deviation of a borehole while in process of being drilled, or of making an offset from one already drilled, added interest to the paper and assisted in bringing it up to date.—Two other papers were on the agenda, but had to be taken as read; these were:—G. T. **Holloway**: Notes on the valuation of ores and minerals and on metallurgical calculations; and T. A. **Rickard**: The domes of Nova Scotia.

Linnean Society, April 18.—Dr. D. H. Scott, F.R.S., president, in the chair.—Dr. D. H. **Scott**: *Botrychioxylon paradoxum*, a Palæozoic fern with secondary wood. The plant is from the Lower Coal-measures, and is a member of the family Zygopterideæ, belonging to the Primofilices of Arber. The stele has a "mixed pith," consisting of internal tracheides and parenchyma; the surrounding zone of wood is entirely secondary, diminishing in thickness upwards. The branching of the stem, as in *Ankyropteris corrugata* and some other Zygopterideæ, is dichotomous. The leaf-trace, like the stele, shows a considerable development of secondary xylem, but in the peticle the tissues of the bundle are

entirely primary. The structure differs from that of Ankyropteris in the apparent absence of "peripheral loops." "Aphlebiæ," forming branched, spine-like organs, are borne both on stem and petiole.—Dr. E. A. Newell **Arber**: *Psygmophyllum majus*, sp. nova, from the Lower Carboniferous rocks of Newfoundland, together with a revision of the genus, and remarks on its affinities. This paper deals with a rare and little-known genus of Palæozoic plants. A new species of Psygmophyllum (*P. majus*, sp. nov.) from the Lower Carboniferous rocks of Newfoundland is first described, and a full account of *P. flabellatum*, Lindl. and Hutt., the British representative, is added. The genus is revised and the affinities of the genus discussed.

PARIS.

Academy of Sciences, April 22.—M. Lippmann in the chair.—J. Violle, M. Bassot, H. Deslandres, G. Bigourdan, B. Baillaud, MM. Fournier and Bourgeois, Joseph Eysséric, Louis Fabry, M. Stéphanik, Fr. Iñiguez, D. Eginitis, A. Lebeuf, E. Cosserat, Charles André, Alfred Angot, Henry Bourget, E. Carvallo, and Maurice Hamy contributed papers dealing with the eclipse of the sun of April 17 (see p. 221).—Paul **Appell**: Remarks on the possible use of the energy of acceleration in the equations of electrodynamics.—A. **Lacroix**: The radio-active uraniferous niobotantalotitanates of the Madagascar pegmatites and their frequent association with minerals containing bismuth. Analyses are given of four of these minerals. Details of the radio-active properties of these substances are reserved for a later communication.—A. **Chauveau**: The stereoscopic inversions caused by the association of two systems of retinal impressions in opposition and of unequal power. The influence of the preponderating impression. It is shown that in the stereoscope, in the case of two retinal impressions in the same visual field and of unequal strength, the feebler retinal impressions are subordinated to the stronger ones. The latter can cause the inversion of the retinal impressions produced by the former.—Pierre **Termier** and Robert **Douvillé**: The rocks and fossils of the region of the high plateaux between Bou-Denib and the Mlouya, on the southern Algero-Morocco border.—Arnaud **Denjoy**: Calculation of the primitive of the most general derived function.—Harald **Bohr**: The $\zeta(s)$ function in the half-plane $\sigma>1$.—Ch. **Fremont**: The distribution of the deformations in metals submitted to forces. Case of the folding of tubes.—G. **Kœnigs**: Joule's cycle. A comparison of the efficiency of an internal-combustion motor working on a Carnot cycle and a Joule cycle.—Samuel **Lifchitz**: The path of particles in Brownian motion. The formation of vortices.—E. E. **Blaise**: Syntheses by means of mixed organo-metallic derivatives of zinc. Formyl-lactyl chloride with the zinc compound R—Zn—I gives lactic acid and the aldehyde R—CHO. The method is general, and in some cases furnishes a serviceable process for the preparation of aldehydes.—Mme. **Ramart-Lucas**: The dehydration of pseudo-diphenyl-carbinol.—Maurice **Lanfry**: The action of hydrogen peroxide upon the bromothiophens. Monobromothiophen is partially converted into the dibromo-derivative; tribromo- and tetrabromo-thiophens are not attacked by the reagent.—Edouard **Bauer**: Reduction of the β-diketones. Acetylacetone can be reduced to the corresponding diglycol by reduction with sodium in boiling alcohol.—A. **Wahl**: Researches on coal. A study of the substance extracted by boiling pyridine from various classes of coal.—R. **de Litardière**: The phenomena of somatic kinesis in the radicular meristem of some Polypodiaceæ.—M. **Ravin**: The carbon nutrition of Phanerogams with the aid of some organic acids and their potassium salts.—G. **André**: The displacement of the food substances contained in seeds by water.—Em. **Bourquelot** and Mlle. A. **Fichtenholz**: The presence of arbutin in the leaves of *Grevillea robusta*.—Albert **Robin**: Delay in the consolidation of a broken limb in a tuberculous case. Treatment based on the disturbances in the exchanges caused by tuberculosis.—MM. **Desgrez** and **Dorléans**: The hypotensive action of guanine. Experiments with dogs and rabbits proved that guanine lowers the arterial pressure, and is opposed in this respect to the action of adrenaline.—Jean **Effront**: The action of light and hydrogen peroxide upon albumenoids and amido-acids.—A. **Zimmern** and P. **Cottenot**: The effects of irradiation of the suprarenal glands in physiology and therapeutics. A. **Trillat**: The favourable influence exercised on the development of certain cultures by association with *Proteus vulgaris*.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), parts i. and ii., for 1912, contain the following memoirs communicated to the society:—

