THURSDAY, MARCH 2, 1905.

A TEXT-BOOK OF ELECTROMAGNETISM.

Elements of Electromagnetic Theory. By S. J. Barnett, Ph.D. Pp. 480. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1903.) Price 12*s.* 6*d.* net.

MODERN electromagnetic theory is so full of interest, and yet at the same time so full of difficulties, that every fresh attempt to present an elementary account of it in a systematic and connected form is sure to attract the attention of students who are endeavouring to gain a grasp of the fundamental principles of the subject. Such students are always looking out for a "good text-book," hoping that this book, when found, will be better adapted to their needs than those they already possess. Their desire for something better probably arises, in part, from the difficulty of the subject, and the large number of new ideas which it presents to their minds. It is perhaps too much to expect that a student should be able to gain from any single book really vivid physical conceptions of electric and magnetic phenomena and principles, for perhaps, after all, these can only gradually grow in the mind. The author of the treatise under review has, it is clear, made a serious attempt to supply the student's want, so far, at least, as the more formal theory is concerned.

The book is meant to give an introduction to the subject, and thus the author does well to keep the analytical processes within the limits which are suitable for students whose mathematical attainments do not go beyond some knowledge of the differential and integral calculus and of simple differential equations.

In the first part of the book, general electrostatic theory is treated in a fairly complete way, many problems being solved. The chapters on the conduction current, on electrolysis and on thermal and voltaic E.M.F.'s, which then follow, will be found useful. The author next introduces magnetism, the magnetic action of currents, electromagnetic induction and the magnetic effects of moving charges, and concludes with a chapter on the transference of electromagnetic energy and on electromagnetic waves.

Throughout the book the system of rational units originated by Mr. Oliver Heaviside is employed. On this system, if two unit charges are placed at unit distance apart in a vacuum, each exerts a force of $1/4\pi$ dynes upon the other. The adoption of this system banishes the great 4π from many important formulæ; for instance, on the rational system, the magnetomotive force in any circuit is numerically equal to the total current linked with the circuit, and the energy per unit volume in an electrostatic field is $\frac{1}{2}cE^2$, where E is the electric force and c the specific inductive capacity. But though the 4π is driven from some formulæ it finds a refuge in others, with the result that every one of the rational units corresponding to the practical units, *i.e.* to the Coulomb, Volt, Farad, Ampere, Ohm, Gauss, Maxwell and Henry, differs from the practical unit by some power of 4π. Yet the rational system is doubtless an advantage from the point of view of pure theory, and would probably have been adopted in practice if only there had been someone to suggest it in the early days of the science. The student must remember that he is using the rational system when he compares the formulæ in this treatise with those in most other text-books.

The magnetic properties of currents are deduced from Ampère's result that the mechanical action experienced by a circuit carrying a current I is the same as it would experience if each element of length dL were acted on by a force IB sin $\theta.d$L, where B is the magnetic induction and θ is the angle between dL and B; the direction of the force is at right angles to both dL and B. In this way the idea of the equivalent magnetic shell is avoided, and, in fact, we have found no mention of a magnetic shell in the book. Yet the ideas which group themselves round a magnetic shell and the solid angle subtended by it are of real assistance, and are not easily replaced.

The book, for the most part, goes over well worn ground, and thus the reviewer's attention is naturally directed more to the treatment of the various propositions than to the propositions themselves. The treatment is generally fresh and vigorous, but in a few instances is hardly satisfactory. Taking the electrostatic field due to a point-charge, the author considers the equilibrium of a portion of the field bounded by an elementary circular cone and two concentric spheres, and shows that the tension along the lines of force requires a pressure of equal amount at right angles to them. The result is extended to the general case by the remark that "since the field within the element of volume is uniform when the element is made indefinitely small, and since this is true of any electric field, the result just obtained for a radial field holds universally."

The attempt to establish a general result by the consideration of a single special case is seldom satisfactory. In the present instance the student would not fail to notice that the method which succeeds for the non-uniform field within the conical element will not apply if the tube of force is a circular cylinder so that the field within the element is really uniform.

In chapter xiii. "the coefficient of self induction (L) of a coil or circuit is defined to be the quotient of the coil flux, N, due to the coil's own magnetic field divided by the current I in the coil." This is the way in which the coefficient is usually defined, but it is an exceedingly unsatisfactory way, for unless the conductivity of the wire be infinite, lines of magnetic induction penetrate the wire, and then it becomes difficult to understand what is meant by the "coil flux." It is impossible to escape from the difficulty by supposing the wire to become infinitely thin, for the only result of this is to make L become infinite.

Later in the chapter the coefficient of self induction is defined by means of the expression $(\frac{1}{2}LI^2)$ for the energy of the system. It would be preferable to follow

Maxwell and to adopt this definition at the outset, for it is from the value of the energy that the coefficient is always calculated.

The methods of vector analysis are so useful in electromagnetic theory and present so little difficulty that the reader naturally expects to find them used in a book which is intended to present a "thoroughly modern introduction" to that theory. The author makes a slight use of this analysis in his later chapters, but in the case of vector products adopts a hybrid notation. In the true vector analysis, as used by Heaviside, if the vector product of the two vectors **A** and **B**, which make an angle θ with each other, be the vector **C**, the result is denoted by

$$\mathbf{C} = V\mathbf{AB},$$

while the magnitude (C) of the product is given by

$$C = AB \sin \theta.$$

In the author's notation the relation between **C**, **A** and **B** is expressed by

$$C = \mathbf{V}AB \sin \theta,$$

the letter **V** serving to indicate that **C** is at right angles to the plane of **A** and **B**. It is difficult to see that this hybrid notation has any advantage over Heaviside's.

A few misprints have been noticed in a list sent out by the author; only a few others have been detected.

The reader has probably already gathered from this review that the treatise can hardly be described as that "good text-book" for which the student searches. Yet it is undoubtedly a useful book, and with a little modification and revision would be one of the best books of its class. The student who is fortunate enough to have it at hand will often turn to it with profit. G. F. C. SEARLE.

ASTRONOMICAL LECTURES AT CHICAGO.

Astronomical Discovery. By Herbert Hall Turner, D.Sc., F.R.S., Savilian Professor of Astronomy in the University of Oxford. Pp. xi+225. With plates. (London: Edward Arnold, 1904.) Price 10*s.* 6*d.* net.

THE object of this book and the reason for its appearance are explained in a short preface. The purpose is "to illustrate by the study of a few examples, chosen almost at random, the variety in character of astronomical discoveries." The words "almost at random" seem a little out of place, for we learn that the book comprises the matter that was originally delivered in a series of lectures to the University students of Chicago, at the hospitable invitation of President Harper. The expression is probably not to be taken too seriously. It is not likely that a distinguished astronomer, enjoying what may be regarded as a cathedral position, would be careless in the preparation of his material. He would be anxious to give his best, both for the credit of English astronomy and for his own reputation. There is ample internal evidence, not only that the lectures were carefully prepared, but also of judicious selection.

The subjects chosen are about equally distributed between those that are made at the telescope and those that have resulted from the discussion of the observations so made. This will be seen from a list of the several chapters or lectures—(1) Uranus and Eros, (2) discovery of Neptune, (3) Bradley's discoveries of aberration and nutation, (4) accidental discoveries, (5) the sun-spot period, and (6) the variation of latitude. Some subjects which might have been expected to find a place, such as the discoveries resulting from the application of the spectroscope, have been omitted, but the list is sufficiently varied, and we gratefully acknowledge having received a considerable amount of pleasure from reading the well-known and familiar tales, treated, as they are, with the brightness and acuteness characteristic of the author.

The choice of the discovery of Uranus permits a well-deserved tribute to be paid to the memory of the elder Herschel for the keenness, assiduity and patience which mark the work of that astronomer; while the mention of Eros allows something to be said of the problem of the sun's distance and of the history of those times when the discovery of a small planet added something to the reputation of the lucky discoverer. The Savilian professor has some amusing remarks on the subject of naming the host of small planets that diligence has added to our catalogues. He quotes the case of Victoria as giving rise to an outcry by foreign astronomers, who objected to the name of a reigning sovereign being found in the list. But the real struggle of the purists was, we believe, over the christening of Fortuna, which Airy happily settled in favour of the discoverer's choice, by aptly quoting the well known lines of Juvenal:—

"Nullum numen habes si sit prudentia
Sed nos te facimus fortuna deam, cæloque locamus."

The second chapter or lecture is probably the least satisfactory in the book. The tale might have been told without parading the old scandal of sixty years ago to such wearisome length. Controversy seems out of place in lectures of this character. Prof. Turner in reopening the old sore has apparently two objects, the one, the whitewashing of Airy, and the other, the besmirching of Challis' reputation. Very hard things are said of the latter to which we do not wish to give further currency by repeating, but on the subject of Challis' lectures we doubt whether the words given in Airy's "Life" will bear the construction put upon them by Prof. Turner. There is no evidence to show, or at least the author has not produced it, that Airy's opinion was different in 1844 from what it was in 1834, when he wrote to the Rev. T. J. Hussey: "I am sure it could not be done (predict the place of the disturbing planet) till the nature of the irregularity was well determined from several successive revolutions" (of Uranus), p. 43. Airy, it may be suggested, did not believe the problem soluble until he received Le Verrier's memoir in 1846.

The account of Bradley's discoveries is excellent, and the feature in it which will be especially valued is the brief history given of the Rev. James Pound,

Bradley's maternal uncle. The reputation of Pound has been overshadowed by that of his more brilliant, but perhaps less versatile, nephew, and it is most desirable to give the uncle his proper position. The whole chapter constitutes a most delightful piece of biography.

The accidental discovery of a "new star" does not differ materially from that of a planet, and the author admits that this fourth chapter might very well have been the first of the series, but we agree with him that it is not a matter upon which to lay any particular stress. The particular discovery is only a peg on which to hang the remarks that the author wishes to make on certain subjects. In this case the discovery of the "new star" in Gemini, at Oxford, by means of photography, serves to introduce an account of the International Chart of the Heavens, and some remarks connected with the behaviour of Nova Persei. This chapter presents a careful examination of the facts and suggestions that have been brought to light by observation. The history of Schwabe and his work on sun-spots do not call for any particular remark. The chapter is not long, and it covers the ground very satisfactorily. In the last lecture, Prof. Turner gives an account of the variation of latitude, wherein he is seen quite at his best. The subject is not so hackneyed as some of the other selections, but to speak to Americans of the work accomplished by Mr. Chandler was, no doubt, inspiring, and the successive steps by which Mr. Chandler established his case are described with clear, logical sequence. Usually the author ends his lecture by pointing out what particular lessons are to be drawn from the discovery under examination, and they generally amount to this, that there is no line of research, however apparently unimportant or monotonous, which can be safely neglected. Some inquiries seem to offer a more immediate prospect of success, such as the establishment of observatories in the Southern Hemisphere, to make accurate observations on the motion of the Pole; but at the same time unexpected discoveries may lie in a direction precisely opposite to that indicated by the most educated opinion at present available. The conclusion may be obvious, but the remark is not unnecessary. To be led too strictly by authority is unwise, to neglect the teachings of experience is a crime. W. E. P.

ZOOLOGICAL RESULTS.

Zoological Results based on Material from New Britain, New Guinea, Loyalty Islands and Elsewhere, collected during the Years 1895, 1896, *and* 1897, *by Arthur Willey, D.Sc.Lond.* Parts i.–vi. Pp. vi+830; illustrated. (Cambridge: University Press.)

THIS splendid series of "zoological results" should have been recognised at an earlier date in our columns, but the six volumes have appeared through a lustrum of five years, and the fine series of memoirs has mounted up to a total which baffles reviewing. As Balfour student of the University of Cambridge, Arthur Willey went in 1894 to the Pacific in search of the eggs of the pearly nautilus. He found these, but so much more of great interest, *e.g.* as to Peripatus, Amphioxus, Balanoglossus, Ctenoplana, that his tenure of the Balfour scholarship was on two successive occasions judiciously extended for a year beyond the allotted triennium. In his arduous but well rewarded explorations, Dr. Willey was aided by the Government Grant Committee of the Royal Society, who may congratulate themselves on the fact that the money at their disposal was never better spent than on this enterprise. It has seldom been the happy fortune of a single zoologist to bring together in a short span such rich material, including some of the most interesting zoological types.

In part i. Dr. Willey describes the structure and development of *Peripatus novae-britanniae*, n.sp., and in so doing throws some fresh light on the heterogeneity of the class Onychophora, which this "delightful creature" represents. Dr. Paul Mayer describes a new caprellid; Mr. G. A. Boulenger discusses a very rare sea-snake (*Aipysurus annalatus*) from the South Pacific; Mr. R. I. Pocock reports on the centipedes, millipedes, scorpions, Pedipalpi, and spiders; and Dr. Sharp gives an account of the phasmids, with notes on their remarkable eggs.

In part ii. Prof. Hickson reports on Millepora, showing that the single species (*M. alcicornis*) illustrates that great variability in the form of growth which is a characteristic feature of the genus. Prof. Jeffrey Bell discusses the echinoderms (other than holothurians, which are dealt with separately by Mr. F. P. Bedford). Mr. Arthur E. Shipley reports on the sipuculoids, Mr. J. Stanley Gardiner on the solitary corals and on the post-embryonic development of Cycloseris, Mr. Beddard on the earthworms, and Miss Isa L. Hiles on the Gorgonacea, which includes some interesting new species.

In part iii. Dr. Gadow has an interesting essay on orthogenetic variation in the shells of Chelonia, that is to say, cases in which the variations from the normal type seem to lie in the direct line of descent; Dr. Willey describes three new species of Enteropneusta, and develops several theories, *e.g.* that the gill-slits arose originally as perforations in the inter-annular grooves for the aëration of the gonads which occupied the dividing ranges; and Mr. A. E. Shipley reports on the echiurids, making a welcome attempt to revise the group and to determine its geographical range.

In part iv. Mr. Stanley Gardiner describes the structure of a supposed new species of Cœnopsammia from Lifu, and comes *inter alia* to the striking conclusion that the so-called endoderm in Anthozoa, giving rise to the muscular bands and generative organs, and performing also the excretory functions, is homologous with the mesoderm of Triploblastica. In terms of the layer theory, of whatever value it may be, the actinozoon polyp must be regarded as a triploblastic form. Dr. Sharp reports on insects from New Britain, Mr. L. A. Borradaile on Stomatopoda and Macrura from the South Seas, Mr. Walter E. Collinge on the slugs, Mr. E. G. Philipps on the Polyzoa, Miss Laura Roscoe Thornely on the hydroid zoophytes, and Mr. J. J. Lister describes a remarkable type of a new family

of sponges (*Astroclera willeyana*), a very interesting novelty. Mr. W. P. Pycraft discusses the pterylography of the Megapodii, Prof. Hickson and Miss Isa L. Hiles the Stolonifera and Alcyonacea, and Dr. Ashworth the Xeniidæ.

In part v. Mr. Arthur E. Shipley gives a description of the Entozoa which Dr. Willey collected during his sojourn in the western Pacific, including *Parocephalus tortus*, Shipley, a member of the interesting family Linguatulidæ. Mr. R. C. Punnett discusses some South Pacific nemertines, Mr. L. A. Borradaile has an interesting note on the young of the robber crab, Miss Edith M. Pratt describes the structure of *Neohelia porcellana*, Mr. Boulenger reports on a new blind snake from Lifu, and the Rev. T. R. R. Stebbing deals with the Crustacea.

Part vi. contains Dr. Willey's contributions to the natural history of the pearly nautilus—a fine piece of work—and his personal narrative, which is not less creditable. In his narrative, amid interesting details of how he went about his collecting business, he discusses, as a zoologist, his new Peripatus, the Ascidian *Styeloides eviscerans*, which readily throws out its entrails in holothurian fashion, the interesting intermediate type Ctenoplana, "which no zoologist could encounter without experiencing a momentary thrill of satisfaction," the lancelets and enteropneusts which he observed, some of the remarkable new forms which he discovered, such as Astroclera, and the egg-laying of nautilus—his main quest. The whole story reflects great credit on the indefatigable explorer himself and on those who have assisted him in working up the descriptions which form this imposing six-volume series of zoological results.

OUR BOOK SHELF.

Flora of the County Dublin. By Nathaniel Colgan. Pp. lxx+324. (Dublin: Hodges, Figgis and Co., Ltd., 1904.)

In many respects this district is an interesting one, and the floral distribution not quite what might have been expected from a consideration of the adjacent counties. The flora resembles that of southern rather than northern Britain, but the somewhat unexpected result is arrived at that the western Irish flora has a considerably larger proportion of northern plants than has the corresponding eastern flora. The book opens with a summary of previous work in the district from the fifteenth century to the present day. The physical features are then described, and a section headed "Relations of Plants and Soils" lays particular emphasis on the distinction between "calcifuges" and "calcicoles."

Some plants curiously absent from the county are mentioned, one of which, *Nymphaea alba*, L., occurs in Meath, Kildare, and Wicklow. Both *Trifolium repens*, L., and *T. dubium*, Sibth., are stated to do duty as the shamrock or shamrogue. Probably *Oxalis acetosella*, L., has never served as the Irish national badge, this erroneous impression apparently dating from a paper by J. E. Bicheno published in 1830. Mr. Colgan cannot add *Epilobium tetragonum*, L., to the Irish list, although *E. obscurum*, Schreber, is common in the upland districts. A description of that interesting hybrid *Senecio Cineraria*, D.C., × *S. Jacobaea*, L., is given. The belief that one of its forms is identical with the Italian *S. Calvescens* must be abandoned if Sig. Sommier's conclusion that this last plant is *S. Cineraria* × *S. erraticus*, Bertolini, be accepted. It is decidedly suggestive to find that our common *S. Jacobaea* hybridises so much more readily with an alien species than with its fellow Senecios of the British Isles. Another curious fact concerning hybrids deserves mention. The common cross *Primula veris* × *vulgaris*, as found in Kenmure Park and in several other localities, approaches very nearly to the primrose, while the Ballinoscorney plant closely resembles the cowslip. This curious state of affairs demands experimental investigation. Space limitations forbid mention of any more of the numerous points of general botanical interest contained in the volume.

