THURSDAY, APRIL 16, 1903.

## ECONOMIC VEGETABLE PRODUCTS.

*Die Rohstoffe des Pflanzenreiches.* By Dr. Julius Wiesner. Second Edition. Ten parts. In two volumes. Pp. xi + 795 and vi + 1070. (Leipzig: Engelmann, 1900-1903.) Price 3*l*.

THE vast importance of an accurate knowledge of the raw materials of vegetable origin must be so patent to everyone as to give rise to the thought that the number of text-books on the subject must necessarily be very large. From the vast and ever-increasing colonies of this country huge quantities of material of the most varied description, and almost incalculable value, are annually poured into its markets. Hundreds of different kinds of timbers, fibres, gums, resins, dye-stuffs, tanning materials, &c., are brought hither to be devoted to various technical uses or to be distributed to other countries. Very frequently, too, specimens of drugs and other products are sent from abroad accompanied by queries as to their quality, uses and value; such queries are generally addressed to brokers or to the sender's private friends. It is therefore evidently a matter of primary importance that these products should be investigated and classified, their uses examined into, and the means by which their identity and purity may be established should be determined and recorded. A lexicon or handbook might thus be compiled which would be of inestimable worth to those who deal in or use such vegetable products, and might be the means of introducing valuable substances, or even of establishing new industries. It is in England of all countries where one would expect to find properly staffed institutions where such investigations would be carried out, and where men would be trained for such work; in England, unfortunately, this study is much neglected, although the conditions are more favourable than elsewhere. Museums with large collections of economic products exist, but they remain for the most part a mass of unsifted and undigested material. An effort in the right direction has, it is true, been made in the Imperial Institute, which, properly encouraged and extended, may yet yield valuable results.

It is remarkable that Austria should be the country in which the study of economic vegetable products has been most sedulously pursued. The first edition of Prof. Wiesner's "Rohstoffe des Pflanzenreiches" was published in Vienna in 1873, but since that time the field has so rapidly increased in extent that the author found it necessary, in preparing a second edition, to invite the cooperation of a number of his colleagues, each of them a specialist in his particular department. Amongst these the names of Hanausek, v. Höhnel and Vogl may be mentioned as a sufficient guarantee of the excellence of the work thus contributed. No better plan than this could have been followed; it has been adopted in other works with conspicuous success.

The subject-matter is divided into twenty-three sections, of which, perhaps, those dealing with the gums, resins, vegetable fats, starches, barks, woods and fibres are the most important, comprising, as they do, some 1135 pages out of 1822. The classification of the substances dealt with rests, therefore, upon a scientific basis, and is no doubt the best that could have been adopted, though it has the disadvantage of disregarding the uses to which the various products are put; materials that are used in any particular industry are therefore often scattered throughout the work, an inconvenience which might easily be remedied by the introduction of lists of the substances tabulated according to their uses.

The arrangement of each section may be illustrated by a short description of one of the most important, viz. the resins, which covers some 200 pages, and has been written by Profs. Wiesner and Bamberger. Commencing with a description of the characters of resin generally, the authors pass to the consideration of the physical characters of the resins, and then deal with the chemical composition of such as have been investigated. Following upon this is a long list of plants, mostly trees, from which resins have been obtained, and lastly, a detailed account of each of the more important members of the group. Considerable attention has been paid to the appearance of the interior, as well as the exterior, when examined under the microscope, the various lines, fissures and other markings that make their appearance during the drying and weathering of the resin being described. Many of these appear to be characteristic, but they are not always easy to discern.

The formation of the resins in the cells in which they are produced, and especially the pathological formation, whether intentionally or accidentally induced, is, however, briefly treated. This is somewhat a matter for surprise. Recent researches have shown that certain valuable resins and oleo-resins are pathological products the formation of which is artificially induced, and it remains to be seen whether in other cases a similar formation or increase of production cannot be brought about, a problem of great economic importance.

The chemical composition is well brought up to date, all the recent investigations of Prof. Tschirch and his pupils having been thoroughly sifted.

The sections on fibres, by Prof. Wiesner himself, and on woods, by Prof. Wilhelm, both very important subjects, are most completely and attractively dealt with. More than 100 different kinds of timber are described, and many are illustrated by woodcuts of their transverse sections. In both of these sections the hand-lens and the microscope play, as may be imagined, a very important part. A useful adjunct to each of these sections would be an analytical key by which an unknown member of the class might, within certain limits, be identified.

The starches form another group that has received detailed treatment. The formation of starch, its chemical composition and the changes it undergoes when hydrolysed, are very thoroughly discussed. The groups of catechus, india-rubbers and vegetable fats have been dealt with by Prof. Mikosch, and somewhat more briefly, considering their great technical importance, than the other sections of the work.

Very conspicuous throughout both volumes is the scientific treatment that underlies the descriptions of the substances dealt with. It is this that raises the work above an ordinary handbook for merchants, and places it amongst scientific treatises. It is, in fact, a scientific treatise on the raw materials of the vegetable kingdom.

Whilst the information given is generally trustworthy, it must be admitted that here and there defects occur. Thus, for instance, the commercial varieties of benzoin are scarcely in accordance with the conditions obtaining on the London market at least; African kino might have received more consideration than it does, whilst Butea kino is comparatively rare; the botanical source of patchouli leaves is open to question. But these are small matters, and do not appreciably detract from the value of the treatise.

Prof. Wiesner and his colleagues have undoubtedly supplied a want that has long been felt. They have given to all who are interested in economic products a ready means of obtaining scientific as well as technical information concerning them. Such a work cannot but prove indispensable to many busy men, and as such it can be confidently recommended.

HENRY G. GREENISH.

## *DISEASES OF THE RESPIRATORY AND CIRCULATORY ORGANS.*

*A Manual of Medicine.* Edited by W. H. Allchin, M.D., F.R.C.P., Lond. Vol. iv. Diseases of the Respiratory and Circulatory Systems. Pp. xi+493; illustrations, charts, coloured plates and tables. (London: Macmillan and Co., Ltd., 1902.) Price 7*s.* 6*d.* net.

*Diseases of the Organs of Respiration.* By Samuel West, M.A., M.D., F.R.C.P. In two volumes. Pp. xix+913; with numerous diagrams and illustrations. (London: C. Griffin and Co., Ltd., 1902.) Price 1*l.* 10*s.* net.

THE first book before us is the fourth volume of Dr. Allchin's "Manual of Medicine," and deals with the diseases of the circulatory and respiratory organs; as in the other volumes of this manual different sections are dealt with by different writers. It may be said at once that volume iv. is quite up to the high standard already attained by its predecessors, and while being less cumbrous and involved than the larger manuals or systems of medicine, contains all that can, in ordinary circumstances, be required by either the advanced student or the practitioner of medicine; as in the preceding volumes bibliographies have been suppressed, and references to authors are few and far between. The book suffers, perhaps, from being too condensed, but it is difficult to see how this, without restricting its sphere of usefulness, was to be avoided.

In the present review it would be impossible to give any detailed account of the essays which compose the volume. They are written by authors of reputation in the subject of which they write, and bear sometimes more, sometimes less marked evidence of individuality. Two essays by Mr. Leonard Hill, one on the general anatomy and physiology of the respiratory system and one on that of the circulatory system, open the respective sections of the book. These articles are very condensed but very comprehensive, and occupy approximately one-tenth of the volume. The advisability of including such articles in a book of this kind may be open to question; if they are included, however, it is certainly well that they should be complete.

Approximately 300 pages are devoted to the diseases of the respiratory organs; more than 200 of these are written by Dr. Hector Mackenzie; in this connection we would draw especial attention to a section on the general symptomatology of diseases of the lower respiratory tract, which is lucidly written and well classified.

Practically the whole of the section devoted to diseases of the circulation is written by Dr. Mitchell Bruce. The author devotes considerable space to the physical examination of the heart and vessels, and to the general symptomatology of cardio-vascular disease. The section devoted to the course and prognosis of heart disease is one of the most valuable in the book, the subject being treated in a very able manner. The public are far too prone to regard morbus cordis from the point of view of prognosis as an entity; the section before us shows how utterly unjustifiable this generalisation is, and how the whole key to the question of prognosis in heart disease depends upon the way in which the patient's cardio-vascular system reacts to the cardiac lesion, and the life which he is prepared to lead. The treatment of heart disease is fully discussed upon accurate physiological lines, but here we think the author might have entered more fully into the physical methods of treatment, such as massage, exercises, &c., and the effect of these upon the normal and pathological circulation.

The volume closes with a very interesting essay upon œdema, including under this term dropsy in its general sense. Although much in this chapter is to be found in text-books on general pathology, yet, nevertheless, the inclusion of it in the volume before us will doubtless prove of convenience to the reader.

In conclusion we may say that the volume is thoroughly to be recommended, both to the student and the practitioner, and we have little doubt it will receive at the hands of the medical profession the success it deserves.

The second work we have before us is one of quite a different character. It is a compendious treatise on diseases of the respiratory organs. Its author, Dr. West, has devoted much time and work to its compilation, and the book bears very strongly an individual stamp. Many diseases, and occasionally even different varieties of the same disease, are illustrated by the notes of clinical cases for the most part derived from the practice of the author. It is difficult with the space at our command to draw adequate attention even to special chapters.

It may be at once said that the book is not suitable for the ordinary student, and will probably find its

chief usefulness as a book of reference; and in this connection it is to be regretted that the index is not so complete as it might be. The reviewer can find, for instance, no mention of oxygen or St. Moritz in the index. The latter omission is perhaps excusable in that Davos is indexed, but the former should certainly not have been omitted. The treatment of cyanosis by oxygen is, however, mentioned in the text under acute pneumonia, and though discussed somewhat insufficiently, forms a paragraph heading. To continue with the article on pneumonia, the author draws attention to the value of bleeding in this disease, and clearly points out its indications.

In the opinion of the reviewer, one of the best written chapters in the book is the one on respiratory neuroses, including under this term asthma, whooping cough and Cheyne-Stoke's breathing, the section devoted to the latter condition being of especial interest, and containing the clinical notes of a case which presented this phenomenon continuously for eight weeks.

Under the subject of broncho-pneumonia, the author adopts an original classification for the disease, which he illustrates by cases. He brings forward evidence to show that this classification has a bacteriological justification. Some 200 pages are devoted to phthisis, and of these approximately thirty are concerned with the treatment of the disease. The subject is not treated in a specially exhaustive manner, and certain statements of the author will not meet with general acceptance. That fever rarely requires treatment in phthisis is a statement that requires modification; also it is somewhat odd that in the treatment detailed for fever by the author, no mention is made of rest in bed, although in a very short account of the open-air treatment of phthisis, obtained apparently second hand, it is distinctly stated that the patients are not permitted to take exercise if the morning temperature be above normal.

The book contains a mass of clinical fact, and the author has spared neither words nor illustrations in recording what must be regarded essentially as the result of his own clinical experiences. Judged from this standpoint, the work is interesting and valuable. As is clearly pointed out in the preface, the task was no easy one; the greater, however, will be the satisfaction of having succeeded in accomplishing it.

## *THE GEOLOGY OF THE ISLE OF MAN.*

*Memoirs of the Geological Survey, United Kingdom: The Geology of the Isle of Man.* By G. W. Lamplugh, F.G.S., with Petrological Notes by Prof. W. W. Watts, M.A., F.G.S. Pp. xvi + 620. (His Majesty's Stationery Office.) Price 12*s.* net.

NOT only will this memoir, which embodies the results of a recent survey of the Isle of Man by the author, be appreciated by those who are interested in the stratigraphy of the island, but the volume will be equally welcomed by geologists generally for the valuable additions which it makes to our knowledge of dynamical and glacial geology.

The term "Skiddaw Slates," formerly applied to the rocks which form the hilly massif of Manxland, is now wisely abandoned in favour of "Manx Slate Series." Neither top nor bottom of this group is exposed, nor is its age certainly known, though Cambrian is suggested. The general structure is held to be most probably of the nature of a *synclinorium* (Dana) or *inverted fan-structure* (Heim) in opposition to the older view that it was an anticline, but the stratigraphical difficulties have not allowed this important point to be definitely established. Worm-tracks are not uncommon in some of the beds, but the author thinks that the so-called trilobite and graptolites obtained from the series are more likely to be imitative inorganic structures than true fossils.

When we read that the pebbly-looking tracts in the slates are pseudo-conglomerates, that igneous dykes simulate and have been regarded as interbedded greywackes, that truly interbedded grits have acquired an intrusive aspect and seem in some way to be connected with the metamorphism of the adjacent slates, and that earth-movements can also manufacture ripple-marks, oblique lamination, and "graptolites," it is evident that the stratigraphy has presented special difficulties, and that the surveyor has had to exercise extreme caution to avoid committing serious mistakes.

The effects of earth-movements on the Manx Slates are most interestingly described, though the principal evidence and conclusions are already familiar from Messrs. Lamplugh and Watts's paper on "The Crush-conglomerates of the Isle of Man," published in 1895. Some additional details are, however, now given. A more suitable term than "crush-conglomerate" is needed. It is liable to be confused with "crushed conglomerate," and is not sufficiently expressive of the fact that the rocks described were never true conglomerates. Another term, "autoclastic," introduced by American writers and frequently used in this memoir, might with advantage be changed to "authiclastic" (=brecciated *in situ*).

In the chapter on the Carboniferous Rocks of the Castletown area, the remarkable structures exhibited in the volcanic and associated beds, as originally described by Mr. Lamplugh in 1900, engage most attention. The details are very carefully and clearly set forth, and the conclusions, though at first startling, appear to be warranted by the evidence. The author claims that, owing to the thrusting of the Carboniferous Rocks towards the central massif of the island, interbedded lavas were broken up into blocks and displaced, and that fragments of them and of the underlying limestone were torn off and involved in the adjacent volcanic ash, thus forming an agglomerate-looking rock which is practically an uncrushed "crush-conglomerate." He suspends judgment as to the origin of the limestone "knolls" of the locality.

The author takes the view that the Peel Sandstones are of Lower Carboniferous age, whereas Prof. Boyd Dawkins asserts that they belong to Permian time. The age of these rocks is admitted to be a difficult question, but the two writers are at conflict as to facts which ought not to be in dispute. Thus, Dawkins states

that certain red rocks passed through in a boring at Knock-e-Dooney "are identical physically with those which are exposed on the shore to the north-east of Peel," while Lamplugh remarks of the same strata that "they bear no resemblance . . . . to the Peel rocks."

As would be expected from his previous glacial work the author has devoted particular attention to the glacial drifts and other superficial deposits of the isle, and in this portion of the book the writer is seen at his best. His principal conclusions are confirmatory of those of Kendall, whose work is fully acknowledged, as, indeed, is the work of all previous writers on Manx geology. He rejects the "submergence" hypothesis, and traces the sequence of events from the gradual formation of the ice-sheet through its various phases to its final disappearance. The thickness of the ice on the bed of the Irish Sea is estimated at not less than 3000 feet. The phenomena that occurred during the melting of the ice have been ably worked out, especially in the north of the island, where the formation of glacial lakes with their overflows is clearly and convincingly described.

The full details given of the metalliferous deposits should be valuable in connection with mining enterprises. The account of the igneous rocks is fairly exhaustive, the petrological descriptions being in the form of notes mainly from the pen of Prof. Watts. Considering the space devoted to the descriptions, it is a pity that the microscopic characters, especially the structures of the rocks, are not illustrated by a plate or a few text-figures.

The volume bears evidence throughout of the author's stratigraphical skill. His facts are well arranged and clearly stated, and his conclusions carry confidence to the reader's mind because there is no appearance of any attempt to make the evidence prove more than the facts will reasonably explain. C. A. M.

## MEMOIRS OF PHYSICS.

*Rapports présentés au Congrès international de Physique réuni a Paris en* 1900. Edited by Ch. Ed. Guillaume and L. Poincaré. 4 vols. (Paris: Gauthier-Villars, 1900.)

WHEN the Société Française de Physique organised its international congress on physics, at the Paris Exhibition in 1900, it was the wish of several members of the commission appointed for that purpose, notably of their distinguished president, M. A. Cornu, whose death we have since had occasion to deplore, that a volume should be prepared which might survive the reunion which gave it origin, and form a suitable record of the same. This happy thought led to the request that a number of investigators should give accounts of their life works, showing the connections with the results obtained by previous investigations, and indicating probable advances in the future. These investigators were asked to forget, for the moment, the multitude of interesting details involved in their researches, and to treat their respective subjects from a general point of view. As a consequence, we have before us a series of memoirs on important branches of physics, each written by a recognised authority, dealing with important and far-reaching advances in physical science. The value of these memoirs is greatly enhanced by full references to original publications.

In the first volume, amongst other important papers, we may notice a paper on the precision of length determinations, by J. René Benoit. This paper contains an account of Prof. Michelson's standardisation of the metre, in terms of the wave-length of light. An interesting paper by P. Chappuis deals with practical and theoretical scales of temperature, while J. S. Ames contributes an article on the mechanical equivalent of heat, and E. H. Griffiths adds an appendix on the specific heat of water.

To the general reader, vol. ii. will perhaps be found of greatest interest. This volume deals with recent advances in optics, electricity, and magnetism; W. Wien contributes an article on the theoretical laws of radiation, which is followed by a paper on the radiation of a black body, by O. Lummer, and another on the emission of light by gases, by E. Pringsheim. These three papers form an excellent introduction to the recent extensions of thermodynamical methods to the theory of radiation. Prof. Lebedew gives an account of his experimental proof of the mechanical pressure of light, while H. Rubens describes his investigations of infra-red waves of great length. A paper by J. R. Rydberg gives a brief account of the distribution of lines in the spectra of the elements. This is a subject which will probably be greatly extended in the future; it may very probably lead to a complete mechanical theory of atomic structure, a domain into which the researches of Lorentz and Zeeman have already given us a glimpse. M. Cornu's paper on the velocity of light will be read with great interest, although it would hardly appear that the author made out a very strong case against the researches of Michelson and Newcomb. A paper on the electromagnetic theory, by J. H. Poynting, should be in the hands of all advanced students of physics. These, together with the remaining articles in vol. ii., render this of unusual interest.

