THURSDAY, MARCH 22, 1900.

## THE CAMBRIDGE CRYSTALLOGRAPHY.

*A Treatise on Crystallography.* By W. J. Lewis, M.A., Professor of Mineralogy in the University of Cambridge. Pp. xii + 612; 553 figures. (Cambridge: University Press, 1899.)

IT is now more than sixty years since Prof. Miller, of Cambridge, published his famous "Treatise on Crystallography." At that time crystallography was a new science, and studied by few. Since that date it has entered into the educational programme of most universities, and at Cambridge is now (combined with mineralogy) a recognised Tripos subject, pursued by a considerable number of students.

Miller's successor, under whose hands the Cambridge School has developed its present activity, now issues a volume the substantial dimensions and weighty contents of which are worthy of a university publication; this volume and Maskelyne's "Morphology of Crystals" provide English students with a pair of adequate text-books on the geometry of crystals.

Prof. Lewis preserves in his book all Miller's results and methods; his treatment of the subject, however, resembles that of Maskelyne and other recent authors, in attaching primary importance to the subject of symmetry; the general relations of crystal symmetry are, in fact, briefly stated in the third chapter; although the mathematical development of these principles is reserved for Chapter ix. Chapters iv. to viii., being devoted to the law of rational indices, the relation of zones, the methods of drawing and projecting crystals, and the anharmonic ratio of four planes, are almost necessarily an exposition of the work of Miller, Mohs and Naumann.

It is to Chapter ix. that the critical student will first turn for possible novelty of treatment; here he will find a series of thirteen propositions establishing the nature, order, number and disposition of axes and planes of symmetry; a footnote on p. 119 gives for the first time the interesting information that the trigonometrical proof now familiar to all students is due to Prof. Story-Maskelyne, and was given by him in lectures in 1869, two years before the *publication* of Gadolin's classical memoir, in which a similar proof was independently employed. The author calls the reader's attention to the assumption that an axis of symmetry is parallel to a possible edge and perpendicular to a possible face of the crystal, and points out that this cannot be proved for a three-fold axis. The fact is commonly ignored, but does not affect the main object of the argument, which is to show that four-fold and six-fold axes are the only axes of symmetry of degree higher than three which are possible. Euler's theorem is then employed to show how axes of symmetry may be combined, and how two or more such axes involve the presence of others; and the number possible in a crystal is deduced from the expression for the area of a regular closed polygon on a sphere. At this point complaint may fairly be made of a serious omission, for the whole course of the argument in Chapter ix. prepares the reader to expect that the thirty-two classes of crystals are about to be established, whereas the following chapters which contain the detailed description of the various classes are not preceded by any proof that they alone are possible. A link is wanting in the logical sequence, and since the principle of merohedrism is expressly rejected (see p. 259), there remains no principle of development or classification to correlate the thirty-two classes.

The author, in his preface, expresses the opinion that the accurate drawing of crystals develops the student's power of solving crystallographic problems, and his book differs from other text-books above all in the attention paid to the construction of diagrams, and in the number of examples by which this subject is illustrated. An early chapter describes the methods of crystal drawing, including orthographic and clinographic projections, and they are constantly illustrated in the subsequent chapters. The greater portion, the systematic section of the book, consists of a detailed discussion of the various classes; each of these is treated in a very complete manner; formulæ and methods of calculation are established; numerous propositions concerning the elements of symmetry and their mutual relations are proved, many of them new; crystals of many substances are figured and described, and (a special feature of the book) a number of fully worked examples are given as exercises in computation and drawing; this affords opportunity for the description of several specimens in the University collection. Excellent also in its wealth of detail is the long chapter on twin crystals, which follows the systematic section, and here again each substance described is treated as an exercise in crystallographic determination, calculation and drawing. To gain an idea of the unusually elaborate, as well as practical, manner in which these various problems are treated, let the reader refer, for example, to the geometrical propositions concerning rhombohedral crystals on pp. 365–403, to the four pages relating to Gypsum in Chapter xii., and to the nine pages devoted to the twinning of Cassiterite in Chapter xviii.

In the systematic treatment of the thirty-two classes, the less symmetrical systems are treated first, an arrangement introduced by Groth in a non-mathematical treatise, but one which introduces the most difficult calculations at the outset; unfortunately also, the somewhat arbitrary sequence adopted in the present book does not bring the most symmetrical (holohedral) class to the end, or even to the same place, in each system.

It is really difficult to make an elementary treatise on geometrical crystallography a readable book. The principles of symmetry must be established by the aid of the zone law, so that propositions on indices and anharmonic ratios must precede the description of the crystals and their symmetry, and yet these propositions are scarcely intelligible without some knowledge of the crystals. Prof. Lewis makes no attempt to surmount this difficulty—and, in fact, recommends his reader to travel backwards and forwards rather than to read consecutively; but he succeeds in his main object of presenting the essential features of the science to a student who is not required to possess more than elementary mathematical knowledge, and gives him a hand-

book full of information, and illustrated by examples excellently chosen and ably elaborated.

A little adverse criticism may be devoted to the following points:—Proof should surely be given of the important problem (5) on p. 82, for which the reader is referred to works on spherical trigonometry, where he may not find it, or to Reusch's treatise on stereographic projection, which is probably not accessible to him; tetrahedral is a misleading name for the class to which sodium chlorate belongs; $\tau$, being used to indicate tetartohedral classes (p. 149), should scarcely be applied to the trigonal bipyramidal class considered as belonging to the rhombohedral system; the nature of this class and of some others would be much simplified by the modern conception of the simultaneous action of an axis and plane known as "composite symmetry," as one of the general elements of crystal symmetry; this is only alluded to on p. 274, but its introduction as a mode of crystal symmetry would render possible a definition of the tetragonal system by means of its tetragonal axis instead of the somewhat awkward definition on p. 139. Similarly, the joint action of an axis and plane of *twinning* has to be taken into account to explain certain twins of sodium periodate mentioned on p. 359, and is overlooked in the discussion on p. 463. Most readers will find the argument on pp. 258–9 that the conception of merohedrism leads to inconsistencies far from convincing.

In describing the stereographic projection, it is really confusing to the student, and unnecessary, to speak of his eye as being situated on the surface of the sphere. Mention might have been made of the convenient device for crystal drawing described by Maskelyne, under the name crystallograph; and the method of finding the edge between two faces in a perspective drawing by reducing them to a common intercept on an axis, and finding their trace on the other two, might have been introduced into Chapter vi.

If the above be some defects of the book, many are the features in which it is superior to its predecessors.

Among new or specially instructive propositions may be noted the proof relating to tetrad axes on pp. 276–278, and the discussion of indices on pp. 288–295; the proof of the relation between a face and its inverse on p. 356; the propositions in the rhombohedral system relating to Millerian and Naumannian symbols, to indices referred to three and four axes, and to the drawing of the rhombohedron (p. 376). The useful proposition relating to a small circle (p. 83), and its application, are not generally found in text-books. Especially to be commended are the examples illustrative of the drawing of twin crystals. Among the new terms introduced, "stereogram" will doubtless be found serviceable. Finally, as evidence of the up-to-date character of the book, we may note the adoption of Cesaro's proof of the anharmonic ratio, the discussion of Wellsite, and the description of Mr. Smith's three-circle goniometer.

Owing to the author's desire to avoid analytical methods and spherical trigonometry, many of the proofs are somewhat tedious; but Chapter xix. contains analytical proofs and much suggestive material for the more mathematical reader, particularly some propositions relating to the rhombohedral system; *e.g.* the expression for the length of a trapezohedron edge (p. 578).

The book is an eloquent witness to the scientific method of the teaching which Prof. Lewis has carried on at Cambridge for nearly twenty years—teaching to which the present writer is glad to acknowledge his own indebtedness.

The author and the University Press may be congratulated on the completion of a treatise worthy of the subject and of the University. H. A. MIERS.

## *THE CORRESPONDENCE OF OLBERS AND GAUSS.*

*Wilhelm Olbers, sein Leben und seine Werke.* Im Auftrage der Nachkommen herausgegeben von Dr. C. Schilling. Zweiter Band. Briefwechsel zwischen Olbers und Gauss, Erste Abtheilung. Pp. viii + 767. 8vo. (Berlin: Springer, 1900.)

THE first volume of this work, published in 1894 (NATURE, li. p. 74), contained the collected scientific papers of Olbers; the present one gives the first half (1802–19) of his correspondence with Gauss. These old letters will nearly all be read with great attention by any one interested in the history of astronomy during the early part of this century, as the two correspondents were equally devoted to theoretical and practical astronomy, and discussed new publications and new discoveries in all their bearings. Many readers will perhaps think with the reviewer that here and there some parts of the letters might with advantage have been omitted, and that the editor when leaving out ephemerides of comets and minor planets might have gone further, and have omitted many results of observations, &c., which have been published elsewhere.

The correspondence began in January 1802, when Olbers had just succeeded in recovering the lost planet Ceres by means of the elliptic elements calculated by the young mathematician Gauss by a new method devised by himself. The great sensation which Piazzi's discovery had produced was kept up for some years by the discovery of Pallas, Juno and Vesta, the first and last of these minor planets being found by Olbers, and Juno by Harding, so that (as Gauss remarks) of five planets found in the years 1781 to 1807, the four were found by natives of Hanover. The great respect in which the wonderful success of the computations of Gauss with regard to Ceres were held by astronomers, naturally led to his being left to compute orbits and ephemerides of all the four minor planets, and they consequently occupy a very large part of the letters for the first seven or eight years, until Gauss gradually handed over this work to his pupils. Among many interesting matters connected with the minor planets, which are touched on in the letters, we may mention Olbers' well-known hypothesis as to the origin of these bodies, which directly led him to the discovery of Vesta, also the annoyance of Bode at the discovery of a second planet between Mars and Jupiter, whereby his ideas about the harmony in the solar system were upset. That these new bodies were not followed with the same attention outside Germany is evident from the fact that Vidal, of

Mirepoix, found a planet in December 1804 and observed it for three weeks, without its identity with Ceres being noticed either by him or by Lalande, who christened the new planet by the name of the discoverer, and sent the observations to Germany. Already, in 1802, Gauss sent Olbers a sketch of his new method of computing elliptic elements, and after being more than once urged to bring out a detailed account, he began to work at the "Theoria Motus Corporum Cœlestium" early in 1806, and had it nearly finished in March 1807, when the discovery of Vesta gave him a welcome opportunity to apply his method once more, and particularly to compute an orbit of small inclination from four observations.

As comets were the favourite celestial objects of Olbers, observations and computations on them were on every occasion exchanged by the two correspondents. In 1806 we find Gauss pointing out that Olbers' method of finding a parabolic orbit fails when the direction of the apparent motion of the comet nearly passes through the place of the sun, a fact which Olbers had, however, already noticed, having had his attention drawn to it by a remark of La Place, which had reached him through Burckhardt, and apparently in a mutilated form.

Unlike most great mathematicians, Gauss was exceedingly fond of observatory work, and before his appointment to the Göttingen professorship (in 1807) he repeatedly expressed the wish to become attached to some large observatory, and be relieved from teaching and lecturing, for which he felt no taste. Owing to the disturbed times, the building of the new observatory at Göttingen made very little progress for some years, and Gauss had only the old instruments of Tobias Mayer's Observatory at his disposal. He made diligent use of a small refractor furnished with an annular micrometer; and in January 1808, shortly before Bessel published his paper on this subject, Gauss communicated to Olbers very convenient formulæ for correcting observations with this micrometer for the effect of refraction, based on the idea that within the ring there is visible a part of the sky which may be considered as an ellipse with the major axis vertical. He never published anything on this subject; but in 1830 C. A. F. Peters gave formulæ based on the same idea, though this is not explicitly stated. Again, in 1874, Dr. C. Schrader, in an inaugural dissertation issued at Göttingen, developed similar formulæ without alluding to Gauss, whose ideas on this, as on other methods of reducing observations, have doubtless not been forgotten at the Göttingen Observatory. In a review of this paper (*Vierteljahrschrift*, x. p. 214), Prof. Schönfeld, however, called attention to Gauss' method, with which he had become acquainted through MS. notes of one of Gauss' lectures. The tardy publication of the method in the present volume is most welcome. We notice also some interesting remarks about a small heliometer by Fraunhofer and Reichenbach, received in 1814, and an instructive comparison between it and the old so-called object glass micrometers. This heliometer was in 1874 and 1882 still capable of doing good work in connection with the transits of Venus.

Towards the end of the volume we find Gauss very much occupied with the three new meridian instruments mounted in 1818 and 1819, of which the Repsold transit circle of seven feet focal length and four inches aperture, with a circle read by two microscopes, deserves special mention as the first modern instrument of its kind. It banished mural quadrants and mural circles from the Continent; but, unfortunately, English astronomers thought it necessary to wait a good many years yet before adopting the idea put forward by Römer towards the end of the seventeenth century. In 1817 Gauss expresses the hope that a circle of this kind may soon be established at the Cape, an idea warmly taken up by Olbers, and which bore fruit a few years later when the Royal Observatory at the Cape of Good Hope was established. The Göttingen instruments were almost immediately put to good use in the continuation of the Danish geodetic survey through Hanover, which occupied Gauss (perhaps far too much, as a smaller mind could have done most of the work equally well) for a number of years.

The political events of the time are not infrequently alluded to, though with a certain caution, as it was doubtless not safe to be too outspoken even in private letters. In 1807, we learn, the Leipzig Academy proposed to make a Napoleon constellation of the central part of Orion, and Gauss remarks that this chopping up of old star groups would fitly correspond to the state of things on the earth at that moment. Göttingen formed part of the ephemeral kingdom of Westphalia; while Bremen was, in December 1810, annexed to the French Empire, and formed part of the Département des Bouches du Weser, to the great grief of Olbers, who clung to the old institutions of the free town. He askes Gauss, in August 1811, to tell him as many astronomical news as possible, as scientific and medical journals (except French ones) are strictly forbidden in Bremen. As a member of the Legislative Corps, he had to pay two lengthy visits to Paris in 1812 and 1813, whence he wrote some interesting letters about the meetings of the Academy and the Bureau des Longitudes.

The editor has confined himself to seeing the letters through the press, and appears to have performed this task well; we have only noticed a curious error on p. 504, Bredebour for Lerebours. But he has not given any bibliographical or other references, for which the contents of the letters offer many opportunities, but has only in footnotes given some references to Gauss' collected works and the correspondence between Olbers and Bessel. In one of his few footnotes he makes a mistake, which looks strange in a German book (p. 522); it was in April 1813, during the war of liberation, that Schröter's Observatory was destroyed, and not in December 1812, when everything was quiet throughout Germany. As an example of a place where a footnote ought to have been inserted, we may mention p. 337. Gauss here states that a star occuring in the Histoire Céleste is missing, and suggests that it may have been Vesta. This star (LL46570) is not missing, its place is quite correct, and so far no variability seems to have been detected.

For nearly fifty years the correspondence between Olbers and Bessel has been an astronomical classic, supplemented in 1880 by the publication of that of Bessel and Gauss. The chain is now being completed by the correspondence between Olbers and Gauss, the promised second half of which will no doubt give much valuable information about Gauss' geodetic and magnetic work.

J. L. E. DREYER.

## MEXICAN FOLK-LORE.

*Catalogue of a Collection of Objects illustrating the Folk-lore of Mexico.* By Prof. Frederick Starr. With 32 Figures. Pp. xiii + 132. (London: Folk-lore Society D. Nutt, 1899.)

THE Museum of Archæology and Ethnology in Cambridge has recently been enriched by the permanent loan from the Folk-lore Society of a valuable collection illustrating the folk-lore of Mexico, which had been generously given to that society by Prof. Starr, the energetic and enthusiastic Professor of Anthropology in the University of Chicago.

Prof. Starr enhanced the value of the collection by writing a full and descriptive catalogue, which has just been issued by the Folk-lore Society as one of their publications. Owing to the labour Prof. Starr has expended upon it, this catalogue will prove of permanent value to students of folk-lore, although the author modestly disclaims it to be a treatise on Mexican folk-lore.

There are three main groups in the population of Mexico: the enlightened and progressive Mexicans, of whom Prof. Starr speaks in high terms, the Indians of the south, and the common Mestizos or mixed bloods of Northern and Central Mexico. The six hundred and more objects in the collection illustrate the customs and beliefs of this last group, whose daily life is a mixture of that of Spain in the fifteenth and of America at the end of the nineteenth centuries, and whose religion is a mixture of native paganism and imported Christianity, the latter being itself a complex of Old-World beliefs and practices. "Here," as Prof. Starr writes, "are proverbs, witty and wise; here are folk-songs, sweet and touching; here are folk-tales untouched by scepticism; here are charms and formulæ; here are witches and fairies in the full height of their power; here are popular street celebrations and dramas; here are a hundred Oberammergaus with passion-plays and miracle-plays unspoiled by the crowds of visitors; here are a thousand strange survivals of pagan barbarism in the midst of Christian civilisation."

One-third of the book is devoted to children's toys and games, illustrated by over a hundred specimens; but, in addition, there are descriptions of numerous outdoor and indoor children's games, which will be of great interest to those who pay attention to this not unimportant branch of ethnography. Many of the popular ceremonies are very quaint, especially those connected with Holy Week. From Thursday to Saturday the church bells cease ringing, as on the Friday "the spirits of the bells have gone to Rome." During this interval great rattles are sprung in the church towers, and innumerable small rattles are sold in the streets, and the noise they make must be dreadful. On the "Saturday of Glory" the gaiety reaches its culmination in the public destruction of Judas, the betrayer. Thousands of images of Judas are sold annually, of all sorts and grades, and from a few inches to ten feet or more in length. In some places a drama is played in the streets on St. James's Day, representing the victory of Christianity over paganism; the heathen wear hideous masks.

The Feast of the Dead is a famous festival, and the collection contains a large number of skulls, skeletons, funeral processions, and toys that delight the people on that occasion. Enough has now been said to indicate the great interest of this unique collection, more complete than any hitherto made in Mexico. The Cambridge Museum cannot now be safely neglected by students of comparative religion, as, in addition to other folk-lore collections, there are the collections presented by Mr. Skeat from the Malay Peninsula, and by Mr. C. Hose from Sarawak, as well as the specimens obtained by Dr. A. C. Haddon's expedition.

## ORGANIC EVOLUTION.

*A First Book in Organic Evolution.* By D. Kerfoot Shute, A.B., M.D. Pp. xvi + 285, 12 plates (10 coloured), and 27 figures. (London: Kegan Paul Trench, Trübner and Co., Ltd., 1899.)

THE aim of this little book is an interesting one—to supply a handy introduction to evolution-doctrine, which will be of use to over-burdened students of medicine and to others who may not have time to read the classic works. "The author makes no claim for originality, unless it be in the manner of presenting the subject. He has utilised the facts collated by other observers, and sometimes quoted the exact language and expressions of well-known writers on evolution, and has endeavoured to put them together in a way that may be helpful to those who are beginning the study of the evolution-theory." It seems to us that the author has attained no small success in his difficult task, for the book is clear and interesting; it is neither too simple nor too difficult; it is conspicuously free from crankiness and dogmatism; and it is evidently the work of one who has had experience in the task of teaching.

The plan of the book may be indicated by an enumeration of the sections:—Organic cells, heredity with variation, unstable environment, transmutations of living forms, natural selection, evolution of man, classification of animals and plants, works of reference, and glossary. There are ten coloured plates, which to some eyes will add attractiveness to the volume, though several of them show an unnatural and unpleasant predominance of red tint, *e.g.* in the pouter pigeon on the frontispiece, the birds of paradise, and the *Kallima* butterflies.