The author is to be congratulated on having produced something far more useful than the mere catalogue of names and places sometimes dignified by the title "County Flora." Particularly pleasing is the attention paid to local names, given in the Irish-Gaelic characters. It is rather surprising that philologists do not devote more study to local and often rapidly disappearing dialects. The botanist working a country district is exceptionally well placed for collecting information on such subjects, and might with advantage make use of his opportunities.

Exercises in Practical Physiological Chemistry. By Sydney W. Cole, M.A. Pp. vii+152. (Cambridge: W. Heffer and Sons; London: Simpkin, Marshall and Co., Ltd., 1904.) Price 5*s.* net.

Practical Exercises in Chemical Physiology and Histology. By H. B. Lacey and C. A. Pannett, B.Sc. Pp. 112. (Cambridge: W. Heffer and Sons; London: Simpkin, Marshall and Co., Ltd., 1904.) Price 2*s.* net.

Nothing more forcibly illustrates the growing importance attached to the chemical side of physiology than the institution of practical courses dealing with this branch of the subject in centres of physiological teaching. Accompanying this is a multiplication of practical guides. Every teacher has his idiosyncrasies in the exercises he selects for his classes, but one is inclined to doubt whether these are always sufficiently pronounced or important to justify him in issuing a fresh handbook. Competition, however, is not to be despised, and will in the end lead to the survival of the fittest. In the struggle, Mr. Cole's little book, which represents the Cambridge course, will doubtless maintain its own. Though short it is admirably clear, and the practical exercises are judiciously selected. The author is well known for his researches in physiological chemistry, and possesses that preliminary knowledge of pure chemistry which is so necessary nowadays for a successful pursuit of its physiological application.

The book is free from illustrations; the student is required to make his own drawings of crystals, absorption spectra, and so forth in the blanks left for the purpose. This is an admirable idea, and one hopes that the zealous and interested care that Mr. Cole asks from the students in his preface will be responded to in the manner he desires.

The book does not pretend to be complete, but as an elementary introduction to more advanced work it is excellent. I do not propose to direct attention to faults of omission, for these are obviously intentional; the only fault of commission I have discovered is on p. 78, where the statement made implies that potassium ferricyanide contains oxygen.

The second book, that by Messrs. Lacey and

Pannett, demonstrates that practical classes in physiology are not confined to universities and colleges of university standard. The book itself is not a serious contribution to scientific literature, and its authors have neither the requisite training nor knowledge to make it such. It is a mere compilation or *rechauffé* from other well known text-books. One notes that one of the authors blazons upon the title-page that he has obtained a scholarship at the inter. M.B. examination at the University of London, and this is a fair index of what the reader may expect in the interior of the volume. A note-book carefully kept by any moderately good medical student would be equally worthy of publication.

W. D. H.

Laboratory Notes on Practical Metallurgy: being a Graduated Series of Exercises. Arranged by Walter Macfarlane, F.I.C. Pp. x+140. (London: Longmans, Green and Co., 1905.) Price 2*s.* 6*d.*

THIS little book is apparently intended as a first course for beginners in practical work in a metallurgical laboratory, and especially for those who are preparing for the examination of the Board of Education in stages 1 and 2 of practical metallurgy. For these classes of students it will be useful and deserves commendation.

It consists of a series of practical exercises, all well within the grasp of the average boy, graduated and arranged with the view of developing the habit of observation, and the instructions given for doing them show a much more intimate acquaintance with the simpler operations of a metallurgical laboratory than is generally found in works of this class. In the first eighteen pages the student is introduced to furnace work by simple experiments on the melting of metals under various conditions, to prepare him for the subsequent more difficult operations.

The preparation of the ordinary common alloys follows, and then a series of well-chosen exercises illustrates the oxidation of metals and the reduction of metallic oxides and sulphides. Later, the more complex subject of the principles on which the processes for the extraction of copper, lead, gold, and silver from their ores depend is dealt with.

The book concludes with a few elementary exercises in assaying gold and silver ores, and the analysis of coal and coke. In the appendix are several tables, the most important being one giving the percentage composition of some of the common alloys.

There are a few slips and blemishes in the text, but they are for the most part trivial, one of the chief being in the table just mentioned, in which the composition of the British gold coinage is given as gold 91.66, silver 8.33; the latter should of course be "copper." The book contains much useful information for junior students, and can be recommended for their use.

Le Liège. Ses produits et ses sous-produits. By M. Martignat. Pp. 158. (Paris: Gauthier-Villars and Masson et Cie.) Price 2.50 francs.

THE latest addition to the "Encyclopédie Scientifique des Aide-Mémoire" is divided into two parts. The first part is concerned with the formation of cork in *Quercus suber*, the distribution of the tree, its treatment, its maladies and enemies, &c., and concludes with an account of prices and other commercial considerations. The second part describes how the natural product is treated in the manufacture of corks of all kinds, and how it is utilised in the production of linoleum and other materials.

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.*]

Charge carried by the α Rays from Radium.

No special difficulty has been experienced in showing that the β particles (electrons), expelled from radium, carry with them a negative charge of electricity. The positive charge left behind on the vessel containing the radio-active material is simply and strikingly illustrated in the arrangement devised by Strutt, which is now popularly known as the "radium clock."

Since the α particles are deflected by a magnet as if they carried a positive charge, it is to be expected that this charge should be easily detected; but all the initial experiments made for this purpose resulted in failure. Since there are four products in radium which give out α particles, and only one which gives out β particles, it is theoretically to be expected that four α particles should be expelled from radium for each β particle.

In the Bakerian lecture (*Phil. Trans.*, series A, vol. ccix., p. 212, 1904) I described some experiments that were made to determine the charge carried by the α particles. About half a milligram of radium bromide was dissolved in water, and spread uniformly over a metal plate and evaporated to dryness. With a plate of 20 sq. cm. in area, the absorption of the α rays in the thin film of radium bromide is negligible. The solution of the radium released the emanation, and, several hours after removal, the activity of the radium fell to about one-quarter of its maximum value, and the β and γ rays from it practically disappeared. The experiments were made with the radium film at this minimum activity, in order to avoid the complication which would ensue if the β particles were present. An insulated plate was placed parallel to the radium plate and about 3mm. away from it. The apparatus was enclosed in an air-tight vessel, which was exhausted to a very low vacuum. The current between the plates was measured by an electrometer. The saturation current between the plates rapidly fell with decrease of pressure, but soon reached a limiting value—about 1/1000 of the initial—which could not be reduced further, however good a vacuum was obtained. No certain evidence that the α particles carried a positive charge could be obtained. It was thought possible that the inability to reduce the current below this value might be due to a strong secondary radiation, consisting of slow-moving electrons, which were liberated by the impact of the α particles on matter. Strutt (*Phil. Mag.*, August, 1904) has also observed a very similar effect, using a plate of radio-tellurium, which is well suited for this purpose, as it gives out only α rays.

J. J. Thomson (*Proc.* Camb. Phil. Soc., November 14, 1904; see NATURE, December 15) has recently shown in a striking manner that a large number of slow-moving electrons are liberated from a plate of radio-tellurium, although this substance is supposed to emit only α particles. These electrons could be readily bent back to the plate from which they came by the action of a magnetic field. No indication, however, that the α particles carried a charge was obtained.

I have recently attacked this problem again, using the methods and apparatus previously described, but, in addition, employing a strong magnetic field to remove the slow-moving electrons present with the α particles. The apparatus was placed between the pole-pieces of an electromagnet, so that the field was parallel to the plane of the plates. In such a case, most of the escaping electrons describe curved paths and return to the plate from which they set out. On application of the magnetic field, a very striking alteration was observed in the magnitude of the current. The positive and negative currents for a given voltage were greatly reduced. The upper plate, into which the α particles were fired, rapidly gained a positive charge. In a good vacuum, this was the case whether the lower plate was charged positively, or negatively, or connected to earth. The magnitude of the charge, deduced from these experi-

ments, was found to be practically independent of the voltage between 0 and 8 volts. When once a magnetic field had been applied, of sufficient strength to stop all the slow-moving electrons, a large increase in its value had no effect on the magnitude of the positive charge. I think these experiments undoubtedly show that the α particles do carry a positive charge, and that the previous failures to detect this charge were due to the masking action of the large number of slow-moving electrons emitted from the plates.

Observations were made under different experimental conditions, and with very concordant results. In one set of experiments a weight of 0·19 mg. of radium bromide was used, spread on a glass plate, which was covered with a thin sheet of aluminium foil; in the other 0.48 mg., spread on an aluminium plate. The saturation current due to the latter plate, measured between parallel plates 3·5 cm. apart by means of a galvanometer, was found to be $7{\cdot}8 \times 10^{-8}$ amperes. It is possible that the failure of Prof. Thomson to detect the positive charge carried by the α rays from radio-tellurium was due to the smallness of the effect to be measured; for with the plate of radio-tellurium in my possession, the current was only about 1/40 of the above value.

Since the film of radium bromide is so thin that all the α particles escape from its surface, it is easy to deduce from the observed charge from a known weight of radium the total number of α particles expelled per second from one gram of radium bromide. Taking into consideration that half of the α particles were projected into the radium plate, and assuming that the α particle carries the same charge as a gaseous ion, it was deduced that one gram of radium bromide emits $3{\cdot}5 \times 10^{10}$ particles per second. Now the activity of radium bromide in radio-active equilibrium is four times this minimum, and contains four products which emit α particles at the same rate. It is thus probable that one gram of radium bromide in radio-active equilibrium emits $1{\cdot}4 \times 10^{11}$ particles per second. I had previously deduced (*loc. cit.*), from indirect data, the value about $1{\cdot}1 \times 10^{11}$, so that the theoretical and experimental numbers are in very good agreement.

I have also made experiments, by a special method, to determine the total number of β particles emitted from one gram of radium bromide in radio-active equilibrium, and have found a value about the same as the number of α particles emitted at its minimum activity. It is thus seen that four α particles are expelled from radium for each β particle. The number of β particles obtained by Wien was much smaller than this, but, in his experiments, a large proportion of the more slowly moving β particles was absorbed in the radium itself and in the envelope enclosing it.

The number of α particles expelled per second from one gram of radium is a most important constant, for on it depends all calculations to determine the volume of the emanation, and of helium, the heat emission of radium, and also the probable life of radium and the other radio-elements.

E. RUTHERFORD.

McGill University, Montreal, February 10.

Compulsory Greek at Cambridge.

THE conclusion to be drawn from Mr. Bateson's letter seems to be that it is useless to compel candidates to get up subjects for which they have no aptitude, or in which they take no interest. The glories of "another world," whether in science or art, are reserved for those that can see them, and a bright boy, not to say a dull one, is unlikely to discover the beauties of compulsory Greek, if he happens to have a distaste for dead languages. But is it not rather a narrow view which recognises only one new world and the entrance to it through compulsory Greek? It is said of a great creative mathematician that surveying his subject from a high pinnacle of abstract thought, he exclaimed, "And we too are poets"; but the most enthusiastic would scarcely expect this feeling to be aroused by compulsory mathematics in a dull boy; it does not seem to have occurred even to an exceptionally bright one.

Sullied, as Mr. Bateson seems to consider mathematics, by a degrading usefulness to "trade and professions," it nevertheless remains of essential importance to nine-tenths of our scientific work, and most of those of us who have but little of it sigh that we have not more. Mr. Bateson himself has not disdained its assistance in his work on breeding and heredity.

The point of previous letters is not that the writers had no aptitude for Greek, but that they found it useless to them in the studies to which they devoted their life. German is indispensable; soon we shall have to read Russian too, and if a man is to keep abreast of his subject he must not only read German, but read it with ease, so great is the bulk of literature to be got through. Arbitrarily to compel a boy to learn Greek, which, if he does not appreciate it, will be perfectly useless to him, when he might be learning German, which, whether he likes it or not, is indispensable for the full pursuit of his scientific studies, seems to be one of the cruellest conceivable tyrannies of pedantic folly. Could there be greater intellectual waste, and could any means be designed more likely to defeat the end for which it is designed? Compulsion and education are terms as opposed philosophically as they are etymologically; let the student be encouraged to work at the subjects he has really at heart and he will proceed from one success to another, and may even find his training in natural science leading him to the higher things in Greek literature.

But since the most natural classification of candidates would seem to be into those having a tendency to exact thought—who will naturally gravitate towards mathematics, and those with a love of art—who will naturally aspire to literature, and those with a little of both—who will be given over to natural science, why not allow a first class in any two of the three to count as a pass? such a measure would prove a great relief both to congenital non-mathematicians and non-linguists.

Finally, why should a want of sympathy with Greek, the noblest language of the noblest literature the world has known, be imputed to those who think that it is too good a thing to be wrested to injurious purposes?

X.

IF Mr. Bateson's case is that of hundreds, I make bold to say the case of the boy who wastes hundreds of hours on Greek grammar is that of thousands.

We do not want to abolish compulsory Greek because it has no value in the market, but because, stopped where the boy who takes it no further than the Little-Go stops it, the study of Greek has no value, ninety-nine times out of a hundred, in the forming of an active, living intelligence.

Mathematics may have contributed nothing to the formation of Mr. Bateson's mind; it is not unlikely, though it is deplorable. But if Mr. Bateson seriously thinks that elementary mathematics contributes no more than elementary Greek to the sound training of an average mind, surely he is curiously destitute in experience of the run of faculties in a young human being. This explanation of Mr. Bateson's astonishing argument suggests itself the more readily, because his idea that Greek is one of the things that put "one touch of art in the life of a dull boy, and open his eyes to another world," appears absolutely grotesque.

The narrow (and conspicuously *unintelligent*) utilitarian idea of education represented by Mr. Bateson's "intelligent lady" must be fought with all our strength, but it cannot be fought successfully with the rusty sword of Mr. Bateson's reactionary classicism. That is a weapon which will break in our hands and leave us defenceless to the spoiler.

A. G. TANSLEY.

New University Club, London, S.W., February 23.

MAY I be permitted to suggest, with all deference, that Mr. Bateson's statement that his knowledge of mathematics is "*nil*" must be taken *cum grano*! He is now, I believe, largely engaged in the business of counting chickens before they are hatched. How could he do this without some mathematics? As a matter of fact, the research in which he is engaged involves mathematical conceptions of no mean order, yet I presume he knows something about his subject.

Mr. Bateson's letter might be a good argument in favour of lowering the mathematical standard in the previous examination. But, as he uses it, it is merely an unusually frank example of the reasoning which is the real support of compulsory Greek, *viz.*, "When I was a little boy the big boys bullied me; now that I am a big boy myself I mean to take it out of the little ones!"

EDWARD T. DIXON.

Racketts, Hythe, Hants, February 24.

A Large Indian Sea-Perch.

THE dimensions and weight of a sea-perch caught in December last by some native fishermen near Diamond Harbour in the River Hooghly seem to me to be worth recording.

Its length is nearly seven and a half feet, its girth just behind the shoulder is a little more than five feet nine inches, and its weight, the day after its capture, was four hundred and sixty pounds.

The fish is so old and worn that its specific identity must remain in doubt, but it agrees fairly well with Day's description, in the "Fauna of British India," of *Epinephelus lanceolatus*, Bloch.

The largest Indian sea-perch of which I can find any record is the one mentioned by Russell (quoted by Day under *Epinephelus pantherinus* and *malabaricus*), which was taken at Vizagapatam in January, 1786, and measured seven feet in length, five feet in girth, and weighed upwards of three hundred pounds.

The scales of the Diamond Harbour monster are so altered by deposit that their accretion lines are very difficult to follow; but in a large scale from the shoulder I can count between 500 and 600 such lines, which are sometimes grouped in series of about eight, but oftener show no grouping at all. A. ALCOCK.

Indian Museum, Calcutta, February 2.

Attractions of Teneriffe.

THOSE members of the British Association who visit South Africa this year will probably desire to spend as much time as they can near their journey's end. But it is just worth mentioning that some of the oceanic islands en route have very special attractions. For instance, I write from Teneriffe, which has igneous rocks, cinder cones, and lava streams for the geologist; and for the botanist all zones of vegetation from the subtropics to the snows. The scientific literature of the island is at present more in German than in English. A single day's excursion, 2000ft. up into the hills by electric tram, is possible whilst the steamer waits to coal. A week would allow of a short tour to Orotava and across the mountains to Guimar, through some of the most interesting parts of the island.

HUGH RICHARDSON.

SAMUEL PEPYS AND THE ROYAL SOCIETY.

MAGDALENE COLLEGE, Cambridge, with which the name of Samuel Pepys is indissolubly associated, held in his memory at the college on Thursday last, his birthday, a reunion which may become an annual event. Some of the institutions with which he was more especially connected were invited to send delegates to this gathering. Thus the Royal Society was represented by one of its secretaries and its foreign secretary. From the immortal Diary it appears that the first proposal that Pepys should join that Society was made to him in the spring of the year 1662 by his friend Dr. Timothy Clerke, who offered to bring him "into the College of Virtuosos and my Lord Brouncker's [P.R.S.] acquaintance, and to show me some anatomy; which makes me very glad, and I shall endeavour it when I come to London." Two years, however, elapsed before his election. From the minute-books of the Society it appears that he was unanimously elected and admitted on the same day (February 15, 1664)—a rapidity of procedure which contrasts with the much more leisurely action of the present day. He records that he "was this day admitted by signing a book and being taken by the hand by the President, my Lord Brunkard, and some words of admittance said to me. But it is a most acceptable thing to hear their discourse and see their experiments. . . . After this being done they to the Crowne Taverne, behind the 'Change, and there my Lord and most of the company to a club-supper."