Vol. iii. contains papers on recently discovered magneto-optic phenomena, by H. A. Lorentz; the theory of dispersion and metallic reflection, by P. Drude; and on radio-active substances, by H. Becquerel and by M. and Madame Curie. Prof. J. J. Thomson considers the results of recent researches on the passage of electricity through gases; V. von Lang examines the evidence as to the back E.M.F. of the electric arc, while A. Potier contributes a very readable article on polyphase currents. C. V. Boys gives an account of the various methods of determining the Newtonian constant of gravitation, with an able criticism of the various values obtained.

The fourth volume contains the minutes of the congress, a number of replies to criticisms and short communications, and, finally, a list of names of the members. E. E.

## OUR BOOK SHELF.

*Grundriss der qualitativen Analyse, vom Standpunkte der Lehre von den Ionen.* Von Dr. Wilh. Böttger. Pp. xii + 249. (Leipzig: W. Engelmann; London: Williams and Norgate, 1902.) Price 7*s.* net.

THIS work is intended to fill in the outlines sketched with such ability a few years ago by Prof. Ostwald in his little book on analytical chemistry. In that book it was shown how the facts and operations of analysis may be viewed in the light of physicochemical doctrines in general, and of the ionic theory in particular. Dr. Böttger now supplies the detail, so that a student may make his way over the whole territory of analysis hearing and speaking only the language of the new dualism.

It is probable that a casual examination of this book will arouse feelings of exasperation in the minds of those who think that the ionic theory should be kept in a state of suspended animation, and not used until somebody (at present unknown) has either made it perfect or else has shown that it is unfit to live. To those who see in the new dualism a theory which accords in a singularly complete way with the phenomena of analysis, Dr. Böttger's book will be extremely welcome.

It is too early yet to judge of the stamp of chemist that will be produced out of students whose whole chemical discipline has been in the school of thought represented by this book, but one thing seems certain in regard to analysis, and it is that such students will be habituated more than has ever previously been the case to look behind the mere reaction and learn something of the play of forces to which it is due. This will undoubtedly be a great gain, for the bane of analysis for educational purposes has been the tendency of people to regard it more as an art than as a science.

Dr. Böttger divides the subject under the usual headings—examination of a solution for the metallic constituents in the six analytical groups, examination of a solution for the anion in five groups, complete analysis of a given substance, solution and fusion of solids, rarer elements. A set of analytical tables is contained in a pocket inside the cover.

Very full explanations are given throughout of the individual reactions and of the separation processes, and short sections are devoted to such subjects as reversible reactions, mass action, solubility-product, &c.

It is probable that Dr. Böttger's book will for some time to come rank as the standard work on analysis as considered from the point of view of the ionic theory.

A. S.

*A Treatise on Roads and Pavements.* By Ira Osborn Baker, C.E. Pp. viii+635; with 171 illustrations. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1903.) Price 5 dollars.

THE object of this book, as set out in the preface, is to give a discussion from the point of view of an engineer of the principles involved in the construction of country roads and city pavements. The contents of the book relate almost entirely to American practice, where, according to the author, 95 per cent. of the mileage of the public highways consists of earth roads, a form which has almost entirely vanished from this longer established country. To the making and manufacture of earth roads the author therefore devotes a considerable part of his book; the remainder deals with roads having permanently hard surfaces used in urban and suburban districts; this part also is based on American experience, because, to use the author's words, "the principles of road making worked out in America are probably best suited to American conditions, and also because in most particulars American roads and pavements are superior to any other in the world." Yet, notwithstanding this superiority over the rest of the world, which may be open to question, the author admits that even in America there is still room for improvement.

The book is divided into twenty chapters, dealing respectively with the location, making and management of earth roads; roads covered with gravel and broken stone; horse tracks; street pavements, their design, drainage, foundations, and materials for paving, including bricks, asphalt, cobble stones, granite and other cubes, wood and tar macadam; foot-ways and bicycle tracks.

Although the estimates of cost and methods of procedure do not apply to work done in this country, there is a great deal in the book that may be read with profit by English road engineers and surveyors. The information and statistics given in the chapter on traction might be useful to the committee of the British Association that is now engaged in considering this subject.

*International Catalogue of Scientific Literature.* Vol. v. First Annual Issue. Astronomy, E. Pp. xiii+303. Published for the International Council by the Royal Society of London. (London: Harrison and Sons, 1902.) Price 21*s.*

READERS of NATURE are now familiar with the method adopted in classifying the subject-matter brought together in these annual volumes, seventeen volumes of which form a complete yearly issue of the catalogue. The work before us is the first of these annual issues dealing with astronomy, and one, therefore, of special interest to astronomers, as the latter are already well supplied with the valuable volumes of the *Astronomischer Jahresbericht* (published by Walter F. Wislicenus with the support of the Astronomischen Gesellschaft), which have now reached their third year, and contain in addition a brief abstract of nearly every paper.

Comparing the two volumes from the point of view of subject classification, there are some slight variations, which, however, make no material difference. On p. 1 of the volume before us "spectroscopy" seems to be added to the list of "primary divisions" as a kind of appendix, but on further investigation this arrangement, which is a very good one, seems to have been adopted since this subject is common to more than one of the primary divisions. Before using the book, the British reader is advised to read the instructions on pages xii. and xiii., and it seems curious that these instructions are not translated into French, German, and Italian, like the other portions of general information.

It is difficult to overestimate the importance of the present publication and its value to astronomers in aiding them to follow the work carried on in other countries.

*Der echte Hausschwamm und andere das Bauholz zerstörende Pilze.* By Dr. R. Hertwig. Second and enlarged edition, by Dr. C. F. von Tubeuf. Pp. vii+105; illustrated. (Berlin: Springer, 1902.)

BOTH mycetologists and practical men will welcome the appearance of this second and revised edition of a well-known work dealing chiefly with the life-history of the fungus of dry rot (*Merulius lacrymans*) and the best modes of preventing its devastations, but likewise discussing other kinds of wood-boring funguses. In the first chapter the distribution of this fungus and the woods it chiefly attacks are discussed in detail, while in the second attention is concentrated on its mode of development, and the means by which its presence can be detected. Illustrations, one in colours, in the latter chapter show the appearance presented by

wood in an early stage of dry rot, while others depict the spores of the fungus. The life-history of Merulius forms the subject of the third chapter, in the course of which it is shown that moisture aids in its development and spread. The mode in which it affects wood, and the manner of its propagation, are discussed in subsequent chapters, after which the best methods of prevention are taken into consideration. A second and much shorter section of the work is devoted to the nature and ravages of *Polyporus vaporarius* and other wood-destroying funguses. R. L.

*How to Work Arithmetic.* Parts i. and ii. By Leonard Norman. Second Edition. Pp. xvi + 77 in each part. (Rugby: G. E. Over, 1902.) Price 1*s.* 6*d.* net each.

THESE small volumes contain the same series of 136 "model problems worked in full by elementary, and advanced methods" respectively. In part ii., the shorter method of long division is adopted, which makes it preferable to part i., even for beginners; and questions which are solved by the "unitary method" in part i. are solved by "proportion" in part ii. The problems are, many of them, of a somewhat old-fashioned and useless character, and while the range is fairly comprehensive, the omission of examples of methods of approximation seems remarkable. There is a misprint in the recurring decimals which are "worth knowing"; the terms "odd" and "even" instead of "alternate" in the test of divisibility by 11 are apt to be misleading. Every pupil with a good teacher ought to make a collection like this for himself, but the books should prove useful to self-taught students.

*Untersuchungen über den Lichtwechsel Algols.* By Ant. Pannekoek. Pp. xxiv+236. (Leyden: L. van Nifterik, 1902.)

IN this volume the author has collected and discussed the chief observations of Algol that have been made since the publication of John Goodricke's results in 1783.

The observations of Plassman, Argelander, Heis, Müller, Wilsing, the author and others are included, and the various methods of obtaining and interpreting the results are analysed and compared.

The construction of comparison-star light scales, photometric measurements, the magnitudes at, and the duration of, the maxima and minima, the construction of the light curves and their asymmetry, are amongst the other subjects which are discussed in detail.

There are two appendices, the first of which deals with the corrections which have to be applied to these observations, whilst the second gives the details of the observations of Plassman, Pannekoek, Argelander and Heis respectively, in tabular form. W. E. R.

*My Nature Notebook.* By E. Kay Robinson. Pp. ii +211. (London: Isbister and Co., Ltd., 1903.) Price 2*s.* 6*d.*

DURING 1902, Mr. Robinson contributed weekly a series of interesting "nature notes" to the *Daily Graphic*, and the fifty-two instalments are here re-published in book form. Under each week are to be found five or six short paragraphs, describing in a chatty way certain aspects of nature noticeable at that period of the year. To the intelligent person living in the country, such a book as this should prove of great use, for under the author's guidance there will be no difficulty in knowing what and how to observe, and quite a short experience of such personal observation will develop a love for plants and animals of many kinds.

## 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.]*

### Can Dogs Reason?

THE answer to the question, "Can an animal reason?" depends upon the sense in which the word "reason" is used. If dog-stories are to be accepted as evidence, the question must be answered in the affirmative, even though the most liberal, and human, significance be attached to the word. It is, however, of great importance that data should be obtained under conditions which can be rigidly controlled, in order that the credibility of anecdotes may be tested by the results of observations which can be easily repeated. Already excellent work has been done in this field by Lloyd Morgan, Thorndike, Small, Mills, Hobhouse, and others, but the science of animal psychology is still in its infancy.

That an animal can compare a sensation newly received with memories of sensations, and form a perceptual judgment, which leads to action suitably adapted to its circumstances, no one doubts; but this is hardly reasoning in the usually accepted meaning of the term. We may, for the sake of simplicity, term the forming of a perceptual judgment putting one and one together. But can an animal compare an inference with an inference? Is it capable of what we term the syllogism, when speaking of human thought? Can it "put two and two together" within the

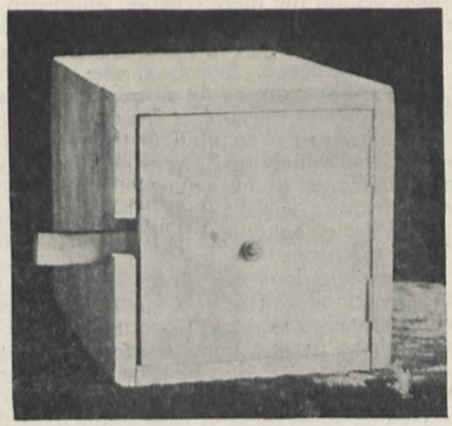


FIG. 1.

common meaning of this phrase? I am, of course, conscious of the absurdity of applying the term syllogism to the wordless thought of an animal, and also of the fact that a perceptual judgment may be expressed in syllogistic form, but my meaning will, I think, make itself sufficiently clear in the description of the following experiment:—

An exceptionally intelligent fox terrier was taught to open a box by lifting a wooden latch with its nose. Some care was spent upon the design of this box (Fig. 1). The latch was in the first instance long, and therefore easily lifted. Behind the door was placed a spiral spring, which could be twisted until it exerted any degree of pressure which seemed desirable. As the dog learnt to lift the latch, the length of the latch was curtailed. At the same time the spring was tightened until it pressed against the door with a degree of force which made the latch so stiff that the dog could not lift it without deliberate effort. There was no risk of its being opened by a chance movement. The dog was rewarded with food for performing the trick, which soon became so familiar as to be a game. As often as the door was closed the dog opened it. If he found the box on the floor he invariably opened it without waiting for any sign.

Frequently he examined the interior of the box when he had opened it, but food was never placed inside it. One evening, after the trick had been shown to a number of friends in order that the dog's almost ridiculous familiarity with it might be noted, Peter was sent to bed without his supper. He is fed but once a day. Next morning a hot grilled bone was placed in the box. The box was placed in a small yard surrounded by the house. The "boot-room" opens into the yard on one side, and into a passage on the other. After the dog had had a run in the garden the passage door into the boot-room was opened. We were watching the yard from an upper window. Two minutes after entering the boot-room Peter smelled the bone, ran through into the yard, and approached the box. When he saw the latch he ducked his head as if intending to lift it, but desisted. He then sniffed excitedly at the box and pushed it with his nose. He returned to the boot-room. After a few minutes he came out again into the yard and sniffed in the same way at the box. Twice he pushed the latch from behind, but did not put his head beneath it. After a while he returned to the boot-room and showed no signs of revisiting the box. He was then taken for a twelve-mile run in the country. As he seemed to be tired when he reached home, he was left for half an hour in the boot-room to rest. After a run in the garden, he was re-admitted to the boot-room, with the yard-door open. Unluckily the wind blew the door to before Peter had gone into the yard. After we had watched for some time my son went down to see what had happened—opened the door and pushed the dog through it, backwards. He went straight to the box, lifted the latch in the most business like way, and took out the bone.

The experiment was repeated a fortnight later with identical results. The dog ran into the yard, sniffed at the box, pushed it with his nose, was very eager to get the meat, but, this time, he showed no sign of remembering the way to open the box. He returned a second time, and then desisted altogether. During the morning the dog remained about the house. He constantly asked to be admitted into the boot-room, and showed in the clearest manner that he remembered that the grilled bone was to be found that way. At twelve o'clock the door was opened for him. He went straight through into the yard, opened the box, and took out the bone, which he attacked without any sign of doubting his legal right to its possession. It may be noticed that he is frequently fed in this yard.

In this experiment the dog knew two things. He knew how to open the box. Indeed, the sight of the latch was so strongly associated in the dog's mind with the action of lifting it that it is surprising that the usual, almost mechanical, response to sensation did not occur. Had he lifted the latch it would not necessarily have implied that he did it with the object of securing the food. He knew that the box contained meat. Eager as he was to secure the meat, he did not reason "The way to secure the meat is to lift the latch." I have described the experiment in detail, because all details are, as it appears to me, of great importance. It is to be noted that the opening of the box was associated in the dog's mind with the approbation of a human being. Great care was taken that no person should be present when the dog found the box. The sight of the box was strongly suggestive to the dog's mind of the action of opening it. With a view to diminishing the urgency of this sensori-motor association, a piece of hot meat with a strong "brown smell" was placed in the box. Its rich scent distracted his attention from the latch. When the dog was readmitted to the yard later in the morning, he was aware that the box was in the yard, and he went straight from a person to the box. By this time the bone was cold, and its scent less striking. It is impossible to repeat the experiment upon Peter, because now, when he opens the box, he invariably searches for food inside it. But I should be grateful to any of your readers who would repeat this experiment, taking great care (1) that the opening of the box is not associated in the dog's mind with finding food inside it, and (2) that, when the dog finds the box containing food, he is quite alone. I need hardly add that I shall be still more grateful to anyone who will suggest to me another test of the same kind. ALEX. HILL.

Downing College Lodge, Cambridge.

## Spherical Aberration of the Eye.

AN account of the recognised methods of investigating the spherical aberration of the eye is given by Tscherning, "Rapports presentés au Congrès international de Physique réuni à Paris en 1900," tome iii., pp. 551–557. These methods for the most part require special experimental appliances, and for some to succeed it is necessary to resort to cocaine or homatropine injections in order to increase the size of the pupil. The following method, which requires no special apparatus or preparation, appears to have escaped observation, and may therefore be worth describing. Place a piece of white paper, on which a broad black band has been ruled horizontally, just beyond the shortest distance of distinct vision from the eye, and while looking at the upper edge of the black band, cover the pupil progressively from below by means of a card with its upper edge horizontal, placed as near as possible to the eye. At the moment when the pupil is all but completely covered, the edge of the black band will be seen to suffer a depression, its original position being regained on uncovering the pupil. On raising and lowering the card at a rate of once or twice a second, this displacement is very marked. The best success is obtained in a fairly dim light, when the pupil is expanded; care must be taken to keep the eye carefully focused on the edge of the black band, or an exaggerated displacement, due to relaxation of the accommodation of the eye, may result. The above experiment shows that, when accommodated for near vision, the optical system of the eye is over-corrected for spherical aberration, the rays transmitted near the edge of the pupil being insufficiently deviated. To prove this, let us suppose the edge of the black band to be situated on a continuation of the optic axis of the eye. Then, provided the accommodation of the eye is correct, the rays traversing the middle of the pupil will form an image of the edge of the black band at that point of the retina which is cut by the optic axis. If the rays transmitted through the upper peripheral portion of the pupil are insufficiently deviated, they will cut the retina at a point above the true image, and owing to the mental inversion of retinal images, an image apparently below the true image will be observed. On covering up the pupil from below, the true image is obscured, and that formed by the rays traversing the upper edge of the pupil is alone seen.

On repeating the above experiment, when the eye is fixed on a distant object, the image of the latter will apparently rise, showing that it really sinks, as the pupil is covered from below. This proves that, when at rest, the optical system of the eye is under-corrected for spherical aberration, thus resembling an ordinary lens.

If an image of a gas flame is formed on a white card by means of a lens of three or four inches focus, the depression of the image on the card, as the lens is progressively covered from below, can easily be observed. EDWIN EDSER.

April 2.

## The Name Solenopsis.

IT appears from your issue of March 19 (p. 480) that Dr. Wheelton Hind was to read a paper before the Geological Society on March 25, on a new species of Solenopsis. We have here an illustration of the extraordinary persistence of an untenable name. The name Solenopsis was bestowed by Westwood in 1841 (*An. Mag. Nat. Hist.*, vi. p. 86) on a very common and well-known genus of ants. In 1844 McCoy gave the same name to the genus treated of by Dr. Hind, which consists of Mollusca occurring fossil in the Carboniferous rocks. This Molluscan genus (which was made the type of a family Solenopsidæ by Neumayr) cannot possibly retain the name it bears, and it may be called Solenomorpha.

I observe that recently Reiffen has proposed the name Ludwigia for a genus of echinoderms. The same name was bestowed by Pic in 1893 on a group of beetles. More strange is Distant's recent proposal of Melania for a genus of Coreid bugs, this being the name of one of the best-known of Molluscan genera!

T. D. A. COCKERELL.

E. Las Vegas, N.M., U.S.A., April 2.

### The Thermal Energy of Radium Salts.

IT is well known that when ordinary chlorine gas is exposed to sunlight its temperature rises above that of the surrounding medium. The rise of temperature is proportional to the intensity of the light. A certain maximum temperature is finally attained at which the rate of cooling is proportional to the rate of conversion of actinic into thermal energy. If the light stimulus be removed, the temperature of the chlorine takes about half an hour to return to that of its surroundings.