A thoroughly good introduction to the study of organic evolution might be written, even at the present youthful stage of ætiology, by an author of real genius, like Goethe, but the probability is that he would not write it; it might also be written by a genius according to Buffon's mistaken definition,—a man of persistent patience, but he would probably die niggling at his task; it might more feasibly be written as a co-operative work by six experts who were not very good friends. Then we should have a work that would endure. For what we have, however, let us be grateful; and Prof. Shute's book is a very useful introduction.

At the same time we must make two criticisms. (*a*) Is it wise in "a first book in organic evolution" to have any talk either about religion or the castration of habitual criminals? We admire the author's courage of conviction, but in regard to the subjects referred to we doubt the relevancy of the virtue here. And might not the dry classification chapter have been left out to

advantage, especially when it tells us that "sponges possess, essentially, a bilateral symmetry," and various other things which are not true? (*b*) In an elementary work of this sort it is of the utmost importance that there should be precision in the use of words, and though the author has been unusually careful we do not think that he has always succeeded. Thus, he speaks about "the forces of heredity"; he tells us that "Darwin convinced naturalists that the great underlying principle of the tree-like system of classification was heredity"; he calls the nucleus of the fertilised ovum "hermaphroditic," and so on. Is it wise at present to call the chromosomes "the hereditary threads"? is it fair to speak of "the gastrula phase in man's existence," and to refer to a figure of a typical gastrula, as if it were all plain sailing? is it warrantable to say "the evidence seems to favour the view that acquired characters can be transmitted"? is anything gained by making a special category of "insect-selection"? Without criticising the exposition of the Pangenesis hypothesis, we should also like to ask if it is not the case that Darwin expressly said that he thought of the gemmules not as circulating in the blood, but as diffusing from cell to cell? But a book should be judged relatively to its aim, and Prof. Shute is to be congratulated on the success with which he has accomplished a difficult and serviceable piece of work.

J. A. T.

## *OUR BOOK SHELF.*

*Mining Engineers' Report Book and Directors' and Shareholders' Guide to Mining Reports.* By Edwin R. Field. Pp. 39. (London: Charles Griffin and Co., Ltd., 1900.)

EVER since the search for the gold mines of El Dorado in 1595 was described by Sir Walter Raleigh in his work on the discovery of Guiana, the prototype of modern mining reports, experts have constantly been engaged in reporting on mineral deposits with a view to induce capitalists to invest money. A report on a mining property should set forth clearly details of the position, means of access, fuel, water and timber supply, amount of development, and the character, value and form of the deposit. It should, moreover, be written in so lucid a manner as to be intelligible to the educated investor. Unfortunately, this is not always done. Many so-called experts of eminence have been known to fill up their reports with a bewildering mass of abstruse technicalities and theories, and to omit many essential details requisite for arriving at the value of the mine. While it is obvious that a thorough examination of a mine cannot be covered by a set of rules, it is highly desirable that the work should be carried out in a systematic manner, and errors of omission avoided. With this object in view, Mr. Field has drawn up a series of suggestions in a convenient form. He enumerates 126 queries that should be answered as far as possible in the report on any mine. Blank pages are appended; and it is recommended that the various heads should simply be indicated by numbers during the inspection of the property, and subsequently incorporated in the observations recorded in the report. The volume is issued in pocket-book form so arranged that the blank pages, which can be replaced by others, shall be facing the page of questions. The right hand pages, which would be covered when the book is in use, are devoted to selected tables and memoranda. The volume is of handy size—it measures 5 by 3½ inches—and will undoubtedly prove useful to experienced mining engineers. Whether it will also be of assistance to directors and shareholders, as the title-page suggests, may be questioned.

B. H. B.

*Flora of Kent.* By F. J. Hanbury, F.L.S., and E. S. Marshall, M.A., F.L.S. Pp. 444; with two maps. (London: F. J. Hanbury, 1899.)

MANY years ago "The Flora of Middlesex," by Trimen and Dyer, showed the way for a scientific construction of a local flora, and it has served as a model for all the best works of this kind which have appeared since its publication. To say then that the present volume strongly recalls the best features in the Middlesex Flora is to pay it a well-earned compliment, and, indeed, from cover to cover Messrs. Hanbury and Marshall's book exhibits abundant evidence of a careful, sound and successfully accomplished sifting of an immense body of facts, with the result that the reader is furnished with an exceedingly able and interesting account of the flora of the south-eastern county of England. The introduction includes a sketch of the physiography and geology of the county, and then follows the customary delimitation of the botanical districts into which the whole area is divided. These divisions are, as the authors admit, not entirely based on scientific considerations, but are partly determined by convenience, and some of them are consequently somewhat artificial in character. It would, perhaps, have been advantageous to have added another chapter on the more purely natural geographical distribution of the plants.

The body of the flora is devoted to an account of the plants found growing in the county, together with brief topographical and historical notes.

The work is excellently printed, and will be found of great service to those who care to know about the flora of one of the most interesting counties in England.

*Leitfaden für den Unterricht in der Anorganischen Chemie.* Didaktisch bearbeitet von Dr. Joachim Sperber. Erster Teil. Pp. 120. (Zurich: E. Speidel, 1899.)

A BOOK expressly "didaktisch bearbeitet," and bearing a motto *Repetitio est mater doctrinarum*, would be expected to disclose some novelty of treatment for good or ill. This expectation is, however, not realised in Dr. Sperber's book. It may be described as an aggregation of condensed chemical information, from which it is impossible to augur any good educational result. We have already had a surfeit of this kind of book in England, and can only regret that the improvements now so evident here do not seem to have spread to Switzerland. The illustrations in the book are unnecessarily elaborate, and in some cases altogether superfluous. There are, for example, two striking full-page illustrations—one to show the holding of a platinum spiral in a bunsen flame, the other to show a burning magnesium ribbon. It is really difficult to understand the attitude of mind of a teacher who considers that any intellectual or practical value can lie in pictures of this kind.

A. S.

*Aufgaben aus der Chemie und der physikalischen Chemie.* Von Dr. P. Bräuer. Pp. 70. (Leipzig: B. G. Teubner, 1900.)

THE author has collected a number of exercises dealing with some of the most important provinces of general chemistry. The book differs from previous attempts in this direction, inasmuch as attention is paid not only to purely chemical problems, but also, and more especially, to such points as the Laws of Avogadro, Faraday, Joule, &c., together with the elements of thermal chemistry. The explanatory notes at the head of the various sections will be found of great assistance to students working without the aid of a teacher.

N.

## LETTERS TO THE EDITOR.

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

### The Rostrum of "Mesoplodon."

IN Mr. Beddard's recent and very interesting "Book of Whales," I observe that on p. 214 he gives as a character of *Mesoplodon* (one of the Ziphioid genera) "the thorough ossification of the mesethmoid," and in describing *Berardius* he states that "the mesethmoid plate is short, comparatively speaking; that is to say, compared with what we find in *Mesoplodon*." Here Mr. Beddard undoubtedly compares two structures which are entirely different. As I have shown and figured in the *P.Z.S.*, February 1893, the "mesorostral bone" is not the result of the ossification of the cartilaginous bar occupying in early life the spout of the animal's vomer. I have examined a number of these Cetaceans in the flesh, and have made sections of the dried beaks (a series of which I deposited in the British Museum) of individuals of ages from the quite young calf's to that of the very adult male, and I have shown in the paper referred to that the first appearance of the mesorostral bone is due to an increase in the walls of the premaxillaries by which the sides of the vomerine-spout are pressed towards each other, and, proliferation being apparently induced, both the vomer and the premaxillaries increase in size, and very variously in form, according to pressure unequally acting on them, till the cartilaginous bar is entirely absorbed or, at all events, disappears. The increase—from some pathological cause, probably—in the premaxillaries is apparently the main cause of the solidification of the beak.

Now what happens in *Berardius* is of an entirely different character. In *B. arnuxii* an ossified bar lies, often to a length of twelve inches, in the vomerine trough; but this is unmistakably an ossification of the anterior part of the mesethmoid cartilage. It takes place in a very different way, also, from the ossification in *Mesoplodon*. It is an ossification of the upper and outer layers of the mesethmoid cartilage; it is of an open and spongy texture; it never becomes ivory-fied, so that in the dried skull it is a mere prolongation of the mesethmoid—hardly seen in *Mesoplodon*—and merely covers in to some extent the gape of the vomerine trough, which underneath is quite empty, with its sides and bottom entirely unaffected. Indeed, the mesethmoid plate, with its extension, is in *Berardius* much longer than in *Mesoplodon*. What takes place in the former genus is precisely what occurs so frequently in *Clymenia*.

In a note on page 280, Mr. Beddard writes, "the Scottish vernacular for this creature [Globiocephalus] 'Ca'aing Whale' means Driving Whale." The proper orthography of "ca'aing" should be "ca' in" (two words), which being interpreted out of, to the Southerner, its foreign tongue, means "the drive in- or driven in-whale." Ca'a is entirely erroneous. Ca' (in Orkney, Kaa), as it should be printed, stands for "call." In the common order to the herd on a Scottish farm of "Ca' in the Kye" (meaning "Drive in the Cows") the expression arises, doubtless, from the custom of the past—which is the custom to-day, as I have seen in New Guinea in regard to their pigs, and in Sokotra last year in regard to the flocks and herds—of actually by voice "calling in" the cattle. The phrase has now become the common one to "drive in," by some one going for them. The method of capturing the *Globiocephalus* in the north of Scotland is for the fishers, when they see a school, to hurry out in their boats, surround and drive on to the beach the Blackfish, which is, therefore, always spoken of there as the "Ca' in Whale," *i.e.* the whale they can *drive in*, in contradistinction to a species which they have to harpoon or chase in the open.

HENRY O. FORBES.

The Museums, Liverpool, March 2.

### Vector Diagrams.

IN a paragraph on the last number of *Terrestrial Magnetism*, in NATURE of March 1, p. 421, I notice the following sentence: "Dr. Lüdeling investigates graphically the phenomenon of the diurnal variation of the earth's magnetism for eleven stations with the aid of von Bezold's vector diagrams." These diagrams are curves in which the radius vector represents in magnitude and direction the resultant of the disturbing forces to which we may attribute the diurnal variation of the horizontal component of the earth's magnetic force at any particular station.

So far as I know, the earliest use of these curves by von Bezold was in a paper in the *Berlin Sitzungsberichte* of 1897. This may have been their first appearance in Germany, and if so, their association with the well-known name of von Bezold in that country need hardly occasion surprise. In England, however, their use dates from at least 1863, when Airy employed them in discussing the diurnal variation at Greenwich in different years and at different seasons of the year (see *Phil. Trans.* for 1863). Airy used them again in the *Phil. Trans.* for 1885, and they also appear on p. 186 and on Plate iii. of Lloyd's "Treatise on Magnetism, General and Terrestrial." More recently I employed them myself in discussing the diurnal variation of the magnetic elements at Kew Observatory (*B. A. Report* for 1895, pp. 209–227)

The only apparent difference between Airy and von Bezold is, that the former made use of the recorded variations of horizontal force and declination, drawing his magnetic meridian towards the top of the page, whereas the latter made use of the northerly and easterly (or westerly) components of the force, and drew his astronomical meridian towards the top of the page. The curves given by Airy and by myself show the positions of both the magnetic and astronomical meridians, and if it is preferred that the astronomical meridian should point to the top of the page, all that is necessary is a bodily rotation of the curves through an angle equal to the declination.

When comparing results at different stations, or at the same station at different epochs, there *may* be an advantage—as, in fact, I pointed out myself (*B. A. Report*, *loc. cit.* pp. 218, 219)—in taking the astronomical meridian as the line of departure; but as yet this is largely problematical. The interesting tables and diagrams for polar stations given by Lüdeling—as Lüdeling, I think, has himself noticed—seem to indicate, on the whole, less symmetry about the astronomical than about the magnetic meridian. If so, it is open to doubt whether Airy's original practice might not, after all, have been the better fitted to bring out points of resemblance.

C. CHREE.

Richmond, March 8.

### Similar Geological Structures in South Tyrol and the Isle of Man.

IT may be of interest to Alpine geologists to note that the general results now obtained by Mr. Lamplugh in the Isle of Man are, in respect of the origin of the "Crush-Conglomerates" and the causes and effects of differential movements between subjacent series of rock, practically the same as the results previously obtained and described by me in maps and sections of the Enneberg area in South Tyrol (*Quart. Journ. Geol. Soc.*, *cf.* M. M. Ogilvie Gordon, 1899, and G. W. Lamplugh, 1900). In both cases the geologist deals with *resultant* local effects combining the pressure-components of at least two epochs of disturbance. In both cases the geologist is presented with strongly-marked lithological contrasts in the original succession, and, as a consequence, with highly complex superinduced structures due to differential movements between subjacent beds. This remarkable parallelism between the essential geological structures in two neighbourhoods so remote from one another, and in belts of strata belonging to utterly distinct geological epochs, is well worthy of comment and consideration by our present school of geologists.

Aberdeen, March 16. MARIA M. GORDON.

### Tides along the Antarctic Continent.

IN Prof. Drygalski's statements (NATURE, February 1) of the work mapped out for the proposed German Antarctic Expedition, no mention is made of obtaining tidal observations along the Antarctic Continent. In ascertaining the *verae causae* of tides which occur along many shores, even along the eastern coast of the United States, I believe this region to be of great importance.

Hourly readings of the height of the surface of the sea above an arbitrary datum for even so short a period as twenty-four hours at each station occupied for the purpose, would be of value.

It seems to me especially desirable to have the following questions answered:—

(1) Along the Antarctic lands from long. 20° W. to about 40° E., is the (Greenwich) co tidal hour vi ?

(2) Near long. 80° E., is the co-tidal hour ix. ?

(3) Near long. 135° E., is the tide chiefly solar? If so, is the co-tidal (solar) hour xii. ?

(4) On the western coast of Graham Land, is the co-tidal hour vi. ?

Although it seems that no observations have been made farther south than Kerguelen, South Georgia, and Cape Horn, there are reasons for believing that the above questions can be answered in the affirmative. If so, then certain logical connections between the tides in this region and elsewhere would be fairly well established. At any rate, such observations would be valuable; and it is believed that the results would compare favourably in importance with those obtained in almost any one of the lines of inquiry alluded to by the leader of the expedition. R. A. HARRIS.

Washington, D.C., February 28.

## Crab Ravages in China.

IN the "Kwoh-Wu," or "Good Words from the States," attributed to Tso Kiu-Ming (6th century B.C.), a king of Yueh (now the province of Cheh-Kiang) is said to have been advised by his counsellor to postpone his warlike preparation with "good words," in which the officer adverts to the "Rice-Crab (*Tau-Hiai*) that spared for man not a seed [of rice] in late years." A Japanese naturalist, Aoki Kon-yō, quoting a Chinese work, "Ping-Kiang Ki-Sze," speaks of a crab-devastation which took place in the Wu District (now Kiang-Su) in 1297 A.D., "when all plains were full of crabs, wasting all crops of rice." ("Kon-yō Manro Ku," written 1763, ed. 1891, p. 164.)

Twan Ching-Shih (died 863 A.D.) briefly speaks of this crab, thus: "In the eighth moon of the year, the crab has in its belly an ear, really that of rice, about an inch long, which it carries eastwards as a present to the 'God of the Sea'[1]; before the carriage is accomplished, the crab is not edible" ("Yu-Yang Tsah-tsu," Jap. reprint, 1697, bk. xvii. fol. 4, *a*). Contemporaneously, Luh Kwei-Mung (died *c.* 881 A.D.), in his "Notes on the Crabs" (*ap.* "Yuen-Kien-lui-han," 1701, bk. 444, fol. 18) narrates:—"These crabs live in holes, which they dig in bogs, until the season that intervenes the autumn and winter, when they emanate from their homes. The people of Kiang-Tung say, when rice is ripening, the crabs take each one ear in order to pay court to their chief. Every morning and every evening they all run towards the river, when men fish them by setting weirs across the affluents. Yet six or seven out of ten crabs would pass over the dams, and in the river they grow larger; whence they proceed to the sea in the same manner as their previous march, also being persecuted as before, which, however, they escape with more skill than in former occasions." Later, in the dynasty of Sung (961—1279 A.D.), appeared a "Monograph of Crabs," by a certain Fu Kwang, who relates in it:—"In the crevices on rocks along mountain streams occurs a small crab, red and hard, and so named *Shih-hiai* (Stone Crab). When still young, in mid-summer, owing to absence of any edible cereals, it feeds on the root of reed, whence its name *Lu-kan-hiai* (Reed-root Crab), and is meagre in size and taste. About the eighth month it grows larger after moulting, and, when rice or millet is mature, every one crab bellied with one spike of the cereal runs to the river, when it is termed *Loh-Hiai* (Merry Crab), and is very fat and best to eat. Thus it goes to the sea where it presents the spike to its chief" (*ibid.* fol. 19, *a*). These are very good samples of the celebrated celestial whims, which once expressed, no literatus doubts; for, to me, it is too clear that the tribute which these so-called "grain crabs" are said to pay to their king is nothing but their spawn, which they carry under the abdomen to lay down in the sea.

I do not know whether the rice-carrying crab is the same with what devastates the plantations, as is supposed by Aoki (*l.c.*), although very probably so. And I shall be very much obliged if, through your medium, some one will answer my questions: (1) What species of crabs is the cause of such stories? and (2) Is such a crab-ravage reported in modern times from China? From De Rochefort's "Historie . . . des Iles Antilles," Rotterdam, 1665, p. 255, I gather the renowned Violet Land-Crabs of the West Indies to make some damage to tobacco farms, but not to grain as is so vastly attributed to the Chinese crabs; while F. Legnat, about the end of the 17th century, described a land-crab of Rodriquez, whose destructive power during its emigrating period appears to equal that of its Chinese kin (see his "Voyages," ed. 1891, p. 92).

Yu Pau (4th century A.D.) writes in his "Sau-shin-ki":—"In the year 283 A.D. all crabs in the District of Hwui-Ki were turned into rats, whose group covered the rice-farms and made an extensive devastation. When yet immature, these rats had hair and flesh but no bones, and unable to pass over the ridges in the farms, but became vigorous after a few days." This erroneous exposition, to account for the origin of rats or field-mice, would seem partly to originate in some similarity of the fur of rats with that of the so-called Hair-Crab (see Stebbing, "Crustacea," Pl. III.), but more in the people's familiarity with the land-ravaging crabs[2] in ancient times.

KUMAGUSU MINAKATA.

1 Crescent Place, South Kensington, S.W.

[1] The Japanese who worship the deity of Kotohira (the patron-god of mariners) taboo the eating of crabs.

## Leonid Meteor Showers.

I HAVE nowhere seen an account of a very remarkable display of these meteors visible here (in Shanghai) on the morning of November 15, 1886. Though the date is distant, it may be of use to record it, as it may throw light on the conditions of the orbit.

I was sleeping in a room with an almost due north exposure looking into an open compound, and chanced to wake up about three in the morning, when I saw a number of meteors flashing across the window. I got up on recollecting the date, and for about an hour witnessed the most brilliant pyrotechnic display I have ever seen.

The meteors were flying in every direction from the radiant point in numbers past all calculation, and the intensity of the shower was keep up without intermission the whole of the time I was gazing.

I expected to hear from other quarters an account of the phenomenon, and was much surprised to find it had apparently not been noticed elsewhere. I had to leave shortly after for the interior, where I was practically cut off from communication with the outer world for some months, and hence did not at the time report the fact.

As much stress is laid on the appearance of the meteors in Europe in 1833 and 1866, the shower may be some of interest.

Shanghai, February 12. THOS. W. KINGSMILL.