The meetings of the Royal Society in those days must have been a good deal more lively than they are at present. Robert Hooke, the most fertile and inventive genius of his time, was then "Curator of Experiments," and brought forward at each meeting either some ingenious contrivance of his own or some device provided by one of the members. This constant and exciting variety of practical demonstration would be entirely after Pepys' heart, gratifying his spirit of curiosity and his keen desire to increase his knowledge in every direction. Another feature of the meetings could not but gratify one of his most characteristic proclivities—his sociability and love of congenial company. The evening adjournments to the "club-supper" at the Crowne Taverne behind the 'Change or to the Devil Taverne in Fleet Street would end off his day as he always delighted that it should end. These meetings for supper contained the germ of the Royal Society Club, the oldest extant records of which do not go back further than 1743. This club consists of a limited selection of fellows of the Society who still dine together at some restaurant on the evenings of the Society's meetings.

At the time of Pepys' election the Society met at Gresham College, but a few years afterwards moved to Arundel House. An effort was then being made to raise money for the purpose of building a house in which the "virtuosos" might hold their meetings and place their library and apparatus. Among the other fellows, Pepys was applied to for a subscription. Under date April 2, 1668, he writes, "with Lord Brouncker to the Royall Society, where they were just done; but there I was forced to subscribe to the building of a College and did give 40*l*."—certainly a generous donation at that time. He evidently had some reluctance to join in the scheme, for he thought that this canvassing for money "may spoil the Society for it breeds faction and ill will, and becomes burdensome to some that cannot or would not do it."

The Royal Society held its annual meeting for the election of the council and officers on St. Andrew's Day, November 30—a date which is still kept sacred for the same purpose. But some of the usages that were formerly in vogue have disappeared. Thus Pepys writes on November 30, 1668, "To Arundel House and there I did see them choosing their Council, it being St. Andrew's Day; and I had his cross in my hat, as the rest had, and cost me 2*s*." The diarist himself had already been nearly selected to serve on the council, so well did he stand in the esteem of his fellow members. Only three years and a half after his admission into the Society he records that "I was near being chosen of the Council, but am glad I was not, for I could not have attended, though, above all things, I could wish it; and do take it as a mighty respect to have been named there."

At last, at the end of twenty years from the time of his entry into the Royal Society, his associates showed the estimation in which they held him by electing him President on December 1, 1684. He was the sixth who filled that office in the history of the society. The council minute-book shows that he obtained twenty-nine votes out of thirty-nine, and that he was sworn in upon December 10. The council included at that time Sir Christopher Wren, Dr. Martin Lister, Robert Hooke, E. Halley, John Flamsteed (Astronomer Royal), John Evelyn, and Sir John Hoskyns. The difficulty which Pepys would have had in attending the meetings of council appears to have still continued after his election to the presidency, for he was only occasionally able to be present. Unfortunately, the Diary, which gives such a full and

faithful record of his daily life, stops short long before the date of his election to the chair of the Royal Society, so that we are without any memoranda of his own regarding what took place during his tenure of the office. The minute-books of the Society, however, furnish some interesting particulars.

One of the undertakings of the Royal Society during the time that Pepys presided over its business was the publication of the elaborately illustrated work of Francis Willughby, the "Historia Piscium." It was a somewhat costly production, so that several members of the Society agreed to subscribe for one or more plates, which were to be supplied at the cost of one guinea each. Pepys far surpassed all other subscribers in his generosity, seeing that he paid for no fewer than sixty plates. The book is appropriately dedicated to him, and when it was ready for issue the council, to mark its appreciation of his assistance (June 30, 1686), "ordered that a Book of Fishes, of the best paper, curiously bound in Turkey leather, with an inscription of dedication therein, likewise five others bound also, be presented to the President." On the same occasion the following amusing entry was made on the minutes:—"Ordered that the Society to encourage the measuring a Degree of the Earth do give E. Halley 50*l.*, or fifty Books of Fishes (!) when he shall have measured a degree to the satisfaction of Sir Christopher Wren, the President and Sir John Hoskyns." There is no record to show which alternative the future Astronomer Royal accepted.

Undoubtedly the most important event which occurred at the Royal Society during Pepys' term of office was the acceptance and publication of Newton's immortal "Principia." In the MS. journal-book of the Society under date April 28, 1686, it is recorded that Dr. Vincent "presented the Society with a manuscript Treatise intituled *Philosophiae Naturalis Principia mathematica*, and dedicated to the Society by Mr. Isaac Newton wherein he gives a mathematical demonstration of the Copernican hypothesis, as proposed by Kepler, and makes out all the phenomena of the celestial motions by the only supposition of a gravitation towards the centre of the sun, decreasing as the square of the distances therefrom reciprocally. It was ordered that a letter of thanks be wrote to Mr. Newton and that the printing of the book be refer'd to the consideration of the Councell; in the mean time the book to be put into the hands of E. Halley, who is to make a report thereof to the Councell." On May 19 it was "ordered that Mr. Newton's book be printed forthwith in a quarto of a fair letter, and that a letter be written to him to signifie the Societye's resolution, and to desire his opinion as to the print, volume, cutts and so forth." On June 30 the council ordered "that the President be desired to licence Mr. Newton's book, dedicated to the Society." Accordingly the title-page of the famous quarto bears the licence in conspicuous print—"Imprimatur, S. Pepys, Reg. Soc. Praeses, Julii 5, 1686."

Pepys held the office of president for two years, and was succeeded on St. Andrew's Day, 1686, by the Earl of Carbery, by whom he was named one of the vice-presidents. Though not in any sense a man of science, he was distinguished among his contemporaries for his keen interest in scientific progress and his eager desire to acquire as much as he could of "natural knowledge." Though careful of his money, he could be generous where the interests of science appealed to him. The absorbing character of his work at the Admiralty and the enthusiastic devotion with which he applied himself to it no doubt prevented him from taking as active a share in the business of the Royal Society as he would have wished to do. But among the distinguished men who during two centuries and a half have occupied the presidential chair there have been few more entitled to kindly remembrance than Samuel Pepys.

ARCH. GEIKIE.

COMPULSORY GREEK AT CAMBRIDGE.

IT is earnestly to be desired that every member of the Senate who is on the side of the Studies and Examinations Syndicate will record his vote in favour of their proposals on either Friday or Saturday, March 3 and 4, between the hours of 1–3 p.m. or 5–7 p.m.

The proposals of the syndicate have been in many places misrepresented. The committee which is opposing them heads its manifestoes "Defence of Classical Studies at Cambridge," but no one has yet attacked these studies. It is true that the proposals allow a modern language instead of either Greek or Latin, but every candidate must take one ancient language, and whichever he elects to offer for the Previous Examination he will have in the future to show a really respectable knowledge of that tongue. At present, as is demonstrated by the students of Newnham and Girton, and many others, and as letters in NATURE have shown, a mere smattering of Greek which can be "got up" in a couple of months is all that can be demanded in view of the existing state of education in our public schools.

Those who think no man can be cultivated without Greek (they do not say the same about women) often forget that the Greeks, who are held to have been incomparable educators, dispensed entirely with the study of dead or foreign languages. They did not educate their sons on a basis of ancient languages, they educated them on their own language and their own literature. The Romans, again, got on very well without studying dead languages. It is true that the educated men in ancient Rome studied the Greek authors, but Greek was to them a living language, and the intercourse between the thinkers and the doers of classical times was at least as close as between the French and British of our own day.

The supporters of the present proposals are often charged with encouraging undue specialisation. But what do we mean by specialisation? The term is usually used to denote the study of one subject to the exclusion of others. If this definition be sound it is the advocates of what is called compulsory Greek who are the culprits. A boy begins Latin, say, at eight or nine, and shortly afterwards takes up Greek, and for the next nine or ten years, at many of our public schools, does comparatively little else. He has specialised to such an extent, and his intellect is so cramped and dulled by the process, that he not unfrequently fails to reach the low standard of the Previous Examination when he leaves school. Even if he has a real gift for classics he is often but a narrow specialist. Fifty-five years ago a Mr. John Smith published in his "Sketches of Cantabs" an appreciation of the classical man of the middle of the last century. "He seldom reads an English work, and of the history of his native country is strangely, almost supernaturally, ignorant. Passing occurrences do not affect him. He doesn't care how many men are slaughtered on the banks of the Jhelum. His heart is at Marathon, his sympathies with the great Hannibal at Cannae." We have improved since then, but the type is not extinct.

It is to be regretted that the proposals do little to encourage science. It must distinctly be understood that the alternative to Greek or Latin is not science,

but French or German. The papers on experimental mechanics and other parts of elementary physics, and the paper on elementary inorganic chemistry are, with three other papers, alternatives of which two must be taken.

The case for additional recognition of science has been put so well by a distinguished naturalist who was a member of the syndicate, and one of the three who did not sign the report, that we cannot do better than quote his words. "The real substitute for Greek, and the only worthy substitute as it seemed to him, was science. If they are not to meet art let them at least meet truth. Let the boys know the place man had in nature. It seemed to him shocking that they should turn out hundreds of men every year who had not the faintest idea of what was going on in nature, in combustion or chemical decomposition, and who knew nothing of the relation of man to the animal world."

The present issue does not lie between the friends of science and the friends of letters. Nearly one-third of the classical staff at Cambridge are on the side of reform, and amongst them are many of the men who have built up the present classical tripos until it is amongst the biggest of the Cambridge schools. A majority of the university professors and readers *other than those in mathematics and natural science* are on the side of the syndicate. The head masters are half-heartedly with the syndicate, a majority of the Head Masters' Conference and the Head Masters' Association desiring the exemption from Greek of candidates for honours in mathematics and science. A very large majority of the assistant masters in secondary schools are in favour of the change, and it must not be forgotten that the assistant masters have a far more intimate experience of the actual teaching of the boys than have the head masters.

A certain number of the resident members of the Senate have declared their intention of not voting. Some of these are tutors and coaches, who, while agreeing with the general principles of the report, fear that the proposed examination will be so difficult that their pupils will fail to pass. Amongst the residents who intend to vote there is now a majority in favour of the report. If the matter rested upon the Cambridge vote there is little doubt which way it would go. The result, however, rests on the vote of a large electorate of which the resident members form roughly one-tenth. From the fact that the committee for supporting the proposals has issued a very long list of supporters, and from the fact that the committee opposed to the proposals has thought it more politic to publish but a short, select list, there is a strong feeling of confidence that reform may this time win. But the duty of voting cannot be too strongly urged. A single vote may decide the issue.

FOLK-TALES OF PLAINS INDIANS.

A NOTICEABLE addition to the literature of American folk-tales has been made by two recent publications of the anthropological series of the Field Columbian Museum *Publications*. Vol. v. of this valuable series is devoted to the traditions of the Arapaho by Drs. G. A. Dorsey and A. L. Kroeber, collected under the auspices respectively of the Field Columbian Museum and of the American Museum of Natural History. The authors worked independently, and in many instances collected variants of the same tale; but they have published all as they were collected rather than amalgamate the two versions of the one legend. Certain incidents in the tales are translated into Latin, and even some whole tales are similarly translated. A synopsis is given at the end of the volume of each of the hundred and forty-six tales, a feature that will prove of great use to the student. There are one origin-myth and three or four culture-myths; a large number of the stories refer to an individual called Nihançan, whose doings were frequently of a reprehensible nature. No. 1 of vol. vii. of the same series contains a collection of forty folk-tales of the Osage by Dr. Dorsey, who admits that this collection does not adequately represent the traditions of the tribe. The Osage are of Siouan stock, and are now degenerating rapidly, as they are very lazy and much addicted to drink; further, the use of the peyote, or mescal, among them is rapidly increasing, and for these reasons there was great difficulty in engaging the attention of the old men for any length of time. In No. 20, "The Rabbit and the Picture," we have a tar-baby episode. An abstract is given of each tale.

A third collection of folk-tales by Dr. Dorsey is entitled "Traditions of the Arikara"; these were collected under the auspices of the Carnegie Institution at Washington, and the eighty-two tales constitute *Publication* 17 of that institution. The Arikara belong to the Caddoan linguistic stock, and were formerly closely allied with the Skidi band of Pawnee. Like the Skidi, they constructed the earth-lodge, and their social organisation and religious ceremonies in general were also similar. An examination of the tales shows, as might be expected, many points of resemblance with those of the Skidi (*cf.* "Traditions of the Skidi Pawnee," by G. A. Dorsey, *Memoirs* of the Am. Folk-Lore Soc., vol. viii., 1904), but it is apparent that the mythology of the Arikara contains many elements not found among the Skidi; possibly it will be found that there are Mandan affinities, but material for this comparison is not yet available. Two tales narrate the creation of the earth by the Wolf and Lucky-Man, and the creation of people by Spiders through the assistance of the Wolf. The variant tales of the emergence of the Arikara from the earth are undoubtedly original. In several tales a poor boy is a culture hero; in one case he was the son of a woman who climbed to heaven and married a star; his greatest work was freeing the land of four destructive monsters. The Sun-Boy made long life possible after a series of contests with his powerful father. Another boy, Burnt-Hands, saved his tribe from despotism and famine, and furnished by his life a perpetual example to the poor of the Arikara of the value of honest and long-continued effort. Some tales are rite-myths, as they refer to the origin of a ceremony or rite, or to incidents connected with a ceremony. In one tale is found an interesting account of the origin of the well known ring and javelin game of the plains, which is really part of the ceremonial calling of the buffalo (bison); the tale also relates the origin of the buffalo dance. Eleven tales relate to animals; in all of them the coyote plays a prominent part, always as a mean trickster, and committing deeds that generally result disastrously to himself. Several are ordinary traditions, in some of which the supernatural crops up. Abstracts are given of all the tales.

Another memoir on folk-tales, entitled "The Mythology of the Wichita," by Dr. Dorsey, forms *Publication* No. 21 of the Carnegie Institution. The Wichita are a small and dwindling tribe of Caddoan stock who differ somewhat from the surrounding plains tribes; both men and women tattoo, they are very moral and good natured, and their home life is extremely well regulated. The pursuit of the bison was secondary to that of agriculture, and, as among the Pawnee, many of their most important ceremonies

were concerned with the cultivation of their fields. All the details of the grass-lodges were symbolic. The social organisation was by villages, at the head of each of which was a chief and a subchief. Election to the chieftainship was never through heredity alone; it was possible for the youngest and meanest-born boy of the village to rise to this position through bravery, generosity, and kindness. In general, the gods of the Wichita are spoken of as "dreams." The sixty tales refer to the first period or Creation, the second period or transformation, and the third period or the present. A few tunes are given by F. R. Burton. Three long Wichita tales by the same indefatigable observer will be found in the *Journal of American Folk-lore* (vol. xv. p. 215, xvi. p. 160, xvii. p. 153). Legends of ancient time were related that the listeners might realise that evil creatures and monsters and evil spirits no longer exist; they were removed from the earth and their destructive powers taken from them by Wonderful Man, who knew that the world was changing, so that human beings might be human beings, and animals exist as animals to serve as food for man. But, above all, the value of many stories for the young lay in the lesson taught by example

FIG. 1.—Hupa woman soaking acorn meal on the river shore. The meal is placed in a crater of sand, water is heated in the basket to the right by dropping hot stones into it, and the hot water is ladled out by means of a basket-cup and poured over the meal until it loses its bitter taste.

that bravery and greatness depended solely upon individual effort, and that there might befall him the same longevity and good fortune as was possessed by the hero of the tale.

In the handsome volume which contains the ninety traditions of the Skidi Pawnee collected by Dr. Dorsey, there are fifteen plates and some interesting ethnological and explanatory notes. The village was the basis of the organisation of the Skidi, no trace of the clan having been found. Each village possessed a sacred bundle, and marriage was endogamous in each village. The religion of the Pawnee reached a higher development than that of any other of the plains tribes, and its ceremonial side was especially developed among the Skidi. Each bundle ceremony and each dance was accompanied, not only by its ritual, but by its tale of origin, and all of these are regarded as personal property. Dr. Dorsey makes some interesting remarks upon the ownership and telling of the tales. Of these some are cosmogonic; a number tell of boy heroes in which the path to renown is due to fixity of purpose and a humble spirit. Numerous tales relate to the tricky coyote; these are told whenever the men assemble during the winter months, but never during the summer, or rather during those months when snakes are visible, for at such times the Coyote-Star directs the Snake-Star to tell the snakes to bite those who talk about the coyote. In one group of tales there is a marriage between humans and animals, or the transformation of a man into an animal.

The first volume of the University of California *Publications*, American archæology and ethnology, contains a study of the Hupa by Mr. P. E. Goddard. The Hupa Indians occupy the beautiful lower valley of the Trinity River; so secluded was it that sixty years ago the news of the coming of the white man had not reached the inhabitants. The people seem to have lived a simple, peaceable life; their social organisation was very simple, but more information is required. A family consisted of a man, his wife or wives, his sons and their wives, the unmarried and half-married daughters and unmarried or widowed brothers and sisters of the man and of his wife. There appears to have been a classificatory system of relationship. The next social unit was the village; a man lived and died where he was born; the women married into other villages. Each village was ruled by the richest man. There seem to have been no formalities in the government of a village or tribe. There was a deep undercurrent of religious feeling, and a great reverence for the spoken word.

The texts are word for word translations and anglicised versions of fourteen myths and tales, and thirty-seven texts relating to the dances and feasts, the majority of which are formulæ. The latter are of especial value, as it is usually so difficult to get the exact words of a magical formula. Thirty excellent heliotype plates embellish the volume.