I have just read the interesting paper by MM. P. Curie and A. Laborde in the *Electrician* for April 3 (my only source of information at present), and it is reasonable to suppose that the increased temperature of radium salts there recorded might be traced to the same source. The effect with radium salts would be more persistent than with chlorine gas. But this matter can only be decided experimentally by those possessing specimens of the salts of this remarkable compound. J. W. MELLOR.

London Villa, Newcastle, Staffs, April 9.

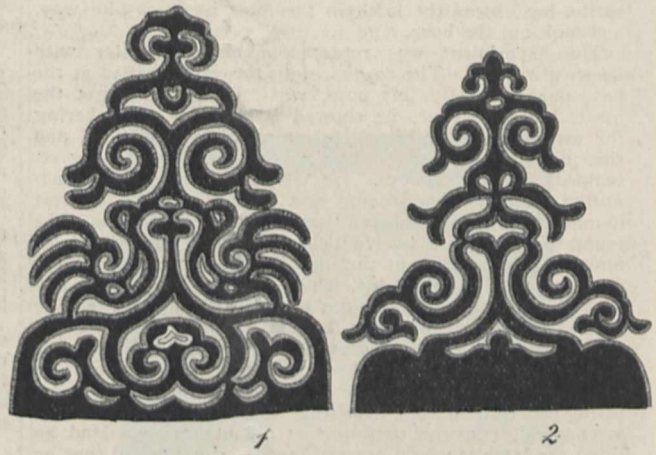
## *EAST SIBERIAN DECORATIVE ART.*[1]

ALTHOUGH of late years the investigation of the decorative art of primitive peoples has received considerable attention, yet the interest taken in the subject is not so great as its importance merits. There are two methods of study, (1) the collation of specimens which happen to be in museums, with armchair deductions from the material examined; and (2) investigations in the field. When we recall the errors into which the former method has landed students, we must endorse the following remarks made by Mr. Laufer:—"I must confess," he says, "I adhere to the principle that ornaments should not be regarded as enigmas which can be easily puzzled out by the homely fireside. Neither are ornaments of primitive tribes like inscriptions, that may be deciphered; they are rather productions of their art, which can receive proper explanation only from the lips of their creators." Mr. Laufer speaks from experience, as he spent two years among the various tribes of Saghalin Island and the Amur region, and one result of his painstaking investigations is an exhaustive memoir on the decorative art of the Amur Tribes, which has recently been published in the *Memoirs* of the American Museum of Natural History. The researches were undertaken under the auspices of the Jesup North Pacific Expedition, and they have been published with that wealth of excellent illustration to which our American colleagues have accustomed us.

Among the Amur tribes plastic art is practically unrepresented, except among the Gilyak, but they excel in the decoration of surfaces. The Gold are well versed in all branches of this latter art, especially in embroidery, while the Tungusian tribes of the Amgun and Ussuri Rivers are unsurpassed in cutting ornaments for decorating birch-bark baskets. The farther to the east the more destitute is the art, but it attains its climax where it is in direct contact with Chinese influence. It is extremely probable that the decorative art of these Tungusian tribes was primitively very poor in quality, but from very early times they adopted Chinese devices and, very likely, further developed them independently. It is, however, surprising that exactly corresponding devices have never been found in China, nor adequate explanations obtained for related ones, the explanation being that traditions regarding the meaning of certain patterns are fuller, and have been better preserved in the minds of the unlettered tribes than in the fleeting memory of a writing nation; but, after all, we know very little about the significance of Chinese decorative art. On the whole, we may regard the decorative art of the Amur tribes as an independent branch of East Asiatic art which sprang from the Sino-Japanese cultural centre.

The materials used by the Amur tribes for decorative purposes are wood, birch-bark, fish-skin, elk and reindeer skin, cotton and silk. The general style of the decorative art can be gathered from the accompanying illustrations. The Gilyak used to carve spoons for domestic use; these are now replaced by spoons of Russian make, but carved spoons are still employed for the bear-festival, the decoration of which has special reference to the festival; all are provided with an interlaced band ornament, which represents the ropes with which the living bear is bound.

There are many patterns and devices which appear to be simple or grouped spirals, sometimes associated with bands and circles, but in the vast majority of the designs Mr. Laufer has demonstrated that the cock and the fish play a very important part; the former is more frequently reproduced than all other animals together. The cock is not indigenous, but was first introduced by the Chinese, nor does it enter into the mythology of the natives as it does with the Chinese.




FIGS. 1 and 2.—Embroidered designs for trimming the pocket of a shirt.

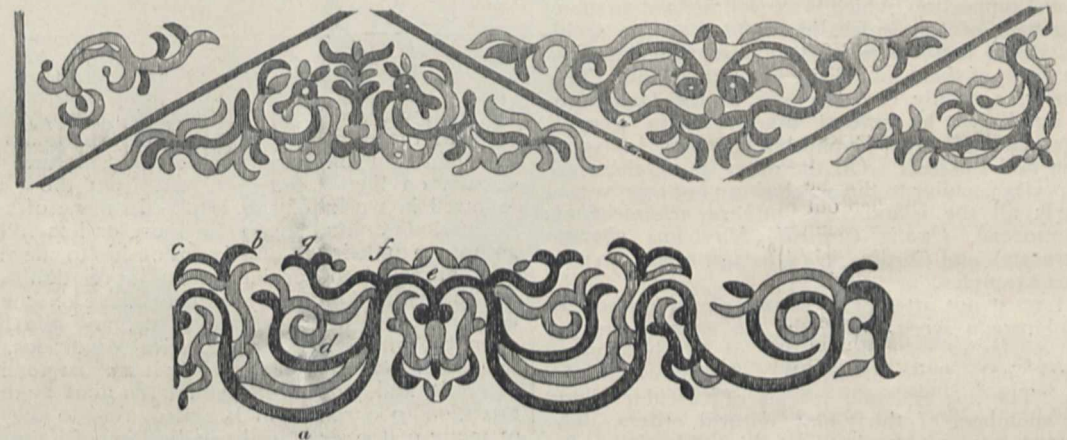
In China, the cock is a symbol of the sun, because it announces the rising of the sun; besides the earthly cocks there is a heavenly cock, which sings at sunrise perched on a willow tree, which also symbolises the sun; further, it belongs to the class of animals that protect man from the evil influence of demons.

In Fig. 1, two combatant cocks are grouped about a central axis; in Fig. 2, the cocks are highly conventionalised, their tails being in the form of an ornamental double fish-tail. The bifurcated arms projecting on either side above the cocks are meant for fishes, which are essentially characterised by the form of the tail. In the large triangle to the left in Fig. 3 we have two musk deer, which is the animal most frequently represented after the cock and fish, but their bodies are implicated in cock and fish motives. The other large triangle should be looked at upside down; there is an oval object between the two cocks' beaks in the centre; above the beaks are the cocks' combs, and below are two easily recognised fishes. The smaller triangles contain a medley of bird and fish motives. In Fig. 4 a fish is represented at *a*, above its head is a beak-like figure *c*, and two curves *b*, which are probably the tail feathers of a cock; *d* is a spirally-

[1] "The Decorative Art of the Amur Tribes." By Berthold Laufer. The Jesup North Pacific Expedition: *Memoirs* of the American Museum of Natural History. Vol. vii. (Anthropology, vol. vi.) Pp. 86, 33 plates containing 230 figures, and 24 figures in the text. (New York, 1902.)

formed fish which passes into a beak at *e*; but this fish forms the body of a cock (there is also a fish in the body of each cock in Fig. 1); *f* is its beak with an oval in front of it, behind it is an eye which touches the crest, or cockscomb, which itself terminates in a fish's tail *g*. Between this and the corresponding figure are two degenerate cocks rampant, their feet are united, the long falciform beaks directed upward and the tails downward, the latter being connected by a pair of small ellipsoids. Decorated fish-skin garments, worn only by women, illustrate nearly all the forms of cock and fish ornaments, and numerous hybrids besides. The body of a cock is often shaped like a fish, and frequently has another fish enclosed within it; there are also numerous, rather complicated, ornamental arrangements, which are built up of spirals, trigrams, leaves, conventionalised fishes, and elements of the cock ornaments. Those who take the trouble to study Mr. Laufer's memoir with the care it deserves will satisfy themselves that the figures will bear these interpretations, which, after all, it must be remembered, are the explanations that the natives gave to him.

According to our author, no other explanation of the predominance of the cock and fish in the decorative art of the Amur tribes can be found than that these




Figs. 3 and 4.—Decoration in red and light green on the rim of the cover of a lacquered tobacco box.

particular animals have an extremely ornamental character because of the great permutations of their graceful motions, and they thus lend themselves admirably to the spirit which strives after beauty of form. There is no chronological sequence in the stages of development; the single phases of development are merely various forms of different kinds of adaptation to certain spaces or to given geometrical forms, mostly spiral. The spiral, in his opinion, is not the final result of the gradual conventionalisation of realistic images, but is employed for the symbolic expression of the most varied things, since its forms are so convenient for this particular purpose. The same applies to the triskele; an entire cock is never represented by a purely geometrical triskele; the triskele plays an active *rôle* in indicating single parts of the body, but not for the whole creature. As an independent element, having a definite meaning, the triskele never occurs.

Mr. Laufer insists it should not be imagined that the representations of animal life continued to lose more and more of their original forms, and gradually shrunk into geometrical devices. On the contrary, the multifarious kinds of conventionalisation have their final cause, last but not least, in a faithful observation of nature, especially in that ability to watch motions which is so highly developed in the East Asiatic mind. The conception of a fish in the form of a spiral is based, he contends, on a true observation of that animal in its natural state; it would never have been drawn in spiral form, never have clung to a spiral, without a foundation of fact. This very capacity of the fish for motion, together with the highly cultivated power of the people to observe its motions, formed the reason for its adoption in ornamentation. The same remark holds good for the cock. It is doubtful whether this view of the author's will appeal to all of his readers; the idea that the bulk of the ornamentation of a group of people is based mainly upon conceptions of motion is certainly new. Whatever diversity of opinion there may be on minor points, there can be none as to the value and excellence of Mr. Laufer's work. It is no exaggeration to say that this is the most minute and thorough study we possess of the decorative art of an uncivilised people.

Alfred C. Haddon.

## *FLORA OF THE GALAPAGOS ISLANDS.*[1]

It is now more than half a century since Sir Joseph Hooker published his famous essay on the flora of this archipelago, founded mainly on the collections made by Charles Darwin. Since then, until within the last decade, little had been done towards a more complete investigation of this highly interesting flora and fauna. It is to various American expeditions that we are indebted for a more complete knowledge. The late Dr. G. Baur was foremost in this work, and his collections and theories were briefly discussed in Nature (lii., 1895, p. 623). Baur boldly promulgated the theory of subsidence, in opposition to upheaval, in accounting for the origin of the islands, basing it upon biological evidence. Dr. Robinson, the author of the essay under consideration, and Mr. J. M. Greenman, his collaborator, in working out Baur's botanical collections were almost converted to Baur's theory. In the present work Dr. Robinson practically recants, and attempts to demonstrate that the composition of the flora favours the assumption that it is derived rather than original. I will first give some particulars of the general composition of the flora, limiting them, however, to the vascular plants.

Unfortunately for purposes of comparison, Robinson's enumeration and tabulation of the plants include all that were found growing in the islands, amongst them *Brassica campestris, B. Sinapistrum, Raphanus*

1 "Flora of the Galapagos Islands." By B. L. Robinson. *Proceedings* of the American Academy of Arts and Sciences, xxxviii. (1902). Pp. 77-270 with three plates.

*sativus*, and a number of others which might have been eliminated as certainly introduced, and placed in a separate list. As it is, without considerable labour, one can only distinguish two elements, namely, the endemic and the non-endemic, the latter comprising both indigenous and certainly introduced species. It is further complicated by the fact that "undetermined species," "varieties," and "forms" are all tabulated equally, and the percentages of the constituents of the flora are calculated from mixed totals.

For instance, the percentage of endemic species of flowering plants is obtained from a total which includes fifty "undetermined species," some of which, one would suppose, are also endemic. On the other hand, fifteen "varieties" and nineteen "forms" are included in the calculation, by which the endemic element is made out to be 44·4 per cent. This Dr. Robinson designates an "extraordinary endemic element"; but, as compared with some other islands and continental areas, it is low. In the Hawaiian Islands it has been placed at 81·4, in Juan Fernandez at 68·6, in St. Helena at 61·3, in West Australia at 85, and in Central America, including Mexico, at 70 per cent. This is the specific endemic element. According to the now generally accepted generic limits, there is almost no generic peculiarity in the flora of the Galapagos. Scalesia (Compositæ), which is as well defined as many other genera of this order, is confined to the archipelago, where it is represented by seventeen described species, most of them inhabiting only one island. This peculiarity, specially characteristic of the Galapagos flora, is shared by several other leading genera, amongst them Castela, Euphorbia, Croton, Acalypha, Opuntia and Borreria. On the other hand, there are some species peculiar to the archipelago but represented in nearly all the islands. *Telanthera echinocephala* (Amarantaceæ), *Oxalis Cornelli*, *Maytenus obovata* (Celastraceæ), and *Cordia lutea* (Boraginaceæ) are conspicuous examples.

But I must not attempt to summarise the whole of Dr. Robinson's work. Briefly, he enumerates 500 named species of vascular plants, of which fifty-two are ferns, only three of which are confined to the islands. The 205 endemic species of vascular plants include members of thirty-nine natural orders. The orders most numerously represented by endemic species are Compositæ, 39; Amarantaceæ, 29; Euphorbiaceæ, 25, besides 7 endemic varieties and 7 endemic forms; Rubiaceæ, 16; Gramineæ, 13; and Boraginaceæ, 14, giving a total of 136, or two-thirds of the whole, contributed by six orders. Against this there are seventeen other orders, limited to one endemic species each. But the Cactaceæ, the species of which are still badly defined, are much more prominent and generally dispersed than some of those much more numerous in species. Members of the Cactaceæ are recorded from all of the islands except Gardner, but including the small and remote Tower, Wenman, and Culpepper Islands. The Leguminosæ, counting only six endemic species, are also very prominent in the arboreous element, from the presence of the genera Acacia, Cassia, Mimosa and Parkinsonia. *Astragalus Edmonstonei* is a noteworthy outlier of this genus, not found by any recent collector. The presence of four species of the Loranthaceæ is another interesting fact.

The affinities of the flora of the Galapagos Islands are wholly American, for the very few exceptional species may be accidental introductions. In composition it differs from that of the smaller flora of Juan Fernandez in having almost no generic endemic element, and in the specific endemic element being furnished by relatively numerous natural orders. From the flora of the Hawaiian Islands it also differs in being much less highly specialised. There are no tree-ferns, no gymnosperms, and, with the exception of grasses and sedges, of which there are 52 and 25 species respectively, monocotyledons are very poorly represented. There is one orchid, *Epidendrum spicatum*, one bromeliad, *Tillandsia insularis*, and *Commelina nudiflora*, a very widely dispersed weed in warm regions, and *Hypoxis decumbens* complete the petaloid series. The aquatic genera Potamogeton, Ruppia, Naias, and Lemna rest on single records of American collectors.

Dr. Robinson concludes his essay with an examination of the "botanical evidence regarding the origin of the Galapagos Islands." After a brief examination of the evidence in favour of the opposed theories of submergence and emergence, he says:—"During a re-examination of the whole vascular flora of the islands, I have sought further light upon this question, and now find the peculiar distribution of the plants less difficult to account for on the emergence theory than it seemed when the Baur plants were studied some years ago." I should like to discuss this "new light" briefly in a separate communication, and will merely remark here that all the proved means of dispersal of the seeds of plants to long distances are insufficient, to my mind, to account for certain insular floras generally regarded as derived rather than as residues.

W. BOTTING HEMSLEY.

## *A NEW NATURAL HISTORY.*[1]

THE increased interest in zoology certainly existing at the present time is one of the causes which has induced Prof. Davis to attempt a natural history written on lines totally different from those usually followed in works of this kind. In place of treating the various animal groups in more or less full detail according to their presumed relationship to one another, it is proposed to consider them in relation to their environment, and to lay special stress on the interdependence of animals and plants, and the bearing upon life of chemical and physical conditions. Such a mode of treatment undoubtedly has great possibilities before it, and is one which should do good by drawing attention to our lack of knowledge as to the reason of many of the structural peculiarities of animals. It is, indeed, one of the reproaches that may be legitimately brought against our present methods of zoological study that we attach far too much importance to describing and recording minute differences between closely allied animals to the utter neglect of the study of their life-history. Whether the author will be successful in this mode of treatment we cannot at present even conjecture, for the two sections of the work now before us are devoted to a brief systematic survey of the leading groups of the animal kingdom, which must form a necessary introduction to its proper subject. These two sections may, indeed, be regarded as a kind of "index-museum" to the rest of the work. They are important as serving to show that from no point of view can systematic zoology be neglected, and also that the issue of a work like the present in no wise renders the older type of natural history superfluous. There is ample room for both, and neither poaches on the preserves of its fellow.

As a whole, the author's treatment of the systematic part of his subject may be regarded as fairly successful, and the volume before us is rendered highly attractive to the general reader by the beauty of its coloured plates and other illustrations. Where all are excellent it is difficult to select any for special commendation.

[1] "The Natural History of Animals; the Animal Life of the World in its various Aspects and Relations." By J. R. A. Davis. Half-vols. i. and ii. Pp. xxxii+429; illustrated. (London: Gresham Publishing Co., 1903.)

and we take as a sample, selected almost at random, the accompanying cut of Sahara foxes, or fennecs.

In regard to classification, so far as vertebrates at any rate are concerned, the author follows in the main some of the older schemes, especially in the case of birds, and in this, we think, he is well advised. We cannot, however, agree with him in making a special "order" for the lemurs, especially in view of the recent investigations of Dr. Forsyth Major and Prof. Elliot Smith. We are, moreover, somewhat surprised to find no mention of the okapi under the heading Giraffidæ, and the statement that the giraffe is the sole living representative of that family. Naturalists will be still more surprised to find the African Anomalurus classed as a member of the squirrel family, and no mention made of the fact that it has a relative unprovided with a flying-membrane. Again, it is quite

Fig. 1.—Sahara Foxes. (From "The Natural History of Animals.")

against modern usage to place the American mice and rats in the same genus (Cricetus) as the hamster. Neither is it correct to call the Indian elephant *Euelephas*, while the statement (p. 108) that the hippopotamus has only two upper incisors is inaccurate.