March 7, 1908, and July 29, 1911.—The late K. **Zoeppritz**, L. **Geiger**, and B. **Gutenberg**: Seismic waves, part v.

December 10, 1910.—**Angenheister** and **Ansel**: The Iceland expedition of 1910, part i. (observations on terrestrial magnetism) and part ii. (observations on atmospheric electricity and meteorology from May 10 to June 2, with reference to the passage of Halley's comet).

BOOKS RECEIVED.

Text-book of Hygiene for Teachers. By Dr. R. A. Lyster. Pp. viii+496. (London: W. B. Clive.) 4*s*. 6*d*.

Grandeur et Figure de la Terre. By J. B. J. Delambre. Ouvrage augmenté de notes, &c., by G. Bigourdan. Pp. viii+402. (Paris: Gauthier-Villars.) 15 francs.

Volumetric Analysis for Students of Pharmaceutical and General Chemistry. By C. H. Hampshire. Pp. vii+104. (London: J. and A. Churchill.) 3*s*. 6*d*. net.

Scottish National Antarctic Expedition. Report on the Scientific Results of the Voyage of S.Y. *Scotia* during the Years 1902, 1903, and 1904 under the Leadership of Dr. W. S. Bruce. Vol. iii.—Botany. Parts i.–xi. Pp. ix+153+12 plates+chart. (Edinburgh: Scottish Oceanographical Laboratory; Edinburgh and London: Oliver and Boyd.) 23*s*. 6*d*.

The Life of the Plant. By Prof. C. A. Timiriazeff. Translated by Miss A. Chéréméteff. Pp. xvi+355. (London: Longmans and Co.) 7*s*. 6*d*. net.

A Geography of Europe. By T. Alford Smith. Pp. xi+272. (London: Macmillan and Co., Ltd.) 2*s*. 6*d*.

Wild Flowers as they Grow. Photographed in Colour Direct from Nature. By H. E. Corke. With descriptive text by G. C. Nuttall. Third series. Pp. viii+199. (London: Cassell and Co., Ltd.) 5*s*. net.

The Horse and its Relations. By R. Lydekker. Pp. xii+286. (London: G. Allen and Co., Ltd.) 10*s*. 6*d*. net.

Lectures on the Differential Geometry of Curves and Surfaces. By Dr. A. R. Forsyth. Pp. xxiii+525. (Cambridge: University Press.) 21*s*. net.

The Doctor and the People. By H. de C. Woodcock. Pp. xii+312. (London: Methuen and Co., Ltd.) 6*s*. net.

Handbuch der vergleichenden Physiologie. Edited by H. Winterstein. 21 Lief., Band iv. (Jena: G. Fischer.) 8 marks.

Die neuen Vererbungsgesetze. By Prof. C. Correns. Pp. viii+75. (Berlin: Gebrüder Borntraeger.) 2 marks.

Experimental Domestic Science. By R. H. Jones. Pp. ix+235. (London: W. Heinemann.) 2s. 6d.

Matter and Energy. By F. Soddy. Pp. 256. (London: Williams and Norgate.) 1s. net.

Ueber Vererbung und Rassenhygiene. By Prof. H. Bayer. Pp. iv+50+5 plates. (Jena: G. Fischer.) 2 marks.

Trattato di Chimica Organica Generale e Applicata all' Industria. By Prof. E. Molinari. Seconda Edizione. Pp. xxiv+1087. (Milano: U. Hoepli.) 18 lire.

Modern Science and the Illusions of Prof. Bergson. By the Hon. S. R. Elliot. Pp. xix+257. (London: Longmans and Co.) 5s. net.

Cocoa: its Cultivation and Preparation. By W. H. Johnson. Pp. ix+186. (London: J. Murray.) 5s. net.

The National Physical Laboratory. Collected Researches. Vol. viii., 1912. Pp. iv+251+plates. (Teddington: The National Physical Laboratory.)