Mr. Goddard and the university authorities are alike to be congratulated on this excellent piece of work, which augurs well for the success of the new department of the University of California.

A. C. H.

A NATURALIST'S JOURNAL.[1]

THIS daily journal of an observant field-naturalist may be heartily welcomed by every lover of country life and country scenes. It is true the style is somewhat scrappy and *staccato*, but this is to a great extent unavoidable in a work of this nature, and is, after all, no great drawback, although we think it might have been somewhat modified during the revision for press. Mr. Robinson, who is already no stranger to the reading public, has the good fortune to be a resident in Norfolk, the county *par excellence* of redundant bird-life and of enthusiastic bird-lovers; and he is therefore practically assured of a number of sympathetic readers, for every dweller in Norfolk likes to be acquainted with all that is written about his own district.

To the general reader the most attractive feature of the book will almost certainly be the large series of exquisite reproductions from photographs of animal and plant life, taken, we infer, by the author himself. Where all are of such high excellence, it is difficult to make a selection; and the illustration we present to our readers as a sample must not be regarded as either better or worse than its fellows. It has been chosen on account of its depicting an interesting phase of bird-life.

As a rule, the author has nothing specially new to

[1] "The Country Day by Day." By E. K. Robinson. Pp. xix+371 illustrated. (London: W. Heinemann, 1905.) Price 6*s*.

tell, and his book may be regarded as a guide to what the observant country resident ought to see and notice, rather than as an exponent of fresh facts. In places, indeed, he forsakes his usual style for what we suppose must be called "word-painting," but we can scarcely congratulate him on the result of the change. Neither, we think, is he altogether happy in his theory that bird-song is largely due to rivalry and jealousy; although his eagerness to trace out the reason of every phenomenon in natural life is a trait deserving of the highest commendation.

The reader who follows in Mr. Robinson's footsteps and takes him as guide will not have much to learn about the animals and plants of his native district after a year's diligent apprenticeship.

R. L.

FIG. 1.—Young Peewit hiding. From "The Country Day by Day."

PROF. G. B. HOWES, F.R.S.

GEORGE BOND HOWES, whose state of health for the past two years had been the cause of grave anxiety, passed away on February 4. Born in London on September 7, 1853, his active and useful life was cut short at the age of fifty-one.

Howes was of Huguenot extraction; his father, the late T. J. Howes, married the daughter of the late Captain G. H. Bond—a member of a talented family. While attending a private school he spent his spare time in making microscopical slides, and a prize of one of J. G. Wood's books helped to arouse further his interest in natural history. His parents at first intended that he should prepare for entering the Church, but this plan was given up, and on leaving school he was for a short time in business, which proved very distasteful to him. Having worked out the anatomy of the house-fly, made careful drawings of his preparations, and given a lecture on the subject, his talent was recognised by a friend of the family—a clergyman—who introduced him to Mr. Walter White, then secretary to the Royal Society. Through Mr. White's instrumentality an introduction was obtained to Prof. Huxley, and this resulted in an appointment under the Science and Art Department.

A short time previously, Huxley, assisted by T. J. Parker, had begun to organise his pioneer practical classes in biology at South Kensington, and Howes's first scientific work consisted in making a series of enlarged coloured drawings illustrating the anatomy of various animals, and thus further developing his powers as a draughtsman. These drawings now form the well known series hanging on the walls of the laboratory at the Royal College of Science, copies of which were subsequently made by Howes for use in various universities and colleges in this country and abroad. Although he had no previous scientific training, he rapidly became an expert anatomist, and many of his exquisite dissections are still to be seen on the shelves of the laboratory.

All this time, Howes was taking every advantage of his opportunities for studying under our greatest biological teacher in a school of high tradition, where students are able to devote themselves to one subject at a time, and are fortunate in being unhampered by syllabuses. He was soon appointed assistant demonstrator, and on Parker's election to the chair of biology in the University of Otago, Howes succeeded him as chief demonstrator, so that his originality, zeal, and enthusiasm had full scope for development. The wide knowledge he gradually obtained of his subject, his valuable contributions to zoological literature, and more especially his power and influence as a teacher, soon made it apparent that he was to take an important place in the scientific world. On Huxley's partial retirement in 1885, Howes was appointed assistant professor, and in 1895—when the chair of biology was subdivided—professor of zoology. During his career as demonstrator, he had also for two years held the post of lecturer on comparative anatomy to the St. George's Hospital Medical School.

In 1897, Howes was elected to the fellowship of the Royal Society. He was a vice-president of the Zoological Society, honorary zoological secretary to the Linnean Society, honorary treasurer of the Anatomical Society, ex-president of the Malacological Society, president of Section D of the British Association at the Belfast meeting, corresponding member of the New York Academy of Science, and an honorary member of the New Zealand Institute. He also took an active interest in the work of several local natural history societies, of which he was a member. In 1902 he acted on the committee for the reorganisation of the Zoological Gardens, and in the same year received the degree of D.Sc., *honoris causa*, in the Victoria University, having previously —in 1898—received that of LL.D. at St. Andrews. He had held examinerships in several universities, *e.g.* London, Oxford, Victoria, and New Zealand.

The veneration and affection which Howes felt for his great chief were unbounded, and apparent in all his work, to carry on which on the lines laid down by Huxley was the summit of his ambition.

His publications are too numerous to be mentioned in detail; they consist of some fifty papers and

addresses, as well as numerous reviews and articles, all written in a characteristic style; apart from the two editions of his well known "Atlas," and the revised and extended editions of Huxley and Martin's "Elementary Biology" (in collaboration with Prof. D. H. Scott). He also edited the translation by Bernard of Wiedersheim's "Bau des Menschen," and had undertaken to prepare a new edition of Huxley's "Anatomy of Vertebrated Animals," which he had mapped out in his mind, but never actually began. His original work deals mainly with vertebrate comparative anatomy, and all shows the same thoroughness and accurate knowledge.

Considerable and important as his direct contributions to science have been, they only represent a part of his life's work in this direction, for he considered it his duty to devote much time to the business of scientific societies and in helping any serious workers who applied to him; he spared no trouble in assisting others.

Never a robust man, Howes's power of work was extraordinary. He never seemed to be in a hurry, and did not give one the impression that he spent an excessive amount of time in reading the current literature of his subject, although his knowledge and memory in this direction were quite unique. His mind was of a remarkable type, and was, one may say, almost overburdened with details, though he never lost sight of the main issue, and was always clear and stimulating. He absorbed everything which had the remotest bearing on his science, and would talk by the hour on almost every branch of zoology; one had only to ask him some question and he would either have the point at issue at his finger-ends, or would at once give references to the most recent papers on the subject. When giving a lecture or an address, he would put so much into an hour's discourse as to make his hearers marvel at his memory and grasp of the subject. His presidential address to the zoological section of the British Association in 1902 contains no less than 186 references to original authorities, and its preparation must have cost him an enormous amount of labour at a time when he was already over-fatigued.

Howes was a man of high moral standard and ingenuous nature, generous and unselfish in all he did, and his death is mourned by a wide circle of scientific friends, who will long cherish the memory of his friendship and hospitality. He carried out his own belief that "higher ambition than that of adding to the sum of knowledge no man can have; wealth, influence, position, all fade before it; but we must die for it if our work is to live after us."

W. N. P.

NOTES.

THE following fifteen candidates have been selected by the council of the Royal Society to be recommended for election into the society:—Mr. J. G. Adami, Mr. W. A. Bone, Mr. J. E. Campbell, Mr. W. H. Dines, Capt. A. Mostyn Field, R.N., Mr. M. O. Forster, Mr. E. S. Goodrich, Mr. F. G. Hopkins, Mr. G. W. Lamplugh, Mr. E. W. MacBride, Prof. F. W. Oliver, Lieut.-Col. D. Prain, I.M.S., Mr. G. F. C. Searle, Hon. R. J. Strutt, and Mr. E. T. Whittaker.

THE piercing of the Simplon Tunnel was completed at 7.20 a.m. on February 24. At the time of piercing, the north gallery was inaccessible on account of the accumulation of water. The south gallery is on a lower level than the north, and the final connection was made by the explosion of charges placed in holes driven into the roof of the south gallery, which left a large hole on a level with the floor of the north gallery. No sooner was the piercing effected than the accumulated water flowed rapidly away down the southern side, and was discharged into Italy without doing damage. It is unnecessary again to direct attention to the particulars of this triumph of engineering skill, for a detailed account of the difficulties with which the engineers have had to contend, and the expedients utilised to surmount these obstacles, will be found in an article by Mr. Francis Fox in NATURE for October 27, 1904 (p. 628, vol. lxx.). The work that now remains to be done is to put in place the masonry arching, to cover over the water channel beneath the floor of the tunnel, and to lay the permanent way. It is expected that within three months trains will be running, and the railway will prove a vital link in the line of communication between the Italian cities and mid-Europe.

ON Friday, March 17, Senor Manuel Garcia, the inventor of the laryngoscope, will complete his hundredth year, and the anniversary will be celebrated by a meeting of laryngologists at the rooms of the Royal Medico-Chirurgical Society, Hanover Square. We learn from the *British Medical Journal* that the Spanish Ambassador will attend to congratulate the illustrious centenarian in the name of the Government of his native country, and among the addresses will be one from the Royal Society, before which Senor Garcia read his paper entitled "Physiological Observations on the Human Voice" just fifty years ago. The Berlin, Vienna, French, Dutch, Belgian, and South and West German Laryngological Societies will send special deputations. Most of the addresses will be taken as read, and the proceedings will conclude with the presentation of a portrait of Senor Garcia, painted by Mr. John Sargent, R.A., together with an album containing the names of all the subscribers. In the evening a banquet will take place at the Hotel Cecil, at which it is hoped that Senor Garcia himself will be present.

THE death is announced, on February 6, of Father Timoteo Bertelli. Father Bertelli was born in Bologna in 1826, and was the son of the professor of astronomy at the University of Bologna. At eighteen he joined the Order of the Barnabites, and taught physics in various colleges of the Order. In 1871 he joined the Collège de la Querce in Florence, with which institution he appears to have been associated continuously until the time of his death, except for the three years 1895–7, when he was called to Rome by Leo XIII. to succeed Father Denza at the Vatican Observatory. But his state of health did not permit him permanently to accept this position, and in 1897 he returned to Florence. Father Bertelli first devoted himself to meteorology, and later was attracted by the study of seismic phenomena, inventing the tromometer to assist in his observations. He gave much attention to researches into the history of the sciences and especially to that of the mariner's compass. The results of his life's work are contained in some sixty memoirs, the first of which is dated 1859.

DR. A. S. PACKARD, professor of zoology and geology at Brown University, died on February 14, at the age of sixty-six years. The death occurred, on February 22, of Dr. Ernst F. Dürre, formerly professor of metallurgy at Aix-la-Chapelle, and author of several important treatises on the metallurgy of iron and steel. Dr. Guido Hauck, professor of mathematics at the Berlin Technical College, died on January 14. The deaths are also announced of J. C. V. Hoffmann, founder and editor of the *Zeitschrift für mathematischen und naturwissenschaftlichen Unterricht*, Dr. T. H. Behrens, professor of microchemistry at Delfdt, Prof. Ludwig von Tetmeyer, principal of the Vienna Technical College, and Prof. Ditscheiner, of Vienna.

WE learn from the *Times* that Prof. Adolf Bastian, director of the Berlin Ethnographical Museum, has died at Port of Spain, Trinidad, in his seventy-ninth year, while on a scientific expedition. Prof. Bastian, who was a distinguished traveller for many years, enjoyed a wide reputation as the author of numerous ethnological and anthropological works, of which the best known is "The Peoples of Eastern Asia."

THE council of the University of Birmingham recently assigned a plot of land on the new university site at Bournbrook in order to enable Mr. Walter E. Collinge, the lecturer in zoology, to continue his experiments and observations upon the life-histories of the black-currant gall-mite and the plum aphis, with the view of obtaining remedies for exterminating or holding in check these pests to fruit-growers.

THE annual dinner of the Institution of Civil Engineers will be held on Wednesday, March 22, at Merchant Taylors' Hall, Threadneedle-street, E.C. Sir Guilford Molesworth, president of the institution, will occupy the chair.

AN interesting excursion has been arranged by the American Institute of Mining Engineers. In the first week in July a meeting will be held at Victoria, British Columbia, and this will be followed by a three weeks' trip to the mining districts of Alaska.

A VALUABLE contribution to economic geology is afforded by an article on the Hauraki goldfields of New Zealand published by Mr. W. Lindgren in the *Engineering and Mining Journal* of New York. The occurrence of gold is very similar to that in Transylvania. The gold is met with in quartz veins traversing andesite altered into propylite. The minerals accompanying the gold are dolomite, pyrites, blende, galena, and ruby silver ore. Near the surface the sulphide ores are oxidised; and the greatest yield of gold has been obtained at points where the veins cross.

IN the *Transactions* of the Faculty of Actuaries, No. 18 (1905), Dr. James Buchanan discusses the use of various modifications of Simpson's rule in the performance of the integrations involved in the calculation of survivorship benefits.

IN the *Physikalische Zeitschrift* for February 1, Profs. Elster and Geitel discuss the radio-activity of certain sediments from the German mineral springs, and Messrs. A. Herrmann and F. Pesendorfer describe experiments indicating traces of radio-activity in the gases from the Sprudel spring at Carlsbad.

AN interesting feature of the Johns Hopkins University *Circular* is the series of "Notes in Mathematics," edited by Prof. Frank Morley, appearing in the January number. These notes deal with "A system of parastroids" and "A curve of the fifth class" (Mr. R. P. Stephens), "Applications of quaternions to four dimensions" and "Some invariant relations of linear correspondences" (Mr. H. B. Phillips), "A closed system of conics" (Mr. Charles C. Grove), and "The normal form of a collimation and the reduction of two conics to normal form" (Mr. A. B. Coble).

PROF. HANS LANDOLT, of Berlin, has received the Prussian Imperial Gold Medal for Science.

THE city of Lincoln is now suffering from a serious outbreak of typhoid fever. The epidemic started at the beginning of January, and up to date nearly 800 cases have been notified. The epidemic is plainly a water-borne one, milk and other articles of diet being excluded as channels of diffusion by the extent of the outbreak and its regular distribution over the whole area. The water supply of Lincoln is derived from the River Witham, the water being passed through sand filters before distribution. Attention has been directed from time to time to the unsatisfactory quality of the water, and in 1901 the boring of a deep well into the sandstone was commenced, but after the bore had reached a depth of 880 feet in 1903 the boring tool was lost, and has not been recovered, thus entailing serious delay. The epidemic, it is surmised, has been caused by pollution of the Witham or its tributaries above the intake. It is unfortunate that works were in progress in the autumn to improve the filter beds by deepening the layer of fine sand, but were put a stop to by the early frost, and the same event caused many of the consumers to leave their taps running, and thus to necessitate an increase in the rate of filtration to meet the increased demand.

THE Fishmongers' Company has published a preliminary report by Dr. Klein, F.R.S., on experiments undertaken for the company to ascertain the duration of vitality of the typhoid bacillus when introduced into shell-fish. The main conclusions arrived at are:—(1) Oysters readily take up into their interior the *Bacillus typhosus* which has been introduced into their shell or into the surrounding sea-water. (2) Oysters, clean at starting, rapidly clear themselves of the ingested typhoid bacilli if they are kept in clean water which is frequently changed. (3) Oysters, clean at starting, clear themselves of the ingested bacilli to a less extent and slower if they are kept in a "dry" state—*i.e.* out of the sea-water. (4) Oysters, from a polluted locality, clear themselves of the ingested bacilli to a less extent, and at a slower rate, even if kept in clean sea-water, than oysters clean at starting. (5) Oysters from a polluted locality, containing a large number of the *Bacillus coli*, very rapidly clear themselves of this microbe, whether kept in or out of the water. This shows that *Bacillus coli* is foreign to the oyster and is rapidly destroyed by it. When, therefore, it is present in the oyster, it must have been derived from the surroundings. (6) However largely infected with typhoid bacilli, the oysters at no time present to the eye any sign of such infection; they remain in all parts of normal aspect. (7) Cockles and muscles similarly take up the typhoid bacillus, but clear themselves much more slowly, particularly in the case of cockles, than do oysters.

THE geographical results of the National Antarctic Expedition, in so far as they relate to the distribution of land, water, and ice within the area allotted to the expedition for exploration, were described by Captain R.F. Scott before the Royal Geographical Society on Monday. He remarked that the main geographical interest of the expedition was the practical observation of a coast-line from Mount Melbourne, in lat. 74½°, to Mount Longstaff, in lat. 83°, and of the conditions which lie to the east and west of this line. The coastal mountains are comparatively low between Mount Melbourne and the Ferrar glacier, and it was the tabular structure of these that first indicated the horizontal stratification of the mainland. But low as the mountains are, in one place only does the internal ice-sheet seem to pour any volume of ice into the sea. It is certain that the ice-cap is of very great extent, and there is evidence that it maintains a great and approximately uniform level over the whole continent. The greater portion of this great ice-sheet is believed to be afloat. The soundings made by the expedition show that some hundreds of fathoms of water still intervene between the bottom of the ice at the barrier edge and the floor of the sea; but the barrier edge sixty

years ago was in advance of its present position, in places as much as 20 or 30 miles, and therefore the soundings lie directly beneath Sir James Ross's barrier, and a considerable distance from its edge. The ice-sheet, and the curious and often vast ice-formations met with in the Ross sea, are therefore regarded, not as the result of present-day conditions, but the rapidly wasting remnants of a former age.