Although we by no means agree in many instances with the author's practice in regard to nomenclature, yet this is to so great an extent a matter of opinion that we forbear criticism. There can, however, be no excuse for describing the Indian rhinoceros in the text (p. 106) as *Rhinoceros unicornis*, and in the plate and its accompanying note as *R. indicus*, or for styling (p. 122) the llama *Lama lama* in the text and *Auchenia lama* in the plate and its explanation. *Lamaguan acus* for the guanaco, in place of *Lama guanacus*, must be credited, we presume, to the printer's "devil." The want of an index is a serious drawback to a volume which in most respects is full of interest. R. L.

## NOTES.

It is now more than a quarter of a century ago that the Duke of Devonshire's Royal Commission on Science, among its many important recommendations, few of which have been taken advantage of either by the then or subsequent Governments, urged the importance of the creation of a body of scientific advice which should bring all departments in close touch with the progress of science. We warmly congratulate Lord Curzon upon the steps he has recently taken to extend the many benefits of such a body to the Indian Empire. We reprint elsewhere the text of a resolution of the Indian Government which has recently appeared in the *Gazette*, and we may hope that in a few more decades the matter may be considered by the Government of Great Britain, in which certainly such a council is as much required as in India.

The Prince Auguste D'Arenberg, Mr. Chamberlain, and Sir Archibald Geikie, F.R.S., have been elected honorary members of the Institution of Civil Engineers.

A Lahore correspondent of the *Pioneer Mail* states that the Kanwar Sahib of Patiala has made a free gift of his house at Kasauli to the Pasteur Institute at that place, with the object of its being devoted to the purposes of that institution.

The *Times* correspondent at Rome reports that the King and Queen of Italy were present on April 13 at the inaugural meeting of the International Congress of Agriculture. The congress, which is attended by representatives from many countries, will sit in Rome until April 18, when it will start on a tour of three weeks through Italy and Sicily.

Reuter reports that an eruption of the volcano Del Tierra Firme (Colombia), near Galera de Zamba, occurred on March 22 by which the village of Tiojo was destroyed. Brightly illuminated clouds, giving rise to the appearance of flames, were seen above the volcano on the night of March 24 by ships passing sixty miles off the coast.

Sir W. T. Thiselton-Dyer, K.C.M.G., has sent us a copy of a letter from Mr. H. Powell, the curator of the Botanic Station at St. Vincent, to Dr. D. Morris, the Imperial Commissioner of Agriculture for the West Indies, as an official report upon the eruption of the Soufrière on March 22; he has also sent a cutting from the *Barbados Advocate* of March 28 describing some of the phenomena of the eruption. Mr. Powell reports that the clouds of stones, ashes, &c., were of stupendous size, and rose to enormous heights, similar to those of May 7, 1902. The noise on March 22 was, however, far less than on May 7, and the electric display was very little. At 11.30 a.m., and again at 12.30 p.m., on March 21 last, huge volumes of vapour were seen ascending from the crater, and at about 6.30 next morning the serious eruption commenced, and continued during the morning and most of the afternoon.

At 9 a.m. on March 23 there was another huge outburst. On March 22 a slight layer of dust fell at the Botanic Station, and the northern half of the heavens was shrouded in gloom, but there was no real darkness. At Georgetown a layer of ejecta about three inches deep, with stones the size of the fist, is reported, and at Tourama a layer of five inches. An estimate of the large quantities of dust which fell in the neighbourhood of the volcano can be formed from the fact, reported in the *Barbados Advocate*, that the Commissioners of Health for St. Michael at their meeting on March 23 agreed to pay 20*l*. for the removal from the streets and public ways of the volcanic dust which fell during the previous day. The dust on this occasion was very coarse, dark, and heavy, resembling that of May last rather than the impalpable grey dust of October.

FROM a note in a recent number of the *West Indian Bulletin*, it is satisfactory to learn that the planters of Dominica appreciate the assistance given them by the Imperial Department of Agriculture for the West Indies. An illustration of the useful work being done by this Department is afforded by a report on the soils of Dominica, which has just been issued by the Commissioner of Agriculture for the West Indies. The report gives the physical and chemical composition of twenty-three typical soils examined in the Government chemical laboratory of the Leeward Islands, and is the work of Mr. F. Watts, Government chemist. Samples were taken in all parts of the island, and the analyses published give the composition of both virgin and cultivated soils. In general, the soils of Dominica were found to be well furnished with available compounds of nitrogen and potash, but were almost uniformly deficient in phosphates, and in many cases also in lime. A microscopic examination of the soil minerals showed that they were much the same in all parts of the island, and further that they closely resembled the minerals found in the volcanic dust of the Mont Pelée eruptions. Mr. Watts concludes that "the recent volcanic activity is similar in character to that of the past."

ON Tuesday next, April 21, Prof. Allan Macfadyen will deliver the first of three lectures at the Royal Institution on the blood and some of its problems; on Thursday, April 23, Prof. Dewar commences a course of two lectures on hydrogen, gaseous, liquid and solid; and on Saturday, April 25, Prof. Langton Douglas begins a course of two lectures on the early art of Siena. The Friday evening meetings will be resumed on April 24, when the Hon. R. J. Strutt delivers a discourse on some recent investigations in electric conduction. The discourse on May 1 will be delivered by Prof. W. J. Pope on recent advances in stereochemistry.

THE first Easter vacation party of workers at the new Biological Station, Port Erin, is a large one, including two students from Oxford, four from Owens College, two from Liverpool, one from Leeds, and also Mr. Isaac Thompson, Mr. J. Lomas, Prof. Gregg Wilson, Mr. Chadwick, and Prof. Herdman. A small class of school teachers from the Isle of Man has also been formed for "nature-study," and is being conducted in the junior laboratory and in the field by Mr. Chadwick and Prof. Herdman. The season is a late one, both in fish-spawning and in the general condition of the fauna, but, notwithstanding the unsettled weather, a good deal of collecting and field work has been carried on.

REUTER'S agent at St. Petersburg reports that Captain Kozloff lectured there on April 6 on his scientific expedition to Central Asia and Tibet, lasting from 1899 to 1901. As a result of the expedition, the central steppe of the Gobi desert and the country of Han-su and Tsaidam were traversed. Numerous meteorological observations were made, as well as a great many notes with regard to the flora and fauna of the country. After establishing a meteorological station in the Tsaidam, where the collections were left, the party started for the heights of Tibet. Captain Kozloff's expedition was at first allowed to enter the territory of the Dalai-Lama, but it was stopped on reaching districts strictly reserved. It was consequently compelled to winter for five months in the Mekong Valley. The expedition traversed and made a study of parts of Tibet which had never before been visited by Europeans, and made collections which will have an important bearing on the study of the ethnography and the flora and fauna of that country.

As already announced, the annual meeting of the Iron and Steel Institute will be held on May 7 and 8. At the opening meeting the council will present the report for the year 1902, and the president-elect, Mr. Andrew Carnegie, will deliver an address. The Bessemer gold medal for 1903 will be presented to Sir James Kitson, Bart., past-president, and the awards of the Andrew Carnegie gold medal and research scholarships for 1903 will be announced. Among the papers to be read and discussed are the following:—the alleged diffusion of silicon into iron, Mr. J. E. Stead; the influence of sulphur and manganese on steel, Prof. J. O. Arnold and Mr. G. B. Waterhouse; the open-hearth process, Lieut.-Colonel L. Cubillo; the application of electric furnaces in metallurgy, Mr. Albert Keller; the manufacture of Portland cement from blast-furnace slag, Mr. C. von Schwarz; and the effect of flue dust upon the thermal efficiency of hot blast stoves, Mr. B. H. Thwaite. Reports on research work carried out during the past year will be submitted by Messrs. O. Boudouard (Paris), W. Campbell (New York), A. Campion (Coopers Hill), P. Longmuir (Sheffield), E. Schott (Berlin), and F. H. Wigham (Wakefield), the Andrew Carnegie research scholars of 1902. The autumn meeting will be held at Barrow-in-Furness during the first week in September. An influential reception committee has been formed with His Grace the Duke of Devonshire, K.G., as chairman.

THE Easter holidays have been to a considerable extent marred by the inclement weather which has been experienced generally in the British Islands. The *Daily Weather Report* issued by the Meteorological Office on Saturday last, April 11, showed that a disturbance lay to the north of Scotland and was likely to be followed by further unsettled weather. Very cold winds, chiefly north-westerly, spread over the whole country and caused frequent sharp showers of snow and hail, with very low day temperatures on Sunday and following days, the readings on the ground at night being eight or more degrees below freezing. Much damage has been done to fruit trees in blossom, and in some cases small seeds have been blown from the fields. Bright intervals of sunshine followed the squalls, and, in places sheltered from the coldness of the winds, were very agreeable. The advance of a cyclonic disturbance from the Atlantic during Tuesday has occasioned a change of wind and milder weather.

WE have received the first part of vol. xvi. of *Mittheilungen* relating to German Protectorates. This valuable publication is so well known that it is unnecessary to say that it contains a large amount of useful information both for travellers and men of science. We wish particularly to draw attention to the care and thoroughness with which the German officials establish meteorological stations and collate and publish useful data for districts which would

be otherwise meteorologically unknown. The volume in question contains full results of rainfall or other statistics at no less than forty-two stations in German South-West Africa, and at thirty-two stations in German East Africa. In the latter Protectorate values for several years are given, with useful particulars relating to the instruments and their exposure. The work is accompanied by a very clear map of the north-western portion of Cameroon, between Rio-del-Rey and Bali.

WE have received a catalogue of new experimental apparatus from the firm of E. Leybold, which describes a number of instruments suitable for general and special experimental and demonstration work. Amongst these may be noted a convenient form of hand regulated arc lamp, having an arrangement by which any one of six carbons can be used, apparatus for wireless telegraphy, selenium cells, and other apparatus for wireless telephony, &c. We also note that the firm includes in the list Poulsen's telegraphone, which was described in NATURE some time ago; this is, we presume, only an experimental apparatus, as we have not heard that the invention is sufficiently perfected yet for commercial purposes.

A METHOD of electrically locating ore deposits which has been devised by Messrs. L. Daft and A. Williams was demonstrated a short time back at the Telacre Mine in North Wales. The method is practically an application of wireless telegraphy by earth conduction. An induction coil which is used as transmitter has the terminals of the secondary connected to two metal stakes, which are pushed into the soil; radiating currents are thus produced which can be detected by a telephone connected to similar stakes. Normally, the telephonic disturbance is greatest in a line at right angles to, and bisecting, the line joining the transmitting electrodes, but the presence of ore disturbs the current distribution, and the amount of shifting of the point of maximum disturbance enables the position of the deposit to be determined. It is also said that the nature of the sounds can, in some cases, indicate the depth and mineral richness. The demonstration in Wales passed off very successfully, and it seems that the system, on further development, may possibly become of considerable assistance in prospecting for ore.

WE have received from Dr. Hubert Jansen, the editor of the trilingual technical dictionary which is being published by the Society of German Engineers, a batch of circulars relating to the publication. The object, as our readers are probably aware, is to bring out a thoroughly comprehensive vocabulary of technical terms in German, English, and French; mathematical, physical and chemical words are to be included, as if not now of technical importance they may become so at any time. Special effort is to be made to include all "trade" expressions used in particular industries, local dialectical terms, and even workmen's "slang" names for machines, &c., as these often pass in time into general use. In order to make the dictionary as complete as possible, collaboration is asked from technical men, institutions, or works; the publishers will supply note-books for jotting down technical expressions (with or without their foreign equivalents) to anyone who is willing to collaborate, and these will be collected some time next year, and collated by the editors. The editors also ask that circulars, price-lists, &c., may be sent to them, as these are a fruitful source of technical expressions. We would strongly urge all who have the time and opportunity to give what assistance they can, as there can be no question of the need for the dictionary, which will be more valuable the more complete it is made. A little help from a larger number of collaborators is likely to be of greater use than a greater amount of work by a few whose experience must necessarily be limited to one or two branches of technical work.

PROF. C. LE NEVE FOSTER, F.R.S., in the fourth part of his general report and statistics concerning the mines and quarries of the world in 1901, provides much information concerning the relative importance of different countries in the mining industries. For instance, the total amount of coal produced in the world amounted in 1901 to 789 million tons, of which the United States yielded rather more than one-third and the British Empire rather less than that proportion; Germany's output was almost one-fifth. The United States, the British Empire, and Germany produced six-sevenths of the world's supply. Of the total output of minerals the British Empire produces about one-third of the coal, one-ninth of the copper, half of the gold, one-eighth of the iron, one-fifth of the lead, one-seventieth of the petroleum, one-quarter of the salt, one-ninth of the silver, five-eighths of the tin, and one-fiftieth of the zinc. More than four and a half millions of persons are engaged in mining and quarrying at home and abroad, of whom, roughly speaking, one-fifth are employed in the United Kingdom and one-third in the British Empire.

THE Charnwood Forest rocks form the subject of a well-illustrated essay by Dr. F. W. Bennett (*Trans.* Leicester Lit. and Phil. Soc., January). As the author remarks, he joined the excursion of the Geologists' Association under the leadership of Prof. W. W. Watts, and he has expounded in a clear and useful way the views arrived at by that geologist in his detailed survey of the area.

IN the first annual report, for 1902, of the Rhodesian Museum, Bulawayo, it is stated that the rock and mineral collections have been fully classified and arranged, and that a geological map of Southern Rhodesia, on a scale of an inch to four miles, is being compiled. The report contains a brief sketch of the geology of the country around Bulawayo, by the curator, Mr. F. P. Mennell; also a list of Rhodesian minerals.

THE Western Australian tellurides form the subject of an essay by Mr. L. J. Spencer (*Mineralog. Mag.*, February). The author observes that since 1896, when tellurides of gold were first recognised in Western Australia, these minerals have proved of the greatest importance, and the telluride mines at Kalgoorlie, in the east Coolgardie goldfield, now yield as much gold as all the remaining goldfields in the colony. The tellurides occur as large lenticular masses and as impregnations in schistose rocks, and they are only found below a certain depth; nearer the surface, the minerals have been decomposed with the separation of native gold. At present no definite crystals of tellurides have been found, and the author suggests that cavities in the ores should be searched. He describes several tellurides, including lead telluride (altaite), which has not hitherto been recorded from Western Australia. He further brings forward evidence to show that "Kalgoorlite" and "Coolgardite" are not homogeneous minerals, but mixtures of known tellurides.

IN the *Proceedings* of the Royal Society of Victoria (vol. xv. part ii. 1903) all the subjects dealt with relate to natural history. Mr. Frederick Chapman has commenced the description of the new or little-known Victorian fossils in the National Museum at Melbourne. Mr. G. B. Pritchard continues his account of the Tertiary mollusca, and

Mr. O. A. Sayce contributes an account of the Phyllopoda of Australia, including descriptions of some new genera and species. Prof. J. W. Gregory describes under the name Heathcotian a series of phyllites and schists, with diabases, porphyrites and amphibolites, which occur along the floor of the Heathcote Valley, and form the crest of the Colbinabbin Range, about seventy miles north of Melbourne. Conflicting opinions have been expressed with regard to the age of these rocks, and even now it is uncertain whether they are Cambrian or pre-Cambrian. In Lower Ordovician times they formed an extensive land area across Central Victoria. A new genus of trilobite, Notasaphus, is described from the Lower Ordovician rocks, and evidence is given to show that Dinesus (previously described by Mr. R. Etheridge, jun.) is also a trilobite.

THE geographical distribution of fresh-water decapods forms the subject of an interesting essay by Dr. A. E. Ortmann (*Proc.* Amer. Phil. Soc., vol. xli. No. 171). He points out that any division of the earth's surface into zoogeographical regions should not be based exclusively on the present distribution of animals. The geological history must be considered, and even then it is impossible to create any scheme that covers all cases, owing largely to the difference of the means of dispersal of the various groups of animals. In most cases the instances of "abnormal" distribution have to be traced back into the geological past to be understood properly, and the introduction of "regions" in our method is only a means of tabulating the more interesting and important facts, and not the final aim of zoogeography. The author deals fully with the geographical distribution of the fresh-water decapods, and discusses the great changes in the distribution of land and water which have modified the shapes of the continental masses since Cretaceous times. His views are clearly explained and illustrated by maps showing the "regions" of past periods, and these lead up to the "regions" of recent time, which do not differ materially from those constructed by Wallace on distinct principles. The author deals not only with the causes of present distribution, but points out reasons for the local absence of particular forms—the crayfishes and crabs, for instance, being mutually exclusive.

IN the *Publications* of the Field Colombian Museum, Dr. Millspaugh has compiled a "Flora of the Island of St. Croix." Baron Eggers published a "Flora of St. Croix and the Virgin Islands" in 1879, and the present list incorporates the plants brought together by Prof. Ricksecker of Iowa, but does not include the collections made by several Danish botanists.

THE characters and affinities of the oxlip form the subject of a small brochure, in which Mr. C. Bailey amplifies a paper read before the Manchester Field Club. The true oxlip, known distinctively as Jacquin's oxlip, is found only in certain of the eastern counties, grows in the uplands on Boulder-clay, and is associated more often with the cowslip than with the primrose. Crosses with the cowslip are rare, with the primrose more frequent, suggesting that its racial affinities are closer with the latter.

THE problem of unravelling the true relationships between various plant rusts has been taken up by Prof. J. C. Arthur in America, and in addition to papers published in the *Botanical Gazette*, this subject formed the theme of an address to the Botanical Society of America. By means of cultures extending over several seasons, the author has endeavoured to discover the second host plants on which many rusts complete a stage of their life-history, and also to determine the differences between apparently similar forms which develop as totally different varieties. Prof. Arthur has confined his experiments mainly to the rusts which occur upon grasses and sedges.

A THIRD edition of Engler's "Syllabus der Pflanzenfamilien" shows some additions of which the more important are the incorporation of several paragraphs summarising the principles of systematic classification, and the introduction of a list of the more definite vegetative formations of the world. In the syllabus the changes refer mainly to points of detail, as in the ultimate subdivisions of a few of the phanerogamic families, also there has been some rearrangement of the main divisions of the lower organisms. The value of the book lies, of course, in the portion dealing with the higher plants, and objections might be offered to the arrangements of several of the cryptogamic groups. Under the Dictyotales, the occurrence of motile antherozoids demonstrated five years ago by Lloyd Williams is not yet noted.