## The Capture of Butterflies by Birds.

CONCERNING the capture of butterflies by birds, permit me to relate an incident which I witnessed in the summer of 1899 at the Deserted Village, near Scotch Plains, N.J.

My attention was attracted to a maple tree on a lawn by a violent fluttering of the wings of a robin among the leaves. Presently a large brown butterfly, evidently wounded, but still attempting to fly, fell from the branches. The robin pursued the butterfly eagerly, and attacked it upon the ground, alternately striking with its beak, with lowered wings, and running off a short distance to observe developments. Finally, the butterfly ceased to move. The robin thereupon tore the body from the wings and devoured it. I picked up the mutilated wings and showed them later when narrating the incident.

29 Broadway, New York. GEORGE A. SOPER.

## The Smell emitted by Quartz when Rubbed.

WHEN two quartz pebbles are rubbed hardly, or ground together, so as to give an electric spark, that seems under their surface, and then smelt, they emit a very peculiar smell, which some people call a sulphurous smell, but I cannot trace any resemblance to sulphur, or ozone, or phosphorus. What is it supposed to be? E. L. GARBETT.

25 Claremont Square, N., March 7.

[2] The "Hair-Crab" of Japan is caught in the same way as the Chinese mode of fishing the rice-carrying crab. The Japanese well know its descent down the river in autumn, and have well noticed it never to reascend it afterwards as some fish do (Kaibara, "Yamato Honzô," 1708, bk. xiv. fol. 48), but never possessed a belief in a crab carrying grain to the sea. Only one case that slightly approaches that of the latter, I find in "Hokusô Sadan," where it is narrated that near the end of the last century the river Yodo, near Kyōto, was one day so swarmed with small crabs that every handful of water was full of these creatures.

## THE UNIVERSITY OF LONDON.

AT last, after six-and-thirty years of discussion, after the formulation of some twenty different schemes of reform and the report of two previous Royal Commissions, the Statutes and Regulations of the reconstituted University of London have been framed by the Commissioners appointed under the Act of 1898, and the new University is created. The institution thus established is in its way unique; there is nothing else exactly like it in the world, and it is therefore impossible to predict with any confidence what will be the extent or the nature of the influence it will exert on the progress of education either in the United Kingdom or in the restricted area over which its newly-created functions will be specially exercised. The old Examining Board will continue to exist almost as heretofore, and the famous system of examinations, which has undoubtedly been in its day potent for good, will be continued under safeguards and conditions but slightly altered. But in addition there is to be a new and distinct system administered by the same supreme authority, the Senate, which has hitherto directed the examinational machine.

Under this system students who pursue certain definite courses of instruction in recognised institutions or under recognised teachers will be admitted to degrees after passing certain examinations in which their own teachers will directly or indirectly take part. The institutions and teachers so recognised are situated within a radius of thirty miles from the central office of the University.

The purposes of the new University of London are declared by the Commissioners to be threefold: (1) "to hold forth to all classes and denominations, both in the United Kingdom and elsewhere, without any distinction whatsoever, an encouragement for pursuing a regular and liberal course of education"; (2) "to promote research and the advancement of science and learning," and (3) "to organise, improve and extend higher education within the appointed radius." Broadly, it may be said that of these three purposes the first has been more or less completely fulfilled by the previously existent system of examining all comers in subjects selected according to a definite scheme in orderly succession, from matriculation to the final examination for a degree. Without doubt the existence of this scheme, whatever drawbacks there may be to a pure system of examination which does not stop to enquire how the knowledge of the candidate has been gained, nor to ask too curiously as to its reality, has done great service to large numbers of industrious, intelligent and deserving students. Times, however, during the last quarter of a century, have changed considerably in respect to the opportunities of higher instruction, and while the greater part of the United Kingdom has been divided into academic provinces, each with its own university and their affiliated colleges, London and the South have remained without many of the advantages which such institutions provide. London, however, possesses all the materials which are required for the equipment of a great university. The metropolis is the home of the great learned societies; it is also the central depository of the chief treasures of science, art, antiquities and industry in the national museums, and without disrespect to the many distinguished men connected with other parts of the kingdom, it is inevitable that a certain concentration of intellectual eminence should result from the attractions offered by the greatest city of the world. The third purpose of the new university will therefore surely be inseparably connected with (2) "the advancement of science and learning."

Under the new Statutes the University will consist of the Chancellor, the existing Fellows, for their respective lives, the Senate, the Graduates and the Students. It is enacted that the Chancellor of the old University shall continue to be Chancellor. The University will thus retain the advantage of Lord Kimberley's long experience as a member of the Senate. All else, however, will be changed. The existing Fellows are to retain their fellowships for life, but will cease as such to be members of the Senate, and probably many of them will drop out. The new Senate will be composed of the Chancellor, the Chairman of Convocation, and fifty-four persons who may or may not be graduates of the University. Of the fifty-four senators, sixteen will be elected by Convocation (chiefly graduates of the University), and sixteen by the Faculties (composed of teachers of the University). Of the remaining twenty-two, four are to be appointed by the Crown, and eighteen by various institutions, including six by the Inns of Court and the Incorporated Law Society. After the first two years the term of office of each senator will be four years. The Vice-Chancellor will be elected annually by the Senate from among its own members.

The work of administration will be accomplished chiefly through the medium of three standing committees of the Senate—namely, the Academic Council, the Council for External Students, and the Board to Promote the Extension of University Teaching. Concerning the last, it may be said, with considerable confidence, though not, of course, without fear of contradiction, that, however good its intentions, it cannot afford much assistance in the development of serious university work. The chief business of the University will be done by the two councils.

The Academic Council will consist of the Chancellor, the Vice-Chancellor, the Chairman of Convocation, the sixteen members of the Senate appointed by the Faculties, and an additional member or members to make up the number to twenty. Four-fifths of this council, therefore, consist of teachers. Their duties are advisory, and will relate to all that appertains to the Schools of the University, the appointment of Teachers, the organisation and regulation of the teaching, and generally to all matters which relate to the Internal Students—that is, to those students who have matriculated and are pursuing a course of study in a School or under Teachers of the University. The functions of the Academic Council are, therefore, the most important exercised on the part of the new University, and upon the care and judgment with which they are discharged will hang all the future development and usefulness of the University.

The Council for External Students is to consist of twenty-eight members of the Senate, whereof sixteen are the nominees of Convocation. The duty of this body is to watch over the interests of the External Students, who are defined as all matriculated students who are not Internal Students. Among the duties assigned to both these councils the difficult task is appointed of equalising, as far as possible, the standards of knowledge and attainments prescribed for the degrees conferred upon Internal and External Students respectively. But the Academic Council has nothing to do with External Students, and the other council has nothing to do with Internal Students; and unless provision is made by the new Senate for frequent conferences between the two councils, it is difficult to see how this equalisation is to be effected, for a mere inspection of syllabuses or of the questions set in examination papers would be, as every teacher or examiner could point out, a most delusive and inadequate test of equality. It is to be hoped that the Senate will bear in mind the importance of bringing these two councils into frequent contact, and that they will not be unduly influenced by fanatical adherents, if there be any, of the pure system of examination with its detailed limited syllabus, and its superstitious reverence for marks. Every encourage-

ment should be given to External Students to become Internal, and if in time the University acquires the means and the power to administer its own funds, the External Student may become an extinct species, so far as the science faculties are concerned. Then shall chemical analysis no longer be taught by post, and "correspondence" colleges fatten only on the ingenuous arts.

One or two points deserve to be noticed in connection with the examinations or qualifications for degrees. One novelty is the proposal to hold "separate matriculation examinations for different classes of students, having regard to the courses of study which the students propose to follow." This power will doubtless be exercised by the Senate with great deliberation. A loose interpretation of this provision might lead to consequences which would be disastrous for the future dignity and reputation of the University. It is easy to recognise here the influence of the "practical" man who is anxious to get rid of the incubus of the classical languages.

This is not the place to enter upon the discussion of that question, but coupling this suggestion of relaxation with the provision relating to the Bachelor of Science degree, it is easy enough to smell danger. For the degree of B.Sc., the Senate may accept in place of the whole or part of the final examination, the results of the study or research of any candidate who, in the opinion of the Senate, has thereby made a distinct contribution to the advancement of learning or science in any of the subjects in which that degree is conferred. Whatever may be the fate of Latin under the new arrangements, it is to be hoped that more care than ever will be taken to insist upon a real and practical command by all candidates at matriculation of the orthography and syntax, if not the etymology, of their own language.

Another important statute gives power to the Senate to make arrangements to hold any intermediate examination or part thereof for the students of any School of the University jointly with the governing body of such School. In all such cases the examination would be conducted by the professor of the subject jointly with an external examiner appointed or recognised by the University. This recognition of college examinations was recommended by both the previous Royal Commissions.

The "Regulations" made by the Commissioners form a separate issue. They contain schedules of the Boards of Studies, of the recognised Teachers, of the provisionally recognised Teachers, and of the members of the Faculties, also details relating to the B.Sc. degree by research. It remains to be seen what will be the effect of requiring a student to submit to the Senate, before he begins his work, a statement of the nature of the research upon which he proposes to enter, and having started the research to carry it on for a period of not less than two years. Those who have a practical acquaintance with the prosecution of research, and the unexpected turns which inquiry often takes, will see some difficulties in these requirements; but it is, perhaps, worth while to make the attempt to develop a scheme by which successful work of this kind may receive academic distinction.

The business of the new University, like that of the old which it supersedes, still relates wholly to curricula, to studies, to examinations and degrees. The real value of a university in helping to form character and building up the intellectual and moral constitution of the man has no place, and could have no place, in the work of a Royal Commission. Nevertheless, the association of a number of institutions, individual and separate, though geographically near together, in a common interest and united effort cannot but have an effect in quickening the collegiate life of each, in promoting the mutual interest of teacher and student, in stimulating research, and in fostering schools of thought. Such ends the new University must keep clearly in view. The Senate must see to it that amid the clamour of contending interests, which for a few years can hardly be expected to be satisfied and silenced, the claims of true education shall not be forgotten. W. A. T.

## *DIFFICULTIES OF THE CALENDAR.*

### THE DATE OF EASTER.

SOME interest has been excited by the fact that Easter appears to fall this year on a date not in accordance with the rule in the Prayer-Book; and a question was even asked about it in the House of Commons on Thursday last. The Attorney-General, of course, explained that the full moon of the Prayer-Book is not the real full moon, but the fourteenth day of the moon according to certain rules, confessedly not very simple or generally "understanded of the people." The same difficulty was stated on the last occasion (in 1846) when this calendar or ecclesiastical full moon fell on a different day at Greenwich from that of the real full moon. But it may serve as an object-lesson on the futility of attempting to regulate Easter by the real moon, which would often produce the consequence of making it fall on a different day (that is, as it must be on a Sunday, a different week) at places some of which would be not far apart.

On the present occasion the absolute time of the full moon, which follows the vernal equinox, corresponds by Greenwich time to 2 minutes past 1 o'clock on the morning of April 15. All over Europe its time will be on the morning of that day: at Paris, at 1h. 11m.; at Berlin, at 1h. 56m.; at Rome, at 1h. 52m.; even so far west as Lisbon, at 0h. 25m. (25 minutes past midnight on April 14), and therefore by civil time reckoning as April 15. But on the west coast of Africa the local time of full moon will be before midnight on April 14; and in America, of course, still more so, its time at New York being 6 minutes before 8 o'clock on the evening of that day. The ecclesiastical full moon (artificially formed and tabulated) will be April 14, so that the Sunday following, *i.e.* the next day, April 15, will be Easter Day.

### THE RUSSIAN CALENDAR.

It is well known that the question has again been recently discussed of assimilating the Russian calendar with that of the rest of Europe; but after consideration the Russian Government again decided against adopting the Gregorian reformation of the Julian calendar, according to which a leap-year is dropped in the last year of three centuries out of every four, the exception being those of which the century-number is divisible by four without remainder. The Russian non-adoption of this is the cause that their calendar is several days behind ours, and has this year become one day more so than heretofore in consequence of their having a 29th of February in 1900, which those who follow the Gregorian reckoning have not. But they now propose to invite other nations to join them in adopting a rule for the calendar which will make it more accurate than the reckoning in question. Prof. Glazenap explained this at a meeting of the Russian Astronomical Society; and, as it consists in dropping a leap-year at regular intervals instead of having an exception of an exception, which (as Sir John Herschel pointed out) needs, to be quite accurate, an exception again, we have no hesitation, on our part, in expressing approval of it. Prof. Newcomb, it may be remembered, in his "Popular Astronomy," suggested that there was no sufficient reason for abandoning the Julian reckoning, on the ground that it

was more simple than the Gregorian, and that there was no object in keeping the date of the month and day of any year corresponding exactly to the season in years several centuries apart; and no doubt Julius Cæsar was aware that the tropical year (as we call that on which the seasons depend) was several minutes short of three hundred and sixty-five days and a quarter in length. No doubt also the omission of several days on the greatest part of the continent in the sixteenth century, and in England in the middle of the eighteenth century, owing to the supposed necessity of making the seasonal dates correspond to what they were at the epoch of the Council of Nicæa, must have caused much confusion. But all that has long been a thing of the past; and it would seem best now to have, if possible, a general usage keeping the year in accordance with its true length.

W. T. LYNN.

## *THE MELBOURNE MEETING OF THE AUSTRALASIAN ASSOCIATION.*

THE eighth annual meeting of the Australasian Association for the Advancement of Science was opened in Melbourne on January 9, in the University buildings, which were placed at the disposal of the Association. At the inaugural meeting, the President of the last session, Prof. Liversidge, F.R.S., vacated the chair in favour of the President-elect, Mr. R. L. J. Ellery, C.M.G., F.R.S., the late Government Astronomer of Victoria, who delivered an address on "The beginnings and growth of astronomy in Australia," in which he sketched the progress of astronomical science from the days of Captain Cook up to the foundation of well-equipped observatories in Melbourne, Sydney, Adelaide, and, more recently, in Perth, concluding with a reference to the co-operation, at the present time, of the three first observatories in the international survey of the heavens by means of photography, for the purpose of forming a chart of all stars down to the fourteenth magnitude.

The following Presidential addresses were delivered in the various sections: Astronomy, Mathematics and Physics, by Mr. G. H. Knibbs, on "The development of the atomic theory of matter"; Chemistry, by Mr. F. B. Guthrie, on "Some landmarks in the progress of chemical science"; Geology, by Prof. R. Tate, on "An attempt at a refutation of the doctrine of homotaxy"; Biology, by Mr. J. J. Fletcher, on "The rise and early progress of our knowledge of the Australian fauna"; Geography, by Mr. W. H. Tietkins, on "A review of geographical research during the past two years"; Ethnology, by Mr. F. J. Gillen, on "Magic amongst the Central Australian natives"; Economic Science, by Prof. Jethro Brown, on "Loyalty, liberty, brotherhood: a study in the political ideal"; Agriculture, by Prof. Lowrie, "That in our practice of agriculture the determining influence of climatic conditions is not sufficiently recognised"; Engineering, by Mr. H. Deane, on "The George Street tramway, Sydney"; Sanitary Science, by Dr. Jamieson, on "The advance of sanitary science"; Mental Science, by Dr. Cleland, on "The anatomy of mind as bearing upon education." In the various sections 160 papers were read. Public lectures were delivered by Prof. Morris, on "Early men of science in Australia"; by Dr. George Brown, on "An anthropologist in the South Seas"; and by Mr. H. W. Jenvey (to working men), on "The Marconi system of wireless telegraphy."

Reports were received upon the magnetic survey of New Zealand, and also from the seismological committee, the photographic geological survey committee, and the glacial committee. Amongst others, committees were formed to investigate and report upon the following subjects: the best method of utilising diamond drill bores for the determination of underground temperatures; the drawing up of a catalogue of recent Australian and Tasmanian marine shells; the collecting and cataloguing of geological photographs of interest in Australia and Tasmania; the need of separate State education for defective children. It was determined to urge the various Colonial Governments to adopt a uniform system of spelling native names of places in accordance with that adopted by the Admiralty and the Royal Geographical Society, and to approach the Governments of the several colonies with the object of trying to induce them to provide for the appointment of a properly qualified philological expert to make researches into the Australian and Papuan languages.

It was decided to hold the next session in Hobart, in January 1902, Captain Hutton being nominated as President. Prof. Liversidge was reappointed Permanent Secretary, and Mr. H. C. Russell, Treasurer. The arrangements for the meeting was made by Prof. Baldwin Spencer, the organising secretary for Victoria.

An instructive "Handbook of Melbourne," edited by Prof. Baldwin Spencer, was published for the use of members of the Association. Mr. A. Sutherland contributes the opening chapter, on the history of Victoria, and he concludes it with the following remarks, which show that there has always been enthusiasm for scientific work in the colony. "When the colony was but a couple of years old, a mechanics' institute was formed with its courses of scientific lectures and its little museum. A botanic garden was laid out when Melbourne was three years old, and when the goldfields had brought to its shores crowds of energetic and intelligent men, the fervour for knowledge increased. A National Museum, a University, a great Public Library, on a plan to cost eventually a million of money, and to form a vast national repository of all that science, literature and art could provide, were the notable features of that period; but amongst them must also be reckoned the Royal Society, the result of the amalgamation of two rival efforts in the cause of science. The Society has completed some forty years of existence, with a volume of papers for nearly every year."

The geology, biology in its various branches, ethnology, climate, commerce and manufactures of the colony form the subject of different chapters in the volume, and much valuable information is given in a concise form.

## *THE BI-CENTENARY OF THE BERLIN ACADEMY.*

LAST week we referred to the history of the Berlin Academy during the present century. The celebration of the bi-centenary was commenced on Monday. From the telegraphic account which appears in the *Times*, we gather that the Emperor opened the celebration by receiving in state the members of the Academy as well as the foreign deputations which have come to Berlin. The reception took place in the White Hall of the Royal Castle in the presence of the German Crown Prince, many princes of the Prussian and other German Royal Houses, the foreign Ambassadors, the Imperial Chancellor, and the Ministers and Secretaries of State. His Majesty, who wore the white uniform of the Gardes du Corps, with the eagle-crested helmet, sat on the throne surrounded by the insignia of Empire, the crown, sceptre, sword, orb and seal, which had been brought in on cushions of gold and silver cloth by the Minister of War and other generals. On a table near the throne were a pile of books, globes, and scientific instruments "picturesquely arranged" and surmounted by an eagle carrying a twig of laurel. Before the pro-

ceedings were opened by the dutiful addresses of the secretary of the Academy (Prof. Auwers), and the Minister of Education (Dr. Studt), a choir from the Royal School of Music sang Haydn's "Du bist dem Ruhm und Ehre gebührt." At the close of the ceremony, Löwe's "Salvum fac Regem" was sung.

In the speech from the throne his Majesty welcomed the delegates and recalled the long and intimate connection which had existed between the Academy and the House of Hohenzollern, and its foundation by the Elector Frederick III. (King Frederick I. of Prussia) on the initiative of Leibnitz, its first president. All the Prussian kings had been protectors of the society. William I. had said:—"The interest in learning which is felt by every Prussian king is shared by me." These words had been illustrated in connection with the Academy. The Emperor was glad to be able to say that the society had now maintained its activity throughout two centuries, and had completely fulfilled the expectations which his ancestors had placed in it. There were, no doubt, good reasons for the fact that German science had developed in close connection with the Universities. As the immortal Helmholtz had borne witness, academic teaching and intercourse with the students furnished abundant sources of energy for scientific research. But none the less the organisation and conduct of scientific work by academies had proved itself to be an essential element of scientific progress, and one which could not be neglected if great objects were to be attained. The Academy had come into existence more than a century before the University of Berlin, and had at an earlier date undertaken the task of simultaneously promoting all branches of learning. The Emperor intimated that he would now extend the society by the addition to the philosophical and historical section of a number of chairs principally devoted to German philological research. German philological research, his Majesty considered, should be especially cultivated in the capital of the United German Empire. The physical and mathematical section was to be strengthened in the same way, in consideration of the importance of the technical sciences in the present day.