SENOR A. ARCIMIS informs us that Mr. Valderrama, director of the Municipal Meteorological Observatory at Santa Cruz (Canaries), observed a fall of dust on January 29 and January 30. During all the former day a very fine dust fell continuously, but not in great amount. On January 30 a rain of a yellow and very fine dust began at 15h. The wind-vane pointed to the S.S.W., and the atmosphere was charged with the very fine dust, the horizon being invisible through a kind of dry fog that introduced itself into the mouth and throat, producing the same effect as when marching on a dusty highway in a hot summer day. All the instruments exposed freely out of doors were covered with the nearly impalpable dust.

AT the recent annual meeting of the Glastonbury Antiquarian Society, Prebendary Grant gave an account of the exploration at the ancient British Lake Village at Glastonbury during the summer of 1904. Three new mounds were examined, and the exploration of four others was completed. The "finds" included amber and glass beads, spiral finger-rings of bronze wire, a massive bronze buckle (taken to have been connected with horse-harness), a bronze object which is supposed to have been some part of horse-trapping, a variety of bone objects, wool combs, hammers, portion of horses' bits, and a roedeer antler, pointed and used as a modelling tool for decorating pottery. Several pieces of pottery were dug up. Flint flakes and knives were found, proving that flint implements were made at the village. With respect to wooden articles, two wheel-spokes, finely turned and finished, were found, and a fragment of an axle-box belonging to the same wheel. Iron bars were found also at the Lake Village, and after minute investigation the conclusion has been arrived at that these bars are iron currency bars used by the ancient Britons at the time of Cæsar's invasion.

A LARGE number of new types of Japanese land-shells of the Clausilia group are described by Mr. Pilsbry in the December issue of the *Proceedings* of the Philadelphia Academy.

THE shore fishes of the Galapagos and other Pacific islands are described by Messrs. Snodgrass and Heller in part xvii. of the publications of the Hopkins-Stanford Expedition (*Proc.* Ac. Washington, vi., pp. 333–427). Two species are described as new.

THE *Emu* for January contains Captain Hutton's presidential address to the Australasian Ornithologists' Union, which deals with the geographical origin and subsequent development of the land birds of New Zealand. An interesting feature of the issue is the reproduction of a photograph of a red gum-tree containing the nests of seven species of birds.

Naturen for January and February contains two illustrated articles on whales and whaling. In the former issue Prof. G. Guldberg describes the method of hunting the Greenland right whale, illustrating his article with reproductions from two old prints. In the February number Mr. E. Koefoed records the capture of a Biscay right whale, or "nordkaper," at Mjofjord, on the west coast of Iceland, and also of a cachalot in northern waters. Two photographs of the former cetacean are reproduced.

STEPNEY has published a handbook to the vivaria and aquaria in the Borough Museum, the text of which is reproduced, with certain alterations and additions, from the handbook to the Horniman Museum. It is to be hoped that the descriptive portion, when read in the museum, may aid visitors to a right appreciation of the exhibits, but as it stands the guide is admirably calculated to puzzle beginners in systematic zoology. For instance, from the headings on pp. 24 and 25, the reader would be led to infer that while *Argyroneta* is the scientific designation of the water-spider, and *Podura aquatica* that of the water-springtails, *Blattidae* is the name for the cockroach, and from p. 50 that *Lacertilia* is the generic title for the typical lizards. Again, from p. 17 he would be led to suppose that *Gastropoda* is the generic term for snails, and that these rank in classificatory value with the viviparous pond-snail (*Paludina vivipara*). Careful study of the text may in some cases put matters right, but the muddle is as bad as bad can be for beginners.

THE address on morphology generally, its modern tendencies and progress, and its relation to other sciences, delivered by Prof. A. Giard before the Congress of Sciences and Art at the St. Louis Exhibition in September last, is published in the *Revue Scientifique* of February 4 and 11. After referring to the revolution in biology effected, first by Lamarck and subsequently by Darwin, the author proceeds to sketch the gradual evolution of modern biological conceptions and theories, dwelling especially on Wolff's hypothesis of epigenesis. Reference is then made to the importance of the study of variation, both among living and extinct types, after which the author passes on to review the influence that palæontology has exerted on biology and the doctrine of evolution. Abiogenesis next claims attention, while the author concludes his discourse by reference to some of the evils attendant on the extreme specialisation of scientific work at the present day. It is time, he urges, that a general organisation to direct scientific work should replace the present state of anarchy, whereby much energy that is now practically wasted would be diverted towards the attainment of a common end and object.

THE fifth part of Mr. J. H. Maiden's "Critical Review of the Genus Eucalyptus" includes three species. *Eucalyptus stellulata* receives its name from the disposition of the buds, and is known as black Sally, or muzzlewood; the leaves show longitudinal lateral veins similar to those of the next species, *Eucalyptus coriacea*, which is distinguished by its clean white stem. The third species, *Eucalyptus coccifera*, confined to Tasmania, is sufficiently hardy to have been planted in parts of the United Kingdom.

THE alien problem is not unknown to botanists, and the genus Sisymbrium has added two foreign species to the flora of Lancashire. *Sisymbrium pannonicum* is definitely naturalised along the coast from St. Anne's to Crosby, and according to a recent account by Mr. C. Bailey in vol. xlix. part i. of the *Memoirs and Proceedings* of the Manchester Literary and Philosophical Society, *Sisymbrium strictissimum*, a native of continental Europe, has obtained a foothold near Heaton Mersey, where it has been observed for fifteen years.

IN a paper only recently published in vol. ii., No. 3, of the *Contributions* from the botanical laboratory of the University of Pennsylvania, but which represents work done two years earlier, Dr. O. P. Phillips maintains that the central body in the cells of the Cyanophyceæ represents a true nucleus, but he failed to obtain complete stages in its

mitotic division. Dr. Phillips is of opinion that the movement of the filaments of Oscillaria and Cylindrospermum is due to protoplasmic processes or cilia which, he says, are to be observed around all the cells. The chromatophore, containing cyanophycin granules, was identified as a peripheral zone.

AN interesting address on the present problems of meteorology was given by Mr. A. I. Rotch to the section of cosmical physics of the International Congress of Arts and Sciences at St. Louis, and was printed in *Science* on December 23 last. The author pointed out that although it is nearly fifty years since the first commencement of weather telegraphy, and much has been done to complete and extend the area under observation, the methods employed in the preparation of weather forecasts are still essentially empirical, and practically little or no progress has been made. This is mostly due to the fact that until recently observations have been carried on solely at the bottom of the atmosphere. Even the observations made at mountain stations still pertain to the earth and do not represent the conditions prevailing in free air. The still more recent use of unmanned balloons and kites has led to the acquirement of a knowledge of the vertical gradients of meteorological elements which contradicts previous conceptions, *e.g.* that the temperature diminished with increasing altitude more and more slowly, whereas the results show that it decreases more and more quickly with increasing altitude. The international cloud observations at various altitudes discussed by Dr. Hildebrandsson also show that theories held heretofore are untenable, and that there is no exchange of air between poles and equator. With regard to cosmical relations to meteorology, the author points out that neither the effects of the periods of solar or lunar rotation upon the earth's meteorology can be claimed to have been proved. But coincidences—if nothing more—have been shown by Sir Norman and Dr. Lockyer to exist between sun-spot frequency and atmospheric changes, especially as manifested by barometric pressure, rainfall, and temperature. It does not seem impossible, therefore, that the discussion of meteorological observations from the point of view of their relation to solar phenomena may eventually lead to seasonal predictions of weather possessing at least the success of those now made daily.

THE Survey Department of the Egyptian Public Works Ministry has sent us the meteorological report for the year 1902. This volume indicates that the Director-General of the Survey Department, Captain H. G. Lyons, is making rapid strides, not only in increasing the number of stations which send in records, but in publishing a considerable amount of valuable information which should prove of great value. We are told that arrangements are in progress for commencing a systematic measurement of rainfall in the Delta and western part of the Mediterranean coast; that a monthly *résumé* of the weather has been started; and that forecasts during the early and late months of the year have been issued. All these show the activity that is being displayed in the collection and dissemination of meteorological data. The present report includes magnetic as well as meteorological observations, and also Nile gauge readings. At the end are given numerous curves representing the variations of the meteorological elements as registered at the Abbassia Observatory.

THE *Journal* of the Röntgen Society (vol. i., No. 2) contains a note by Mr. J. H. Gardiner on the new ultra-violet glass manufactured by Messrs. Schott and Genossen, of Jena; it is illustrated by photographs of spectra showing the transparency of the glass in the ultra-violet region.

FLUORESCENT substances are usually regarded as exceptions to Kirchhoff's law of absorption on account of their being able to emit light which in ordinary circumstances they do not absorb, but hitherto no investigation has been made of the absorptive power of such substances during active fluorescence. In the *Physical Review* for December, 1904, Messrs. E. L. Nichols and Ernest Merritt show that substances such as fluorescein, when caused to fluoresce strongly in solution, produce a decidedly different absorption from that of the feebly illuminated material, and that the absorption curve obtained in this way is intimately connected with the curve of fluorescence. In the case of five different substances, moreover, there is conclusive evidence of a slight increase in electrical conductivity accompanying the phenomenon, and on this account a dissociation hypothesis is brought forward to explain the nature of fluorescence.

AN address delivered by Prof. Edward B. Rosa at the opening of the John Bell Scott Memorial Laboratory of Physical Science at Wesleyan University, Connecticut, is printed in *Science* for February 3. It deals with the National Bureau of Standards, which commenced work in the United States in 1901, and defines its functions and ideals. It is to be noted that research plays a prominent part in the programme of the bureau. We have already had occasion to refer to Dr. Guthe's critical investigation of the various forms of silver voltameter (NATURE, vol. lxx., p. 583), and to the determinations by Drs. Waidner and Burgess of the temperature of the electric arc (NATURE, vol. lxxi., p. 132). Both these researches were carried out under the auspices of the bureau, and in addition to these, the *Physical Review* for December, 1904, contains a valuable communication by Drs. Waidner and Burgess on "Radiation Pyrometry," in which the degree of accuracy of several radiation pyrometers is discussed. The bureau does not confine itself entirely to physical and mechanical measurements, but contains a department devoted to chemistry, one of the purposes of which is to attempt to secure uniformity in technical analyses. A characteristic of the bureau which deserves particular notice is its aim not only to conduct investigations through its own staff, but also to afford facilities for research to others who may come to work for a limited period as scientific guests. In this way it is hoped that "the output of original research in America will be materially increased."

THE remarkable catalytic power of reduced nickel, discovered some years ago by MM. Paul Sabatier and J. B. Senderens, has been applied by them in many directions, and has been especially fruitful in the addition of hydrogen to cyclic compounds. Applying this reaction in another direction, the authors in the current number (February 20) of the *Comptes rendus* describe the reduction of nitriles to amines. The nitrile, with an excess of hydrogen, is passed over reduced nickel at temperatures between 250° and 300° C. Hydrocyanic acid might be expected to yield methylamine, but, as a matter of fact, the nickel was found to exert a further action, both dimethylamine and trimethylamine being produced, together with ammonia and the primary amine. With acetonitrile all three amines are likewise produced, the diethylamine, which forms about three-fifths of the mixture, predominating. Dipropylamine was similarly the chief product of the reaction with propionitrile; with capronitrile, derived from ordinary amyl alcohol, besides the three amines, two of which were new, an appreciable proportion of the hydrocarbon α-methyl-pentane was obtained. The yields were in all cases good with fatty compounds, but the reaction was less satisfactory when applied to the aromatic series, there

being a tendency for the hydrocarbon and ammonia to be the chief products.

Globus for February 23 is a special number containing contributions by friends and admirers of Prof. R. Andree, who reached his seventieth birthday on February 26.

THE third part of the *British Journal of Psychology*, published by the Cambridge University Press, has been received. The number contains five papers in addition to a report of the proceedings of the Psychological Society. Mr. Norman Smith discusses Malebranche's theory of the perception of distance and magnitude; Mr. F. N. Hales considers the materials for the psychogenetic theory of comparison; Mr. W. G. Smith makes a comparison of some mental and physical tests in their application to epileptic and to normal subjects; Prof. Mary W. Calkins defines the limits of genetic and of comparative psychology, and Mr. C. Spearman makes an analysis of "localisation," illustrated by a Brown-Séquard case.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN MARCH:—

March 5. 17h. Sun eclipsed; invisible at Greenwich.
7. 13h. Juno in conjunction with Moon. Juno 1° 27′ S.
9. Jupiter in conjunction with Venus. Venus 5° 30′ S.
,, 11h. Jupiter in conjunction with Moon. Jupiter 3° 15′ N.
12. 10h. 11m. to 11h. 6m. Moon occults γ Tauri (mag. 3·9).
17. 12h. 34m. Minimum of Algol (β Persei).
20. 9h. 2m. to 9h. 49m. Moon occults β Virginis (mag. 3·8).
,, 9h. 23m. Minimum of Algol (β Persei).
21. 12h. Venus at maximum brilliancy.
24. 7h. Mars in conjunction with Moon. Mars 3° 40′ S.
,, Vesta in opposition to Sun.

REPORTED DISCOVERY OF A SEVENTH SATELLITE TO JUPITER.—A telegram received from the Kiel Centralstelle announces the discovery of a seventh satellite in the Jovian system. The description reads:—16 magnitude, position on February 25 62 degrees, distance 21 minutes, daily motion 60 seconds south-easterly.

PLANETARY TIDES IN THE SOLAR ATMOSPHERE.—In a communication published in the *Bulletin de la Société astronomique de France* (February, 1905), M. Émile Anceaux discusses the question as to whether the undecennial periodicity of sun-spots may not result from the fluctuations of tides set up in the solar atmosphere by the concerted action of Jupiter, the earth, Venus, and Mercury. He classifies the tides as binary, ternary, and quaternary, according to the number of planets acting in their production by being in, or near, opposition or conjunction. The ternary tide due to the combined action of Jupiter, Venus, and the earth is supposed to be the most important factor in regulating the appearance of spots, and a curve showing the fluctuations in the strength of this tide, as calculated from the knowledge of the planetary positions, agrees fairly well with the sun-spot curve for the years 1891 to 1905.

Finally, the author arrives at a number of conclusions of which the more important are:—(*a*) That sun-spots are the indirect consequences of such tides; (*b*) that the combined action of the three planets especially mentioned governs the fluctuations of the spot period; (*c*) that this ternary tide obeys an eleven-year period; (*d*) that the variation of the sun-spot period is due to the eccentricities of the planets, chiefly Jupiter.

THE BRUCE PHOTOGRAPHIC TELESCOPE.—The Bruce photographic telescope, with which a number of beautiful photographs of nebulæ, Milky Way regions, &c., have already been obtained at the Yerkes Observatory, is described in detail in an illustrated article by Prof. Barnard published in No. 1., vol. xxi., of the *Astrophysical Journal*.

The telescope was erected, at the cost of Miss Catharine Bruce, at Yerkes in April, 1904, but has now been dismounted and shipped to Mount Wilson, Pasadena, where it is to be used for photographing those regions of the Milky Way not attainable at the former observatory.

It consists of a 5-inch guiding telescope firmly bolted to two other tubes, which carry photographic doublets of 10-inches and 6¼-inches aperture respectively. The focal length of the 10-inch is only 50 inches, and the polar axis of the instrument has been formed by bending the upper part of the iron pier to the required inclination so that the camera may make a complete revolution about the axis without having to be "reversed." For use in different latitudes an iron wedge-shaped section may be introduced between the upper and lower parts of the pier in order to produce the required change of inclination, whilst a special arrangement, whereby the clock motion may be reversed in two minutes, has been introduced into the driving gear so that the same mounting may be used in the southern hemisphere.

The 10-inch doublet, by Brashear, gives excellent definition over a field 7° wide, and the scale is such that 1 inch = 1°·14, or 1° = 0.88 inch. The ratio aperture/focal length = 1/5.03 is that which Prof. Barnard believes to be the best for the purpose for which this instrument was designed. The 6¼-inch Voigtländer doublet has a focal length of 31 inches, and is used in conjunction with the 10-inch for the purpose of verification. Specimen photographs accompany the description, and these testify eloquently to the satisfactory performance of each of the doublets.

PHYSICAL CONDITIONS OF THE PLANETS.—In a communication to No. 3992 of the *Astronomische Nachrichten* Prof. T. J. J. See deals exhaustively with the methods that he has employed and the results he has obtained in a research on the internal densities, pressures and moments of inertia of the principal bodies in the planetary system. Some of the results obtained in the preliminary discussion of the available fundamental data are of great interest. For example, he arrives at the conclusion that the most probable values for the rotation period and for the oblateness of Uranus are 10h. 6m. 40.32s. and 1 : 25 respectively, whilst for Neptune the similar values are probably 12h. 50m. 53s. and 1 : 45.

In the case of the earth, Laplace's law of densities appears to be a natural law, for the value obtained for the oblateness of the outer stratum, or surface, of the globe agrees very well with that obtained as a mean of the most trustworthy of the determinations by more direct methods. The probable value obtained for the pressure acting at the earth's centre is 2383·152km. of mercury, a quantity so enormous that Prof. See attempts to render it more comprehensible by suggesting that it is 7838 times as great as a column of mercury equal in height to the Eiffel Tower.

The probable pressure at the sun's centre is nearly 212 billion atmospheres. A column of mercury acting solely under terrestrial gravitational acceleration would have to be high enough to extend beyond the sun in order that it might exert such a pressure.

Similar results for the density and pressure at different levels in the planets and satellites are given in two of the tables accompanying Prof. See's paper, and are also shown diagrammatically, whilst a third table shows the ratios of the actual moments of inertia to those of corresponding homogeneous spheres.