A NEW monthly journal devoted to bacteriological research, the *Bulletin de l'Institut Pasteur*, has just been commenced. It is to be conducted by the junior staff of the Pasteur Institute, and appears to be much on the lines of the *Centralblatt für Bakteriologie*. The first number issued contains an introduction by M. Duclaux, an article by M. Roux upon microorganisms that are so minute as to be invisible, and a number of reviews of articles in current periodicals.

THE Corporation of the City of London is rightly taking part in the crusade against tuberculosis. It has for many years instituted legal proceedings against farmers, butchers and meat-salesmen for sending tuberculous meat into the City markets, or for exposing the same for sale. Since it would appear that in some cases such offences may have been due to ignorance, the Public Health Department has issued a circular describing the indications of tuberculosis in the carcase, and the symptoms of the disease in the living animal, drawn up by Dr. Collingridge and by Mr. King, the Medical Officer of Health and the Veterinary Inspector respectively.

WE have received the report of the Director of the Illinois State Laboratory of Natural History for the years 1899–1900.

THE necessity for financial assistance, if its work is to be adequately carried on and expanded, is the cry of the Committee of the Marine Biological Association of the West of Scotland, of which the report for 1902 is just to hand. It has been decided to issue an appeal for an endowment fund of 25,000*l*. "The Millport Station," according to the report, "has the almost unique distinction of being a scientific institution founded and maintained entirely by private effort, and the committee would therefore address an earnest appeal to all who have hitherto shown an interest in the station to direct their attention to this object." During the past year the opportunities offered by the Association for obtaining practical instruction in dredging and marine biology have been taken advantage of by several educational bodies. Our knowledge of the fauna of the Clyde estuary has likewise been considerably increased.

IN the report of the Lancashire Sea-Fisheries Laboratory and Sea-Fish Hatchery at Piel for 1902, Prof. Herdman makes some comments on the proposal that the British Government should take a share in the international investigation of the North Sea and its products. Prof. Herdman remarks that if those who have advised the Government to take part in it will declare distinctly that they

regard the scheme as a purely scientific investigation which may throw light on fishery problems, he is prepared to endorse their recommendation, but not otherwise. In the same report Dr. J. T. Jenkins discusses the differences between the spring and autumn broods of herring, and the question whether these are the offspring of the same parent herrings (which in that case must spawn twice in the year), or whether they belong to different races of the species, one of which breeds in the spring and the other in the autumn. The question is left undecided, although it is pointed out that the alleged differences in form between the fish of the two broods are not constant.

PROF. H. F. OSBORN has sent us a budget of extracts from our American contemporary, *Science*. In one of these articles it is proposed to divide reptiles into two main sections, Synapsida and Diapsida, according to the presence, primarily, of single or double temporal arches. From a second article it is satisfactory to learn that the splendid collection of Pampean vertebrate fossils acquired by the late Prof. Cope has been unpacked in the American Museum, and is in course of being worked out. Recent investigations, it is stated in a third, have led to the abandonment of the lake-basin theory of the origin of the Tertiary strata of the great plains. Attention is likewise drawn to the large series of vertebrates—inclusive of two mammals—from the Cretaceous of Canada, recently described by Mr. Lambe. Of considerable interest is the provisional identification of a fossil mammal from Japan, to which reference was made some time ago in our columns, with Desmotylus, of the later Tertiary of California.

THE Saturday afternoon excursions of the London Geological Field Class, conducted by Prof. H. G. Seeley, F.R.S., will commence on April 25. Among the localities to be visited this season will be Walton-on-the-Hill, Aylesbury, Harefield, Sevenoaks, Leighton, and Tunbridge Wells. Further particulars can be obtained from the hon. sec., Mr. R. Herbert Bentley, 33 Church Crescent, Muswell Hill, N.

THE second edition of Prof. A. Winkelmann's "Handbuch der Physik," which originally appeared in 1896, is in course of publication by the firm of J. A. Barth, Leipzig. The new edition will be published in six volumes, dealing respectively with general physics, acoustics, heat, electricity and magnetism, and optics. Each volume will be complete in itself, and the editor, Prof. Winkelmann, has obtained the assistance of many well-known men of science in Germany for various branches of physics. The first half of the volume on electricity and magnetism, which we have received, shows that the complete work will be a more detailed treatise of physics than exists at present for English-reading students.

PROF. W. A. TILDEN, F.R.S., was elected president of the Chemical Society at the annual general meeting on March 25. The retiring president, Prof. J. Emerson Reynolds, F.R.S., delivered an address, in which he directed attention to the publication of some recent reports on progress in chemical research, and urged the publication of similar digests. He urged the study of "comparative chemistry" of inorganic compounds. There were few inquiries of greater interest than those involving inorganic isomerism, which was now either completely ignored or only slightly mentioned. Polymerism, or molecular condensation, was well known to exist in many inorganic compounds, as in the oxides of nitrogen, vanadium, niobium and tantalum. Silicon showed a great analogy to carbon, and it was highly probable that some of the native silicates were benzenoid combinations of $6SiO_2$. The more familiar cases of isomerism were the nitrites and sulphites, and isomerism had also been observed in the thiosulphates and the salts of the phosphorous acids. Attention was directed to some cobalt, platinum, and molybdenum compounds which showed this peculiarity. Another analogy between carbon and inorganic compounds was the curious and interesting catalytic action, referred to by Bredig under the title of "inorganic ferments." Colloid platinum solutions acted on many substances in the same way and under similar laws as enzymes. The whole subject was little known, but it suggested that the broader study of inorganic chemistry, especially in the light of our knowledge of the "organic" division of the science, was well worthy of much greater attention than it had received of late.

THE additions to the Zoological Society's Gardens during the past week include two Maholi Galagos (*Galago maholi*) from South Africa, presented by Captain Crosse; a Greenland Seal (*Phoca groenlandica*) from the Firth of Forth, presented by Mr. E. H. Bostock; two Lesser Kestrels (*Tinnunculus cenchris*), captured at sea, presented by Mr. L. Ovens; a Long-necked Chelodine (*Chelodina longicollis*), three Muricated Lizards (*Amphibolurus muricatus*), a Quoy's Lizard (*Lygosoma quoyi*) from Australia, a European Pond Tortoise (*Emys orbicularis*), European, presented by Mr. E. Hulton; a Purple-faced Monkey (*Semnopithecus cephalopterus*) from Ceylon, a White-crowned Mangabey (*Cercocebus oethiops*) from West Africa, a Fringed Gecko (*Uroplates fimbriatus*), two Green Geckos (*Phelsuma madagascariense*) from Madagascar, four Derbian Zonures (*Zonurus giganteus*), a Blessbok (*Damaliscus albifrons*) from South Africa, an Antarctic Skua (*Stercorarius antarcticus*) from the Straits of Magellan, six Amboina Box Tortoises (*Cyclemys amboinensis*), a Ceylonese Terrapin (*Nicoria trijuga*, var. *ediniana*) from India, a Raven (*Corvus corax*), European, deposited; a Mouflon (*Ovis musimon*) born in the Gardens.

## OUR ASTRONOMICAL COLUMN.

NOVA GEMINORUM.—Several observations of the new star announced by Prof. Turner on March 24 are contained in No. 3858 of the *Astronomische Nachrichten*.

Prof. Deichmüller, of Bonn, has looked up some old observations of the region, made during 1856, 1857 and 1858, and cannot find therein any record of an object having the position occupied by the Nova.

Prof. Hartwig (Bamberg) compared the Nova with two neighbouring stars, viz. B.D.+29° 1336 (given as magnitude 8·3) and B.D.+30° 1331 (given as magnitude 8·7), on March 26, and found that it was equal to the former and about 0·1m. brighter than the latter, whilst he records its colour as "bright orange." Two heliometer measures of the Nova's position, using the stars B.D.+29° 1342 and B.D.+29° 1307 as reference stars, gave for 1903 :—

$$\alpha = 6\text{h. } 38\text{m. } 0{\cdot}47\text{s.}, \quad \delta = +30^\circ\ 2'\ 27''{\cdot}0$$

and

$$\alpha = 6\text{h. } 38\text{m. } 0{\cdot}46\text{s.}, \quad \delta = +30^\circ\ 2'\ 31''{\cdot}1$$

respectively.

Prof. Hartmann and Dr. Ludendorff, using the 80 cm Potsdam refractor with the No. 1 star-spectroscope, obtained a spectrum of the Nova, with three hours' exposure, on March 29. The star then appeared to be of about the ninth magnitude, and the spectrum on the plate is extremely faint.

The hydrogen line Hβ appears as a bright emission line between λ 4857 and λ 4881, and the middle of the line is shifted about 8 Ångström units towards the red. In the blue part of the spectrum there are many bright lines forming a band which has its maximum intensity from λ 4604 to λ 4672. The line Hγ is also a bright line, but is so extremely faint that it was measured with difficulty; it appears to extend from λ 4343 to λ 4356, and, like Hβ, to

have its centre shifted 8 Å.U. towards the red. Prof. Hartmann deduces from this "shift" that the material emitting these bright line radiations is moving away from the earth with a velocity of 520 kilometres per second. The spectrum is similar to that of Nova Persei during the latter part of March, 1901, and this fact, taken with the similar decrease of magnitude, seems to prove that the object is truly a Nova.

The magnitude was estimated at Strassburg on March 27, 13h. (M.T. Strassburg) as 7·9, and at Utrecht on March 27, 11h. 20m. (M.T. Utrecht) as 8·1.

COOPERATIVE DETERMINATIONS OF VELOCITIES IN THE LINE OF SIGHT.—At a meeting of the Royal Astronomical Society held on March 13, Mr. Newall read a paper dealing with the results obtained at Cambridge in connection with Prof. Frost's cooperative scheme for determining the motions in the line of sight of ten selected stars.

Mr. Newall's results dealt with the stars α Arietis, α Persei, and α Boötis, and for the first named he has obtained a mean value of −14·23 kilometres per second. The measurements of the spectrum of α Persei seem to indicate that there is something peculiar, which is not yet accounted for, in the motion of this star. Fourteen photographs give a mean velocity of −2·61 kilometres per second with a probable error of ±0·28. In the case of α Boötis four of the lines, out of the seventeen which were measured, give a velocity of an entirely different order from that given by the other thirteen lines, although the lines themselves are not remarkable in other respects; two of these lines belong to the iron, one to the scandium, and one to the titanium spectrum (the *Observatory*, April).

WOLF'S RICH NEBULOUS REGION IN THE CONSTELLATION LYNX.—Writing to No. 3857 of the *Astronomische Nachrichten*, Dr. Isaac Roberts states that he photographed both H. iv55 and the new nebula mentioned by Prof. Max Wolf (*Astronomische Nachrichten*, 3847) on March 24, 1897, and included them amongst the regions given in his observatory report which appeared in the *Monthly Notices* for February, 1898.

Dr. Roberts's notes describe the second nebula as 45s. following and 14′·5 S. of H. iv55, and state that "it is a spiral nebula viewed edgewise, about 285″ of arc in diameter from south following to north preceding: nucleus stellar, equal to about seventeenth magnitude, faint indications of condensations."

THE PERIOD AND LIGHT-CURVE OF δ CEPHEI.—In No. 3853 of the *Astronomische Nachrichten* Prof. A. A. Nijland discusses the previous observations and calculations of the period and light-curve of the interesting variable δ Cephei (Ch. 8073). He compares the maxima given by his own formula and that of Schur with the chief observations made between February, 1785, and February, 1897, and arrives at the following formula as the one giving the nearest approximation to the true period:—

Maximum = 1840 September 26d. 10h. 6·2m. (M.T. Bonn)
+5d. 8h. 47m. $45{\cdot}00sE - 0\,00075sE^2 - 0\,00000062\,E^3$,

or, expressed in Julian Days:—

Maximum = J.D. 2393375·421 (M.T. Bonn)
$+5{\cdot}366493dE - 0\,00075sE^2 - 0{\cdot}00000062\,E^3$.

Prof. Nijland has found during the discussion of the data that a variation of the period is suggested, and he urges the desirability of obtaining further trustworthy observations.

## *CONSTITUTION OF A BOARD OF SCIENTIFIC ADVICE FOR THE FURTHERANCE OF SCIENTIFIC WORK IN INDIA.*

SUBJOINED is the complete text of the resolution of the Government of India referring to the appointment of a Board of Scientific Advice to organise and coordinate the scientific work done in the several Departments of the Government of India.

The application of the resources of modern science to the economic and agricultural development of the country has for many years engaged the earnest attention of the Government of India. The Famine Commissioners of 1878 laid much stress on the institution of scientific inquiry and experiment designed to lead to the gradual increase of the food-supply of the country and to the greater stability of agricultural outturn. It was considered desirable, however, first to organise the Land Record system, and so to acquire a stable basis of ascertained fact, before scientific inquiry was undertaken on any considerable scale. The necessity for such investigation was again emphasised by Dr. Voëlcker, who was deputed in 1890 to advise the Indian Government on the best course to be adopted in order to effect improvements in Indian Agriculture. At the same time the experience of recent years has indicated the increasing importance of the study of the economic products of India and of its mineral-bearing tracts, with a view to the development of the industrial and economic resources of the country.

(2) The organisation and work of the Indian Agricultural and Scientific Departments prior to 1897 have been fully described in the important series of Resolutions which issued in that year, and especially in the fourth and fifth Resolutions of the series. These contain a clear exposition of the policy of the Government of India in establishing departments of scientific research to promote the industries of the country and investigate its undeveloped resources, and they describe the means adopted to give effect to that policy. They further show how undue prominence had been given in the past to pure science, to the neglect of its economic application, and they affirm the necessity of extending the economic side of inquiry, and of coordinating the labours of the different departments on the basis of a well-considered working plan.

(3) The policy laid down in these Resolutions has been steadily pursued, though its development has been retarded by an unfavourable cycle of seasons, which seriously affected the financial resources of the Government of India. To the Geological Department two practical mining experts have been added, while each year a portion of the scientific staff devote themselves to inquiries connected with the mineral resources of India. A cryptogamic botanist has been appointed, whose special duty it is to study the fungoid diseases of agricultural staples, such as rust in wheat, which causes such serious and widespread loss to the country. In Madras a botanist has been permanently entertained whose attention will be mainly devoted to economic inquiry. And of late years the attention of the officers of the Botanic Survey has been more and more directed to questions of practical importance to the country. The establishment of the Reporter on Economic Products has been strengthened, and a Curator with special qualifications as an economic chemist has been added to it and provided with a laboratory, while one agricultural chemist pursues his inquiries at Dehra Dun, and it is proposed to procure another for Madras. An entomologist has for some time past been added to the staff of the Indian Museum; a specially qualified Forest officer has been deputed for investigation of the insect pests which devastate the forests, while the Secretary of State has been asked to secure the services of a skilled entomologist in order to conduct similar inquiries in connection with the agricultural and industrial staples of India. In the Civil Veterinary Department a highly skilled bacteriologist is studying the diseases which prove so fatal to agricultural stock in India. An agricultural expert has recently been added to the Provincial staff of the United Provinces. Finally, an Inspector General of Agriculture has been appointed whose function it is to guide and correlate the agricultural inquiries carried on throughout India, whether by the Imperial or the Provincial Governments, and to act as an adviser to both in all matters pertaining to agriculture, while under him work, or will work, the agricultural chemist, the entomologist and the cryptogamic botanist.

(4) The Government of India now desire to provide, as far as possible, for that coordination of scientific inquiry which the development of the machinery of the various departments has rendered more than ever essential. The work of many of the members of the scientific staff covers fields in which experiments of a similar or cognate character are being independently conducted. Thus in chemistry we have several investigators following parallel lines of research; in economic botany there are two departments working independently of each other; in economic entomology

there have been two specialists, each charged with investigations similar in character. Finally, the appointment of an Inspector General of Agriculture adds to the staff an official with a close interest in all the branches of science which bear upon the agricultural conditions of the country.

(5) The subject has received the careful consideration of the Governor General in Council, and he has arrived at the conclusion that a central authority is needed to ensure that the work of scientific research is distributed to the best advantage, that each investigator confines his researches to the subject with which he is most capable of dealing, and that energy is not dissipated by the useless duplication of inquiries or misdirected by a lack of inter-departmental co-operation. The various departments of science are not self-contained, but closely interlinked. Agriculture needs the aid of botany, botany the assistance of geology, geology of chemistry, and an endeavour should be made to combine the different departments in a system of mutual assistance. The Governor General in Council has no wish to imply that there has been any disposition on the part of one department to hold itself aloof from another. But the institution of an authorised scheme of mutual assistance will result in a closer cooperation for the purposes of effective research than has been possible in the past.

(6) A further reason exists for the constitution of a central advisory authority. Though greater prominence has been given in recent years to the practical or economic side of inquiry, its importance is not even yet always adequately recognised. The Government of India fully realise the great value of the work effected in the past by their scientific departments, in the shape of scientific exploration and systematic work, and they recognise that such inquiries must necessarily precede any attempt towards the solution of more practical problems. But in those departments there has been a not unnatural tendency to give the claims of abstract science precedence over the more practically important demands of economic or applied science. In making these remarks, the Governor General in Council has no desire to underrate the importance of original research for purely scientific objects, or to assert that the practical application of science should be the sole aim of technical departments. It is his wish that the high reputation which has been gained by more than one branch of scientific work in India should be maintained, and that the Indian departments should retain touch with scientific progress in Europe and America. But in view of the fact that the Indian Government own the largest landed estate in the world, that the prosperity of the country is at present mainly dependent upon agriculture, that its economic and industrial resources have been very imperfectly explored, and that the funds available for scientific work are limited, the importance of practical research is preeminent, and a central authority, which can speak with knowledge upon scientific questions, will be in a position to enforce the repeated declarations of the Government of India on the subject.