The National Physical Laboratory. Report for the Year 1911. Pp. 103+plates. (Teddington: The National Physical Laboratory.)

For and Against Experiments on Animals. By S. Paget. (London: H. K. Lewis.) 3s. 6d. net.

Handbuch der Pharmakognosie. By A. Tschirch. Lief. 29 and 30. Pp. 641–775+xi. (Leipzig: C. H. Tauchnitz.) Each 2 marks.

DIARY OF SOCIETIES.

THURSDAY, MAY 2.

ROYAL SOCIETY, at 4.—Election of Fellows.—At 4.30.—Petrifications of the Earliest European Angiosperms: Dr. 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: Dr. 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.

GEOLOGISTS' ASSOCIATION, at 8.—The Geology of Sunderland and District with special reference to the Whitsuntide Excursion: Dr. D. Woolacott'.

MONDAY, MAY 6.

SOCIETY OF ENGINEERS, at 7.30.—The Effect of Intermittency in Limiting Electric Traction for City and Suburban Passenger Transport: W. Yorath Lewis.

ARISTOTELIAN SOCIETY, at 8.—Imagery and Memory: Beatrice Edgell.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—United Nigeria: C. L. Temple, C.M.G.

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

VICTORIA INSTITUTE, at 4.30.—International Arbitration in the Greek World: Marcus N. Tod.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—A New Apparatus for the Coking Tests of Coal: R. Lessing.—A New Method for the Determination of Ferrocyanides: H. E. Williams.—A Drying Oven: J. H. Coste.—India Rubber as a Protective Colloid: E. W. Lewis and H. Waumsley.

TUESDAY, MAY 7.

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

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Geographical Distribution of Certain Primitive Appliances: H. Balfour.

ZOOLOGICAL SOCIETY, at 8.30.—Lantern and Kinematograph Demonstrations of Photographs of Fishes and Aquatic Animals in Natural Illumination: Dr. Francis Ward.—On a Collection of Fishes made by Mr. A. Blayney Percival in British East Africa to the East of Lake Baringo: G. A. Boulenger, F.R.S.—Studies in the Fossorial Wasps of the Family Scoliidæ, Sub-families Elidinæ and Anthoboscinæ: Rowland E. Turner.—Notes on the Spanish Ibex: Abel Chapman.

RÖNTGEN SOCIETY, at 8.15.—The Education of the Brain, considered as an Electrical Machine: W. Deane Butcher.

ROYAL SOCIETY OF ARTS, at 4.30.—Colonial Vine Culture: Alan Burgoyne, M.P.

WEDNESDAY, MAY 8.

ROYAL SOCIETY OF ARTS, at 8.—British Rule in Nigeria: E. D. Morel.

THURSDAY, MAY 9.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On the Variation with Temperature of the Rate of a Chemical Change, with an Appendix by Prof. W. Esson, F.R.S.: Dr. A. Vernon Harcourt, F.R.S.—Some Phenomena of Sun-spots, and of Terrestrial Magnetism: Dr. C. Chree, F.R.S.—On the Ultimate Lines and the Quantities of the Elements producing the Lines in Spectra of the Oxyhydrogen Flame and Spark: Sir W. N. Hartley, F.R.S., and H. W. Moss.—The Transformations of the Active Deposit of Thorium: E. Marsden and C. G. Darwin.—On the β Particles Reflected by Sheets of Matter of Different Thicknesses: W. Wilson.

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

INSTITUTION OF ELECTRICAL ENGINEERS, at 7.30.—The Behaviour of D.C. Watt-hour Meters, more especially for Traction Loads: S. W. Melsom and H. Eastland.—Electric Meters on Variable Loads: Prof. D. Robertson.

FRIDAY, MAY 10.

ROYAL INSTITUTION, at 9.—The Gaumont Speaking Kinematograph Films: Prof. W. Stirling.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 8.—A Synopsis of the Recent and Tertiary Fresh-water Mollusca of the Californian Province: Harold Hannibal.—On *Dosinia lucinalis*, Lam., and its Synonyms: A. J. Jukes-Browne, F.R.S.—New Generic Names and New Species of Marine Mollusca: T. Iredale.

PHYSICAL SOCIETY, at 8.—A Method of Measuring Small Inductances: S. Butterworth.—The Conversion of Starch into Dextrin by X-Rays: H. A. Colwell and Dr. S. Russ.—Demonstration of Apparatus for showing the Generation of Electricity by Carbon at High Temperatures: Dr. J. A. Harker and Dr. G. W. C. Kaye.—Calibration of Wave-meters for Radiotelegraphy: Prof. G. W. O. Howe.

INSTITUTE OF METALS, at 8.30.—The Inner Structure of Simple Metals: Sir J. A. Ewing, K.C.B., F.R.S.

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SUPPLEMENT.