DISCUSSION OF CENTRAL EUROPEAN LONGITUDES.—In a series of tables published in Nos. 3993–4 of the *Astronomische Nachrichten*, Prof. Th. Albrecht brings together, weighs and tabulates all the longitude results, affecting central European observatories, hitherto obtained. In the first table the longitude differences between 176 pairs of observing stations, as determined since 1863, are thus dealt with, whilst in the second the longitude differences between Greenwich transit circle and numerous other important circles or observatories are brought together. In the third table the corrections to be applied to the differences given in table i., as determined from the discussion of the whole set, are shown.

THE SCOTTISH NATIONAL ANTARCTIC EXPEDITION.[1]

AFTER getting free from the winter quarters in the South Orkneys on November 23, 1903, the *Scotia* left for the Falkland Islands and Buenos Aires to get into communication with home and obtain a fresh stock of coals and provisions. During the ship's absence a party of six men was left at Scotia Bay under the charge of Mr. R. C. Mossman to carry on the systematic meteorological, magnetic, and biological work.

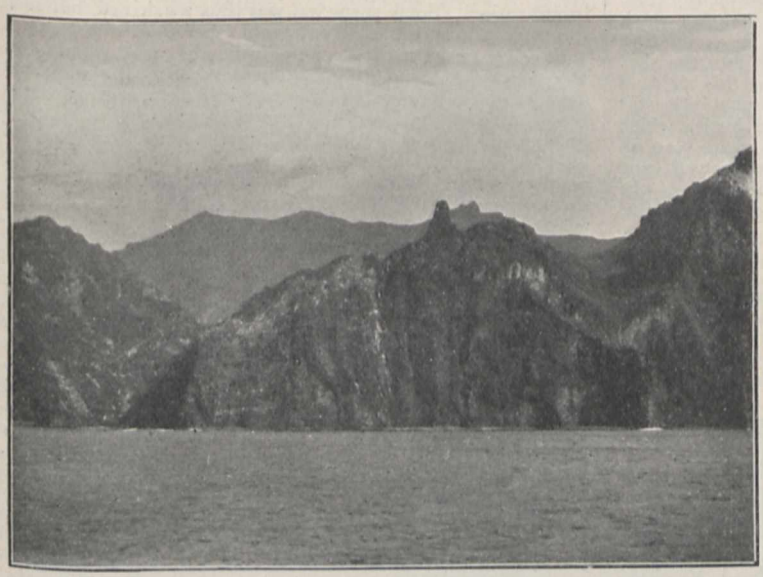

FIG. 1.—Gough Island, showing hanging valley truncated by shore cliff.

Perhaps the most interesting discovery made by the summer party was the egg of the Cape pigeon (*Daption capensis*). Although known to breed on South Georgia and Kerguelen, its eggs had never hitherto been obtained. As is the case with the majority of petrels, only a single egg is laid—a pure white egg, deposited in a nest which consists of a few angular fragments of stone raked together on a bare ledge of the cliff.

While at Buenos Aires Mr. Bruce arranged for the Argentine Government to take over and continue the meteorological and magnetic observatory at Scotia Bay, South Orkneys. On January 21, 1904, the *Scotia* left Buenos Aires with three Argentine men of science on board in addition to her own staff, and on February 22 they were left on the South Orkneys under the leadership of Mr. Mossman, who had consented to remain for a further period of twelve months.

This season the distribution of the pack ice was very different from that of the previous year. Almost no ice was met with near the Orkneys, and very little until reaching the Antarctic circle in about 32° W. long. In the beginning of March the previous year's southern record, and also that of Ross in 1843, was passed, but in 72° 18′ S. 17° 59′ W. a sudden change of conditions was met with. The water suddenly shallowed from about 2500 fathoms to 1131, and at the same time land was reported ahead. Steaming towards this we found a lofty ice-barrier stretching in a north-easterly and south-westerly direction, effectually barring further progress to the south. Close, heavy pack ice prevented a nearer approach than two miles. This barrier was traced for a distance of 150 miles to the south-west. In 73° 30′ S. 21° 30′ W., a depth of 159 fathoms was met with, the barrier being then two and a half miles off. In 74° 1′ S. 22° 0′ W., the *Scotia* was nipped by the ice in a heavy N.E. gale, and was preparing to spend the winter there; but on March 13 the floe broke up and the ship was released. During the six days' imprisonment collections of the marine fauna were got from a depth of 161 fathoms, and a splendid view was obtained of the inland ice. Although no actual bare rock was seen, there can be no doubt we were really on the edge of the Antarctic continent—off "Coats Land," as it has been named after Mr. James Coats, jun., and Major Andrew Coats, the two chief subscribers to the expedition. In this connection we quote the words of Mr. Bruce:—"I have been asked by several if I am sure that this great ice-

FIG. 2.—Glacier at head of bay, north coast of Laurie Island, South Orkneys.

[1] Abstract of a paper on the "Second Antarctic Voyage of the *Scotia*," by Mr. J. H. Harvey Pirie and Mr. R. N. Rudmose Brown in the *Scottish Geographical Magazine*.

barrier was really part of the Antarctic continent. I have no hesitation in saying 'yes,' and my reasons are these: All our soundings between 60° and 70° S. were 2500 to 2700 fathoms. In 72° S. they shoaled to about 2300, fifty miles from the barrier. Thirty-five miles from the barrier they shoaled to 1400 and 1200 fathoms, and two miles from the barrier to 160 fathoms. This alone should answer the question in the way which I have done. Secondly, from the vertical cliff of ice 100 to 150 feet in height which bordered the ocean, the ice rose high inland in undulating slopes and faded away in height and distance into the sky. It was impossible to estimate the height of this field of ice—the true inland ice of Antarctica—but probably it was many thousands of feet. Thirdly, seals and birds, which up till now had become few in numbers, were seen in myriads—penguins, especially emperors, many petrels, and terns swarming in every direction—the inhabitants of the beaches and rocky cliffs of some actual land not very far distant."

After the escape from the ice the *Scotia* turned north-eastwards to continue the oceanographical survey of the Weddell Sea, and had some very successful deep-sea trawling in high southern latitudes—one haul in 71° 22′ S. 16° 34′ W. (1410 fathoms) yielding more than sixty species of animals. Ross's reported *deep* of 4000 fathoms no bottom was shown conclusively not to exist, the whole Weddell Sea being apparently an almost level plain submerged between 2400 and 2700 fathoms.

FIG. 3.—Weddell Seal—off Coats Land.

Pursuing a track northwards along the meridian of 10° W., although encountering very heavy weather between 45° and 55° S. lat., some very interesting soundings were obtained demonstrating the extension of the mid-Atlantic ridge southwards as far as 52° S. lat. The diatom ooze band extends between 48° and 58° S.; to the south of this is blue-mud, the detritus of the Antarctic ice-sheets, to the north, globigerina ooze.

On April 22 a landing was effected with considerable difficulty on Gough Island, a previously unexplored outlier of the Tristan da Cunha group. This apparently entirely volcanic island is richly clad with vegetation, but the extremely precipitous nature of the ground prevented any extensive survey being made, though two new species of plants were obtained—a Cotula and an Asplenium; and amongst the birds two entirely distinct and new species of finches. Shallow water collections were got off the shore by means of the dredge and trap. Between Gough Island and Cape Town several soundings were taken between the parallels of 39° and 40°.

On February 8 of the present year, the Argentine sloop *Uruguay* returned to Buenos Aires from the South Orkneys, having brought back safely Mr. Mossman and his party, and landed a fresh staff there. The station is being continued for meteorological and magnetic work, and a complete outfit of self-recording magnetic instruments has been installed. This work is in connection with the systematic magnetic survey of Argentina which is at present being undertaken.

THE EARLY HISTORY OF SEED-BEARING PLANTS, AS RECORDED IN THE CARBONIFEROUS FLORA.[1]

A LARGE number of the fern-like fronds of Carboniferous age, including many whole genera, as Neuropteris, Alethopteris, Callipteris, Linopteris, &c., have never been found to offer any satisfactory indications of a fern-like fructification. Some suspicion was thus awakened that such fronds may have belonged to plants other than true ferns.

Positive evidence first came from the anatomical side. The vegetative structure of *Lyginodendron Oldhamium* was completely worked out, chiefly by Williamson, and proved to present a combination of filicinean characters with those of cycadaceous gymnosperms. Similar results were attained in other genera, as Heterangium, Medullosa, Calamopitys and Protopitys, and hence the class Cycadofilices was founded to embrace these apparently intermediate forms. Decisive evidence as to the fructification was first obtained in 1903, when it was shown by Prof. F. W. Oliver, in collaboration with the lecturer, that the seed *Lagenostoma Lomaxi* agreed so closely in certain structural features with the associated *Lyginodendron Oldhamium* as to leave no doubt that the one belonged to the other. Observations on other Lagenostomas support this conclusion and show that the seeds were borne on modified fronds. It thus appears that the family Lyginodendræ consisted of seed-bearing plants, allied to the cycads, but retaining filicinean characters; their foliage was of a sphenopteroid type.

In another extensive family, that of the Neuropterideæ, precisely analogous conclusions have been reached. Here, too, the anatomical evidences indicated a position intermediate between ferns and cycads. In the case of *Neuropteris heterophylla* it has been proved by Mr. Kidston that large seeds, referred by him to the genus Rhabdocarpus of Goeppert and Berger, were borne on the frond. There are reasons for believing that Trigonocarpon was the seed of Alethopteris, and M. Grand-'Eury, on the ground of extensive observations on the distribution of fronds and seeds, is led to conclude that the Neuropterideæ generally were seed-bearing plants, of cycadean affinity.

It has been proposed to group these fern-like seed-plants, which in Carboniferous times probably exceeded the ferns themselves in number, under the name Pteridospermeæ. Their relation to the fern-phylum is evident from many points in their structure, apart from the relatively unimportant external characters.

Other seed-bearing plants of the Carboniferous flora have long been known, notably the Cordaiteæ, great trees with large simple leaves, totally different from the Pteridospermeæ in habit, and with little indication of fern-like structure. The fructifications also are of a more advanced character than those of the pteridosperms. In the structure of the seeds, however, and in some anatomical points, a certain affinity, though a distant one, with that family is suggested. It is probable that the Cordaiteæ ultimately sprang from the same stock as the Pteridospermeæ, though at a very remote period. On the other hand, there is reason to believe that the Coniferæ, appearing at the close of the Palæozoic period, were related to the Cordaiteæ. It is thus indicated as probable that the gymnosperms generally were, in a wide sense, of monophyletic origin, as having been ultimately derived from a common stock allied to the ferns; in a narrower sense they may be termed polyphyletic, as having sprung from this common stock at different points.

Although, as we now know, certain of the Palæozoic lycopods had likewise attained to the production of a seed-like fructification, there is at present no satisfactory evidence for connecting the members of this phylum with any of the groups of seed-bearing plants which have come down to our own day.

[1] Abstract of the Wilde Lecture delivered before the Manchester Literary and Philosophical Society on February 28 by Dr. D. H. Scott, F.R.S.

FORESTRY IN THE UNITED STATES.

WE have lately received five publications from the United States Bureau of Forestry, viz. *Bulletins* Nos. 46, 52 and 53, together with *Circulars* Nos. 30 and 31. *Bulletin* No. 46 is entitled "The Basket Willow," by Mr. William F. Hubbard. The author has evidently made a special

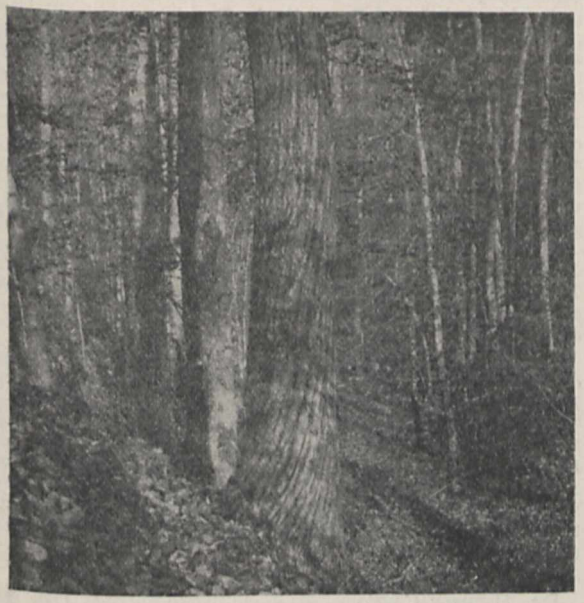

FIG. 1.—Twisted Furrows in Bark of Chestnut from Seed.

study of willow cultivation from every conceivable point of view. At the outset, he gives the general history of willow culture, together with the distribution and characteristics of the willow. This is followed by a most interesting account of willow-growing in the United States from its commencement down to the present time. The present practice is fully described, and much valuable advice is given, showing where improvements can be made on the existing methods of planting and tending the willow holts, choice of species, harvesting, cutting, sorting and packing the rods. The paragraphs which deal with expenditure and returns in American willow culture should go a long way to encourage and increase the development of what is at the present time a somewhat neglected industry in the United States.

The Bureau of Forestry is actively engaged in carrying out field experiments which are yielding, and will yield in the future, information of the utmost importance to willow-growers. The bulletin is not entirely confined to willow-growing in the United States, as the author gives a most interesting account of the development of scientific willow-culture in Europe, which he adds as an object lesson for the guidance of the American cultivator. The manufacture of willow ware in the United States is an important feature of the bulletin, which is replete with suggestions for both grower and basket-maker. A chapter on insects injurious to the basket-willow has been added, by Mr. F. H. Chittenden. A useful appendix at the end of the bulletin gives the production and consumption of willow in the United States.

Forest planting in western Kansas, by Mr. Royal R. Kellogg, constitutes *Bulletin* No. 52. The object of the paper is to show the species of tree best adapted for western Kansas, and the methods of treatment which have proved most successful. It seems, from the nature of the climate, that forestry on large areas is impracticable, but nevertheless, with an intelligent selection of species and a proper method of treatment, it may be possible to raise sufficient timber to exercise a marked effect upon the landscape, and to supply wood for domestic purposes. Among other things, the bulletin shows the enormous importance and influence tree-growth has on agriculture, not only in breaking and tempering the effect of cold, dry winds, but also in increasing the available supply of moisture in the soil. The bulletin is practically a condensed volume on sylviculture. It shows the most suitable species for western Kansas, and the site, soil, method of planting and subsequent treatment, together with the rate of growth and possible returns, are all gone into in a most thorough and workmanlike fashion. Plate iv. in the bulletin shows a row of Russian mulberry, and illustrates how the proper treatment of this species might be turned to the greatest use by the farmer. The above row extends more than 20 rods, and contains 200 trees 3 inches in diameter and 20 feet in height. Its total value, if converted into posts and stakes, would amount to 36.40 dollars, and, as the author remarks, a well-cared-for plantation at this place would evidently be a profitable investment.

Bulletin No. 53, entitled "The Chestnut in Southern Maryland," is by Mr. Raphael Zon. This species is evidently of great commercial importance in Maryland. It is apparently used principally for railway ties and telephone poles. As the result of his investigations, the author has arrived at the conclusion that pure coppice is the sylvicultural system to which the chestnut is best suited. Among other things, the report brings out clearly the difference between trees grown from seed and those from the stool. It is interesting to note that coppiced trees have thicker bark than trees from seed. The author further finds, from careful measurements and observations, that coppiced trees grow faster than seed trees during the first twenty years, and finally yield better and earlier returns than trees from seed. The illustrations reproduced show the interesting fact observed by the author that the furrows in the bark of coppice chestnut are straight, while those in the bark of chestnut from seed show the characteristic spiral twist. The report also contains many tables, showing the rate of growth and dimensions of trees from seed and coppice at various ages.

Circular No. 30, by Mr. Gifford Pinchot, is a description of an exhibit of forest planting in woodlots at the Louisiana Purchase Exposition. The exhibit is intended to illustrate the different methods of planting with different species and mixtures suitable for the different parts of the United

FIG. 2.—Straight Furrows in Bark of Coppice Chestnut.

States. There are in all forty-eight plots, representing different regions to which the various mixtures and density of planting are best adapted. This should form a valuable guide to sylviculturists all over the United States.

Circular No. 31, by the same author, is a description of a forest nursery exhibit at the above exposition. The most suitable form of bed, different methods of sowing, and

various kinds of shelter screens are described. The coniferous and deciduous nurseries are for obvious reasons treated separately.

This batch of literature gives some idea of the value of the work which the United States Bureau of Forestry is doing, and, on the whole, its value to the country cannot be over-estimated.

PROGRESSIVE BUDDHISM.[1]

THE handsomely got-up and well-printed review, *Buddhism*, is an interesting sign of the times. The Buddhist community is apparently realising that it is advisable, so far as possible, to bring itself into line with modern developments, and to the monthly periodicals appearing in Ceylon, Japan, and (strange to say) San Francisco, has now added this quarterly journal appearing in Burma.

The present venture is edited by Ananda Maitreya, the name, in religion, of a Scotchman who has entered the Buddhist Order; and he has secured the cooperation for this number not only of Indian, Burmese, and Sinhalese, but also of American and English writers.

In the editor's article on "The New Civilisation," he maintains that the new civilisation which is beginning, in a way that no ancient civilisation did, to permeate mankind should be heartily welcomed by Buddhists as being based on that conception of the inviolable sequence of cause and effect, of the reign of law, which was, indeed, the main tenet in the teaching of the Buddha. And he ventures on a glowing prophesy of what the future of humanity will be when this conception of law, claimed by him as a special mark of Buddhist teaching, shall have worked out its effect in the daily lives of men by an increased deference to knowledge, and to the men of knowledge, by the growth of a spirit of wide toleration and humanity. The courageous optimism of this article is in striking contrast with ideas usually held about Buddhist teaching; but it is interesting to see how thoroughly the party represented by this newest Buddhist journal is in sympathy with the teachings and the spirit of science.