(7) The Governor General in Council proposes therefore to constitute a Board of Scientific Advice comprising the heads of the Meteorological, Geological, Botanical, Forest, Survey, Agricultural, and Veterinary Departments, together with such other scientific authorities as may from time to time be invited by the Government of India to serve upon it. These latter will include scientific officers in the service of the Imperial and Provincial Governments whose special attainments render their assistance desirable. The Government of India hope that the Trustees of the Indian Museum, who, as custodians of the national scientific collections, have always shown an active interest in the prosecution of scientific work, will associate themselves with the scheme, and they will be addressed separately on the subject. The Secretary to the Government of India in the Department of Revenue and Agriculture, to which the scientific departments concerned are administratively subordinate, will be *ex-officio* President of the Board, and the Secretary to the Board will be selected, subject to the approval of Government, by the Board from amongst its members. The Board will review and advise generally upon the operations of the departments, with due attention to the economic side of their work, and will serve as a referee in all matters connected with the organisation of scientific inquiry in this country. It will annually receive and discuss the proposals of each departmental head in regard to the programme for investigation in his department. In cases where inter-departmental cooperation is necessary, it will rest with the Board to advise as to the lines on which mutual assistance should be given and the department to which the inquiry should primarily appertain. Where the proposed investigation falls exclusively within the domain of a particular department, the function of the Board will be confined to examining and criticising the proposals. It is not intended that the directing influence of the Board should in any way weaken departmental executive control or responsibility, and the precise manner in which, and the agency by which, any required information is to be collected or investigation carried out must be left to the heads of the departments concerned.

(8) The Board will submit annually to Government a general programme of research which will embody the proposals of departmental heads in so far as its subjects are to be exclusively dealt with in one department, and its own proposals in cases where two or more departments are to cooperate. At the end of the year it will submit to Government a brief review of the results obtained in all lines of scientific investigation, based upon the annual departmental reports and upon any papers published by individuals. Generally, the Board will act as an advisory committee to the Government of India and as an intermediary between the Government of India and their scientific officers in respect of all questions of technical research which are dealt with in the Department of Revenue and Agriculture. The Royal Society have already been good enough to offer their aid in furthering scientific work in India, and their invaluable advice and assistance will be freely invoked by the Board now constituted.

(9) To enable the Board to carry out the duties which are assigned to it, the Governor General in Council considers it desirable that its members should meet as a collective body at stated intervals for the purposes of discussion. It will probably be ordinarily sufficient to hold two meetings a year; one to consider the work of the past year and proposals for the programme of the coming year in each department; the other to settle finally those programmes subject to the approval of Government. The most convenient dates for holding these meetings will be settled in consultation with the Board.

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(1) The Surveyor General of India.
(2) The Inspector General of Forests.
(3) The Director, Geological Survey of India.
(4) The Meteorological Reporter to the Government of India and Director General of Indian Observatories.
(5) The Inspector General, Civil Veterinary Department.
(6) The Director, Botanical Survey of India.
(7) The Reporter on Economic Products to the Government of India.
(8) The Inspector General of Agriculture in India.
(9) The Director General of Archæology in India.
(10) The Chief Inspector of Mines in India.

(10) Ordered, that the Resolution be communicated to all Departments of the Government of India and Local Governments and Administrations for information and to the Departments above noted for information and guidance; and that it be published in the Supplement to the *Gazette of India*.

## *SOLAR PROMINENCE AND SPOT CIRCULATION*, 1872–1901.[1]

IN previous numbers of this Journal (vol. lxvi. p. 248, and vol. lxvii. pp. 224 and 377) references have been made to the connection between solar, meteorological and magnetic changes, and some of the results obtained from a reduction of the solar prominences as observed by Prof. Tacchini at Rome were described.

[1] Abstract of a paper recently read before the Royal Society by Sir Norman Lockyer, K.C.B., F.R.S., and William J. S. Lockyer, M.A., Ph.D., F.R.A.S.

The result of the discussion showed that the curve representing the variation of percentage frequency of the prominences for the whole limb of the sun indicated that in addition to the main epochs of maxima and minima coinciding in time generally with those of the maxima and minima of the total spotted area, there were also prominent subsidiary maxima and minima.

Further, dividing the sun's limb into zones of 20° in width from the equator, with a pole zone of 10°, and discussing each zone separately, the variation of the prominence percentage frequency about the equator was found to be very different from that in the higher latitudes, the former changing with the spots, and the latter exhibiting sudden outbursts just previous to the epochs of sunspot maxima, followed and preceded by comparatively long intervals of quietude.

In the present investigation the prominence observations have been discussed from a different point of view, in order to trace out, if possible, the heliographic latitudes of the chief centres of action of prominence disturbance, or in other words, to indicate the regions on the solar disc where prominences were most prevalent in each year, and see if those regions varied their positions in relation to the sun's equator.

In this way it could be determined whether such movements, if any, are subject to some periodic law, in which case it would be possible to increase our knowledge of the circulation of the solar atmosphere in regions outside those in which sunspots alone have, up to the present, been employed.

It has long been known that the centres of action of sunspot disturbances, as shown by Carrington, Spoerer and others, are restricted to particular regions on the solar surface, all of which are included in the two large zones from ±5° to ±35° heliographic latitude. Further, from year to year, the regions of greatest activity undergo changes of position which are periodic. Thus at sunspot maximum there is only one zone in each hemisphere in which spots are situated, the centre of this being about 18° N. and S., while at minimum there are two zones existing simultaneously in each hemisphere; the older cycle dying out in the zone the centre of which was situated in low latitudes, and the new one commencing in high latitudes, its centre being about latitude ±30° to ±35°.

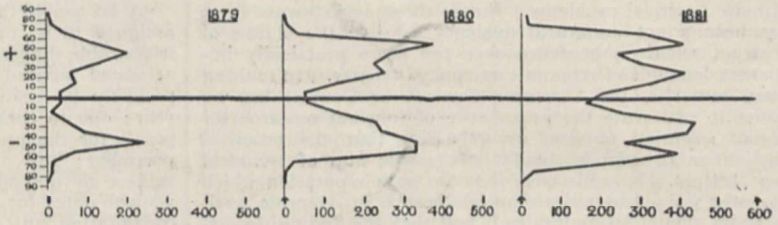


FIG. 1.—Curves illustrating the percentage frequency of solar prominences for each 10 degrees of heliocentric latitude for the years 1879, 1880 and 1881: after the observations of Tacchini.

It may be here remarked that the above results are not strictly, but only generally, true, because the observations of each solar hemisphere have not been treated sufficiently in detail. If this be done by examining the behaviour of the frequency or areas of spots in, say, zones of 5° in width, then it will be found that sometimes there are actually three centres of spot activity. The reduction of sunspots in this manner for the whole period, since accurate measurements have been made, is not yet complete, but it is as well to draw the reader's attention to these facts.

Fortunately, the investigator has at his disposal two splendid series of observations of prominences made independently of each other, so that he is able to check the variations indicated in one series by seeing if they are exhibited in the other.

The observations thus discussed were made by Tacchini at Rome from 1872–1900, and by Ricco and Mascari at Catania from 1881 to 1901. Both sets of observations are handled in exactly the same way, and it will be seen later that the changes indicated in each are practically identical. It is due to the kindness of Prof. Ricco, who forwarded some unpublished data concerning his prominence observations and deductions, that the curves are complete up to the end of the year 1901.

The method of reduction adopted was to determine for each year the percentage frequency of prominence activity for every 10 degrees of solar latitude north and south. A series of curves was next drawn, one for each year, the abscissæ representing the latitudes of prominences north and south, and the ordinates their percentage frequency. It was then found that the centres of prominence activity, or in other words, the maxima of the curves were sometimes single, sometimes double, and in one or two cases even triple in each hemisphere. This suggested that just as sometimes there are two zones of spots existing at one time, so there might be one, two, or occasionally three zones of prominences in existence in each hemisphere simultaneously.

Further, a close examination of the whole set of curves with reference to these points of maxima made it possible not only to study the changes of latitude of these points from year to year, and their positions when commencing to develop or about to disappear, but the intensity of these centres in relation to each other.

The accompanying illustration (Fig. 1) shows the curves drawn for the years 1879, 1880, and 1881, from the observations of Tacchini, and serves as examples of the curves that have been discussed; they exhibit the change from a single to a double centre of activity in each hemisphere.

Thus, in 1879, there was a prominence maximum in each hemisphere at latitudes ±50°. In the next year (1880), both these maxima had retreated further away from the equator, namely to latitudes ±60°, while another centre of disturbance began to make itself apparent at latitudes ±30°. In the year 1881, both centres in each hemisphere were strongly marked and became of about the same intensity, their mean latitudes in each hemisphere being about ±30° and ±60°. These curves thus indicate that during these three years, the direction of motion of these centres of activity tends polewards or away from the equator.

By examining both series of observations made by Tacchini and Ricco and Mascari, and analysing the positions of the principal and subsidiary maxima for the whole period covered by the observations, the results illustrated graphically in Fig. 2 were obtained.

In these figures the facts are brought together for each hemisphere separately. The medials of the lines (curves A and B) show the heliographic latitudes of the centres of prominence action; the thickness of these lines represents the relative percentage frequency of prominence action.

For the sake of comparison, three other curves for each hemisphere are shown. The first curves (C) show the mean heliographic latitude of spotted area for each hemisphere; these curves, as previously pointed out, are only generally accurate. The next curves (D) illustrate the variations of the percentage frequency of prominence action for each hemisphere taken as a whole, and are similar to those given previously.

The last curves (E) show the variation of the mean daily area of sunspots from year to year, also for each hemisphere.

With this diagram the reader will be able at once to compare the variations of the changes of latitude of prominences as determined from the Roman and Sicilian observations. He will also be able at a glance to correlate these variations with those exhibited in the other curves added for comparison. It will therefore suffice if a summary of the conclusions drawn be given.

(1) The centres of action of prominence activity undergo an apparently regular variation.

(2) The direction of motion of these centres is from low to high latitudes, the reverse of that of spots, which travel from high to low latitudes.

This is seen directly from the curves, the prominences beginning in about latitude ±20°, and moving away from

the equator until they terminate in latitude ±80°. The general trend of the spots is from latitude ±35° to ±5°.

(3) At epochs of prominence minima (which are concurrent with sunspot minima) these centres of action are restricted to one zone (about latitude ±44°) in each hemisphere, while those of the spots occupy two zones in each hemisphere.

Since the broken vertical lines in Fig. 2 represent the epochs of prominence and spot minima, it will be seen that these cut curves C when two zones of spots are in evidence, and intersect the curves A and B when there are only single zones of prominences.

(4) At nearly all other times these centres are apparent in two zones, while those of the spots occupy only one in each hemisphere.

This deduction is true if the curves C be taken as representing simply the phenomenon generally, but it should be borne in mind, as stated previously, that a new reduction of these spot zones, which is in hand, is necessary.

(5) The subsidiary maxima exhibited by the curves representing the percentage frequency of prominence activity for each entire hemisphere are due to the presence of two well-developed centres of prominence activity in each hemisphere.

To make the comparison the subsidiary peaks on the curves D should be compared with the curves A and B, and in every case the former are accompanied by two zones of prominences.

Before concluding this article it may be mentioned that other observers, and among them Father A. Fényi, S.J., have studied this question of prominence distribution, but their discussions have been restricted to only comparatively short intervals of a few years; their results are, however, in harmony with those described here.

It is important finally to state that the deductions here made may be partially incomplete owing to the difficulty of determining sometimes whether a new centre of action has been formed or the position of an old one changed. Further, account must be taken of the fact that the material discussed does not represent the record of the percentage frequency of prominences determined from observations made on the disc of the sun (now rendered possible by the Jannsen-Hale-Deslandres method), but one obtained from observations of the phenomena occurring only at the limb of the sun. The close agreement between the observations of the different observers shows nevertheless that this latter method is of great value.

WILLIAM J. S. LOCKYER.

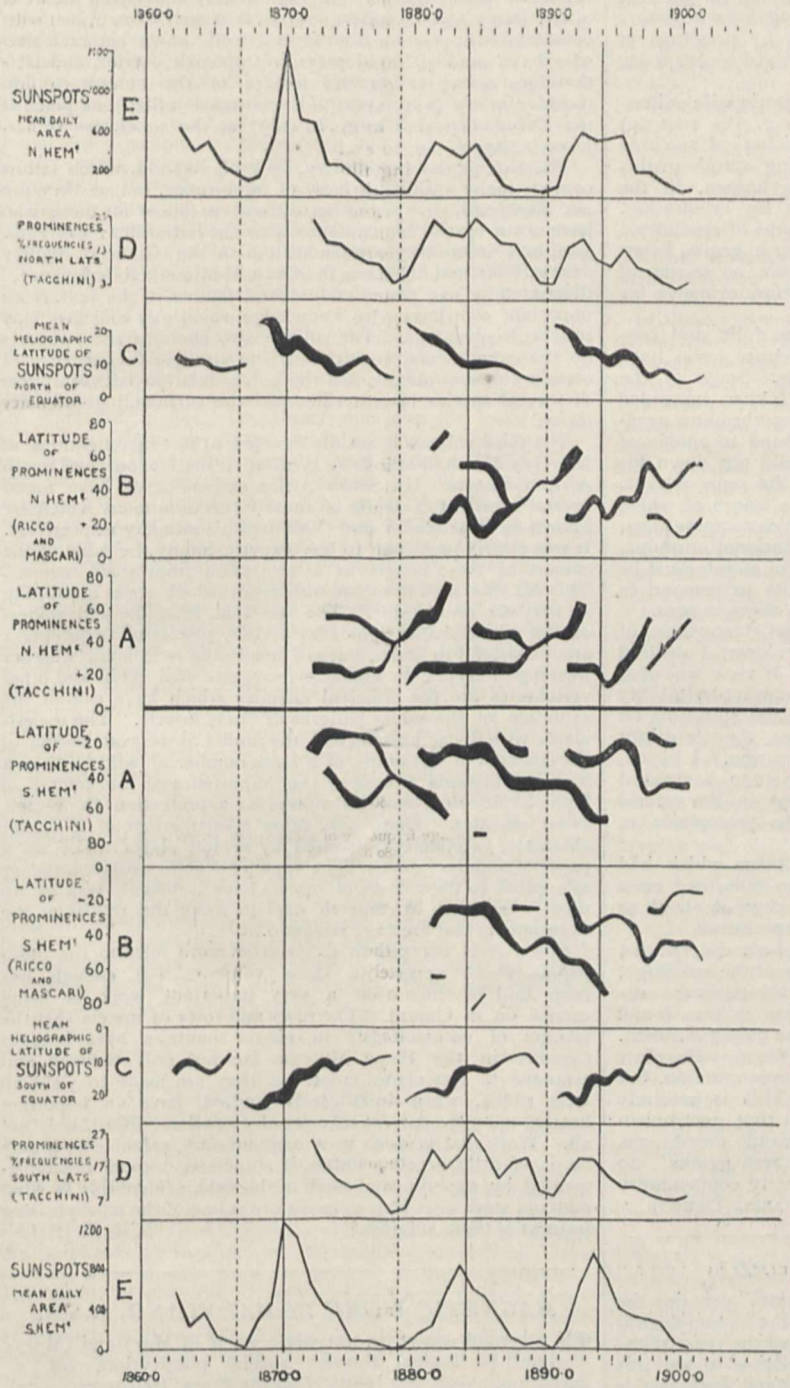


FIG. 2.—A comparison of curves illustrating the variations of the positions the centres of action of prominences (A and B) and spots (C), the percentage frequency of prominences (D), and the variation of spotted area (E). (The continuous and broken vertical lines indicate the epochs of sunspot maxima and minima respectively, the two hemispheres being taken together.)

## THE STATOLITH THEORY OF GEOTROPISM.[1]

THE paper deals with the modern theory[2] of the mechanism by which plants are enabled to regulate their line of growth by means of the force of gravity. When an upright flower-stalk is forcibly subjected to a change of position, for instance by laying the flower-pot on its side, it responds by geotropic curvature, and finally regains the vertical. The statolith theory is not concerned with the mechanism of curvature, but merely with the question how horizontality can originate a stimulus, in other words, how the plant perceives that it is no longer vertical. It is known that in some animals, for example the Crustacean Palæmon, the faculty of spacial orientation depends on statoliths (otoliths) which serve as guides by pressure on the internal surface of the otocyst. This theory has now been applied

[1] A paper by Mr. Francis Darwin, read at the Royal Society, March 12.

[2] Published simultaneously by Haberlandt and Němec in vol. xviii. of the *Berichte d. Deutschen Bot. Gesell.*; see also *Pringsheim's Jahrb.*, vols. xxxvi., xxxviii.

to plants; the function of statoliths is believed to be performed (in Phanerogams, at least) by starch grains which are free and movable, and thus fall to the lower end of the cell. So long as the plant is vertical, the starch grains rest in a layer on the basal walls of the cells. If the plant is placed obliquely or horizontally, the falling starch grains rapidly take up a different position, and, by pressing on a new region of the cell walls, can be conceived to originate a stimulus.

The fact that the power of being gravitationally stimulated occurs in certain definite regions (*e.g.* the root-tip) suggests the existence of that type of physiological machine which we call a sense-organ. Now falling starch grains supply the physical conditions which are known, in the case of animals, to supply a sense-organ for orientation. Therefore, when we find in the root-tip groups of specialised cells provided with falling starch grains, such grains being absent in the parts of the root which have no power of geotropic perception, we have strong *a priori* evidence for the statolith theory.

This general line of argument has been fully and convincingly developed by Haberlandt and Němec, who have also supplied direct experimental evidence. Some of the latter is not quite so satisfactory. Thus Němec succeeded in destroying the starch in bean roots by embedding seedlings in gypsum, when such roots were found incapable of geotropic curvature. Němec not unnaturally put down his results to the loss of an integral part of the sense-organs. But I have shown that grass seedlings, the starch of which has been largely removed by exposure to high temperatures, not only fail to respond normally to gravitational stimulus, but also to the stimulus of light. The loss of starch must be looked at as a symptom of general inability to respond to stimulation rather than as a loss of special sense-organs.

In the autumn of 1901, feeling the unsatisfactoriness of the available methods of attacking the problem, I devised what was then a new method.[1] My point of view was that if gravitational sensitiveness is a form of contact-irritability (which must be the case if the pressure of the statoliths on the plasmic membrane is the critical event), then it might be possible to intensify the stimulus by vibration. I hoped, by applying vibration in a vertical plane to a horizontal seedling, to make the starch grains dance on the lateral walls, and by such repeated blows on the protoplasm to produce a more active geotropic response.

The result was as I expected, the seedlings which had been kept horizontal for from eight to ten minutes,[2] on a tuning-fork vibrating in a vertical plane, showed about 44 per cent. more curvature than the control specimens.