"The Academy," continued the Emperor, "has from the very beginning taken all knowledge to be its province, but, on the other hand, it can be said to its credit that it has refrained from the pursuit of every interest unconnected with learning. The great events of the national life have, indeed, been reflected in its activity, and have often found enthusiastic expression in the words of its speakers on festal occasions. But the Academy has always disdained to descend into the turmoil of political passions, and has regarded the pure and disinterested cultivation of science as its highest duty. In this unselfish devotion, to which it owes so much, and which is a guarantee for its further success, the Academy serves the divinely appointed object of all knowledge, which is to lead mankind to a more profound understanding of Divine truth. However, the natural sciences may seek as their final goal to discover the first cause of all being and phenomena, it still remains true that, in the words of Goethe, himself once a foreign member of this society, 'the real, the only, and the profoundest theme of the history of the world and of humanity, a theme to which all others are subordinate, is the conflict between belief and unbelief,' and—as should be added, in conformity with his meaning—the dealings of God with man. So it holds good of your work that, as was the desire of Liebnitz, 'the honour of God and the good of all humanity are constantly promoted' by science. May this always be so, and to that end may the blessing of the Most High rest upon you in the new century as in the past."

In connection with the bi-centenary the Emperor has conferred the Order of the Red Eagle, first-class, upon Prof. Mommsen; the star of the Royal Order of the Crown, second-class, upon Prof. Auwers, the permanent secretary of the Academy; the Order of the Red Eagle, third-class, upon Prof. Adolf Karnack; and a number of distinctions upon other eminent scholars and men of science who have rendered services to the Academy.

Lord Kelvin and Prof. Max Müller have been elected Foreign Members. The following Englishmen and Americans have been elected Corresponding Members:—Prof. Gibbs, of Newhaven; Prof. Rowland, of Baltimore; Sir J. Burdon-Sanderson, Bart., of Oxford; Prof. William James, of Cambridge, Mass.; Prof. Kenyon, of London; Prof. Mahaffy, of Dublin; Dr. A. S. Murray, of the British Museum; Mr. F. L. Griffith, of Ashton-under-Lyne; and Prof. F. W. Maitland, of Cambridge.

A special meeting of the Academy was held on Tuesday in the Prussian Chamber of Deputies, in celebration of the bi-centenary. Among those present were the Imperial Chancellor (Prince Hohenlohe), the Italian Ambassador (Count Lanza), the British Ambassador (Sir Frank Lascelles), and the Ambassador of Austria-Hungary (Herr von Szögyeny-Marich). The proceedings were opened and closed by wonderful performances of an orchestra from the Royal School of Music under Prof. Joachim, which played a sonata by Giovanni Gabrieli (1597) and Stadler's hymn, "Grosser Gott, Allmächtiger Gott." Prof. Harnack delivered an eloquent address on the history of the Academy, and concluded with the words:—"May the light which was in the beginning and the word which was in the beginning continue to illuminate the spirit of this institution in the third century of its existence!"

The representatives of foreign academies and learned societies then presented addresses of congratulation. The following were among the foreign deputations:—On behalf of the Royal Society of London, Dr. T. E. Thorpe and Prof. W. Ramsay; for the Royal Irish Academy, Dublin, Prof. R. Atkinson and Prof. Mahaffy; for the Royal Society of Edinburgh, Dr. J. Burgess and Dr. R. H. Traquair; for the Royal Asiatic Society of Great Britain and Ireland, Dr. M. Gasten and Mr. H. Lyon; for the Smithsonian Institution of Washington, the Ambassador of the United States of America, Mr. Andrew D. White; for the American Academy of Arts and Sciences, Prof. J. W. White and Prof. J. C. Wolff, of Harvard University; for the Académie des Inscriptions et Belles-Lettres de l'Institut de France, M. Gaston Paris and M. E. Senart; for the Académie des Sciences de l'Institut de France, M. G. Darboux, Doyen de la Faculté de Sciences de Paris; for the Académie des Sciences Morales et Politiques de l'Institut, M. Gréard, Rector de l'Université de Paris, and the Comte de Franqueville, Vice-Président de l'Academie. Dr. Nansen also presented congratulations.

In replying to the addresses of the deputations, Prof. Diels said that contemporaneous with the bi-centenary of the Berlin Academy was the birth of what he might call the "academy of the world," the international association of the academies of all countries, founded four weeks ago. After sketching the objects of this association, he announced that he was able to lay on the table the first fruits of its labours in the shape of the first printed sheets of the "Thesaurus Linguæ Latinæ." He expressed the hope that the nations might follow the example of the academies and the Universities by uniting in the peaceful task of extending to the whole world the civilisation and the culture of Europe and America.

## *INNERMOST ASIA.*[1]

PROMPTED more by the love of sport than by any scientific aspiration, Mr. Cobbold undertook an adventurous (and in many respects an instructive) journey from India into the regions of High Asia; and regarded as a record of sport and adventure, he has told his tale so well that he is likely to produce an embarrassing demand on the Indian Foreign Department for leave to follow in his footsteps. He seems to have had no special difficulty in obtaining permission to visit the Pamirs, in spite of the well known reluctance of the Indian Government to entertain the risk of "complications" involved in the casual collisions of British and Russian officers on the far frontier. Indeed, he naturally finds it difficult to understand why so many more obstacles were placed in the way of his return than of his visit to the Pamirs.

In August 1897, he followed the high road through Kashmir to Gilgit and Hunza, crossing the Kilik Pass in the company of Captain Deasy, who was bent on a scientific mission in the same direction. After fair success with *Ovis poli* in the neighbourhood of the Tagdumbash Pamir, he passed on to Kashgar and started northward from that place to Vierney and Lake Balkash. In the reed beds that surround Balkash he achieved a notable feat, for he bagged a tiger under circumstances that were sufficiently exciting to satisfy the most ardent sportsman; and this may surely rank as

[1] "Innermost Asia." By Ralph P. Cobbold. Pp. xviii + 354. (London: Heinemann, 1900.)

the "farthest north" tiger ever bagged by an Englishman. On his way back to Kashgar he hunted in vain for the great Tian Shan stag (which he calls a Wapiti), and the close association which this form of sport promoted with the people of the country led to observations of their social life and condition which inspires some of the best writing in the book. At Kashgar he obtained a permit from the Russian Consul to visit the Russian Pamirs. This part of his story, illustrating the present position of the Russians on the Pamirs, is instructive. He followed the footsteps of Ney Elias down the vile mountain passes and pathways of the Bartang (or Murghab) river, reached Kila Wamar, where he was politely stopped by the Russian authorities; visited the new Russian post at Charog, and the Afghan fort of Kila Bar Panj; and after a detention, which was as courteously arranged as could well be expected under the circumstances (although the exact reason of the order which prevented him from crossing the Hindu Kush is not clear), he was given an escort of three Cossacks, and sent back again to the Chinese frontier. He recrossed the Hindu Kush by the Mintaka into the Hunza valley, and so returned to India.

FIG. 1.—*Ovis poli* alive.

Of the personal courtesy and hospitality of the Russian officials, Mr. Cobbold has certainly no cause to complain. Whatever may be the political ambition of the Russian nation, or the spirit of international rivalry, it never finds expression in the personal attitude of the Russian towards the Englishman. In this particular, Mr. Cobbold's evidence only confirms that of all English people who have had close personal relations with educated Russians. He was struck with the intelligence of the Russian officers; their frank avowal of their political views and aims; their knowledge of the frontier on both sides the border; and their rough but effective methods of dealing with frontier tribes-people. He was surprised to find that they were well acquainted with certain "confidential" reports of the Indian Government, and that they knew precisely the turn that daily affairs were taking from Kabul to the Afridi Tirah. But he admits that the rough and ready system of local administration, those methods which would enable a Petrovski to pacify our northwest frontier for us "with 1000 Cossacks," are not popular with the people; and that on the whole Russian rule is not much preferred to Afghan. One thing is, however, tolerably clear from Mr. Cobbold's book, *i.e.* that both Afghan and Chinese borders are carefully watched against Russian trespass. The officer in command of the Russian outposts at Charog (? Khorokh) was not on visiting terms with the Afghan commandant on the opposite side of the Panja; neither were matters altogether pleasant for Mr. Cobbold himself when he was mistaken for a Russian officer crossing the Chinese border to Tashkurghan.

Mr. Cobbold gives us his views at some length on the Russian position in High Asia, and even revives the moribund scare of an invasion from the Pamirs. The keynote of his views is expressed in the title of a photograph of the Kilik Pass, which is described as one of the few passes by which India might be invaded. We presume that the Mintaka is another. But both lead to the Hunza river defiles, and Mr. Cobbold, like many other more careful investigators, has failed to reckon up the requirements in provisions of the army of invasion, the number of baggage animals that would have to follow it, the amount of roadway necessary to get them along, and the exceeding facility with which even a small undisciplined force can stop a whole army, when acting in difficult ground and on the defensive. South Africa should emphasise the lessons learnt in Tirah, if such lessons are really necessary.[1]

There are just one or two points in this connection which require attention. The map given at the end of the book is that published by the Royal Geographical Society in 1896, and is, of course, not authoritative. But this hardly justifies the extension of the boundary between China and (presumably) Kashmir, by the red and yellow line which is depicted to the north-west of the Raskam river running right across the base of the Tagdumbash Pamir. Nor would any Russian authority admit the further extension of that line in yellow and green along the crest of the Sarikol range. These extensions are Mr. Cobbold's own. The Tagdumbash Pamir is thus included in Kanjut, and the Kashmir (or British) boundary is made to march with that of Russia at the Beyik Pass. Such an arrangement altogether nullifies the provisions of the Boundary Commission agreement of 1895 (quoted at the end of the book), which provides that the boundary between Russian and Afghanistan frontiers should be "prolonged in an easterly direction so as to meet the Chinese frontier." There is also a photograph of a "boundary pillar" on the Mintaka Pass which is misleading. There is no boundary pillar on the Mintaka. It is probably a pillar erected by Captain Deasy for purposes of observation. There is a curious misprint, too, in page 259, where Karakoram is written for Sarikoram, but as a matter of fact the latter is not a recognised pass at all. It is only a shikari's track. Again, in page 267, the Russians are credited with handing over Wakhan to Bokhara. Wakhan belongs to Afghanistan, and has never been in Russia's possession. Mr. Cobbold's etymology is likewise possibly open to question. In the regions of the Upper Oxus the Tajik meets the Tatar; the Aryan and Mongolian races here join hands. But the Chitráli of the Yarkhun valley hardly acknowledges affinity with the Tajik of the Oxus. Both are of very ancient Aryan

[1] In the final chapters of his book Mr. Cobbold expresses contradictory opinions, and even advocates the opening of the Kilik as a trade route.

extraction, and may have been prehistorically connected, but the Chitráli calls himself Kho, and speaks "Khowar," and his language (ordinarily known as Chitráli) would not be understood in Wakhan. The Tajik (the original Persian stock) of Turkestan and the Oxus does not derive his designation from táj, "a crown," but from Tazi, a word which means "Arabic"—or "of Arab extraction," and which is more intelligible as applied by the pure bred Persian to the Tajik races of Baluchistan (where there has ever been much Arab admixture of blood) than to the people of the Oxus or of the Kabul basin. It practically means "half breed," and may be recognised again in the word Tazi, which Mr. Cobbold applies to the dogs which he brought with him from the highlands.

That the Hindu Kush may ultimately mark the geographical boundary between Russian and British spheres of interest in Asia, or even that Chinese Turkestan (or the New Dominion) may ultimately become as much a Russian province as Bokhara (and it certainly is a fact that Russian influence is already predominant in Kashgar), is an eventuality which many politicians have contemplated for years past. But it strikes no terror into the hearts of those who look upon a definite and final understanding with Russia as the best guarantee for peace and for the advancement of civilisation in Asia. Nor need we as yet concern ourselves with such a consummation as would be involved by the Cossacks gazing down on Kabul from their barracks "on the heights of the Kohistan."

Apart from his political views, Mr. Cobbold's book is instructive as well as interesting. He tells us much that is new about districts which are not within the reach of every traveller, and his chapter on the trade of Innermost Asia is specially worth study. T. H. H.

## *DR. WILLIAM MARCET, F.R.S.*

ALL who are interested in medicine and the cognate sciences learnt with great regret of the death of Dr. William Marcet, which occurred on March 4, at Luxor, at the ripe age of seventy-two years. Dr. Marcet up till last summer continued to take that keen interest in matters scientific which had characterised him all his life, and it was only with a pronounced failure in his health that he discontinued active physiological research. His active scientific life in London was longer than the average, and exceeded half a century ; and this, perhaps, accounts for his many friends, and also for the fact that he was brought into contact with successive generations of physiological workers. His ample means rendered time of less consequence to him than to many of his colleagues, and this good fortune was utilised by him to the full, in that his researches were for the most part directed to themes of a time-consuming nature, and also to those requiring for their adequate prosecution somewhat elaborate and expensive methods.

With the exception of his contributions to meteorology, his work was almost entirely directed to the chemical side of physiology and pathology ; his additions to the literature of clinical medicine were relatively small ; and although he was for some time on the staff of the Westminster and Brompton Hospitals, as a physician, he was by the present generation hardly known.

The first sphere of his chemico-physiological labours was a somewhat unæsthetic one—viz. the human fæces. In 1851 he published "Some observations on the fatty matters of human excrements in disease." In 1856 his first work upon dietetics appeared, entitled "The composition of food and how it is adulterated, with practical directions for its analysis." This book was one of the earliest systematic contributions to this subject, and must have been the expression of considerable labour and research. Dr. Marcet next directed his attention to the physiological and pathological properties of alcohol, and published two monographs upon the subject. His "Chronic alcoholic intoxication" includes a synoptical table of cases. In 1864 he made some observations upon a colloid acid, a normal constituent of human urine, and in the same year published a short essay upon the brine of salt meat and on the distribution of albumen through the muscular tissue. His dietetic researches extended, in 1867, to a description of a method for peptonising meat, and the employment of the formed product in diseases of the stomach.

Dr. Marcet, in this country, was one of the earliest workers with the laryngoscope, and wrote, in 1869, "Clinical notes on diseases of the larynx, investigated and treated with the assistance of the laryngoscope." In 1869 he published the results of some observations he made upon the temperature of the human body during climbing.

Dr. Marcet's two contributions to meteorology and climatology were a monograph on the weather at Cannes during the season 1875–76, which appeared in 1877, and a book of some four hundred pages on the "Principal Southern and Swiss health resorts," which was published in 1883. Although this book cannot be regarded as a systematic treatise on climatology, it is most readable, and contains a mass of useful hygienic information concerning the Riviera, Canary Islands, Madeira, Egypt, &c. Even a discussion of the cause of the green colour of Marennes oysters is to be found in it.

In spite of the somewhat extensive bibliography given above, it is nevertheless as a worker on respiration that the subject of this notice was, and will be, chiefly known. Years of researches upon this subject, both in London and at high altitudes, resulted in the appearance in 1897 of Dr. Marcet's "Contribution to the history of the respiration of man." The book consists essentially of the subject-matter of the Croonian Lectures which were delivered by Dr. Marcet before the Royal College of Physicians in 1895. As this book was fully reviewed in these columns at the time of its appearance, no further mention need be made of it here. Not only will physiology miss Dr. Marcet as a worker, but working physiologists will miss him as a personality ; he was constantly to be seen at meetings of the Physiological Society, and kept up his interest in all the branches of that science which has extended so enormously the field of its knowledge since he joined the ranks of its workers.

F. W. TUNNICLIFFE.

## *SIR MICHAEL FOSTER AND HIS PUPILS.*

WE have been asked to publish the following letter, addressed to Sir Michael Foster on the occasion of his entering Parliament. His biological friends at Cambridge have done well in expressing their loyalty towards Sir Michael, to whom the University owes so much. The signatures might doubtless have been indefinitely multiplied had the opportunity of adding their names been given to Sir Michael Foster's friends and pupils scattered over many lands. This, however, was not attempted, the letter not being circulated beyond the group of old pupils and friends, in Cambridge, with whom it originated.

TO SIR MICHAEL FOSTER, K.C.B., M.P.

DEAR SIR MICHAEL,—We, a few of your Cambridge friends, take the opportunity given by your entering Parliament to express our loyalty, respect, and cordial friendship towards you.

Though we regret anything which takes you from among us, yet we cannot but rejoice that the cause of learning has gained so strong an advocate in Parliament.

The work you have done in Cambridge during the last thirty years seems to us of unique value. You have taught us to recognise what is worth learning, and you have taught us how to learn. If we, in Cambridge, now value and seek after the

advancement of natural knowledge, we owe it to you more than to any man living.

We beg you to believe that we are grateful, and we shall rejoice if we can in any way prove our sincerity.

We can ill afford to lose either the weight of your name or your guidance at our councils; we can indeed hardly imagine a greater misfortune than the breaking of the bond between you and us. But we cannot complain if, after many years of service, you have found it necessary to loosen your official ties to the University. We regret that your enlarged liberty has not come to you in a form which would have marked our sense of what we owe to you. But we rejoice that an arrangement has been arrived at which will allow your interests still to centre in Cambridge, giving you, at the same time, the opportunity of working in a wider field, where you may do for England what you have already done for Cambridge, and where your services to learning may benefit, not only England, but the whole English-speaking race.

We are proud to sign ourselves

Your friends and pupils,

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|---|---|
| H. K. ANDERSON. | J. N. LANGLEY. |
| FRANCIS DARWIN. | A. SHERIDAN LEA. |
| A. G. DEW-SMITH. | J. J. LISTER. |
| WALTER GARDINER. | A. SEDGWICK. |
| W. H. GASKELL. | A. C. SEWARD. |
| ALFRED C. HADDON. | ARTHUR E. SHIPLEY. |
| W. B. HARDY. | L. E. SHORE. |
| S. F. HARMER. | H. MARSHALL WARD. |
| WALTER HEAPE. | |

*March* 9, 1900.

## *NOTES.*

THE preliminary programme of the meeting of the British Association to be opened at Bradford, on September 5, has now been drawn up. The new president is Sir William Turner, F.R.S., and the sectional presidents will be as follows:—Mathematical and Physical Science, Dr. J. Larmor, F.R.S.; Chemistry, Prof. W. H. Perkin, F.R.S.; Geology, Prof. W. G. Sollas, F.R.S.; Zoology (and Physiology), Dr. R. H. Traquair, F.R.S.; Geography, Sir George S. Robertson; Economic Science and Statistics, Major P. G. Craigie; Mechanical Science, Sir Alexander R. Binnie; Anthropology, Prof. John Rhys; Botany, Prof. Sydney H. Vines, F.R.S.; and Corresponding Societies, Prof. E. B. Poulton, F.R.S. There will be a separate department of astronomy in Section A, with Dr. A. A. Common, F.R.S., as chairman. The two evening discourses will be delivered by Prof. Gotch, F.R.S., on "Animal Electricity," and Prof. W. Stroud, on "Range Finders." The lecture to working men will be delivered by Prof. S. P. Thompson, F.R.S., but the subject has not yet been announced.

AT the anniversary meeting of the Royal Irish Academy, on March 16, the following were elected honorary members of the Academy in the section of science:—Aleksandr O. Kovalevskij, St. Petersburg; J. A. Gaudry, Paris; P. G. Tait, Edinburgh; J. H. van t' Hoff, Berlin; J. J. Thomson, Cambridge.