Dr. Paul Carus, of Chicago, follows with an article on "The Philosophy of Buddhism," in which he claims that the latest, as well as the earliest, Buddhism, rests upon the belief in a universal reign of law, and on the idea that nothing is but everything becomes. Mr. Chandra Das has an interesting historical paper on the foundation of Lhassa, and Mr. Tau Seng Ko another on the introduction of Buddhism into Burma, each of them writing with special expert knowledge of his subject. There are shorter articles by other writers, paragraphs of notes and news, and some scholarly reviews. The journal would be useful to those who desire to follow the tendencies in the forward movement among the Buddhist communities; whether it is entitled to speak for all Buddhists is another matter.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. A. W. Hill, of King's College, has been appointed University lecturer in botany until Michaelmas, 1909.

The degree of Sc.D. *honoris causa* is to be conferred on Prof. E. B. Tylor, of Oxford, at a congregation held to-day. At the same congregation Mr. J. W. Willis, director of the Botanical Gardens, Peradeniya, Ceylon, will proceed by proxy to the same degree.

Mr. C. Shearer, advanced student of Trinity College, has been re-nominated to the university table at the zoological station at Naples.

The Board of Geographical Studies has published the following schedule for the special examination in geography and for part i. of the examination for the diploma in geography:—(1) *Physical Geography*.—Form and motions of the earth. Elementary climatology and oceanography. Typical forms of land configuration, their distribution and modes of formation. (2) *Historical and Political Geography*.—The historical development and political partition of the different regions of the world, with a consideration of the influence of their physical features. A more detailed knowledge of the geography of a selected region (for 1905 and 1906, *Europe*). (3) *Economic and Commercial Geography*.—The economic growth of the different regions of the world, and the main lines of commerce and communication by land and sea in past and present times. A more detailed knowledge of a selected region (for 1905 and 1906, *Europe*). (4) *Cartography*.—The construction and use of maps. A general knowledge of the methods of exploratory surveying: plane tabling, latitudes and azimuths by the sun, latitude and azimuth traverses, route traverses and compass sketching. Heights by barometer and boiling-point thermometer. The candidate will be examined orally and practically on maps and on the ordinary surveying instruments. Any candidate who can produce a sketch made by himself of a route traversed by compass, and checked by observations for latitude and azimuth with the necessary computations, will be examined thereon and will receive special credit for good work. (5) *History of Geographical Discovery*.—The outlines of the history of geographical discovery, with special questions on a selected region or period (for 1905 and 1906, *The Fifteenth Century*). (6) *Elements of Ethnology*.—The principal races of mankind, their migrations and present distribution.

LONDON.—At the annual meeting of University College on February 22, the following resolution, moved by Lord Reay, on behalf of the council, was unanimously adopted:—That the Bill now submitted, entitled "A Bill for Transferring University College, London, to the University of London and for other matters connected therewith and for Amending the University of London Act, 1898," be and the same is hereby approved subject to such additions, alterations, and variations as Parliament may think fit to make therein.

DR. MICHELE CANTONE, of Pavia, is to succeed Prof. E. Villari as professor of physics and director of the physical laboratory at Naples. At Göttingen, Prof. F. Dolezalek has been appointed head of the department of physical and electrical chemistry. Dr. H. Kneser has been appointed professor of mathematics at Breslau. Dr. Ludwig Claisen late professor of chemistry at Kiel, has been appointed honorary professor at Berlin, and Dr. Karl Stöckl professor of mathematics and physics at Passau.

IN his last report President Eliot recommends, says *Science*, the collection of 500,000*l*. as an endowment for the college of Harvard University, and it is said that the alumni are making efforts to collect this sum before the next commencement day. The class of 1880 expects to contribute 20,000*l*. on the occasion of its twenty-fifth anniversary. From the same source we learn that Mr. Andrew Carnegie has given to the Rensselaer Polytechnic Institute at Troy 25,000*l*. toward rebuilding the main building which was burned last June. He has also given 20,000*l*. to Tufts College for the erection of a library building.

THE committee appointed by the Prince of Wales, as president of King Edward's Hospital Fund, to inquire into the financial relations between the hospitals and medical schools has now issued its report. The committee has formed, it is to be noted with satisfaction, the opinion that a broad line of distinction ought to be drawn between the preliminary and intermediate studies of a medical student on one hand, and the final studies on the other; and that whilst the final studies can be pursued with advantage only within the walls of a hospital, the earlier scientific studies have no real relation with a hospital, and are pursued more properly in an institution of university character. The committee expresses satisfaction that the statutes of the University of London direct the Senate to "use its best endeavours whenever practicable to secure such common courses of instruction for internal medical students in the preliminary and intermediate portion of their studies under appointed or recognised teachers at one or more centres." To do this effectively will mean a great expenditure, and the Senate of the university is appealing for funds to assist it in carrying out the work. The conclusions arrived at by the committee appointed by the Prince of Wales should prove of advantage both to the hospitals and to the

[1] "Buddhism." An Illustrated Quarterly Review. Vol. i., No. 4. Pp. xxii+170. (Rangoon: Hauthrawaddy Press, 1904.)

university. The hospital should be a school only in the sense of being a school of applied science where general principles of science are applied to a specific technical purpose. But if the medical student is to be no longer provided with instruction in scientific fundamentals at the hospitals, there must be forthcoming—if London is to remain a great medical and surgical centre—funds enough to provide other institutions where this teaching may be given. University College and King's College have long done work of this kind, but the accommodation which they are able to provide is quite inadequate for the instruction of the students of all the hospitals, and other colleges are required where general education of a university standard may be obtained.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 26.—"On the Comparison of the Platinum Scale of Temperature with the Normal Scale at Temperatures between 444° and −190° C., with Notes on Constant Temperatures below the Melting-point of Ice." By Prof. Morris W. **Travers**, F.R.S., and A. G. C. **Gwyer**.

The authors conclude that, as might be expected, it is possible to apply the parabolic formula of Callendar and Griffiths to the re-calculation of the differences between the platinum scale of temperature and the scale of the gas thermometer, though the range through which it is applicable, and value of the constant ∂, precludes the possibility of employing it except for interpolation. A standard scale of temperature, based on Callendar's three fixed points, using standard wire, and taking 1.5 for the value of ∂, would lead to absurd results at low temperatures; and the converse may be said of the authors' own observations. The results referred to in this paper may be summed up as follows:—

Nature of gas thermometer.	Observer.	∂
Constant pressure air (0° to 444°) ...	Callendar and Griffiths	1·50
Constant volume nitrogen (−23° to 445°)	Chappuis and Harker	1·54
Constant volume nitrogen standardised by constant pressure air at 444° (500° to 1000°)	Harker	1·51—1·49
Constant volume hydrogen (−190° to 34°)	Travers and Gwyer ...	1·90

February 2.—"On the 'Blaze-currents' of the Gall Bladder of the Frog." By Alice M. **Waller**. Communicated by Dr. Augustus D. Waller, F.R.S. (From the Physiological Research Laboratory of the University of London.)

This investigation was made in continuation of Dr. Waller's work on blaze-currents. A blaze-current, as defined by Dr. Waller in previous communications to the Royal Society and in his lectures on the signs of life, is a current of action, an electric current aroused in living tissues by stimulus; the term "blaze" has reference to the vitality of the tissue, to a chemical exchange going on within it; a muscle at rest is smouldering, a muscle in action is blazing. Dr. Waller's apparatus and method of work were employed; the apparatus consists essentially of a keyboard containing four keys, opening respectively to an induction coil, a compensator, the object to be studied, and a galvanometer or electrometer. Any accidental current in the object is compensated so that the galvanometer key can be opened without altering the zero, then the object is stimulated by a single break induction shock, the galvanometer key is opened, and the after-effect observed.

As seen in previous work by this method, the direction of blaze-current varies in different living objects or tissues, *e.g.* in a plant the blaze-current is either post-anodic or homodrome or it runs from younger to older tissue, in the crystalline lens from anterior to posterior surface, in skin from within outwards. The tissues and organs of the frog were systematically examined, and it was found that the liver gave responses either antidrome or from surface to hilum, and the gall bladder gave surprisingly large electrical variations, as much as 1/10 volt, always antidrome, in a way that one is accustomed to regard as due to polarisation currents in non-living matter. These polarisation currents were proved to be physiological by their abolition on submitting the organ to strong chloroform, boiling or electrocution by tetanisation. The effect is local, it can be destroyed by tetanus at two spots, and was found to persist at other parts of the round bladder.

Employing Waller's A. B. C. method, in which a three-way switch is employed so that the anode and kathode of the exciting current can be separately interrogated, it is found that the blaze at each pole is post-kathodic or antidrome. The blaze lasts about two minutes; it is often diphasic or triphasic; a single break shock with coil at 5000— (Berne scale) gave +0.0125 volt, then −0.0110, then +0.0010.

The bladder was washed out and filled with salt solution, and the same effect obtained; a piece was snipped off and electrodes applied to mucous and serous surfaces, and still antidrome blaze obtained, though there was a tendency to exhibit the usual mucous to serous blaze.

The simplicity of structure of the gall bladder—a sphere having a single row of columnar epithelium on the mucous interior surounded by layers of smooth muscle fibre cells—may account for the large and definite blaze-currents obtained, but why the cells should exhibit negative polarisation, antidrome rather than homodrome or positive polarisation, is not yet apparent.

Entomological Society, February 1.—Mr. F. Merrifield, president, in the chair.—*Exhibitions*:—Specimens of *Oligota granaria* found in a granary at Holborn, the only other localities reported hitherto being Shoe Lane, London, and Scarborough: H. St. J. **Donisthorpe**.—An Erycinid butterfly *Mesosemia eumene* pinned in its natural position of rest to show its resemblance to the head of a small mammal, such as a mouse: W. J. **Kaye**.—A variety of the female of *Lycaena melanops* named by him var. *wheeleri*: Dr. T. A. **Chapman**. As a mere aberration it was interesting, but it was of value as showing that the position in the genus for long accorded to the species, whether by accident or design, close to the Arion-Euphemus group, was correct. The considerable extension of the blue in this specimen showed up certain black spots on the upper surface of both upper and lower wings, strictly similar to these characteristics of the Arion-Euphemus group.—A living ♀ *H. defoliaria*, taken as late as February 1, at rest on north side of oak-tree, and another ♀ taken January 28 in the same wood at Bexley. A ♂ *Notodonta ziczac* × ♀ *N. dromedarius*, with two hybrids, the colour of the hybrids being that of *dromedarius*, while the markings were those of *ziczac*: F. **Enock**.—A living specimen of *Acridium aegyptium*, L., found in a cauliflower in Bloomsbury, and probably imported from Italy: O. E. **Janson**.—Two specimens of *Malachius barnvillei*, Puton, captured by Mr. Thouless at Hunstanton, Norfolk, in June, 1899, a recent addition to the British list: G. C. **Champion**.—♂ and ♀ specimens of *Machimus rusticus*, Mg., a rare Asilid, taken *in cop.* at Freshwater, Isle of Wight, on August 13, 1903: H. W. **Andrews**.—A ♀ example of *Panorpa cognata* taken at Byfleet Canal on August 23, 1904: W. J. **Lucas**. The insect occurs at Folkestone, and is said to be found in the New Forest. It is a little difficult at times to identify the ♀ alone, but Mr. K. J. Morton also had identified the specimen exhibited as *P. cognata*. For comparison he also exhibited ♀♀ of *P. communis* and *P. germanica*.—*Papers*:—A revision of the genus Criocephalus, with notes on the habits of *Asemum striatum* and *Criocephalus ferus*: Dr. D. **Sharp**, F.R.S., and T. G. **Smith**.—Another entomological excursion to Spain (with descriptions of two new species of Hemiptera by Dr. O. M. **Reuter**): Dr. T. A. **Chapman** and G. C. **Champion**.—On the matrivorous habit of the species of Heterogynis, Ramb., and on the pupal suspension of Thais: Dr. T. A. **Chapman**.—Notes on New Zealand Lepidoptera: E. **Meyrick**, F.R.S.

Zoological Society, February 7.—Mr. Howard Saunders, vice-president, in the chair.—A second collection of fishes made by Mr. S. L. Hinde in the Kenya District of East Africa: G. A. **Boulenger**, F.R.S. Examples of five species were contained in the collection, three of which were new to science.—On some points in the anatomy of a theriodont reptile: Dr. R. **Broom**.—Field-notes on the mammals of Southern Cameroons and the Benito: G. L. **Bates**.—A collection of Heterocera from the Fiji Islands: G. T. **Bethune-Baker**. Of the species enumerated eleven were new to science.—A contribution to the knowledge of

the arteries of the brain in the class Aves: F. E. **Beddard,** F.R.S.—The function of the antennæ in insects: M. **Yearsley.** After reviewing the literature on the subject the author pointed out that Lowne, in his work on the blowfly, suggested that the antennæ were probably balancing rather than auditory organs. Lord Avebury and Latreille were cited in favour of this view, and the work of Yves Delage on Crustacea and of Clemens upon a moth (*Samia cecropia*) as confirmatory experiments. The author then gave details of experiments upon thirty wasps (*Vespa vulgaris*) in which the antennæ had been removed. The results of this mutilation were:—(1) Loss of power of flight; (2) loss of sense of direction; (3) noticeable slowness in all movements. The conclusion arrived at was that in wasps, the antennæ were equilibrating in function. This supported Lowne's surmise and corroborated the experiments of Clemens on *Samia cecropia*.

Anthropological Institute, February 14.—Prof. W. Gowland, president, in the chair.—Exhibition of native dances and ceremonies from the Torres Straits: Dr. A. C. **Haddon,** F.R.S. The exhibition was illustrated by lantern slides and kinematograph films, and dealt with the "Malu" ceremony, secular dances, and fire-making by a rotary method. Dr. C. S. Myers sang several of the native songs, which are sung at the dances, and accompanied himself on a native drum.—Dog-motive in Bornean design: E. B. **Haddon.** The methods of tattooing are constant among the tribes of Borneo, and most of the patterns are derived from the Kenyah and Kayan tribes. The different patterns are all derived from the dog-motive. The rosette pattern, for instance, which is tattooed on the shoulders of the men, is directly derived from the eye of a dog, although the Iban tribe, who have adopted the pattern, call it by the name of various fruits and flowers. The conventional tattoo pattern found on the firearms of Kenyah and Kayan men in Sarawak, although modified out of all recognition, is also clearly derived from the same source, as it is named *asu,* which means dog; from this same pattern a series can be traced to the Iban pattern, which is said to represent a scorpion, *Kala,* but was clearly originally a dog. Similarly the so-called prawn pattern, *Udang,* was shown to be derived from the dog-motive.

Royal Meteorological Society, February 15.—Mr. R. Bentley, president, in the chair.—Report on the phenological observations for the year 1904: E. **Mawley.** The weather of the phenological year ending with November, 1904, was chiefly remarkable for the persistent rains in January and February, the absence of keen frosts in May, the long continuance of hot and dry weather in July, and the small rainfall during the autumn. Throughout the year wild plants came into flower behind their usual dates, but at no period were the departures from the average exceptional. Such spring migrants as the swallow, cuckoo, and nightingale made their appearance in this country at as nearly as possible their usual time. The yield of wheat per acre was the smallest since 1895, while those of barley, beans, and peas were also deficient. On the other hand, there were good crops of oats, potatoes, and mangles. The best farm crops of the year were, however, those of hay, swedes, and turnips. Both corn and hay were harvested in excellent condition. Apples were everywhere abundant, and all the small fruits yielded well, especially strawberries, but there was only a moderate supply of pears and plums.—Observations of meteorological elements made during a balloon ascent at Berlin on September 1, 1904: Dr. H. **Elias** and J. H. **Field.**—The winds of East London, Cape Colony: J. R. **Sutton.**

Linnean Society, February 16.—Prof. S. H. Vines, F.R.S., vice-president, in the chair.—A revised classification of roses: J. G. **Baker,** F.R.S. The author dealt with the genus by dividing it into three groups. In the first group primary species were enumerated; in the second, subspecies and varieties; in the third, the principal hybrids. The primary species as estimated by the author are sixty-nine in number, and they are classified under eleven groups. The geographical distribution can be very briefly stated as follows:—Five species are found south of the Tropic of Cancer in elevated situations, two in Abyssinia, one in the Neilgherries, and two in Mexico. There are six geographical regions in the North Temperate Zone, each with a considerable proportion of endemic species. (1) Europe, with twenty-nine species; (2) Northern Asia with China and Japan, twenty-six species; (3) Western Asia, with eighteen species; (4) India, with nine species; (5) Western North America with the Rocky Mountains, with ten species; (6) Eastern North America, six species.—The botany of the Anglo-German Uganda Boundary Commission—Polypetalæ, E. G. **Baker**; Gamopetalæ excl. Convolvulaceæ, S. **Moore**; Convolvulaceæ, Apetalæ, and Monocotyledons, Dr. A. B. **Rendle.** The Commission commenced demarcating the boundary in the Uganda Protectorate in December, 1902, H.M. Commissioner on the British side being Lieut.-Col. Delmé-Radcliffe. The collections which are the subject of this paper were made by Dr. A. G. Bagshawe, the medical officer. They contain a considerable number (some fifty) of novelties, as also of known plants not hitherto recorded from the Uganda Protectorate. For the Angolan plant previously known as *Asystasia africana,* C. B. Clarke, which also is in the collection, a new genus, Styasasia, is proposed. A considerable percentage of West African coast-plants is a feature of the Protectorate flora as now made known, and worthy of mention is the presence of a small South African element.