In order to make sure that the tuning-fork did not act by merely increasing the *general* irritability of the seedlings, the experiment was repeated with vertical specimens exposed to lateral illumination. In this case it was found that the curvature of the vibrated plants was only 5 per cent. more than that of the control specimens. We may therefore conclude that vibration increases the geotropic reaction, but does not materially affect heliotropism. This is precisely what might be expected on the hypothesis that geotropism is the result of tactile stimulation of the plasmic membranes lining the lateral cell walls by means of starch grains. So far as it goes, the method is therefore clearly confirmatory of the statolith theory.

FRANCIS DARWIN.

## *ENTOMOLOGY AT OXFORD.*[3]

THE second volume of the "Hope Reports" contains the papers published by the workers in the entomological department of the University of Oxford during the years 1897–1900, and it is a cause for much congratulation to see this evidence of the very interesting and important work that is being done under the direction of Prof. Poulton with the valuable collections of tracheate arthropods possessed by the University.

In the first paper, on mimetic attraction, by Dr. Dixey, there is an important contribution to the subject which seems to be a favourite one with the Oxford entomologists, namely, the evolution of the patterns of the wings of those butterflies that form Müllerian associations. The whole theory underlying the work of Dr. Dixey and his colleagues has, it is well known, met with considerable opposition from several well-known entomologists who have studied Lepidoptera in tropical countries, and it is therefore a very satisfactory feature of this volume to find included in it a good report of the discussion that took place at the Entomological Society in 1897 at the conclusion of Dr. Dixey's papers.

The two papers on mimicry, by Prof. Poulton, which follow contain many additional facts of importance, but as they are not illustrated, they are rather difficult to follow for those who have not a special acquaintance with the butterflies; but Prof. Poulton's interesting communication to the Linnean Society entitled "Natural Selection, the Cause of Mimetic Resemblance," illustrated by five plates and several figures in the text, is an important contribution to knowledge which any zoologist may read with advantage. The volume also contains some reports on the experimental inquiry into the struggle for existence in certain common insects, and the colour-relation between pupæ of several species of butterflies and the surroundings of their larvæ.

The third volume is mainly devoted to the investigations of Mr. Guy Marshall and Prof. Poulton on the bionomics of South African insects. In South Africa entomologists have found several excellent examples of those forms of mimicry which are known as "Batesian" and "Müllerian" mimicry respectively. It was clearly important to test experimentally the value of the colours of these insects as a protection from their enemies. This Mr. Marshall has done with results which are as interesting as they are remarkable. The fact that Mantidæ and spiders exhibit unmistakable signs that certain species of Lepidoptera are distasteful to them, but are unaffected by colours whether warning or cryptic in character, suggests that birds and other vertebrates are the principal enemies which have caused the evolution of the colour patterns of these insects. The experiments with living kestrels and the results of an examination of the contents of the crops of a large number of wild birds go a long way towards a proof of the importance of the colours of both Lepidoptera and Coleoptera as a protection from their avian enemies. These and other investigations of a similar character, excellently illustrated by several plates, make up a paper of singular interest. The opponents of the evolution theory as applied to the colours of insects have a difficult task before them when they attempt to explain away the results of the experiments that are here recorded.

Space does not permit us to refer more fully to the other papers which appear in these volumes, but enough has been said to show that a very important work is being carried on in Oxford. The rows and rows of insects that the labours of entomologists in many countries have brought together in the Hope Museum are not only ticketed and arranged in systematic order, but they are made to yield up facts which, when intelligently studied, have an important bearing upon the current theories of evolution. But this is not all. Work that is done in a museum only, valuable as it may be, is of little account unless it stimulates to, and is supplemented by, experimental work in the field. That this is what museum work does lead to in Oxford is one of the most pleasing features of these volumes.

S. J. H.

## *MAGNETIC WORK IN MARYLAND, U.S.A.*

IN a second report on magnetic work in Maryland (Maryland Geological Survey, special publication, vol. v. part i. pp. 23–98, the Johns Hopkins Press, Baltimore, 1902), Dr. Bauer gives the results of the survey which he commenced in 1896. In the earlier years the work was done mainly under the direct auspices of the Maryland Geological Survey, but subsequent to May, 1899, when Dr. Bauer took charge of the magnetic department of the U.S. Coast and Geodetic Survey, the Geodetic Survey contributed materially to it. The result, in Dr. Bauer's words, is that "Maryland now possesses the most detailed magnetic survey of any country, with the exception of Holland," there having been on the average one station to each 100 square miles.

[1] Practically the same method has meanwhile been made use of by Haberlandt, who has published the results in *Pringsheim's Jahrb.*, 1903.

[2] After being subjected to vibration, the plants were placed on a klinostat to prevent further gravitational stimulation. The curvature was measured after several hours slow rotation.

[3] "Hope Reports," vols. ii., iii., 1900, 1902. Edited by Edward B. Poulton. Oxford: Printed for private circulation by Horace Hart, 1901, 1903.)

The present report enumerates the position of all these stations, and tabulates the values of the declination, inclination and horizontal force as observed, and as reduced to the common epoch January 1, 1900. The data are also embodied in a series of charts. In the reduction to a common epoch the secular change was derived from numerous absolute observations made at Linden, Montgomery County; whilst diurnal variations were deduced from the records of the Naval Observatory, Washington. Unfortunately, owing to the disturbing action of electric trams at Washington, no satisfactory data were obtainable for the actual years occupied by the survey, and recourse was necessary to earlier records, mainly of the three years 1889 to 1891, particulars of which appear in the report. This, of course, is open to objection, on the ground that the amplitudes of the diurnal inequalities of the several elements vary from year to year. However, as both the magnetograph records and the field observations relate to years of relatively small sun-spot frequency, the objection is less serious than might appear at first sight.

Calculations are given of the probable errors in single observations with the instruments employed. The results appear fairly satisfactory in the case of the declination and inclination, but less so in the case of the horizontal force (*cf.* Table 18, p. 84). Dr. Bauer considers the weak point in the magnetometer—of the Geodetic Survey's old pattern—to have been the employment of wood in the deflection bar, and he states that the U.S. Survey is now procuring a superior type of instrument. One point that may be also worth reconsidering in this connection is the employment of 35 and 49 cms. as the two distances for deflections in horizontal force observations. Large distances have the advantage of reducing the uncertainties connected with the law of force between two magnets of finite size; but except in regions where the horizontal force is very low, distances such as 35 and 49 cms., with magnets of ordinary strength, imply small deflection angles, and the writer is inclined to think this may more than compensate for any theoretical advantage, especially in field work.

One of the interesting points discussed, and illustrated in the charts, is the existence of a considerably disturbed region near Gaithersburg, some twenty or thirty miles north-west of Washington. The abnormalities here were apparently first disclosed by special observations made with a view to the selection of a site for a magnetic observatory near Washington. The fact emphasises the dangers to which random choice of such a site may be exposed. At the end of the report there is an outline of a scheme for the complete mathematical investigation of the magnetic distribution in Maryland, but the working out of this and various other details is postponed, pending, apparently, the elaborate survey of the entire United States which the U.S. Coast and Geodetic Survey has now in contemplation. C. C.

## SCIENTIFIC SERIAL.

*American Journal of Science*, March.—Studies of Eocene Mammalia in the Marsh collection, Peabody Museum, by J. L. Wortman. Part ii. Primates.—On ceric chromate, by P. E. Browning and C. P. Flora. An excess of chromic acid precipitates a ceric chromate of the composition $Ce(CrO_4)_2,2H_2O$ from solutions of cerium salts. Although the sulphates of lanthanum, didymium and yttrium were present, these metals were not present in the precipitate.—The effects of changes of temperature on permanent magnets, by H. B. Loomis. After giving a historical *résumé* of previous work on this subject, experiments are described showing the changes in the magnetic moment of magnets of different lengths, but of the same cross section, and on the change in distribution due to change of temperature.—On the chemical composition of axinite, by W. E. Ford. Expressed as an orthosilicate, the formula is found to be $Ca_7Al_4(SiO_4)_8$, in which the calcium may be in part replaced by varying amounts of Mn, Fe, Mg, and hydrogen, while a little Fe is isomorphous with the Al.—The electrical conductivity and absorption of energy in the electrodeless discharge, by Bergen Davis.—The geological structure of New Mexican Bolson Plains, by C. R. Keyes.—Note on the marine turtle Archelon. (1) On the structure of the carapace; (2) associated fossils, by G. R. Wieland.—The ionisation of water and of phosphorus nuclei, by C. Barus.—On a method of demonstrating Newton's rings by transmitted light, by H. N. Davis. If a number of wire rings of the same size be mounted in parallel planes, and dipped together in a soap solution, their planes being kept perpendicular to its surface, a series of films results through which light can be passed and caught on a sheet of paper, showing very beautiful colour phenomena.—Note on the amphibole Hudsonite previously called a pyroxene, by S. Weidman.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, March 26.—"An Attempt to Estimate the Relative Amounts of Krypton and of Xenon in Atmospheric Air." By Sir William **Ramsay**, K.C.B., F.R.S.

In these experiments 191·1 kilograms of gaseous air were passed into a Hampson's liquefier, and 11·3 kilograms of air were liquefied. This liquid air was evaporated in a partial vacuum, until only about 200 cubic centimetres remained. The residue, consisting largely of oxygen, and also containing argon, krypton and xenon, was deprived of oxygen and nitrogen by means of red-hot copper and magnesium lime, and the resulting mixture was fractionated, so as to separate the argon, krypton, and xenon. Complete separation was not achieved, but knowing the densities and volumes of the fractions of gas obtained, their relative amounts could be calculated. This method does not preclude loss of the rarer gases, but that loss, especially in the case of xenon, must have been small; the vapour-pressure of krypton at the temperature of fractionation, $-195^0$, being only 2·8 mm., and that of xenon, 0·02 mm.

The results are reproduced in the following tabular statement:—

Percentage krypton in gaseous air, 0·000014 by weight.

Percentage xenon in gaseous air, 0·0000026 by weight.

Krypton equal to 1 part by weight in about 7 millions of air; by volume, 1 part in 20 millions.

Xenon equal to 1 part by weight in about 40 millions of air; by volume, 1 part in 170 millions.

As before remarked, it is not maintained that all the krypton and all the xenon have been separated; it is likely, however, that the separation of the xenon was more perfect than that of the krypton. The results are merely brought forward as the result of a careful experiment to quantitatively isolate these gases.

As a quantity of pure krypton, sufficient for determination of density, had been collected, occasion was taken to redetermine the density of that gas, with the following result, that the value, compared with O=16, was found to be 40·81.

The atomic weight of krypton would accordingly be 81·62; the mean of former determinations is 81·28. This is in accordance with its position in the periodic table, which lies between bromine, 80, and rubidium, 85.

"An Inquiry into the Variation of Angles observed in Crystals, especially of Potassium-Alum and Ammonium-Alum." By Prof. H. A. **Miers**, F.R.S.

The author has endeavoured to trace the changes of angle upon one and the same crystal during its growth by measuring it at intervals without moving it from the solution in which it is growing. This is accomplished by means of a telescope-goniometer in which the crystal is observed through one side of a rectangular glass trough, and the changes in the inclination of each face are followed by watching the displacements of the image of a collimator slit viewed by reflection in it.

Examined in this way an octahedron of alum (ammonium or potassium) is found to yield not one but three images from each face; and closer inspection shows that the crystal is not really an octahedron, but has the form of a very flat triakis octahedron.

When a growing crystal of alum is watched for several hours or days, it is found that the three images yielded by an apparent octahedron face continually change their position; one set fades away and is replaced by another set.

The images do not move continuously, but *per saltum*, indicating that the reflecting planes are vicinal faces which

probably possess rational indices, and must, therefore, be inclined at certain definite angles to the octahedron face; but the indices are very high numbers.

In other experiments crystals of alum were measured after growing for several hours in solution kept continually agitated in order to eliminate the action of the concentration streams. Almost no effect was produced upon the angles of the vicinal faces, which are, therefore, not due to these streams.

Every point within a crystal has at some time been a point on the surface, and has been subject to the conditions of equilibrium between crystal and solution which prevail there. It is believed by the author that a study of the vicinal planes and of the liquid in contact with them may lead to some understanding of these conditions.

In order to ascertain the composition of this liquid, its refractive index was determined by means of the same goniometer by the method of total internal reflection within the growing crystal, for alum, sodium chlorate, and sodium nitrate.

In each case the liquid in contact with the growing crystal was found to be slightly supersaturated. It was not found to exhibit double refraction even in the case of sodium nitrate.

The author suggests that vicinal faces grow upon a crystal in preference to simple forms, because the crystallising material descends upon the growing face in a shower which is not very dense.

"On a New Series of Lines in the Spectrum of Magnesium." By A. **Fowler**, A.R.C.Sc., F.R.A.S., Assistant Professor of Physics, Royal College of Science, South Kensington. Communicated by H. L. Callendar, F.R.S.

The paper records the appearance of faint lines at approximate wave-lengths 4511·4, 4251·0, 4106·8, and 4018·3 in the arc spectrum of magnesium when metallic poles are used. A mere inspection of the photographs suggests that these lines constitute a regular series, associated with the much stronger series described by Rydberg having wave-lengths 5528·75, 4703·33, 4352·18, 4167·81, 4058·45, and 3987·08, and this view seems to be confirmed by calculation.

A formula which has been found to give good results for series in general, namely

$$n = n_\infty - \frac{C}{(m+\mu)^2 - m_0},$$

gives for the two series the equations:

"Rydberg" series, $n = 26{,}601{\cdot}49 - \dfrac{107{,}071{\cdot}37}{(m+1{\cdot}2304)^2 + 2{\cdot}13282}$,

New series, $n = 26{,}587{\cdot}4 - \dfrac{100{,}033\,6}{(m+0{\cdot}495)^2 + 2{\cdot}38919}$,

$n$ being the oscillation frequency *in vacuo* in each case.

The convergence frequency of the new series is as nearly equal to that of the Rydberg series as can be expected with the comparatively rough wave-lengths employed, and in each case the constant $m_0$ is of unusual magnitude.

It is concluded that the arc spectrum of magnesium includes two subordinate series of single lines in addition to the two well-known subordinate series of triplets. No such combination of series appears to have been previously noted in the spectrum of a metal.

"On the Dependence of the Refractive Index of Gases on Temperature." By George W. **Walker**. Communicated by Prof. J. J. Thomson, F.R.S.

Mascart found that the temperature coefficient of refractive index of gases always exceeded the theoretical coefficient given by Gladstone and Dale's law. In the case of air his results do not agree with those of Lorenz and Benoît, who found a coefficient which agrees with the theoretical law. The present paper gives an account of the author's experiments on air, $H_2$, $CO_2$, $SO_2$ and $NH_3$.

Jamin's interference method was used, and the accuracy obtained in the value of $\mu - 1$ was about one part in 600. The temperature coefficients obtained were substantially less than Mascart's values, but they still differ from the theoretical law.

"The Electrical Conductivity imparted to a Vacuum by Hot Conductors." By O. W. **Richardson**, B.A., B.Sc. Communicated by Prof. J. J. Thomson, F.R.S.

This paper is an investigation of the conditions which determine the rate of escape of negative electricity from hot metals at low pressures.

The results of the experiments are explained on the corpuscular theory of conduction in metals. Assuming that the corpuscles which strike the surface are kept in the metal at ordinary temperatures by a surface discontinuity of potential, they will escape when their kinetic energy exceeds a certain value. Calculating in this way, the number of corpuscles which escape per second, at temperature $\theta$, is found to be

$$N = n\left(\frac{R\theta}{2m\pi}\right)^{\frac{1}{2}} e^{-\Phi/R\theta},$$

where $n$ = the number of free corpuscles per c.c. of the metal, $R$ = the gas constant for one corpuscle the mass of which is $m$, and $\Phi$ = the work done by a corpuscle in passing through the surface layer.

The saturation current is equal to N multiplied by the charge on an ion.

The saturation current, in the case of platinum and carbon, and the current under a constant voltage, in the case of sodium, where the current could not be saturated, have been shown to vary with temperature according to a formula of type $A\theta^{\frac{1}{2}}e^{-b/\theta}$ (A and $b$ being constants), over a large range of values. The range of current examined is:—

For platinum from $10^{-10}$ to $10^{-3}$ amperes per sq. cm.
For carbon from $10^{-8}$ to 2 amperes per sq. cm.
For sodium from $10^{-11}$ to $2 \times 10^{-2}$ amperes total current.

The corresponding ranges of temperature for carbon and sodium are roughly from 1000° C. to 1600° C., and from 100° C. to 450° C. respectively.

From the values of A, the number of free corpuscles per c.c. in each conductor is calculated. In the case of platinum the number agrees with that found by Prof. Patterson by another method, but the values for the other conductors are absurdly large. Reasons for the discrepancy are assigned.

The values of the discontinuity in the potential at the surface of the metal are obtained from those of $b$. They are found to be: for sodium, 2·45 volts; for platinum, 4·1 volts; and for carbon, 6·1 volts. The values obtained lead to the conclusion that the work required to force a corpuscle out of a metal varies, approximately at any rate, inversely as the cube root of the atomic volume.

The enormous currents obtained at such very low pressures (as much as two amperes per sq. cm. at 1/600 mm. in the case of carbon) show that the leak is not produced by the interaction of gas and metal. The results also furnish a complete explanation of the Edison effect.