ATTENTION has several times been drawn in these columns to the remarkable properties of Becquerel rays, and, in particular, of those rays emanating from radium. The theory that the radiations consist of material particles is supported by M. Becquerel's recent observations on the action of screens in cutting off the radiations deviated by a magnetic field. From the *Revue Générale des Sciences* for March 15, we learn that a decisive experiment has been performed on this point. It has been established beyond doubt that the emanations from radium communicate a negative charge to bodies on which they fall, while the radium itself becomes charged negatively, and it is inferred that the emanations from radium, or, at any rate, a portion of them, consist of material particles carrying negative charges.

IT will be remembered that the work of the Ben Nevis Observatories would have been brought to an abrupt conclusion in 1898, had not Mr. J. Mackay Bernard come forward with a donation of 500*l.*, which secured its continuance for another year. In 1899, he gave another donation of 500*l.*, under which the directors are now carrying on their important work. The following extract from the report of the Council of the Scottish Meteorological Society, read at the annual general meeting on Monday, shows the present position of the Observatories:—"The position of matters was taken into serious consideration by the council at their meeting on Monday, March 12, when Mr. Mackay Bernard, with a generosity which it is difficult to describe, intimated his wish of making a third donation of 500*l.* to complete the observations in the way desired by the directors in their previous report, and so covering the whole of a sun-spot period of eleven years, and securing at the same time good averages of the meteorological elements for the highest position in the British Islands, and an adjoining Sea-level Observatory at Fort-William. The Ben Nevis work has thus been singularly fortunate in securing very large support from a gentleman, moved by patriotism as well as by a love of knowledge, and the completion of the experiment is secured. This statement does not imply that the council does not continue to be strongly of opinion that the Observatories should not be continued permanently as a national institution, and they are strengthened in this opinion by the character of the results already obtained. The council have now to intimate that another gentleman has offered further support of a very substantial character. In August last, he wrote offering help to the extent, if necessary, of 300*l.*, and the council are now in communication with him in regard to this most liberal offer."

WE learn from the *British Medical Journal* that Dr. W. Osler, F.R.S., professor of medicine in Johns Hopkins University, Baltimore, has sent in an application for the vacant chair of the practice of physic in the University of Edinburgh. Dr. Osler is a graduate of McGill University, Montreal. The other candidates are all graduates of the University of Edinburgh, and in order of seniority are as follows:—Dr. John Wyllie, Dr. Byrom Bramwell, Dr. Alexander James and Dr. G. A. Gibson. Dr. Osler is a Fellow of the Royal College of Physicians of London, while the other candidates are all Fellows of the Royal College of Physicians of Edinburgh.

THE second malaria expedition of the Liverpool School of Tropical Medicine, composed of Drs. Annett, Dutton and Elliott, started yesterday for Nigeria, where they will remain for some time studying malaria and health problems.

THE annual general meeting of the Chemical Society will be held on Thursday, March 29, at 3 p.m. At this meeting the Longstaff Medal will be presented to Prof. W. H. Perken, Junr., F.R.S. In the evening the Bunsen Memorial Lecture will be delivered by Sir Henry E. Roscoe, F.R.S.

SCIENCE has to regret the loss of another of its eminent votaries. Dr. E. J. Lowe, F.R.S., who died on the 10th inst. at Shirenewton Hall, Chepstow, was best known by his indefatigable labours for the determination of the climate of Nottingham, at which place he was born, in November 1825. His meteorological observations began in 1840, and were continued there until 1882, when he removed from Highfield House to Shirenewton Hall. The results of this long series of observations were published in several valuable works, including "The Climate of Nottinghamshire." He also published many other treatises, *e.g.* "Barometrical Tables," as early as 1857, "Weather Prognostics," and the "Natural Phenomena of the Seasons."

This latter work is frequently found very useful for reference to the extreme conditions of weather and unusual occurrences since A.D. 220. In 1856 he published in *Orr's Circle of the Sciences*, in conjunction with Mr. J. B. Scoffern, a "Practical Meteorology," which will well repay perusal at the present day. Mr. Lowe's labours were, however, in no way limited to meteorology. He communicated several joint papers on luminous meteors to the British Association, and assisted the late Prof. E. Forbes in the compilation of his well-known work on "The British Mollusca," and he also wrote several valuable works on British ferns and flowering plants. He was one of the founders and original fellows of the Meteorological Society, of which body he was a life member, and contributed many papers to its *Proceedings* on meteorological subjects and also on earthquake and astronomical phenomena. Mr. Lowe was the inventor of the dry powder tests for the determination of the amount of ozone present in the atmosphere.

THE census of Great Britain will be taken on Sunday, March 31, 1901. The Census Bill was read a third time in the House of Commons on Monday, and as it now stands, the schedules will require the following particulars to be filled in :—(*a*) The name, sex, age, profession or occupation, condition as to marriage, relation to head of family, birthplace, and (where the person was born abroad) nationality of every living person who abode in every house on the night of the census day ; and (*b*) whether any person who so abode was blind or deaf and dumb, or imbecile or lunatic ; and (*c*) where the occupier is in occupation of less than five rooms, the number of rooms occupied by him ; and (*d*) in the case of Wales or the county of Monmouth, whether any person who so abode (being of three years of age or upwards) speaks English only or Welsh only, or both English and Welsh.

AS already announced, an International Congress of Botanists will be held in Paris from the 1st to the 10th of October, in connection with the Exposition. It is proposed to bring before the Congress special subjects for discussion ; and the following have been already approved by the Committee :—(1) Monographic studies ; (2) Species, hybrids and cross-breeds ; (3) Unification of micrometric measures ; (4) Influence of the nature of the substratum on the development of Fungi. The President of the Committee is M. E. Prillieux ; the General Secretary, M. E. Perrot, l'École Supérieure de Pharmacie, Paris. All botanists who notify the General Secretary their desire to become members of the Congress, and who pay the fee (20 francs), will be enrolled as members. Public and general sessions, conferences and collecting trips, displays of fungi, and visits to botanical establishments, are planned.

IN accordance with a recommendation of the Columbus meeting of the Botanical Society of America, and Section G of the American Association for the Advancement of Science, at the Columbus meeting, Prof. W. Trelease, of the Missouri Botanic Garden, has contributed to *Science* (vol. x. No. 255, Nov. 17, 1899) a scheme for the classification of botanical publications. He proposes arranging them under nine heads :—(1) Works of miscellaneous contents ; (2) Biographies of botanists ; (3) Nomenclature, taxonomy and descriptive botany ; (4) Morphology and organography ; (5) Vegetable physiology, including ecology ; (6) Vegetable pathology, including the injuries of plants and therapy ; (7) Evolution, natural selection, &c. ; (8) Man's influence on plants, artificial selection, &c. ; (9) Phytogeography, floras, &c. These are again classified under a large number of subdivisions.

THE Botanical Society of France has elected M. Drake del Castillo President for the year 1900 ; M. Boudier, M. l'abbé Boullu, M. Morot and M. de Seynes, Vice-Presidents.

THE Italian botanical journal, *Erythea*, will be discontinued with the completion of the seventh volume.

A HERBARIUM, collected especially to illustrate the flora of the Rocky Mountains, is being organised in connection with the University of Wyoming.

*Bulletin* 62 of the West Virginia Agricultural Experiment Station, Morgantown, W. Va., consists of a paper, by Mr. L. C. Corbett, on the effect of incandescent gas-light on the growth of plants. He finds that the incandescent gas-light of the Welsbach burner is an active stimulus to the growth of plants when used at night to supplement daylight. The paper is illustrated by charts and photographs.

AN article of archæological interest appears in the March number of the *Engineering Magazine*, which, in discussing the "Gold-mining prospects in Rhodesia," treats of the discovery of gold ornaments found in ancient ruins in Rhodesia, and their probable age. From the text we gather that ornaments have been found in houses dating back, it is believed, three thousand years ago ; it is also pointed out that the ignorant black population could not have made them. The group of objects representing trays, bracelets, beads, and other articles difficult to specify, has been carefully photographed and reproduced.

THOSE of our readers interested in foreign Lepidoptera may be glad to learn that Mr. E. Swinhoe has recently issued his ninth annual list of specimens for sale.

OUR namesake, *Die Natur*, in its issue of March 11, contains an interesting sketch of the collections in the Berlin Museum. From this we learn that the plan of placing a small map to each specimen, indicative of its geographical distribution, has been adopted ; and likewise that a special saloon is devoted to the fauna of Germany. In the latter we further note that the Bats are exhibited in spirit, as is now the case with a large portion of those in the British Museum.

WE have to congratulate the Trustees of the South African Museum on the completion of the first volume of the *Annals* of that institution, the third and concluding part of which has just come to hand. The great bulk of this fasciculus is taken up by the description of various South African Scorpions and their distant cousins the Solifugæ, or "False Spiders," two genera of the latter being recorded for the first time from the Cape district. The volume closes with a short paper, by Dr. R. Broom, on two new species of Dicynodont Reptiles from the well-known Karoo series ; and it is a matter of satisfaction to find not only that the study of extinct forms comes within the province of this useful publication, but that such a competent observer and anatomist as Dr. Broom has turned his attention to this branch of research.

CONFRONTED with the difficulty of mounting the bones of the limbs of extinct mammals at their proper angles of inclination, Prof. H. F. Osborn has undertaken a careful comparative investigation of those of the elephant and the rhinoceros, in the hope of finding a clue from the conformation of the bones themselves as to their true position in the mounted skeleton. The results of his studies are given to the public in the February number of the *American Naturalist*. In regard to the elephant, he makes the noteworthy statement "that the study of the skeleton alone would have given us a very faulty conception of the animal." He is led to conclude that in all primitive ungulates the long bones of the limbs were set at considerable angles to one another, as in the majority of the existing representatives of the order, and that the vertical position they occupy in the elephant is an acquired feature. To quote his own words :—"The straightening of the limb is an adaptation

designed to transmit the increasing weight through a vertical shaft; correlated with it is the shifting of the facets [that is to say, the upper and lower articular surfaces] into the direct line of pressure, and the alteration of their planes from an oblique to a right or horizontal angle with relation to the vertical shaft."

MR. FREDERIC W. SIMONDS writes to us from the University of Texas with reference to the communications on "Floating Stones," which appeared in NATURE early in the present year (pp. 278, 318). He calls attention to a paper of his, entitled "Floating Sand: an Unusual Mode of River Transportation," published in the *American Geologist* (January 1896), in which he described experiments made to determine how sand may be floated, what sand will float, and why sand will float. It was found that sand grains will float in perfectly still water for an indefinite time, that the grains which float are not necessarily siliceous, and that the property of floating depends to a large extent upon the angularity, that is, the shape, of the grains. Several of the characteristics mentioned by our correspondents are referred to in Mr. Simonds's paper.

THE Statistics of Mineral Production in India for the five years 1894 to 1898 have just been issued by the Department of Revenue and Agriculture. About a million tons of salt are produced annually from rock-salt, from salt lakes and wells, and from sea-water. The coal industry is expanding rapidly, the output having increased from nearly three million tons in 1894 to over four and a half million tons in 1898. The coal is employed for railways, coasting and river steamers and factories, but the conditions of transport are not yet sufficiently developed. Nearly all the gold produced in India comes from the State of Mysore, and in 1898 it amounted to over four hundred thousand ounces, valued at 4*l.* an ounce. Nearly twenty million gallons of petroleum were obtained in 1898 from Burma and Assam. Other "minerals" of minor economic importance include iron-ores, tin-ores, saltpetre, gems and precious stones.

WE have received a catalogue of the first four thousand samples in the soil collection of the U.S. Department of Agriculture, prepared by Mr. Milton Whitney, chief of Division of Soils. To all interested in soil investigations this publication will be a useful and suggestive work of reference. Not only does the collection contain specimens of soils from the chief geological formations of the United States, it also includes samples from many of the important agricultural districts, and likewise special collections of wheat soils, tobacco soils, &c., from all parts of the world. Remarks are made concerning the collecting of specimens, their arrangement and classification; and it is stated that sets of representative soils are arranged in boxes, to be distributed to agricultural colleges and experiment stations, with explanatory text regarding their origin, chemical and physical peculiarities, &c. One object in publishing the catalogue is to suggest exchanges with institutions in other countries.

IN an article on the Lower Cambrian terrane in the Atlantic province (*Proc.* Washington Acad. Sciences, vol. i. February 1900), Mr. C. D. Walcott discusses some changes in grouping which have been proposed by Mr. G. F. Matthew, and would, if adopted, lead to the abandonment of the term Middle Cambrian, and to the placing of the *Olenellus*-zone in the Pre-Cambrian ("Etcheminian" terrane). Mr. Walcott maintains that the Etcheminian is in reality Lower Cambrian, and equivalent to strata which elsewhere hold the Olenellus fauna—the representatives of the genus having a range of over a thousand feet at the typical locality in Vermont.

AMONG the earthquakes felt in Asia Minor in 1896, one of the most interesting originated near Balikesri on September 14. This shock is described by Dr. G. Agamennone in a paper published in the last *Bollettino* of the Italian Seismological Society (vol. v. No. 6). Though its intensity was not more than 7 or 8 of the Rossi-Forel scale, the shock was felt over an area of about 400 km. in diameter, and was even recorded by a horizontal pendulum at Strassburg, which is 1850 km. from the epicentre. The mean surface-velocity of the preliminary tremors was about 8⅓ km. per second, and of the slow undulations about 2½ km. per second.

THE success which attended the "Illustrated Annual of Microscopy" last year has induced the publishers (Messrs. Percy Lund and Humphries) to bring out a second number this year. If for no other reason, it is valuable for its summary of new instruments and apparatus put on the market by the leading opticians during the twelvemonth. We are glad to see the popular side of microscopy well represented, since papers of a highly specialised character find a more appropriate medium of publication in the proceedings and transactions of societies. On the other hand, brief abstracts of technical methods are of interest to every one, and in this category we include Dr. Hollborn and Mr. Angus's history and theory of staining, Mr. W. H. Merrett's metallography of iron and steel, Mr. Strangways' hints on dental histology, Mr. Palmer's article on micro-spectrography, Mr. Rheinberg's multiple colour illumination; and notes by Mr. Harris on eucaine hydrochlorate, and by Prof. Hartog on saprolegnieæ. Photo-micrography receives treatment at the hands of Mr. Albert Norman, Don Domingo de Orueta, Mr. F. Noad Clarke (in connection with entomology) and Mr. E. R. Turner, who treats of "stereo-photo-micrography, chromo-photo-micrography, and stereo-chromo-photo-micrography"; while popular microscopy is well catered for by the beautiful coloured frontispiece of "Pond Life" and coloured plate of *Daphnia hyalina*, and by papers on freshwater mites, yeast, plant hairs, molluscan palates, polarised light and the variety of form of diatoms from an artistic standpoint, illustrated by outlines of Triceratia. Dr. M. C. Cooke's skits and songs resuscitated from the early annals of the Quekett Club are most amusing.

WE have received from the United States Weather Bureau the "Meteorological Chart of the Great Lakes," with a summary of the season of 1899. This work, which is accompanied by a large amount of explanatory text, in addition to tables and maps, contains much useful information relating to the storms, monthly rainfall, ice, &c., in the Lake region. The season of inter-lake navigation in 1899 began on April 29, the opening being late on account of the vast amount of ice during April. With the exception of Lake Erie, and probably Lake Ontario, the water was higher than in the two previous years; on Lake Superior the water was higher than that of any previous year since 1876. The work contains some interesting observations of fog. The most frequent formation reported is that of heavy banks, with intervals of clear weather, and narrow bands, which extend for many miles in length. One vessel will run for hours in the band of fog, while another several miles distant will be running parallel with it in clear weather, and can hear the fog whistle and see the wall of the fog bank.

THE *Annuaire* of the Municipal Observatory of Paris (Montsouris) for the year 1900 extends to 578 pages, and contains an immense amount of useful information, and a special analysis of the work relating to the year 1898. The Montsouris Observatory was established in 1871, and its operations embrace: (1) Meteorological physics, including atmospheric electricity, the distribution of rainfall and thunderstorms in the Department of the Seine, and the regular registration of all the usual meteorological elements at Montsouris and at the St. Jacques tower. In this section we may specially mention a useful comparative

*résumé* of mean and extreme values for the twenty-five years 1873–98. (2) Chemical analyses of air and water in different parts of Paris, and researches relating to the comparative value of various disinfecting agents. (3) Micrographical investigations, with a view to determining the amount and nature of organic dust in open spaces and in dwelling houses. The work of each section is under the superintendence of an eminent scientific authority, and the control of the establishment is invested in a permanent Committee appointed by the Municipal Council of Paris.

THE earliest authentic record of bubonic plague has hitherto been accepted as dated 300 B.C. Drs. F. Tidswell and J. A. Dick have, however, recently brought evidence before the Royal Society of New South Wales to show that the epidemic of 1141 B.C., described in the First Book of Samuel (chs. iv.–vi.), was true bubonic plague. After the Philistines had captured the Ark of the Covenant and taken it to Ashdod, severe illness broke out among the people. "The hand of the Lord was heavy upon them of Ashdod, and He destroyed them and smote them with emerods." The Ark was afterwards taken to Ekron, and here again we are told "There was a deadly destruction throughout all the city . . . and the men that died not were smitten with the emerods, and the cry of the city went up to heaven." The word "emerod" has usually been taken to mean hæmorrhoids, but in the revised version of the Old Testament it is stated to mean tumour or plague boil. The epidemic in Philistia occurred at the time of the regular plague season, and mice are mentioned in connection with it, which furnishes additional evidence that the epidemic was plague, for a connection between the death of rats and plague at Bombay and elsewhere has been clearly established. Taking all the facts into consideration, there appears to be contained in the few chapters of I. Samuel an account of an epidemic of bubonic plague that occurred more than three thousand years ago, or more than eight hundred years previous to the hitherto accepted historic record.

PART IV. of the sixth revised edition of Foster's "Text-Book of Physiology" has been published by Messrs. Macmillan and Co., Ltd. It deals with the senses, under sight, hearing, taste and smell, and cutaneous and some other sensations. Dr. W. H. R. Rivers has assisted Sir Michael Foster in the revision of these chapters, and his name appears upon the title-page with that of the original author.

IN the *Transactions* of the Nova Scotian Institute of Science has appeared a series of papers, by Prof. MacGregor and his pupils, on the application of the ionic hypothesis to mixtures of solutions of electrolytes. Vol. x. contains a paper by Mr. J. Barnes treating of the viscosity of mixtures of solutions of various salts of sodium, potassium and barium, in which it is shown that general formulæ developed by Prof. MacGregor hold in this case also. Given data as to the viscosity and electrical conductivity of the constituent solutions, the viscosity of dilute solutions of the salts under consideration can be predicted by the dissociation theory within the limits of experimental error.

THE additions to the Zoological Society's Gardens during the past week include a Silver Pheasant (*Euplocamus nycthemerus*, ♂) from China, presented by the Rev. J. O. Coussmaker; a Greater Black-backed Gull (*Larus marinus*), European, presented by Mr. W. Baker; two Starred Lizards (*Agama stellio*) from Egypt, presented by Mr. Stanley S. Flower; a Green Lizard (*Lacerta viridis*), European, presented by Mr. W. J. R. Elgy; two Grey Struthideas (*Struthidea cinerea*) from Australia, a Bennett's Wallaby (*Macropus bennetti*) from Tasmania, deposited; a Black-faced Ibis (*Theristicus caudatus*) from South America, purchased.