CAMBRIDGE.

Philosophical Society, January 30.—Prof. Marshall Ward, F.R.S., president, in the chair.—On the non-electrification of γ rays; Prof. **Thomson,** F.R.S. Experiments were described in which the electrifications imparted to two equal cylinders made of thin brass, one of them hollow and the other filled with lead, were measured. The cylinders were in electrical connection and were symmetrically placed in a large vessel from which the air was exhausted. The cylinders were exposed alternately to the γ rays of radium, and from the measurement of the charges received by them it was concluded that the electrifications observed when γ rays fall on a body are not due to a charge on the γ rays, but to the charge carried by secondary β rays excited by the γ rays when they fall on the body or on the walls of the vessel containing it.—Are metals made radio-active by the influence of radium radiation? Prof. **Thomson,** F.R.S. From experiments made on lead, brass, and tin it was shown that these bodies, after exposure to radium radiation, exhibit no trace of radio-activity four minutes after the radiation has ceased to fall upon them; there was no evidence of induced activity of any kind, but the method used was not adapted for testing the existence of a very short-lived radio-activity; this has been done by Prof. Bumstead by a method described in the next paper.—Are metals made radio-active by the influence of radium radiation? Prof. **Bumstead.** The experiments described formed a continuation of those reported by Prof. Thomson, and were designed to ascertain whether the secondary rays given out by a surface exposed to the β and γ rays of radium persisted for a very short time after the exposure to the exciting rays had ceased. A rotating disc was used and four substances were tested, viz. copper, lead, tin, and blotting-paper which had been soaked in a solution of uranium nitrate and then dried. The interval between exposure to the rays from 30 mg. of pure radium bromide and the subsequent test for residual activity was less than 0·009 second; and no rays capable of penetrating 7 mm. of air and 0.00005 cm. of aluminium were detected. If any were present they must have been considerably less intense than those given out by a layer of potassium uranium sulphate with a surface-density of one milligram per square centimetre.—Note on the positive leak from hot platinum in air: O. W. **Richardson.** Experiments showing that the rate of discharge of positive electricity by a platinum wire, which had been heated in air long enough for the current to become steady, consists of two parts, one proportional to, and the other independent of, the pressure.—Some methods of increasing the spark length of the Wimshurst machine: B. J. **Palmer.**

February 13.—Prof. Marshall Ward, president, in the chair.—Orthogonal and other special systems of invariants, part i.: Major P. A. **MacMahon,** F.R.S. In this paper orthogonal concomitants are discussed by means of a symbolic calculus with imaginary umbræ. For a binary quantic of any given order, the author finds an inferior limit to the maximum degree of an irreducible covariant of given order

belonging to it: a superior limit is also found in certain cases. For the first three degrees of the concomitants, for a quantic of any order, the actual number of irreducible concomitants is found; and hence the number of fundamental syzygies is inferred. Tables of ground-forms are given for quantics of order 2, 3, 4, 5, 6 respectively.—Reduction of generating functions by means of complex integration: G. B. **Mathews**, F.R.S. It is shown in this note how a class of generating functions which occur in the theory of invariants, and in that of the partition of numbers, may be reduced by means of Cauchy's calculus of residues.

DUBLIN.

Royal Irish Academy, February 13.—Prof. R. Atkinson, president, in the chair.—Verb functions or explicit operations, with notes on the solution of equations by operative division: Major Ronald **Ross**, C.B., F.R.S. If any expression is being considered as the result of an operation performed on one of its elements, the actual operation can be separately and explicitly represented in the following manner. The place occupied by the subject-element is called the base of the operation and is always denoted by β. Thus, $\beta \cos^{-1}\beta$ is the operation performed on x in order to produce the function $x \cos^{-1}x$. As β has no quantitative value, such an expression as $\beta \cos^{-1}\beta$ denotes, not a quantity, but an *action*, and may be called a *verb function*. Before applying such an expression to a subject it must be placed in special (square) brackets in order to distinguish operation from multiplication. The method may be applied to the solution of a complete equation of the nth degree in $2n$ ways, and applies equally to the solution of linear differential equations.

EDINBURGH.

Royal Society, February 6.—Dr. Traquair in the chair.—On Penella, a Crustacean parasitic on the Finner Whale (*Balaenoptera musculus*): Sir William **Turner**. This copepod was originally recognised by Koven and Danielssen as parasitic on *Balaenoptera rostrata*. The author's specimens were obtained in 1903 from *B. musculus*. The memoir comprised an account of the external characters and internal anatomy of the female, which, being from 10 to 12 inches long, varying in different specimens, is a giant amongst copepods. A comparison of the species with other species of Penella was made, and the great length of the thoracic in comparison with the genito-abdominal segment was referred to. The male of this species has not yet been recognised.—The ontogeny of the neuron in vertebrates; a cytological study of the embryonic nucleus: Dr. John **Cameron**. The results of the investigation tend to show that the so-called neuroblasts of the central nervous system in the early vertebrate embryo are really nuclei, from which the rudiments of the axis cylinder are formed as delicate protrusions. The neuroblast nuclei are found to exhibit remarkable structural changes, as evidence of the formation of these processes. The results attained in this research support the central theory of nerve-genesis as formulated by, among others, His and von Kölliker. They also tend to throw fresh light on the properties and functions of the cell-nucleus.

MANCHESTER.

Literary and Philosophical Society, February 7.—Prof. H. B. Dixon, F.R.S., vice-president, in the chair.—A new direct-vision spectroscope: T. **Thorp**. In Mr. Thorp's instrument the dispersion is effected by means of a transparent grating of about 14,500 lines to the inch, mounted on the long face of a light crown prism having a refracting angle of about 37° to secure direct vision. This prism-grating is mounted in a hinged frame and adjusted so that the grating face is at an angle of 45° with the axis of the instrument when the frame is at the centre of its range of motion. A spring holds the frame tightly against the end of a micrometer screw having a graduated head, this head being in the focus of a lens placed near the ocular of the spectroscope so that it can be read off without taking the instrument away from the eye. The D lines can just be separated in the pocket instrument, and readings can be made by taking the mean of several to about one Ångstrom unit.—Leaden weights found at Melandra Castle, an old Roman edifice near Glossop, among them being the uncia, or ounce, and other weights related thereto: F. A. **Bruton**.—A direct determination of the atomic weight of chlorine by burning a known weight of hydrogen in a known weight of chlorine: Prof. H. B. **Dixon**, F.R.S., and E. C. **Edgar**. The hydrogen was occluded in palladium and so weighed; the chlorine was prepared by the electrolysis of silver chloride, and was weighed in the liquid state. The atomic weight comes out about 35·192, higher than the accepted number by 0.012. This higher value is of interest in view of the recent (unpublished) work of Prof. Theodore Richards, of Harvard, who obtains a value 0.019 higher than the accepted atomic weight.—On the occurrence in Britain of the Pacific eider (*Somateria v-nigrum*, Gray), a species new to the European avifauna: C. **Oldham**.—Some habits of bats, with special reference to the lesser horse-shoe bat (*Rhinolophus hipposiderus*): C. **Oldham**. Proofs were given that the hibernation of these animals is not continuous, but interrupted by transient periods of activity.

PARIS.

Academy of Sciences, February 20.—M. Troost in the chair.—Observation of the partial eclipse of the moon on February 19: G. **Bigourdan**. Owing to the cloudy condition of the sky no observations were possible before 7.50 p.m.—On a new method of synthesis of alkyl derivatives of certain cyclic saturated alcohols: A. **Haller** and F. **March**. The sodium derivatives of propyl, isobutyl, and isoamyl alcohols, heated to 200° to 225° C. in an autoclave with β-methylcyclohexanone, act partly as reducing and partly as alkyl substituting agents. Homologues and isomers of menthol result from the reaction.—On the examples of Palinuridæ and Eryonidæ collected in the eastern Atlantic by the French and Monaco expeditions: E. L. **Bouvier**. The study of the collections brought home by the two expeditions has resulted in the discovery of some new interesting species, among others two types belonging to the genera Puer and Eryonicus, examples of which are extremely rare. These two forms show their distinctive morphological characters very early.—The application to the nitriles of the method of direct hydrogenation by catalysis; the synthesis of primary, secondary, and tertiary amines: Paul **Sabatier** and J. B. **Senderens** (see p. 423).—The large solar spot of February, 1905: Th. **Moureux**. On February 2 this spot, which was clearly visible to the naked eye, had a length of 180,200 kilometres. Its area was 1/20th of the solar disc, and hence it is greater than any sun-spot previously observed.—On Taylor's series on the circle of convergence: Paul **Dienes**.—On differential equations of the second order containing a single parameter: G. **Tzitzeica**.—On the approximate integration of differential equations: Émile **Cotton**.—On the mode of working of the differential gear of automobiles: A. **Petot**.—On the coefficient of magnetisation of bismuth and on some fixed points in the diamagnetic scale: Georges **Meslin**. The coefficient found for mercury was $-0{\cdot}185.10^{-6}$, taking water as $-0{\cdot}79.10^{-6}$. For crystallised bismuth the value, with the additive correction for the air, was $-1{\cdot}39.10^{-6}$, whilst a slightly higher result, $-1{\cdot}42.10^{-6}$, was obtained for the fused metal.—On the perborates: P. **Melikoff**. A claim for priority as against M. Jaubert.—On lactyllactyllactic acid and the dilactide of the inactive acid: E. **Jungfleisch** and M. **Godchot**.—On the carbimide of natural leucine: MM. **Hugounenq** and **Morel**. The leucine ethyl ester was heated to 130° C. with carbonyl chloride in toluene solution, and the mixture submitted to fractional distillation *in vacuo*. The carbimide sought for was readily separated in this way from the substituted urea formed at the same time.—On the perborates: J. **Bruhat** and H. **Dubois**. A description of the preparation and properties of the perborates of potassium, sodium, and ammonium.—Assimilation outside the organism: Ch. **Bernard**. It has been stated by Friedel and confirmed by Macchiati that the enzyme extracted from leaves by glycerine in the presence of chlorophyll and light was capable of decomposing carbonic acid and setting free oxygen. The author has not been able to obtain any trace of oxygen under these conditions, and on repeating an experiment exactly in accordance with Macchiati's instructions found that the gas evolved consisted of methane and other inflammable gases, arising from the anaërobic decomposition of the plant tissue, this change not taking place

in the presence of antiseptics, such as camphor. The author therefore regards the decomposition of carbonic acid outside the plant as unproven.—On the composition of brandy from wine: X. **Rocques**. A table is given showing the results of analysis of twenty-two samples of brandy arising from the distillation of wine, and it is pointed out that a brandy containing a relatively small amount of esters contains an increased amount of higher alcohols.—The prediction of a chemical reaction forming a monovariant system: Camille **Matignon**.—On two plants producing rubber: E. de **Wildeman**. A description of two plants, *Bassea gracillima* and *Periploca nigrescens*, the rubber producing properties of which have not hitherto been recognised.—On a new coffee plant in Central Africa: Aug. **Chevalier**. A detailed account of *Coffea excelsa*, with analyses of the soil in which it flourishes and of the coffee-bean produced from it. The amount of caffeine and the taste and aroma of the coffee are good, and would be worth cultivating in the French Congo.—On the secreting apparatus of Dipterocarpus: P. **Guérin**.—On the effect of low temperatures on the zoospores of the Algæ: E. C. **Teodoresco**. The spores of *Dunaliella salina* were found to retain their activity in a salt solution even after exposure to a temperature of −30° C.—On a new cellular type with metamerised cytoplasm, *Taenicystis mira*: Louis **Léger**.—Geographical variations of the Pleuronectidæ: A. **Cligny**.—The extension of the functional states of the auricle to the ventricle: H. **Kronecker**. The author's experiments lead him to regard this effect as being entirely due to nervous elements.—Variations in morbid processes according to the composition of the organs: MM. **Charrin** and **Le Play**. Hydrolysis of the hepatic glycogen produced by the injection of amylase into the portal vein: M. **Pariset**.—On the stimulation of the nerves by very short electric waves: Louis **Lapicque**.—The experimental reproduction of leprosy in the ape: Charles **Nicolle**.—The geology of the Pyrenees of Haute-Garonne and Ariège: Léon **Bertrand**.—On the Amana meteorites: G. D. **Hinrichs**.—The cave lions: Marcellin **Boule**.

DIARY OF SOCIETIES.

THURSDAY, MARCH 2.

ROYAL SOCIETY, at 4.30.—Further Researches on the Temperature Classification of Stars. No. 2: Sir Norman Lockyer, K.C.B., F.R.S.—On the Radio-active Minerals: Hon. R. J. Strutt.—Atmospheric Electricity in High Latitudes: G. C. Simpson.—On the Spectrum of Silicon, with a Note on the Spectrum of Fluorine: J. Lunt.—On the Electric Resistance to the Motion of a Charged Sphere in Free Space or in a Field of Force: G. W. Walker.

ROYAL INSTITUTION, at 5.—Recent Astronomical Progress: Prof. H. H. Turner, F.R.S.

CHEMICAL SOCIETY, at 8.—The Latent Heat of Evaporation of Benzene and some other Compounds: J. Campbell Brown.—The Relation between Natural and Synthetic Glycerylphosphoric Acids: F. B. Power and F. Tutin.—The Reduction of Isophthalic Acid: W. H. Perkin, jun., and S. S. Pickles.—The Transmutation of Geometrical Isomers: A. W. Stewart.

RÖNTGEN SOCIETY, at 8.15.—A discussion on "The Necessity of Accurate Measurement in X-ray and High Frequency Work," opened by Dr. W. D. Butcher.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY, at 8.—Engineering Expert Evidence: J. F. Reade.

LINNEAN SOCIETY, at 8.—Zoological Nomenclature; International Rules and Others (to be followed by a discussion): Rev. T. R. R. Stebbing, F.R.S.—Biscayan Plankton. Part IV. The Thaliacea: Dr. G. Herbert Fowler.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Type-setting by Telegraph: D. Murray.

FRIDAY, MARCH 3.

ROYAL INSTITUTION, at 9.—Recent Advances in Wireless Telegraphy: Chev. G. Marconi.

GEOLOGISTS' ASSOCIATION, at 8.—The Diamond Mines of South Africa: Prof. H. A. Miers, F.R.S.

SATURDAY, MARCH 4.

ROYAL INSTITUTION, at 3.—Archæology: D. G. Hogarth.

MONDAY, MARCH 6.

SOCIETY OF ARTS, at 8.—Internal Combustion Engines: Dugald Clerk.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Mechanics of Fire: Prof. H. E. Armstrong, F.R.S.—On the Estimation of Arsenic in Fuels—A Shortened Method: Dr. G. McGowan and R. B. Floris.

VICTORIA INSTITUTE, at 4.30.—Geological Exterminations: Dr. C. B. Warring.

FARADAY SOCIETY, at 7.50.—Annual general meeting.—At 8.15.—Recent Developments in Electric Smelting in Connection with Iron and Steel: F. W. Harbord.

TUESDAY, MARCH 7.

ROYAL INSTITUTION, at 5.—Some Recent Biometric Studies: Prof. K. Pearson, F.R.S.

ZOOLOGICAL SOCIETY, at 8.30.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Surface-Condensing Plants, and the Value of the Vacuum produced: R. W. Allen. (*Continuation of Discussion.*)

WEDNESDAY, MARCH 8.

GEOLOGICAL SOCIETY, at 8.—(1) Observations on some of the Loxonematidæ, with Descriptions of two New Species: (2) On some Gasteropoda from the Silurian Rocks of Llangadock: Miss Jane Donald.

SOCIETY OF ARTS, at 8.—Ethics of Japanese Society: Baron Suyematsu.

THURSDAY, MARCH 9.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* The Rate of Transmission of the Guatemala Earthquake of April 19, 1902: R. D. Oldham.—Ionic Sizes in Relation to the Conductivity of Electrolytes: W. R. Bousfield.—Explosions of Mixtures of Coal Gas and Air in a Closed Vessel: L. Bairstow and A. D. Alexander.

ROYAL INSTITUTION, at 5.—Recent Astronomical Progress: Prof. H. H. Turner, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Report on Experiments carried out at the National Physical Laboratory: On the Effect of Heat on the Electrical and Mechanical Properties of Dielectrics, and on the Temperature Distribution in the Interior of Field Coils: Dr. R. T. Glazebrook, F.R.S.—On Temperature Curves and the Rating of Electrical Machinery: R. Goldschmidt.

FRIDAY, MARCH 10.

ROYAL INSTITUTION, at 9.—The Structure of the Atom: Prof. J. J. Thomson, F.R.S.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 8.—On a Dibranchiate Cephalopod from the Eocene of Arabia: G. C. Crick.—Note on the Horizon and Locality of the Type Specimen of *Pleuronautilus pulcher*: G. C. Crick.—New Marine Mollusca from the Collection of the late Admiral Keppel: G. B. Sowerby.—On the Occurrence of Internal Septa in *Glyptostoma newberryanum*: G. K. Gude.—Note on a Dart found in the Body Cavity of *Helix aspersa*: R. G. Barnes.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Purification of Sewage: F. G. Helsby.—The Purification of Sewage by Hydrolysis and Oxidation: F. O. Kirby.

PHYSICAL SOCIETY, at 8.—On the Stresses in the Earth's Crust before and after the Sinking of a Bore-hole: Dr. C. Chree, F.R.S.—On the Lateral Vibration of Bars of Uniform and Varying Sectional Area: J. Morrow.—On Direct Reading Resistance-Thermometers, with an Appendix on Composite Thermocouples: A. Campbell.

SATURDAY, MARCH 11.

ROYAL INSTITUTION, at 3.—Electrical Properties of Radio-active Substances: Prof. J. J. Thomson, F.R.S.

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