"On the Evolution of the Proboscidea." By Dr. C. W. **Andrews.**

**Chemical Society**, April 2.—Prof. W. A. Tilden, F.R.S., president, in the chair.—The following papers were read:—The dioximes of camphorquinone and other derivatives of *iso*nitrosocamphor, by Dr. M. O. **Forster.** The four possible dioximes have been prepared in a pure state, and their principal properties ascertained; from these a number of interesting derivatives have been obtained.—Reversibility of enzyme or ferment action, by Mr. A. C. **Hill.** In continuation of the author's researches on this subject attempts have been made to isolate the reversible products produced by the action of enzymes on monosaccharides. The new biose *revertose* has been obtained in this way by the action of yeast ferment upon glucose, and has been characterised by the preparation of its well-crystallised phenylosazone.—Discoloured rain, by Mr. E. G. **Clayton.** The author has examined the terra-cotta coloured deposit obtained from the rain which fell generally in the south of England on Sunday, February 22, and finds that this deposit was merely wind-borne dust from the roads and lanes of Wessex. Dr. Mill, in the discussion which followed, stated that fifty specimens collected in various parts of Europe were now being examined by the officials of the Geological Survey, and that a preliminary examination of some of these samples led him to believe that the explanation of the presence of this solid matter in the rain was less simple than Mr. Clayton had suggested.—The absorption spectra of nitric acid in various states of concentration, by Prof. W. N. **Hartley.** Photographs of the spectra of nitric acid solutions indicate

that in strong solutions there exists either a polymeride of the acid or the compound $N_2O_3,H_2O$; in less concentrated acid there probably exists a compound of the formula $(HNO_3)_2,H_2O$, whilst in more dilute solutions hydrates of the acid are present.—Salts of an isomeric mercaptoid form of thioallophanic acid, and a new synthesis of alkyl iminothiocarbamates, by Dr. A. E. **Dixon.**—Derivatives of *o*-aminobenzophenone and *p*-aminobenzophenone, by Dr. **Chattaway.**—Action of caustic alkalis on cinnamic acid dibromide and its esters, by Messrs. **Sudborough** and **Thompson.** α-Bromocinnamic and bromoallocinnamic acids are produced together in this reaction, and may be separated by conversion into the respective barium salts.—The composition of Caro's acid, by Dr. T. S. **Price.** The author finds that on revising his work on the basicity of this acid, using sodium hydroxide in place of barium hydroxide as a titrating agent, it may probably be represented by the formula suggested by Armstrong and Lowry.

**Mineralogical Society,** March 24.—Dr. Hugo Müller, F.R.S., president, in the chair.—Dr. A. **Hutchinson** described some remarkably interesting experiments which he had made on the diathermancy of antimonite. A cleavage flake of antimonite 0·29 mm. thick and 20 sq. mm. in area, perfectly opaque to light, was placed between crossed nicols and exposed to the radiation from a limelight. The plate was somewhat transparent to radiant heat, and the amount transmitted was measured by Boys's radiomicrometer. No heat was transmitted when the planes of symmetry of the crystal coincided with the planes of polarisation of the nicols, but the maximum effect was produced on the radiomicrometer when the plate was turned through 45° in its own plane. The results so far arrived at are in harmony with the orthorhombic symmetry attributed to antimonite.—Mr. J. B. **Scrivenor** described the occurrence of magnetite in the Upper Bunter Sands at Hinksford, near Stourbridge, and of anatase in the Trias of the midlands. The crystals of magnetite, measuring on an average 0·067 mm., were in cubes or octahedra. The mode of occurrence and the presence of a single set of striations parallel to the cube edge suggest that they are pseudomorphous after iron pyrites. The anatase, in crystals from 0·025 mm. to 0·06 mm., is found more abundantly in the Keuper than in the Bunter. The crystals show the forms {111} and {001}, and according to the predominance of either form are pyramidal or tabular in habit. Many of them are attached to leucoxene derived from ilmenite or sphene. The anatase has been formed *in situ*, after the deposition of the sandstone, as a decomposition product of other titaniferous minerals.—Prof. W. J. **Lewis** described a large crystal of sartorite from the Binnenthal measuring $4'' \times 1'' \times \frac{1}{8}$ An analysis by Mr. Jackson gave the following result:—Pb=42·93, S=25·32, As=31·11. Prof. Lewis also discussed some peculiar twinned crystals of copper-pyrites and cerussite.—Mr. W. B. **Giles** contributed notes on howlite and other borosilicates from the borate mines of California. One of these, for which the author proposes a new name, is a white amorphous mineral resembling in appearance pandermite; the results of two closely agreeing analyses of material from different localities corresponded to a formula

$$8CaO.5B_2O_3.6SiO_2.6H_2O.$$

Mr. Giles also described a tantalite from Green Bushes, W. Australia, which contained 85 per cent. of tantalic with very little niobic acid.—Mr. J. Allen **Howe** exhibited specimens of peculiar pseudo-stalactitic growths of calcite from the north of England.

**Geological Society,** March 25.—Prof. Charles Lapworth, F.R.S., president, in the chair.—On a new species of Solenopsis from the Pendleside Series of Hodder Place, Stonyhurst (Lancashire), by Dr. Wheelton **Hind.**—Note on some Dictyonema-like organisms from the Pendleside Series of Pendle Hill and Poolvash, by Dr. Wheelton **Hind.**—The geology of the Tintagel and Davidstow district (northern Cornwall), by Mr. John **Parkinson.** The country described and mapped extends from the coast eastward towards St. Clether. In the eastern part it extends to the Brown Willy mass of granite. Except in the southern coast region, the strike is fairly uniform in an east-south-easterly and west-north-westerly direction, the beds having a northerly dip; but north and south of Tintagel Head the higher members appear, greatly faulted. The most distinctive rocks, utilised as a datum for mapping, are a group of ashes and lavas. Bluish-black slates and fine laminated quartzose beds overlie and underlie this volcanic series. The remaining rocks are phyllites, closely resembling those from the Ardennes. The author divides them into four groups. The highest of these (Tredorn Beds) overlies the uppermost division of the Blue-Black Slates. The beds underlying the Lower Blue-Black Slates (Hallwell Cottage Beds) are banded phyllites, with quartzose laminæ. The underlying phyllites (Penpethy Beds and Slaughterbridge Beds) contain no distinctive mineral. Taken as a whole, the phyllites consist of a sericitic and chloritic groundmass containing unoriented crystals of white mica, micaceous ilmenite, hæmatite, and minor quantities of tourmaline and rutile.

**Linnean Society,** April 2.—Prof. S. H. Vines, F.R.S. president, in the chair.—The minutes of the general meeting of March 19 were read and confirmed.—Mr. A. Gepp read a paper on behalf of the author, Mrs. Antony **Gepp** (Ethel S. Barton), entitled "List of Marine Algæ collected at the Maldive and Laccadive Islands by Mr. J. Stanley Gardiner." The author stated that there appears to be no record of the marine Algæ of these islands. The list now presented includes one new species, *Liebmannia Laccadivarum*, but the bulk of the remainder are already known from the Indian Ocean.—Dr. D. T. **Gwynne-Vaughan** gave a lantern demonstration of his paper on the comparative anatomy of the Cyatheaceæ and other ferns.

## PARIS.

**Academy of Sciences,** April 6.—M. Albert Gaudry in the chair.—Memorial notice of Sir George Gabriel Stokes, by M. **Mascart.** Sir George Gabriel Stokes had been correspondant of the Academy of Sciences for the department of physics since 1879. He was nominated as a Foreign Associate in 1900.—On animal heat, by M. A. **Chauveau.** A consideration of problems raised by a note of Lord Kelvin's on the regulation of temperature of warm-blooded animals. It is shown that the organism is much less resistant to a raised than to a lowered external temperature. A fall of 60° C. in the external temperature has no effect on the temperature of the body, whereas a rise of 60° C. soon causes the body temperature to increase several degrees, and death quickly follows.—Note by M. **Laveran** referring to M. Chauveau's communication. It is pointed out that man is much more competent to withstand an increase of exterior temperature than most animals. This is borne out by the author's experience at Biskra, where the temperature sometimes reaches 50° C. in the shade.—On Anopheles and malaria, by M. A. **Laveran.** Mosquitoes from paludal districts in all parts of the world have been examined by the author, and it is proved that almost invariably abundance of Anopheles coincides with the prevalence of malaria. Anopheles may be met with in healthy localities, as they are not in themselves dangerous, only becoming so when infected from malarial patients. The different species of Anopheles are not equally effective in spreading the disease.—On waves of the first order in a vitreous medium, by M. **Duhem.**—Report of the Equatorial Geodesic Commission. The work of the commission in the Andes was much hindered by the exceptional weather conditions. At the post of Mirador, altitude 4000 metres, observations were nearly impossible for a period of three months, owing to incessant fogs and storms.—On the volcanic conditions of Martinique; result of the mission to Martinique, by M. A. **Lacroix.**—The fiery clouds produced in the eruption of Mont Pelée have been observed by the author; they consist of large volumes of hot gases and vapours, carrying great quantities of fragmentary products, and are the principal agent of destruction.—On a remarkable property of several developments employed in mathematical analysis, by M. **Stekloff,** presented by M. Émile Picard.—On a new transformation of curved surfaces, by M. C. **Guichard.**—On a form of the relation $\phi(p, v, t)=0$, by M. Honoré **Moulin,** presented by M. E. H. Amagat.—On a new method of rendering horizontal the optical axis of a telescope, by M. Alphonse **Berget,** presented by M. Lippmann.—On observations of atmospheric electricity at the summit of Mont Blanc, by M. G. **le Cadet,** presented by M. Jannsen. The author finds that the diurnal variation of potential in fine weather at the summit of Mont

Blanc shows a simple oscillation, maximum about 3–4 p.m., minimum about 3 a.m.—On magnetic dichroism of liquids, by M. Georges **Meslin.** Solutions of bichromate of potassium in turpentine and in carbon disulphide have the property of absorbing to unequal extents the rays parallel to, and perpendicular to, the magnetic field. This result is exhibited by the whole extent of the spectrum.—On the colour of mercuric iodide at different temperatures, by M. D. **Gernez.** The author has been able to keep yellow mercuric iodide unchanged for years in a vacuum. If the yellow crystals be cooled down from above 126° C. to about −192° C., they become almost white, while the red crystals at this temperature become orange-yellow.—On derivatives of plumbic acid, by M. Alb. **Colson.** Lead tetracetate may be obtained by the action of chlorine on a solution of lead acetate in acetic acid.—On the preparation of the crystalline sulphides of zinc and cadmium, by M. Georges **Viard.** If the vapours of zinc or cadmium chlorides, diluted with carbon dioxide, be passed over the sulphides of various metals, *e.g.* SnS, crystalline ZnS or CdS is formed.—On the action of alkaline earth bases on salts of the pyrogallol sulphonic acids, by M. Marcel **Delage.** If a solution of $Ba(OH)_2$ be added to one of barium, strontium, or calcium pyrogallol sulphonate, coloured bodies of complex constitution are formed.—On organic heats of combustion, by M. P. **Lemoult.** The theoretical and calculated values for the sixty cases given are very concordant.—On nitrated cellulose, by M. Léo **Vignon.** The product obtained gave analytical results agreeing very well with an oxycellulose trinitrate.—Association of bacteria with Ascobolus, by M. **Molliard.**—Action of calcium oxalate in the nutrition of plants, by M. **Amar.** The crystals of calcium oxalate become less numerous as the distance from the vein of the leaf increases; they are probably a product of excretion.—On the localisation of æsculin and of tannin in the chestnut tree, by M. A. **Goris.** The reaction made use of to detect æsculin is the blood-red colour produced by the consecutive action of concentrated nitric acid and ammonia.—On new fossil fungi and algæ of the coal period, by M. B. **Renault.**—On the Lycopodinaceæ of the Trias in Lorraine, by M. P. **Fliche.**—On nephrotoxins, by M. H. **Bierry.** If the bruised kidney of a dog be introduced into the blood of a rabbit, the blood becomes powerfully toxic, and produces strong albuminuria when injected into a dog. Nucleo-albumins derived from the kidneys produced the same effects.—On the speed of flow of subterranean waters, by MM. E. **Fournier** and A. **Magnin.**

## DIARY OF SOCIETIES.

*THURSDAY*, APRIL 16.

MATHEMATICAL SOCIETY, at 5.30.—Exhibition of the Logo-Logarithmic Slide-rule: C. S. Jackson.—On the Deduction of Schlömilch's Series from a Fourier Series, and its Development into a Definite Integral: R. F. Gwyther.—On those Functions which are Defined by Definite Integrals with not more than Two Singularities: E. T. Whittaker.—Note on Exact Solutions of the Problem of the Bending of an Elastic Plate under Pressure: Prof. A. E. H. Love.—Relations between Points (in a Plane) having Conjugate Complex Coordinates: Prof. A. Lodge.

LINNEAN SOCIETY, at 8.—On some Points in Connection with the Ordinary Development of Vaucheria Resting Spores: Dr. H. Charlton Bastian, F.R.S.—The Labial and Maxillary Palpi in Diptera: W. Wesché.—On Freshwater Rhizopods and their Classification: Prof. G. S. West.

*FRIDAY*, APRIL 17

EPIDEMIOLOGICAL SOCIETY, at 8.30.—The Seasonal Incidence of Typhoid Fever and Summer Diarrhœa: Dr. J. T. C. Nash.

*SATURDAY*, APRIL 18

GEOLOGISTS' ASSOCIATION.—Excursion in Conjunction with the Geological Section of the Croydon Natural History Society. Directors: N. F. Robarts and W. Whitaker, F.R.S. Members meet at New Cross Station (L. B. & S. C. R., down platform), at 3.21 p.m. Object: To see the Reopening of the Cutting S. of the Station, showing the Junction of the London Clay with the Beds below.

*MONDAY* APRIL 20.

VICTORIA INSTITUTE, at 4.30.—The Geological Conditions of the West Indian Volcanoes: Prof. J. W. Spencer.—On Volcanic Action, with Special Reference to the Recent Eruptions in the West Indian Islands: Prof. J. Logan Lobley.

*TUESDAY*, APRIL 21.

ROYAL INSTITUTION, at 5.—The Blood and some of its Problems: Prof. Allan Macfadyen.

ROYAL STATISTICAL SOCIETY, at 5.—Agricultural Wages in England and Wales during the last Fifty Years: A. Wilson Fox.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Decay of Metals: James T. Milton and William J. Larke.

ZOOLOGICAL SOCIETY, at 8.30.—On the Geographical Distribution of Spiders of the Order Mygalomorphæ: R. I. Pocock.—On some Mammals collected by Capt. H. N. Dunn in the Soudan: Oldfield Thomas, F.R.S.—Linnæus and Hunter on Feather-tracts: Henry Scherren.

*WEDNESDAY*, APRIL 22.

SOCIETY OF ARTS, at 8.—Modern Bee Keeping: Walter F. Reid.

CHEMICAL SOCIETY, at 5.30.—The Velocity and Mechanism of the Reaction between Potassium Ferricyanide and Potassium Iodide in Neutral Aqueous Solution: F. G. Donnan and R. de Rossignol.—A Microscopic Method of Determining Molecular Weights: G. Barger.—Note on the Spectrum of Pilocarpine Nitrate: W. N. Hartley.—Isomeric Change of Dipropionanilide into Propionyl-*p*-aminopropiophenone: F. D. Chattaway.—Note on the Formation of the Di- and Hexa-Methylammoniacal Chlorides of Cadmium: W. R. Lang.

*THURSDAY*, APRIL 23.

ROYAL INSTITUTION, at 5.—Hydrogen: Gaseous, Liquid and Solid: Prof. Dewar, F.R.S.

SOCIETY OF ARTS, at 4.30.—The Province of Sind: Dr. Herbert M. Birdwood.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Distribution Losses in Electric Supply Systems: A. D. Constable and E. Fawssett.—A Study of the Phenomenon of Resonance in Electric Circuits by the Aid of Oscillograms: M. B. Field. *And, if time permit.*—Divided Multiple Switchboards: An Efficient Telephone System for the World's Capitals: W. Aitken.

*FRIDAY*, APRIL 24.

ROYAL INSTITUTION, at 9.—Some Recent Investigations on Electrical Conduction: The Hon. R. J. Strutt.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Bacterial Sewage-Disposal Works, at Ash, Dover: H. S. Watson.

PHYSICAL SOCIETY, at 5.—An Electrical Thermostat: H. Darwin.—Dimensional Analysis of Physical Quantities and the Correlation of Units: A. F. Ravenshear.—Note on the Dimensions of Physical Quantities: R. J. Sowter.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Address by the president, J. H. Wicksteed.—The Education of Engineers in America, Germany and Switzerland: Prof. W. E. Dalby.

## CONTENTS.


| | PAGE |
|---|---|
| Economic Vegetable Products. By Prof. Henry G. Greenish | 553 |
| Diseases of the Respiratory and Circulatory Organs | 554 |
| The Geology of the Isle of Man. By C. A. M. | 555 |
| Memoirs of Physics. By E. E. | 556 |
| Our Book Shelf:— | |
| Böttger: "Grundriss der qualitativen Analyse, vom Standpunkte der Lehre von den Ionen."—A. S. | 557 |
| Baker: "A Treatise on Roads and Pavements" | 557 |
| "International Catalogue of Scientific Literature," Vol. v. | 557 |
| Hertwig: "Der echte Hausschwamm und andere das Bauholz zerstörende Pilze."—R. L. | 557 |
| Norman: "How to Work Arithmetic" | 558 |
| Pannekoek: "Untersuchungen über den Lichtwechsel Algols."—W. E. R. | 558 |
| Robinson: "My Nature Notebook" | 558 |
| Letters to the Editor:— | |
| Can Dogs Reason? (*Illustrated.*)—Dr. Alex. Hill | 558 |
| Spherical Aberration of the Eye.—Edwin Edser | 559 |
| The Name Solenopsis.—Prof. T. D. A. Cockerell | 559 |
| The Thermal Energy of Radium Salts.—J. W. Mellor | 560 |
| East Siberian Decorative Art. (*Illustrated.*) By Prof. Alfred C. Haddon, F.R.S. | 560 |
| Flora of the Galapagos Islands. By W. Botting Hemsley, F.R.S. | 561 |
| A New Natural History. (*Illustrated.*) By R. L. | 562 |
| Notes | 563 |
| Our Astronomical Column:— | |
| Nova Geminorum | 567 |
| Cooperative Determinations of Velocities in the Line of Sight | 568 |
| Wolf's Rich Nebulous Region in the Constellation Lynx | 568 |
| The Period and Light-curve of δ Cephei | 568 |
| Constitution of a Board of Scientific Advice for the Furtherance of Scientific Work in India | 568 |
| Solar Prominence and Spot Circulation, 1872-1901. (*With Diagrams.*) By Dr. William J. S. Lockyer | 569 |
| The Statolith Theory of Geotropism. By Francis Darwin, F.R.S. | 571 |
| Entomology at Oxford. By S. J. H. | 572 |
| Magnetic Work in Maryland, U.S.A. By C. C. | 572 |
| Scientific Serial | 573 |
| Societies and Academies | 573 |
| Diary of Societies | 576 |