## OUR ASTRONOMICAL COLUMN.

COMET 1899 V.—Herr S. K. Winther, of Copenhagen, communicates an ephemeris of this comet to the *Astronomische Nachrichten* (Bd. 152. No. 3930), from which the following is abstracted:—

*Ephemeris for 12h. Berlin Mean Time.*

| 1900. | R.A. h. m. s. | Decl. ° ′ ″ |
|---|---|---|
| March 23 ... | 21 38 23 ... | +51 58·7 |
| 25 ... | 42 36 ... | 52 43·1 |
| 27 ... | 46 50 ... | 53 27·3 |
| 29 ... | 51 5 ... | 54 11·2 |
| 31 ... | 21 55 22 ... | +54 54·8 |

NEW VARIABLE IN CYGNUS.—In the *Astronomische Naehrichten* (Bd. 152, No. 3629), Mr. A. Stanley Williams, of Hove, draws attention to the variability of the star

B.D. +46°·2966 { R.A. 20h. 29m. 38·0s. / Decl. + 46° 15′·2 } (1900).

The variable was detected from photographs taken with a Grubb portrait lens of 4·4 inches aperture. The brightness was found to change from 9·1 magnitude, on 1899 October 2, to 10·0 magnitude, on 1900 February 11.

Inspection of reproductions from photographs of the star taken by Prof. Max Wolf confirms the variability. In a photograph taken June 1, 1891 (*Knowledge*, 1891, p. 189), the estimated magnitude of the star is 10·2, while on another taken September 9 and 10, 1891 (*Knowledge*, 1891, p. 188), the estimated magnitude is only 9·6. Most of the observations, visual and photographic, furnish an approximate period of 31·0 days.

ESCAPE OF GASES FROM PLANETARY ATMOSPHERES.—In the *Astrophysical Journal*, vol. xi. pp. 36–43, January 1900, Mr. S. R. Cook, of the University of Nebraska, particularises part of the investigation of Dr. G. Johnstone Stoney, who omitted from his discussions the determination, by the kinetic theory, of the number of molecules which would have a velocity sufficient to enable them to escape from the earth or planet, assuming retarding media to be absent. The present author, in commencing this discussion, refers to this velocity as the *critical velocity* of the gas.

The dynamical constants are computed for four different conditions, including those adopted by Dr. Stoney, Prof. Cleveland Abbe (from balloon ascensions at Paris and Berlin), and the recent theoretical conclusions of Ferrel. From the result, it is concluded that under the most probable conditions there would be practically no escape of the gases nitrogen, oxygen, hydrogen and helium from either the earth or the major planets. An atmosphere like that on the earth, however, would not remain on the moon. Tables are given showing the computed temperatures at which the above gases would possess the *critical velocity* for dissipation at the outer limits of the atmospheres of the various planets.

NEW MODE OF USING THE CONCAVE DIFFRACTION GRATING.—In the current number of the *Mem. Soc. degli Spettroscopisti Ital.* vol. xxviii. pp. 241–244, Dr. G. B. Rizzo, of the Physical Institute at Turin, gives a description of his successful experiments dealing with the manipulation of a Rowland Concave Grating in other than the usual manner. The spectroscope is generally so arranged that the grating and eyepiece or photographic plate are at opposite ends of a rigid beam which keeps them at the constant distance of the radius of curvature of the grating, the plate being placed tangential to the focal curve. This gives for a small distance on either side of the axis a practically *normal* spectrum, and although not normal, the other orders of spectra are all brought to focus on the same focal circle, having as diameter the radius of curvature of the grating. It is evident, then, that whatever order of spectrum is being observed *normally* at the end of the beam, there will be another image, of the same order, on the other side of the central image (which has been symmetrically reflected from the grating without diffraction or dispersion), the lines of which will be in focus along a circle having a radius equal to half the grating's radius of curvature. This second spectrum Dr. Rizzo designates the *internal* spectrum, and its position is defined by the condition that

$$\sin\theta = -2\sin i,$$

where $\theta$ is the angle of diffraction,
and $i$ ,, ,, ,, incidence,
reckoned from the centre of the grating.

This spectrum is of *slightly larger* dispersion than the normal one, and may be brighter, although this will probably depend on the particular grating in question. In the grating used this is shown exceedingly clearly by the reproduction given with the paper of the spectrum of iron photographed in the two spectra, that given by the *internal* position being decidedly longer and more intense than the *normal* spectrum.

Dr. Rizzo investigated this disposition on account of being unable to use the instrument as usually set up, but it is possible that the fact of its being a practical arrangement may be of interest to other workers with the concave grating.

## *FORTHCOMING BOOKS OF SCIENCE.*

Mr. Félix Alcan (Paris) promises :—"Minéralogie Agricole," by Prof. Houdaille ; and "Manuel d'Histologie Pathologique," by Profs. Cornil and Ranvier.

Mr. Edward Arnold's list contains :—"A Manual of Elementary Chemistry," by W. A. Shenstone, F.R.S. ; "A Manual of Physiography," by Dr. Andrew J. Herbertson ; "A Manual of Botany," by David Houston ; "A Text-Book of Domestic Science," by Mrs. S. J. Shaw ; "The Dressing of Minerals," by Prof. Henry Louis ; and a new edition of "Lectures on Sound, Light, and Heat," by Dr. Richard Wormell, Part ii., "Chemical Statics."

Messrs. George Bell and Sons announce :—"The Comparative Anatomy of Animals," by G. C. Bourne, vol. i. ; "The Student's Dynamics," by Prof. G. M. Minchin, F.R.S. ; "Elementary Science," by Dr. D. E. Jones and Dr. D. S. Macnair ; and "Physiography," by H. N. Dickson.

Messrs. A. and C. Black's list includes :—"A Treatise on Zoology," by Prof. E. Ray Lankester, F.R.S. To be completed in ten parts, Part iii.; "The Echinoderma," by F. A. Bather, assisted by Dr. J. W. Gregory and E. S. Goodrich ; "Sexual Dimorphism in the Animal Kingdom : a Theory of the Evolution of Secondary Sexual Characters," by J. T. Cunningham, illustrated ; "Studies in Fossil Botany," by Dr. D. H. Scott, F.R.S., illustrated ; and new editions of :—"Travels through the Alps," by the late James D. Forbes, F.R.S., revised and annotated by W. A. B. Coolidge, illustrated ; and "Introduction to Structural Botany," Part ii., "Flowerless Plants," by Dr. D. H. Scott, F.R.S.

Messrs. Cassell and Co., Ltd., give notice of :—"Electric Bells, how to make and fit them," illustrated.

Messrs. J. and A. Churchill's announcements are :—"An Introduction to Vegetable Physiology," by Prof. J. Reynolds Green, F.R.S., illustrated ; "A Treatise on Physics," by Prof. A. Gray, F.R.S., in three parts, illustrated ; "Chemistry, an exact Mechanical Philosophy," by Fred. G. Edwards ; and new editions of :—"Carpenter's Microscope and its Revelations," edited by Rev. Dr. W. H. Dallinger, F.R.S., illustrated ; "A Systematic Handbook of Volumetric Analysis," by Francis Sutton, illustrated ; "The Microtomist's Vade-Mecum : a Handbook of the Methods of Microscopic Anatomy," by Arthur Bolles Lee, illustrated.

The Clarendon Press will publish :—"The Structure and Life History of the Harlequin Fly," by Prof. L. C. Miall, F.R.S., and A. R. Hammond ; "A Catalogue of Eastern Lepidoptera Heterocera in the Oxford University Museum," Part ii., *Nocturna*, by Colonel C. Swinhoe ; Goebel's "Organography of Plants," translated by Prof. I. Bayley Balfour, F.R.S. ; and "A Text-Book of Arithmetic," by R. Hargreaves.

Mr. W. B. Clive's announcements include :—"The Tutorial Arithmetic," by W. P. Workman ; "The Tutorial Algebra," Part i., by R. Deakin ; "First Stage Physiology" ; "Section One Physiography" ; "First Stage Hygiene," by R. A. Lyster ; "Advanced Inorganic Chemistry (Practical)" ; "First Stage Mathematics," edited by William Briggs ; and "First Stage Botany," by Dr. A. J. Ewart.

Messrs. A. Constable and Co. promise :—"Acetylene Gas," by Prof. Vivian B. Lewes, illustrated ; "Auto-Cars and Horseless Carriages," by Worby Beaumont and Dugald Clerk, illustrated ; an illustrated volume by Sir Dietrich Brandis, F.R.S., on Indian forest trees ; a volume by Percy Newberry, giving a record of the exploration and full description, with hieroglyphics, &c., of the tomb of Rekhmara ; and one by Bertram Blount, on the subject of electro-metallurgy.

In Messrs. J. M. Dent and Co.'s list we notice :—"The Races of Mankind," by Dr. Huberlandt ; "Physiology and Hygiene," by Drs. Redman and Sieler ; "An Essay on Mental Culture," by G. A. Hight ; and "Forestry," by Dr. Nesbit.

Messrs. Duckworth and Co. give notice of :—"Agricultural Botany, Theoretical and Practical," by J. Percival ; "A Glossary of Botanic Terms," by B. D. Jackson ; and "A Handbook of British Rubi," by Rev. W. M. Rogers.

In Messrs. R. A. Everett and Co.'s list we find :—"A Handbook of Clinical Veterinary Medicine," by Frank T. Barton ; and "A Handbook of Clinical Veterinary Surgery," by Frank T. Barton.

Mr. Gustav Fischer calls attention to :—"Die Ohrenheilkunde im Kreise der medizinischen Wissenschaften," by Dr. E. Bloch ; "Untersuchungen über den Bau der Brachiopoden," by Dr. F. Blochmann, zweiter teil ; "Bericht über die Thätigkeit des Königl. Instituts für Serumforschung und Serumprüfung zu Steglitz. Juli 1896–September 1899," by Dr. W. Dönitz ; "Das Aether-Verfahren beim Frühtreiben mit besonderer Berücksichtigung der Fliedertreiberei," by W. Johannsen ; "Jahresberichte über die Fortschritte der Anatomie und Entwicklungsgeschichte," edited by Dr. G. Schwalbe, o. ö. neue folge, vierter band, drei abteilungen, litteratur 1898 ; "Lehrbuch der klinischen Hydrotherapie," by Dr. Max Matthes ; "Mitteilungen aus den Grenzgebieten der Medizin und Chirurgie," sechster band, erstes heft ; "Untersuchungen über die Möller-Barlow'sche Krankheit," by Schoedel and Nauwerck ; "Vorträge, Klinische, aus dem Gebiete der Otologie und Pharyngo-Rhinologie," edited by Dr. Haug ; "Die diätetische Küche für Magen- und Darmkranke," by Dr. Carl Wegele.

Messrs. Gay and Bird announce :—"Comparative Physiology and Morphology of Animals," by Le Conte.

The announcements of Messrs. Charles Griffin and Co., Ltd., are :—"The Principles and Construction of Pumping Machinery: Steam and Water Pressure," by Henry Davey, illustrated ; "Road Making and Maintenance," by Thomas Aitken, illustrated ; "The Metallurgy of Steel," by F. W. Harbord, illustrated ; "The Cyanide Process of Gold Extraction," by James Park, illustrated ; "A Dictionary of Dye-Chemicals ; a Compendium of Dyes, Mordants, and other substances employed in Dyeing, Calico-printing and Bleaching," by C. Rawson, W. M. Gardner and W. F. Laycock, with formulæ, properties, applications, &c. ; "A Dictionary of Textile Fibres," by Wm. J. Hannan, illustrated ; "Practical Coal Mining," by George L. Kerr, illustrated ; "Flesh Foods, with Methods for their Chemical, Microscopical and Bacteriological Examinations," by C. Ainsworth Mitchell, illustrated ; "Marine Meteorology, for Officers of the Merchant Navy," by William Allingham, illustrated ; "Official Year-Book of Scientific and Learned Societies of Great Britain and Ireland," seventeenth annual issue ; and new editions of "Gas, Oil, and Air Engines," by Bryan Donkin, illustrated.

Mr. John Lane promises :—"All About Dogs," by Charles Henry Lane, illustrated ; and "Birds of My Parish," by E. Pollard, illustrated.

Messrs. Longmans and Co.'s list includes :—"Malaria, according to the New Researches," by Prof. Angelo Celli, translated by John Joseph Eyre, with corrections and additions ; and "A Manual of Surgical Treatment," by Prof. W. Watson Cheyne, F.R.S., and Dr. F. F. Burghard.

The list of Messrs. Sampson Low and Co., Ltd., contains :—"The Diuturnal Theory of the Earth, or Nature's System of Constructing a Stratified Physical World," by William Andrews ; "Artificial Ice Making and Refrigeration," by L. M. Schmidt ; "The Surgical Diseases of the Genito-Urinary Tract," by Dr. Frank Lydston, illustrated ; and a new edition of "Instruction in Photography," by Sir W. de W. Abney, K.C.B., F.R.S.

Messrs. Macmillan and Co., Ltd., give notice of :—"A Manual of Medicine," edited by Dr. W. H. Allchin, in 5 vols., vol. i. ; "Micro-organisms and Fermentation," by Alfred Jorgensen, translated ; and "Inorganic Evolution as studied by Spectrum Analysis," by Sir Norman Lockyer, K.C.B., F.R.S.

Mr. John Murray's list includes :—"Heredity," by Prof. J. Arthur Thomson, illustrated ; and a new edition of "The Natural History of Religion, based on the Gifford Lectures delivered in Aberdeen in 1889–90 and 1890–91," by Prof. Edward Burnett Tylor, F.R.S.

Messrs. Geo. Newnes, Ltd., will add to their Library of Useful Stories :—"The Story of the Alphabet," by Edward Clodd, illustrated; "The Story of Bird Life," by W. P. Pycraft, illustrated; "The Story of Thought and Feeling," by F. Ryland.

Messrs. Sands and Co.'s list contains :—"The Animals of Africa," by H. A. Bryden, illustrated; "Types of British Plants," by C. S. Colman; and "Walks round the Zoo," by F. G. Aflalo, illustrated.

Messrs. Smith, Elder and Co. announce :—"Orthopædic Surgery," by C. B. Keetley; and "Lectures on the Practice of Medicine," by Dr. W. B. Cheadle.

Messrs. Swan Sonnenschein and Co., Ltd., promise :—"The Antarctic," by Dr. Karl Fricker, illustrated; "Physiological Psychology," by Prof. W. Wundt, translated by Prof. E. B. Titchener, 2 vols., illustrated; "Text-Book of Palæontology for Zoological Students," by Theodore T. Groom, illustrated; "Text-Book of Embryology: Invertebrates," by Dr. E. Korschelt and Dr. K. Heider, translated from the German by Mrs. H. M. Bernard, and edited (with additions) by Martin J. Woodward, vol. iv., illustrated; "Mammalia," by the Rev. H. A. Macpherson; "Birds' Eggs and Nests," by W. J. C. Ruskin Butterfield; "The Romance of the Earth," by Prof. A. W. Bickerton, illustrated; "Biological Types in the Vegetable Kingdom," by Wilfred Mark Webb; and new editions of "Handbook of Practical Botany, for the Botanical Laboratory and Private Student," by Prof. E. Strasburger, edited by Prof. W. Hillhouse, illustrated; "The Dog: its Management and Diseases," by Prof. Woodroffe Hill, illustrated.

Mr. Fisher Unwin gives notice of :—"In Birdland with Field Glass and Camera," by Oliver G. Pike, illustrated.

Messrs. Whittaker and Co.'s announcements are :—"Wireless Telegraphy and Hertzian Waves," by S. R. Bottone; "English and American Lathes," by J. G. Horner; "Electric Wiring Tables," by W. Perren Maycock; "Electrical Engineers' Pocket Book," by Kenelm Edgcumbe; "Inspection of Railway Material," by G. R. Bodmer; and new editions of "British Locomotives, by C. J. Bowen Cooke; and "The Atlantic Ferry," by A. J. Maginnis.

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE.*

A GRANT of 100*l.* has been made to Prof. Schafer from the Earl of Moray Endowment Fund, by the Edinburgh University Court, for purposes of original research.

ANOTHER Bill to establish a University of the United States has been introduced into the Senate. It proposes that University Square, recently occupied by the old U.S. naval observatory, be the site for the national observatory.

MR. W. E. PLUMMER, the director of the Bidston Observatory, Liverpool, under the control of the Dock Board, has been elected to an Honorary Readership in Astronomy at University College, Liverpool. The appointment has given equal satisfaction in the college and the city. It recognises Mr. Plummer's devoted and efficient service as a teacher, and the distinguished position he has attained in scientific observation and research. Without any violation of confidence, it may be said that his claims to such a recognition were cordially supported by some of the most distinguished astronomers in the kingdom.

SPEAKING at Derby on March 12, at the distribution of prizes to students of the Municipal Technical College, Sir William Abney, K.C.B., referred to the fact that at the end of this month the Department of Science and Art will come to an end. It will be merged in a department to be known as the Board of Education, which is to supervise all kinds of education—elementary, secondary and technological. He remarked: In the Queen's Speech they were promised that there should be an Education Bill introduced, reorganising the authorities for secondary education. The introduction of such a bill marked a great advance in public opinion as to the necessity of local co-ordination of the kind in question. Speaking in his private capacity, and not officially, he hoped that not only would secondary education be under a local authority, which would supervise it and look after its interests, but that all other education would be similarly managed.

MR. R. HEDGER WALLACE is entitled to speak with authority upon the subject of "Agricultural Education in Greater Britain," and his paper, published in the *Journal* of the Society of Arts of March 9, admirably summarises what is being done for agricultural education in our colonies and dependencies. The facts stated by Mr. Wallace in his survey afford sufficient evidence to justify the following conclusions :—First, that throughout Greater Britian, irrespective of climatic, racial and political divergences, there is a universal movement to give all interested in the culture of land every opportunity, facility and assistance possible to improve themselves, their art and craft, and the land and its produce. Secondly, that the purely educational or teaching facilities in agriculture offered by other portions of the Empire where the general agricultural conditions are somewhat akin to our own are not only so distributed as to cover fairly the area in question, but are also equal in educational value to any of the agricultural training or teaching institutions in this or the other countries of Europe.

THOUGH University College, Bristol, has not so many generous friends as some of the other provincial colleges of the same rank, the report of the Council shows that it not only continues to impart the highest kind of instruction in the arts and sciences, but also assists in extending the bounds of existing knowledge by means of research. As evidence of the original work carried on during the session 1898-99, an extract is given from the report of the faculty of arts and science. Among the subjects of researches mentioned are :—the physical properties of some hydrocarbons, properties of metal films, velocity of ions in non-conducting liquids, chemical composition of foods, mass of the ions in the silent electric discharge from points, the mammalian remains discovered in the Uphill Caves, and the relation of stimulus to sensation in visual impressions, involving a modification of the Weber-Fechner formula. Original work is the most valuable testimony to the efficiency of a University College; it prevents the members of the staff from falling into merely stereotyped methods of teaching, it is a valuable example and incentive to students, and it serves to make the college known as a centre of intellectual endeavour. Compared with former years, the college was exceptionally fortunate during the session covered by the present report, for it received a legacy of 5000*l.* from the late Mr. Stuckey Lean, and an anonymous donation of 1000*l.*, as well as a generous legacy of scientific books from the late Mr. J. T. Exley, who also bequeathed to the college his collection of scientific apparatus. The council are looking forward with confidence to the newly-established Colston Society, which has for its object the endowment of Colston Chairs in connection with the college, or the assistance of the Institution in such other manner as the committee of the society may approve. It is to be hoped that the promotion of the cause of higher education in Bristol in this manner will receive the strong support of all classes of citizens. The president of the college, the Lord Bishop of Hereford, has been elected first president of the society.

THE following announcements from recent numbers of *Science* show that natural knowledge has many liberal friends in the United States :—Mr. John D. Rockefeller has given 100,000 dollars to Columbia University to endow the chair of psychology. Mr. Andrew Carnegie has given 300,000 dollars to Cooper Union, New York City, and 200,000 dollars has been contributed by Abram S. Hewitt and Mr. Edward Cooper; this will enable the Union to establish courses in mechanic arts. Syracuse University receives 25,000 dollars by the will of the late Mr. Erastus F. Holden, of Syracuse; the bequest will be used for the department of astronomy and for the observatory. Oberlin College receives 75,000 dollars by the will of the late Mrs. Caroline E. Haskell, of Michigan City, Indiana; and 40,000 dollars by the will of the late William Osborne, of Pittsburg. By provision of the will of the late Dr. John Stanford Sayre, Princeton University will receive 40,000 dollars, part of which is for the endowment of fellowships in applied chemistry and in applied electricity. President Schurman has announced an anonymous gift of 80,000 dollars for Cornell University to erect a building for physiology and anatomy. By a decision of the New York Court of Appeal, Yale University will receive the 150,000 dollars bequeathed by William Lampson. President Bashford, of the Ohio Wesleyan University, announces that Mrs. Elizabeth Mebarry, of Richmond, Ind., who recently gave 50,000 dollars to the University, has added 10,000 dollars to the fund, thus endowing two chairs. By the will of the late

Dorman B. Eaton, Columbia University receives 100,000 dollars to found a professorship of municipal science and administration, and Harvard University 100,000 dollars to endow a chair in the science of government. Mr. Louis H. Severance, of New York City, has given 60,000 dollars to Oberlin College for a chemical laboratory. The provision made for the college by Mrs. C. E. Haskell amounts to 77,000 dollars. St. Lawrence University has recently received a gift of 24,000 dollars from a friend of that institution. A half million dollars will be distributed by Dr. D. K. Pearsons, of Chicago, among fourteen colleges throughout the United States. Most of his donations will be made on condition that the colleges raise a certain amount, generally 50,000 dollars, or an amount equal to the gift, within a given time. Dr. Pearsons has already given 2,500,000 dollars to the cause of education.

## SCIENTIFIC SERIALS.

*Transactions of the American Mathematical Society*, January.—At the February meeting of the Society last year, the President announced that the Council had reported that it was "desirable and feasible, and in all respects for the best interests of mathematical science in this country, that the Society should undertake the periodical publication of *Transactions*, beginning with January 1, 1900." The well-printed and altogether admirable first part is now before us, and we heartily wish good speed to the venture, "the success of which is already well assured." The size of the page is approximately 11 × 8 inches, and so is intermediate between the *Bulletin* and *American Journal of Mathematics* pages.—Conics and cubics connected with a plane cubic by certain co-variant relations, by H. S. White, is a paper which was read, with a slightly different title, at the August (1899) meeting. By employing the irrationality that occurs in Hesse's canonical form of the cubic, the writer is able to identify Hilbert's two systems of irrational co-variant conics, and to exhibit certain other relations, and thence to give explicitly co-variant equations of definition for the two cubics which have the same Hessian, and for those which have the same Cayleyan, as a given fundamental cubic. The results are attained by the aid of a canonical form of the cubic containing Hesse's irrationality. The conics discussed are Hilbert's co-variant conics (*cf.* letter addressed to M. Hermite, Liouville, vol. iv. 1888). The invariantive proofs of some of the foregoing results are given in the next paper, Formentheoretische entwickelung der in Herrn White's Abhandlung über curven dritter ordnung enthaltenen Sätze, by Paul Gordan.—Sur la définition générale des fonctions analytique, d'après Cauchy, by E. Goursat, has its object thus indicated.—J'ai reconnu depuis longtemps que la démonstration du théorème de Cauchy, que j'ai donné en 1883, ne suffisait pas la continuité de la dérivée. Pour répondre au désir qui m'a été exprimé par M. le Professeur W. F. Osgood, je vais indiquer ici rapidement comment on peut faire cette extension.—On a class of particular solutions of the problem of four bodies, by F. R. Moulton, treats the case of three bodies finite, moving in *circles* according to one or the other of the solutions of Lagrange, while the fourth is infinitesimal.—Definition of the Abelian, the two hypo-Abelian, and related linear groups as quotient groups of the groups of isomorphisms of certain elementary groups, by Dr. L. E. Dickson, aims at giving a natural definition of these groups based upon Jordan's "important, but artificial, conception of *exposants d'échange*." It is written in the author's usual thorough style.—H. Maschke gives a half-page note on the unilateral surface of Mœbius.—On regular singular points of linear differential equations of the second order whose coefficients are not necessarily analytic, by M. Bôcher. The writer remarks that since the time of Cauchy it has been considered of interest to establish the existence of solutions of differential equations whose coefficients are functions of a real variable $x$, and to do this without requiring these coefficients to be analytic functions of $x$, but merely continuous functions. It is a natural extension of this point of view to wish to investigate the nature of singular points of such equations, *i.e.* of points where the coefficients become discontinuous. It is M. Bôcher's object to carry through such an investigation in a special case, viz. that of

$$\frac{d^2y}{dx^2} + p\frac{dy}{dx} + qy = 0,$$

where the independent variable ($x$) is real, and $p$, $q$ are functions of $x$, which are not required to be analytic.—The elliptic $\sigma$-functions considered as a special case of the hyperelliptic $\sigma$-functions, by O. Bolza. This paper has a two-fold object. In the first place it gives a sketch of the theory of the "elliptic" in the light of the theory of the "hyperelliptic" functions; and secondly, it serves as an introduction for a future paper in which an analogous presentation is given of the hyperelliptic $\sigma$-functions.—Dr. G. A. Miller writes on the groups which are the direct products of two sub-groups, and E. H. Moore discusses certain crinkly curves (reff. are made to papers by Peano, *Math. Ann.* vol. xxxvi.; Cesàro, *Bulletin des Sciences Math.*, vol. xxi. 1897; Hilbert, *Math. Ann.* vol. xxxviii.). There are several diagrams.—Dr. L. E. Dickson gives a new definition of the general Abelian linear group.—If the high character of the present number is maintained, it is safe to prophesy that the *Transactions* are come to stay.

*Bollettino della Società Sismologica Italiana*, vol. v. 1899–1900, No. 6.—On seismic registrations of long period, by E. Oddone (see p. 477).—The earthquake of Ventotine on March 27, 1899, and the tromometric records obtained at the Collegio Bianchi, in Naples, and at Reggio di Calabria, by P. G. Costanzo.—Earthquake of Balikesri, in the north-west part of Asia Minor, on September 14, 1896, by G. Agamennone.—Notices of earthquakes recorded in Italy (July 30–October 11, 1898), by A. Cancani, the most important being the earthquakes of Janina on July 31, Calabria-Sicily on August 6 and 12, and Umbria-Marches on August 25 and September 11, and distant earthquakes on September 1, 13 and 22.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, February 22.—"The Ionisation of Dilute Solutions at the Freezing-point." By W. C. D. Whetham, M.A., Fellow of Trinity College, Cambridge.

This paper contains a description of the electrical part of a joint research, by Mr. E. H. Griffiths and the author, on the freezing-points and electrical conductivities of very dilute solutions of the following substances:—Sulphuric acid, potassium chloride, barium chloride, copper sulphate, potassium permanganate, potassium ferricyanide and potassium bichromate. In order to eliminate the effect of dissolved glass, the water used as solvent was distilled in a platinum still and collected in platinum vessels; a known weight was then placed in a platinum cell, and weighed quantities of stock solution added, in successively increasing amounts. The concentration of the solutions thus prepared was calculated in terms of the number, $m$, of gram-equivalents of solute dissolved in one thousand grams of solution. In order to control the temperature, the platinum cell was surrounded by a coil of tubing through which evaporated ether vapour could be passed. The whole was surrounded by a brass case fixed in the middle of a large tank filled with broken ice. The walls of the platinum vessel formed one electrode, and a platinum cage suspended within it the other. Inside this cage revolved a platinum tube which contained a thermometer, and also served as the shaft of a screw. This screw kept the contents of the cell at a uniform temperature, and mixed the stock solutions with the liquid previously within the cell. The electrical resistances were measured by the method of alternating currents, the connections of the Wheatstone's bridge with a dry cell and with a D'Arsonval galvanometer being reversed simultaneously by means of a revolving commutator driven by a hand wheel and cord. This arrangement is more convenient and more sensitive than the usual telephone apparatus. The conductivity thus found was corrected for the conductivity of the solvent, and the result, $k$, divided by $m$, gave the equivalent conductivity of the solution. Curves were drawn between $\sqrt[3]{m}$ and $k/m$, and the maximum value of these taken to indicate complete ionisation. The ionisation, $\alpha$, of the solutions was then calculated by dividing the maximum $k/m$ into its actual value, and new curves were drawn between $\sqrt[3]{m}$ and $\alpha$. The general form of these curves resembles that of the corresponding ones obtained by Kohlrausch and other observers at 18°, but the slant of the lines is different both from Kohlrausch's observations, and also from new observations made with the present apparatus at 18°. The abnormal type of curve found at 18° for acids and alkalies is shown to appear at 0° in the case of sulphuric acid, the ionisation reaching a maximum as the dilution is increased, and then suddenly becoming much less. Reasons are given for

doubting the usual explanation of this effect, which refers it to interaction with the residual impurities of the solvent, the phenomena being different to those observed in the case of permanganate, a salt showing a somewhat similar drop in the curve, for which the usual explanation is satisfactory. Potassium bichromate gives a curve consisting of two well-marked parts—perhaps owing to a change in the nature of the ions at different concentrations. Mr. Griffiths is engaged in measuring the depression of the freezing-point of corresponding solutions, and, when his results are published, a comparison of the two sets of values will be made.

March 1.—"Mathematical Contributions to the Theory of Evolution. VIII. On the Correlation of Characters not Quantitatively Measurable." From the Department of Applied Mathematics, University College, London. Presented by Karl Pearson, F.R.S.

In August last I presented to the Royal Society a memoir on the inheritance of coat-colour in thoroughbred horses, and of eye-colour in man. This memoir, which was read in November of last year, presented the novel feature of determining correlation between characters which were not capable *à priori* of being quantitatively measured. The theoretical part of that memoir was somewhat brief, but I showed by illustrations that the method could be extended to deal with problems like the effectiveness of vaccination and of the antitoxin treatment in diphtheria. More recently, in studying the phenomena of reversion in Basset Hounds, Mr. Bramley-Moore indicated to me how my method, although correct in theory, differed sensibly in the numerical results with the processes of interpolating employed. I then proposed a new method, and the analytical discussion of its details was worked out in part by Mr. Bramley-Moore himself, by Mr. L. N. G. Filon, M.A., and by myself. Dr. Alice Lee also came to our assistance, and the result is the present joint paper. On the basis of the new methods, we have already worked out upwards of sixty coefficients of correlation, principally of heredity.

The theory of the present memoir depends upon a very simple feature of normal correlation. If $z\delta x_1\delta x_2 \ldots . \delta x_n$ be the frequency of a complex of characters lying between $x_1$ and $x_1+\delta x_1$, $x_2$ and $x_2+\delta x_2 \ldots .$, $x_n$ and $x_n+\delta x_n$, where $x_p$ is the deviation of the $p$th character from its mean, then

$$\frac{dz}{dr_{pq}} = \frac{d^2z}{dx_p dx_q}$$

where $r_{pq}$ is the correlation of the $p$th and $q$th organs.

This simple differential relation enables us to expand $z$ for any number of characters in powers of the correlation coefficients (necessarily less than unity) by Maclaurin's theorem. But since we may replace a differential with regard to a coefficient of correlation by a double differential with regard to the corresponding organs, the coefficients of correlation may be put zero *before* instead of after the differentiation. In other words, we obtain a symbolic operator which, applied to a normal surface of frequency for $n$-uncorrelated organs, converts it into a correlated surface of frequency with $\frac{1}{2}n(n-1)$ coefficients of correlation of arbitrary values. This operator gives us by aid of certain symbolic equations the expansion of the $n$-fold integral

$$\int_{h_1}^{\infty}\int_{h_2}^{\infty}\int_{h_3}^{\infty} \ldots\ldots \int_{h_n}^{\infty} z dx_1 dx_2 dx_3 \ldots\ldots dx_n$$

in terms of the $\frac{1}{2}n(n-1)$ coefficients of correlation, and a series of new functions which we term the $v$-functions. These satisfy the difference equation:

$$v_n = xv_{n-1} - (n-1)v_{n-2}$$

and the differential equation

$$\frac{dv_n}{dx} = nv_{n-1}.$$

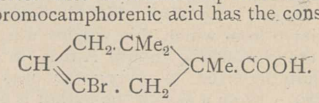
The calculation of these functions is shown to be easy, and their properties are investigated. In this manner the volume of a frequency surface of the $n$th order cut off by $n$ planes parallel to the $n$ co-ordinate planes is shown to be capable of calculation, and its value is determined in the numerical illustrations given for example of 1, 2, 3 up to 6-fold correlation. It may be noted that by putting $h_1=h_2=h_3= \ldots \ldots =h_n=0$, we have really obtained a result which enables us to find the "area" of a "spherical triangle" in $n$-fold hyperspace in terms of a series ascending by powers and products of the cosines of the angles between its faces.

The application of these results to the correlation of characters not quantitatively measurable, arises from the fact that the $n$-fold integral above given, and which we have shown how to evaluate, measures the total frequency beyond certain boundaries. We can observe, for example, whether horses' coats are bay and darker (or chestnut and lighter), whether eyes are grey and lighter (or, dark grey and darker). Thus by forming mass frequencies instead of frequency distributions for small changes of character, we can find equations to determine the correlation. The probable error of such correlation, the convergency of the series, and other points are investigated.

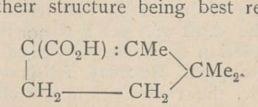
A number of illustrations of the new method are given from heredity in horses, dogs and man, and it is shown how normality of frequency must even for such a character as stature[1] only be looked upon as a first approximation.

An investigation is also made into the influence of superior stock in producing superior offspring. It is shown, for example, that if an individual who possesses a degree of character only found in one in twenty be considered "exceptional," then eighteen times as many exceptional men will be born of non-exceptional parents as of exceptional parents; but, on the other hand, exceptional parents produce exceptional offspring at a rate ten times as great as non-exceptional parents, the greater gross product of the latter being due to their much greater numbers. In other words, distinguished parents are more likely to have distinguished offspring than undistinguished—ten times as likely—and yet only one distinguished man in nineteen will be born of distinguished parents. The importance of such conceptions for both natural and artificial breeding can hardly be over-estimated.

**Chemical Society**, March 1.—Prof. Thorpe, President, in the chair.—The following papers were read:—On pilocarpine and the alkaloids of jaborandi leaves, by H. A. D. Jowett. The jaborine of commerce is shown to be a mixture of isopilocarpine, pilocarpidine and a trace of pilocarpine with colouring matter; no evidence has been obtained of the existence of the alkaloid previously described as jaborine.—Isomeric partially racemic salts containing quinquevalent nitrogen. Hydrindamine bromocamphorsulphonates, chlorocamphorsulphonates and *cis*-π-camphanates, by F. S. Kipping. The author explains the formation of two isomeric salts of externally compensated hydrindamine with bromocamphorsulphonic, chlorocamphorsulphonic or *cis*-π-camphanic acid as due to partial racemism.—New syntheses of indene, by F. S. Kipping and H. Hall. Hydrindamine hydrochloride decomposes almost quantitatively into indene and ammonium chloride when heated.—Potassium nitritohydroximidosulphates and the non-existence of dihydroxylamine derivatives, by E. Divers and T. Haga. Raschig's dihydroxylamine derivatives are merely crystalline compounds of potassium nitrite with the 2/3 and 5/6 normal potassium hydroximidosulphates. — Identification and constitution of Fremy's sulphazotised salts of potassium, by E. Divers and T. Haga.—Some acids obtained from α-dibromocamphor, by A. Lapworth and E. M. Chapman. Camphonic acid, $C_{10}H_{16}O_3$, obtained by hydrolysing α-monobromocampholid, is a ketonic acid yielding an oxime, a semicarbazone and phenylhydrazones; it may be converted into tribromocamphonolactone, which fact indicates that bromocamphorenic acid has the constitution



—Spectrographic studies in tautomerism. The absorption curves of the ethyl esters of dibenzoylsuccinic acid, by W. N. Hartley and J. J. Dobbie.—The curves of molecular vibrations of benzantialdoxime and benzsynaldoxime, by W. N. Hartley and J. J. Dobbie.—On campholytic and isolauronolic acids, by J. Walker and W. Cormack. As a result of further work, the authors consider that campholytic and isolauronolic acids are stereoisomeric, their structure being best represented by the formula



—The configuration of the camphoric acids, by J. Walker and J. K. Wood.—The constitution of camphoric acid, by J. Walker. The author considers the Perkin-Bouveault formula for camphoric acid to be the most satisfactory hitherto proposed.

[1] Cited by so many as an example of "normality."

—On the presence of invertase in plants of the Gramineæ (I.), by J. O'Sullivan.—Iodonium compounds of the type IR′R″R‴ and the configuration of the iodine atom, by F. S. Kipping and H. Peters. The authors have prepared phenylparatolyliodonium hydroxide

$$\begin{matrix} C_6H_5 \\ C_6H_4Me \end{matrix}\!\!>\!\!I.OH,$$

and, since they could not resolve it into enantiomorphous components, they conclude provisionally that the three iodine valencies are arranged in one plane.—Note on the decomposition of semicarbazones, by F. S. Kipping. On heating benzaldehyde semicarbazone it yields the azine

$$C_6H_5.CH : N.N : CH.C_6H_5;$$

the formation of azines from aromatic semicarbazones is a fairly general reaction.

**Geological Society**, February 16.—Annual General Meeting.—W. Whitaker, F.R.S., President, in the chair.—The reports of the Council and of the Library and Museum Committee having been adopted, the medals and other awards already announced (p. 279) were presented. The President then proceeded to read his Anniversary Address, in which he first gave obituary notices of several foreign members, foreign correspondents, and fellows deceased since the last annual meeting. He then referred to the great advance in geological science in his own time, an advance that consisted largely of the arising of new lines of work and not merely of progress in old ones: thus petrology was a new branch of the science. Palæontology had been affected by the growth of the theory of evolution. In physical geology, such subjects as metamorphism, mountain-structure, and erosion had entered into new phases. In stratigraphy the geological series had been extended downward below the Cambrian, and, at the other end of the scale, our knowledge of the Drift had greatly developed, largely owing probably to geological discoveries connected with the antiquity of man. He then treated of the advance in our knowledge of underground geology, especially in the south-east of England, a subject in which comparatively little was known forty-five years ago; and he described in some detail the underground extension and thickness of various formations, particularly of those below the Chalk, under the heads Upper Greensand, Gault, Lower Greensand, Wealden and Purbeck, Jurassic, Lias and Trias, and Older Rocks, referring to the amount of knowledge which we possess in the London Basin, and its southern border in the Wealden district, as compared with the Hampshire Basin.

February 26.—J. J. H. Teall, F.R.S., President, in the chair.—"The Bunter Pebble-Beds of the Midlands and the Source of their Materials," by Prof. T. G. Bonney, F.R.S. The author states the results of occasional work in the Bunter Conglomerate of Staffordshire. After a sketch of matter already published, he gives additional particulars of the lithology of the pebbles, more especially of the felstones and of some rather compact dark rocks. The mode of transport and source of the pebbles are next considered. The reasons, already published, for a fluviatile, as opposed to a marine, origin are briefly summarised.—"Further Evidence of the Skeleton of *Eurycarpus Oweni*," by Prof. H. G. Seeley, F.R.S. The original specimen from which this species was named was obtained from the Sneewberg (South Africa) in 1876, and after being doubtfully referred to *Dicynodon* was described and figured in 1889. From a sketch the author is able to give some account of the skull, including its dimensions. From other material he gives new facts with regard to the vertebral column, the ribs, the shoulder-girdle, the fore-limb, the hind-limb, and the armour, which was present upon the limbs and the fore part of the body. The locality from which the animal was obtained appears to be one of the chief localities for the Lycosaurian types of Theriodontia, and to be on the horizon of the *Dicynodon*-beds. The recovery of the missing half of the Murray slab, with the evidence of the skull and pelvis which it would give, is to be desired in completion of our knowledge of this fossil animal.

**Royal Microscopical Society**, February 21.—Mr. Wm. Carruthers, F.R.S., the President, in the chair.—Mr. E. M. Nelson, in presenting a "'Jones' most improved combined microscope and apparatus," said the Society had not hitherto possessed an example of this instrument in its collection. The exact date of the instrument was a little uncertain, but he believed it to be about the last improvement in the non-achromatic microscope. The first published description of this microscope with a figure is to be found in Adams' "Essays on the Microscope," 1798.—Dr. J. W. Measures exhibited the photomicrographic and projection apparatus made by Carl Zeiss, of Jena. The apparatus was very complete, sufficing both for photo-micrography and for projection. The camera was fitted with a bellows divided into two parts, and though carried upon a stand separate from that which carried the microscope and illuminating apparatus no inconvenience had been found to arise from vibration. An arc light was used supplied by a continuous current of 65 volts and 30 amperes. The condenser, water-chamber, iris diaphragm, and other parts required for illumination were fitted upon saddles sliding upon a Λ-shaped rail in front of the lamp, so that when once they had been accurately centred they could be moved along the rail to any required position without getting out of the centre. The first part of the exhibition illustrated the use of the arrangements for projecting the images of opaque objects upon the screen. This was followed by the exhibition of microscopic slides, comprising insects, plant sections, marine polyps, and preparation of animal tissues chiefly by means of the Zeiss microplanar objectives. The last portion of the exhibition consisted of lantern-slides of plants, animals and landscapes, and some fine photo-micrographs of diatoms, lent for the occasion by Dr. Spitta. The apparatus is constructed so as to render the transition from *micro* to *macro* projection, and the reverse, rapid and easy, the rearrangement of parts being effected in from one to three minutes.

**Linnean Society**, March 1.—Dr. A. Günther, F.R.S., President, in the chair.—Mr. W. Saville Kent exhibited lantern-slides of several British flowering plants to show the remarkable advances which have been recently made in colour photography.—Mr. C. B. Clarke, F.R.S., read a paper on botanic nomenclature. He showed that the new rule adopted at Berlin—not to disturb names that had fifty years' user on the ground of priority alone—resulted in a practical uniformity with the system of naming adopted by Mr. Bentham and Sir J. D. Hooker. The Old World, he said, had thus reached a fair general agreement in nomenclature. The American botanists follow a new system which aims at finality on a so-called "non-shifting basis" in which the genus or species, as the case may be, is established on a type-specimen. Mr. Clarke's paper was devoted mainly to showing by selected instances that this system did not ensure finality; that the errors in determining what should be ranked as the type are enough to discredit the system; and the author commented on the disputed question whether a plant should be given the oldest specific name bestowed upon it, or the oldest specific name it bears in the genus in which it is now placed.—Mr. F. Chapman read a paper on some foraminifera of Tithonian age from the limestone of Nesseldorf.

**Entomological Society**, March 7.—Mr. G. H. Verrall, President, in the chair.—Mr. H. Rowland-Brown was elected into the Council and as joint-Secretary in the place of Mr. J. J. Walker, R.N., who had resigned.—Mr. C. G. Barrett exhibited a series of varieties of *Spilosoma dorsalis* from South Africa, showing variation in some degree parallel with that of *S. lubricipeda* in Great Britain.—G. W. Kirkaldy exhibited several Rhynchota of economic interest, among them *Aegaleus bechuana*, Kirk., from Africa, which attacks coffee, and *Parlatoria victrix*, Ckll., from Phœnix, Arizona, found on date palms. The last-named Coccid was originally introduced from Egypt, and all attempts at eradication had hitherto failed. He also showed a series of thirteen colour-varieties of the oriental Scutellerine *Cantao ocellatus* (Thunb.), and examples of *Distantidea vedda* from Ceylon, in which the rostrum was very long, extending as far as to the apex of the abdomen.—Papers were communicated by Mr. W. L. Distant on "Undescribed genera and species belonging to the Rhynchotal family *Pentatomidae*," and by Mr. G. J. Arrow "On Pleurostict Lamellicorns from Grenada and St. Vincent (West Indies)." Mr. C. J. Gahan read a paper on "Stridulating organs in Coleoptera," in which he remarked that one of the best accounts of them was to be found in "The Descent of Man," but since that work was written several additional instances of their occurrence had been made known, showing that these organs were less uniform in structure and even more wonderfully diversified in position than Darwin considered them to be; while their discovery in the larvæ of certain forms would lead to some modification of the view that they have originated in connection with sex and primarily serve the purpose of attracting the sexes to one another.

**Mathematical Society**, March 8.—Prof. Elliott, F.R.S., Vice-President, in the chair.—The chairman announced that in accordance with a resolution passed at the Council meeting, the meetings of the Society would in future be held at 5.30 p.m. instead of at 8 p.m. as heretofore. The days of meeting will remain unaltered.—Prof. Elliott then dwelt upon the losses to mathematics which had resulted from the recent decease of Prof. E. Beltrami (Hon. Foreign Member), and of Mr. J. J. Walker, F.R.S. The latter gentleman was almost an original member of the Society, had served on the Council some twenty years, had been a most regular attendant at its meetings, and had contributed about twenty papers to its *Proceedings*. He had served as Vice-President four years, and President two years. Votes of condolence were unanimously passed in silence, and the senior secretary was directed to communicate to the relatives of the deceased the sympathy of the Society.—Prof. Lamb, F.R.S., read a paper, "Problems relating to the impact of waves on a spherical obstacle in an elastic medium."—Mr. W. F. Sheppard (Prof. Lamb, Vice-President, in the chair), spoke on the use of auxiliary curves in statistics, with tables for the curve of error.—Major Macmahon, F.R.S., Prof. Lamb and Mr. R. Hargreaves, discussed points which arose out of the communication.—A supplementary note on the theory of automorphic functions, by Prof. A. C. Dixon, was taken as read.

CAMBRIDGE.

**Philosophical Society**, March 5.—Mr. J. Larmor, President, in the chair.—Considerations regarding the Zeemann effect, by J. Larmor.—On the simplest algebraic minimal curves and the derived real minimal surfaces, by H. W. Richmond. The discovery of real algebraic minimal surfaces of the lowest degrees forms a part of the first of the two classical memoirs on the subject of minimal surfaces contributed by Sophus Lie to *Math. Annalen* xiv. and xv. When Lie's work is examined in the light of the fuller knowledge we now possess concerning space-curves of orders three or four, it appears that it is possible in most cases to write down the equations of the curves and surfaces found by him in a fairly simple form; but that one of the surfaces that he quotes is non-existent.—On Diophantine inequalities, by G. B. Mathews. This is a continuation of a recent paper of Major Macmahon's (*Camb. Trans.* vol. xviii).—Experiments on impact, by J. H. Vincent. When inflated india-rubber balls are allowed to fall on a stone floor the coefficient of restitution, $e$, is found to be a linear function of the velocity just before impact. This law holds also for a steel ball impinging on a block of india-rubber; but it does not hold for a steel ball impinging on the plane surfaces of blocks of paraffin wax, lead, brass and cast-iron. In these cases the curve obtained by plotting $e$ against $v$ the velocity of approach is convex towards the origin of co-ordinates and all the four curves are very similar; the value of $e$ rises rapidly as $v$ decreases. The permanent deformation produced by the impact was studied in these cases and was found to obey remarkably simple laws.—On the distance between the striæ and on other phenomena connected with the discharge of electricity, by R. S. Willows.—The teaching of mechanics by experiment, by Prof. Ewing. Prof. Ewing pointed out how by a course of suitable experiments students could not only be rendered familiar with the general principles of mechanics but could at the same time learn how to apply these principles to practical questions, and how to detect and allow for the causes which produce aberrations from what may be called the theoretical result. He exhibited in illustration of his remarks a number of self-contained pieces of apparatus for experiments in statics, dynamics and elasticity.

MANCHESTER.

**Literary and Philosophical Society**, March 6.—Prof. Horace Lamb, F.R.S., President, in the chair.—Dr. F. H. Bowman brought to the notice of the members the results of a series of experiments recently made in regard to the preservation of milk or cream by aeration. He explained that sterilised air is aspirated through the milk or cream in suitable vessels; and, after aeration for about twenty minutes in the sterilised air at ordinary temperature, it is found that the milk or cream so treated will keep sweet for from eight to ten days, though absolutely unchanged in composition in any way; the same milk or cream unaerated will become sour in two or three days. This discovery renders it possible for milk or cream to be kept or distributed in a perfectly pure and natural condition without the use of any preservatives or antiseptics.—On the production of nitric acid from air by means of the electric flame, by A. McDougall and F. Howles. The experiments were carried out with the view of obtaining the best conditions under which the oxidation of the nitrogen took place. The effect of varying the current in the flame was fully entered into, and the results clearly showed that for a maximum oxidation to take place the temperature of the flame must be as low as is consistent with steady working. The mode of obtaining the electric flames in parallel was described, and particulars were given relating to the drop in volts observed at the electrodes when the discharge is running. Various pieces of the apparatus used in the experiments were exhibited, photographs of the larger parts being thrown upon the lantern screen.

EDINBURGH.

**Mathematical Society**, March 9.—Mr. R. F. Muirhead, President, in the chair.—The following papers were read:—A note on change of co-ordinate axes, by Prof. Steggall.—The conditions for multiple roots of the equation in $\lambda$ $(a-\lambda, b-\lambda, \ldots\ldots)=0$, by Chas. Tweedie.—The analytical representation of a potential function by means of cylindrical and spherical harmonics, with applications to Green's problem, by John Dougall.

DUBLIN.

**Royal Irish Academy**, February 26.—Mr. John Ribton Garstin, F.S.A., Vice-President, in the chair.—Prof. D. J. Cunningham, F.R.S., read, for Prof. W. H. Thompson, a paper by the latter on degenerations resulting from cortical lesions of the temporal lobe.

PARIS.

**Academy of Sciences**, March 12.—M. Maurice Levy in the chair.—Notice on the works of M. Eugène Beltrami.—On the sexual apparatus and double fertilisation in tulips, by M. L. Guignard. The author has extended his researches on the double fertilisation in the genus *Lilium*. Similar phenomena were observed to take place in *Lilium candidum* to those previously studied in *L. Martagon* and *L. pyrenaicum*, although the work was more difficult in the case of the cultivated species. In *Endymion*, however, there are differences in the female sexual apparatus, since the two polar nuclei, the union of which produces the secondary nucleus of the embryonic sac, approach and touch each other long before the penetration of the pollen tube into the ovule. But although flattened at the surface of contact, they do not fuse, their contours remaining quite distinct.—On survey work carried out by Russian engineers by the photographic method, by M. Laussedat. An account of the survey operations for the Transcaucasian railway. The photographic method is very expeditious, and costs only about one-third of the usual survey.—On a new reaction between certain aromatic aldehydes and the sodium derivative of borneol, by M. A. Haller. The sodium derivatives of three borneols, ordinary dextrorotatory and lævorotatory borneol and lævorotatory isoborneol treated with benzaldehyde in petroleum solution all gave the same benzylidene-camphor. Derivatives are also described in which methylsalicylic aldehyde and the corresponding para-compound are substituted for the benzaldehyde.—On an application of the method of successive approximations, by M. A. Davidoglou.—On the integration of linear equations when the discriminant is not zero, by M. J. Le Roux.—On the extension of the properties of a reduced function to the fractions of interpolation of Cauchy, by M. H. Padé.—The determination of standard points in the spectrum, by M. Maurice Hamy. The author combats the view put forward recently by MM. Perot and Fabry, that the ray $\lambda 508$ of cadmium may vary slightly in wave-length with the form of vacuum tube employed. The cadmium tube without electrodes has shown no sign of variation in the constitution of the rays emitted by it even after working for fifty hours.—Theory of propulsive helices, by M. Rateau.—On gas motors, by M. L. Marchis. An analysis and criticism of the usual treatment of the cycle in gas engines. The usual assumptions lead to the absurd conclusion that the explosion produces no increase of the pressure.—On the experimental study of the Hertz exciter, by M. R. Swyngedauw. According to the theory of Poincaré and Bjerknes, the Hertz exciter emits a deadened vibration, for

which the intervals between consecutive zeros of intensity are equal; the authors' views lead to the contrary result, that the intervals between two consecutive zeros should be unequal. The experiments here described show that the minima are not equidistant, and hence confirm the latter theory.—On the capacity of symmetrical conductors submitted to polyphase tensions, by M. Ch. Eug. Guye.—On the minimum volume of fluids, by M. Daniel Berthelot. A discussion of the limiting value of the co-volume.—Action of hydrogen peroxide upon baryta, by M. de Forcrand. A thermo-chemical study of the formation of barium peroxide in aqueous solution. The precipitate formed by mixing dilute solutions of baryta and hydrogen peroxide is regarded as $Ba.[O(OH)]_2$, which on further treatment with baryta gives $Ba[O.O]_2Ba$.—Reply to the remarks of M. D. Tommasi on the electrolysis of distilled water, by M. Th. Tommasina. A question of priority.—On the electrolysis of potassium chloride, by H. André Brochet. As the amount of free alkali present in the solution increases, the formation of hypochlorite diminishes.—Solubility of benzophenone, by M. E. Derrien. Determination of the solubility of benzophenone in twenty-four solvents. The measurements were not carried out at any fixed temperature (9°·6 to 17°·6 C.), and only one figure is given for each solvent.—Dichlordimethylamido-benzoylbenzoic acid, by M. Emile Severin.—The acetals of the phenols, by M. R. Fosse. The method employed is to heat the sodium derivative of the phenol, or a mixture of the phenol, with potash, with ethylidene dichloride in sealed tubes at 120° C. The preparation and properties of the acetals $CH_3.CH(O.C_6H_5)_2$ and $CH_3.CH.(OC_{10}H_7)_2$ are described.—Remarks on the transformation of organic material taking place during germination, by M. G. André. A series of proximate analyses of the Spanish haricot during different stages of germination.—The stores of carbohydrates in the seeds of lucerne, by MM. Em. Bourquelot and H. Hérissey.—Localisation of myrosin and gum in the *Moringa*, by M. F. Jadin.—On the origin and connections of the Arthropods with the class of Onychophores, by M. E. L. Bouvier.—Anatomical study of the male generative organs of the Coleoptera with compound testicles, by M. L. Bordas.—On some new bacteria in coal, by M. B. Renault. In addition to the bacilli and micrococci already described, a new species has been found, named *B. colletus*, and another, badly preserved, resembling the *Streptothrix chromogenes* of Gasperini.—On the regional types of metalliferous layers, by M. L. de Launay.—Synthesis of the vowels, by M. Marage. Two causes have been indicated by M. Marey as being concerned with the formation of vowels, the vibration of the air, and the transport of air in the supra-laryngeal cavities. According to the experiments of the author only the first of these is indispensable.—A new method of stereometry, allowing the stereoscopic determination of the three rectangular co-ordinates of any point whatever of a radiographic object, by MM. T. Marie and H. Ribaut.—Anodic influence on nervous conductibility in man, by M. S. Leduc.—Contribution to the study of the relations between the chemical constitution and the physiological action of the alkyl derivatives of the alka loids, by M. W. Rosenstein.

## DIARY OF SOCIETIES.

*THURSDAY*, MARCH 22.

ROYAL SOCIETY, at 4.30.—The Croonian Lecture: On Immunity, with Special Reference to Cell Life: Prof. Paul Ehrlich (of Frankfort-on-Main).

ROYAL INSTITUTION, at 3.—Equatorial East Africa and Mount Kenya: H. J. Mackinder.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Storage Battery Problems: E. J. Wade.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Adjourned Discussion on Improvements in the Longworth Power-Hammer, and Portable Pneumatic Tools.—*Paper to be read:* Observations on an Improved Glass Revealer, for Studying Condensation in Steam-Engine Cylinders and rendering the Effects Visible: Bryan Donkin.

*FRIDAY*, MARCH 23.

ROYAL INSTITUTION, at 9.—Some Modern Explosives: Sir Andrew Noble.

PHYSICAL SOCIETY, at 5.—An Electromagnetic Experiment: Prof. S. P. Thompson, F.R.S.—(1) Some Experiments illustrating Syntony; (2) An Electrical Micrometer: P. E. Shaw.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Development of the Modern Locomotive Engine: J. W. Cross.

*SATURDAY*, MARCH 24.

ROYAL INSTITUTION, at 3.—Polarised Light: Lord Rayleigh.

*MONDAY*, MARCH 26.

SOCIETY OF ARTS, at 8.—The Photography of Colour: E. Sanger Shepherd.

INSTITUTE OF ACTUARIES, at 5.30.—The Methods of Analysing and Presenting the Mortality, Sickness, and Secession Experience of Friendly Societies, with Examples drawn from the Experience of the Manchester Unity of Oddfellows: Alfred W. Watson.

*TUESDAY*, MARCH 27.

ROYAL INSTITUTION, at 3.—Structure and Classification of Fishes: Prof. E. Ray Lankester, F.R.S.

ROYAL GEOGRAPHICAL SOCIETY, at 4.—Methods adopted in Surveying the Cordilleras of the Andes: Prof. Bertrand.

ANTHROPOLOGICAL INSTITUTE, at 8.30.—Native Life and Customs in Sarawak: Lantern Demonstration by Prof. A. C. Haddon, F.R.S.—Discussion by C. Hose, Resident of Baram, Sarawak; Dr. W. H. R. Rivers, and others.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Papers to be discussed:* The Great Central Railway Extension—Northern Division: F. W. Bidder; and The Great Central Railway Extension—Southern Division: F. Douglas Fox.

*WEDNESDAY*, MARCH 28.

SOCIETY OF ARTS, at 8.—Leather for Bookbinding: Douglas Cockerell.

*THURSDAY*, MARCH 29.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* On the Retinal Currents of the Frog's Eye, excited by Light and excited Electrically: Dr. A. D. Waller, F.R.S.—Observations on the Electromotive Phenomena of Non-medullated Nerve: Miss Sowton.—Variation: Prof. J. C. Ewart, F.R.S.—Mathematical Contributions to the Theory of Evolution: On the Inheritance of Characters not capable of Exact Quantitative Measurement: Prof. K. Pearson, F.R.S.

ROYAL INSTITUTION, at 3.—Mountain Exploration in the Andes: E. A. Fitzgerald.

CHEMICAL SOCIETY, at 3.—Annual General Meeting.——At 8.30.—Bunsen Memorial Lecture: Sir Henry Roscoe, F.R.S.

SOCIETY OF ARTS (Indian Section), at 4.30.—The Manufacture and Use of Indigo: Christopher Rawson.

*FRIDAY*, MARCH 30.

ROYAL INSTITUTION, at 9.—Facts of Inheritance: Prof. J. A. Thomson.

*SATURDAY*, MARCH 31.

ROYAL INSTITUTION, at 3.—Polarised Light: Lord Rayleigh.

## CONTENTS.